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count your WATTS and AMPS

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Publications for reference:

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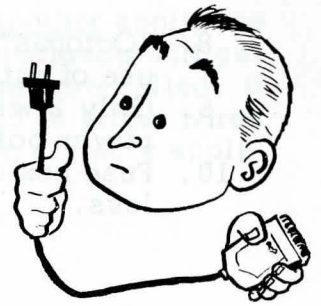
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COUNT YOUR WATTS AND AMPS

- What's a watt?
- What's a volt?
- What's the tops in amperes you should use in your house?
- What's an ampere anyway?
- Do you know how to replace a blown fuse?
- How can you tell how much electricity you're using at one time?
- How can you tell a safe electrical appliance?



For the safety of your home and satisfactory service from your appliances you should know the answers to these fundamental questions. Electricity has become a useful servant and probably contributes more to modern living than any other utility.

It wasn't very long ago when all you needed was a simple wiring system for electric lights and a few handy electrical gadgets. In 1930, the average home had 19 appliances. Today, it has over 60, and every one of them is a real joy if you have "full housepower" - adequate wiring. Electrical hazards are created from abuse and misuse of the wiring systems and appliances. Most homes haven't kept pace. When you use too many of these appliances at one time you run into trouble. Added appliances call for added wiring. As a result four out of five homes are said to be underwired. Is yours?

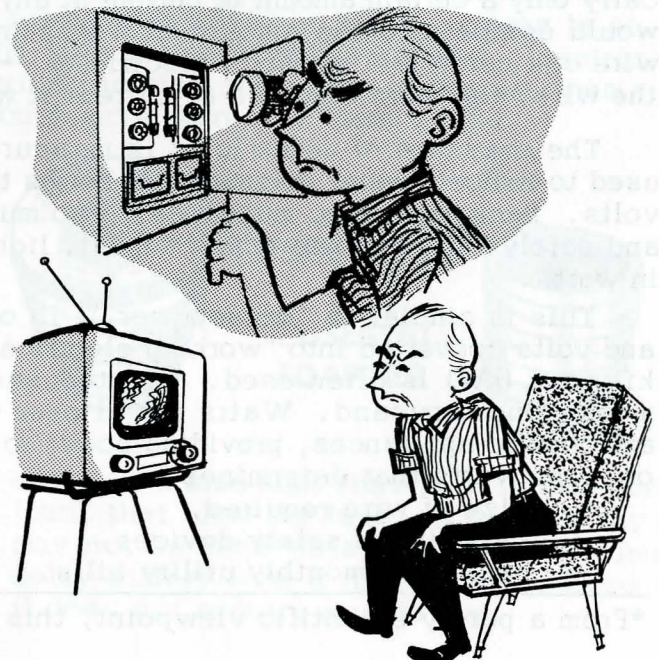
YOU CAN IDENTIFY INADEQUATE WIRING

You don't have to be an expert to tell whether your home is suffering from wiring weakness -- low housepower. There are many little symptoms that show up every day in an inadequately wired home.

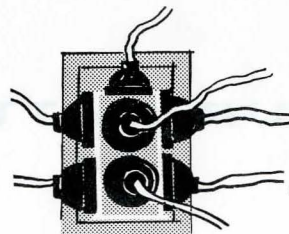
Do your lights dim when you turn on a heat-making appliance? Is the iron slow to heat? Does your TV flicker when the refrigerator starts? Do you have trouble getting waffles to brown in your electric wafflebaker? Don't conjure up a lot of unpleasant thoughts about the dealer who sold you the appliances that don't seem to be as efficient as you think they should be! Nine times out of ten, nothing is to blame for electrical trouble but the wiring in your own house.

Here are 10 clues that indicate that your wiring needs help:

1. Frequent blackouts.
2. Dimming and blinking lights.
3. TV picture shrinks or winces; and radio fades.
4. You grope around in the dark for a switch that should be at the entrance.
5. Heat-type appliances (toaster, wafflebaker, iron, etc.) slow to heat and do not reach high enough heat.
6. Furniture has to be moved to find an outlet or there are long extension cords strung between lamps and/or appliances and outlet.
7. Motors sluggish and overheat.



8. "Octopus" connections for multiple use of outlets.
9. Only 2 wires entering house from power pole.
10. Fuse box contains only 4 fuses, or less.

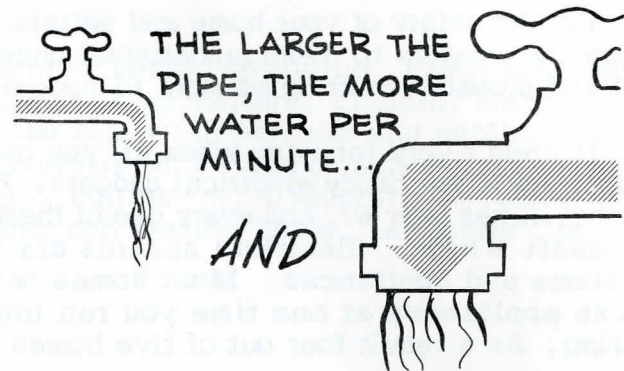


**"ELECTRICUS
INADEQUATUS,"
A DANGEROUS
HOUSEHOLD PEST!**

WHAT ARE AMPERES, VOLTS & WATTS?

Amperes, volts, watts and fuses are common terms to describe our electrical system, but just what do they mean? They're terms you'll have to live with the rest of your life in this inventive age, so it is a good idea to have a working knowledge of them.

*It's easy to understand your electrical system and how wires carry plenty of electricity, or not enough of it, to your appliances if you imagine that these wires are pipes carrying your water supply instead of electrical current. If you have only a half-inch water line and turn on three or four faucets, the water pressure will drop in proportion to the number of faucets open. It will require a long time to draw the required amount of water because of low pressure. In water systems you know that the larger the pipes the larger the stream of water, but there will be no more water than the size of the pipes allows. To have greater quantities, the size of the pipes must be increased.



**THE LARGER THE
WIRE, THE MORE CUR-
RENT PER MINUTE**

No. 14 - 15 AMPS.
No. 12 - 20 AMPS.
No. 10 - 30 AMPS.

No. 8 - 40 AMPS.
No. 6 - 55 AMPS.

No. 4 - 70 AMPS.
No. 2 - 95 AMPS.

The same is true of your electrical system. An electrical circuit is designed to carry only a certain amount of current at any one time, expressed in amperes. An ampere would compare to the amount of water drawn through a certain size pipe. And each wire can carry just so much electricity -- limited by the size of the wire. The larger the wire, the more amperes of current it will carry.

The pressure of electricity is measured in volts, as "pounds per square inch" is used to indicate water pressure. In homes the voltage or pressure is usually 115 and 230 volts. Each appliance must receive so much current in order to do its work efficiently and safely. The amount of work (heat, light or power) an appliance can do is measured in watts.

This is similar to "Horsepower." In other words, a watt is the product of amperes and volts converted into "working electrical power." The watt is so small that the term kilowatt (KW) is often used. One thousand watts are equivalent to one kilowatt; kilo means one thousand. Watts travel over wires buried behind walls and through cords attached to appliances, providing power to heating and lighting devices. It is the total of these watts that determines --

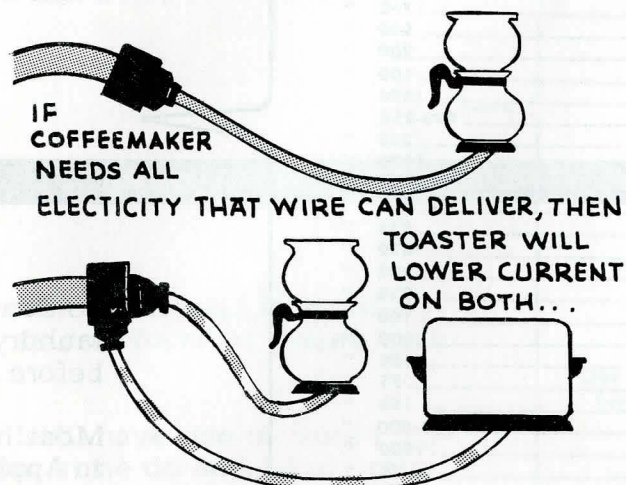
- size of wire required,
- capacity of safety devices,
- amount of monthly utility bills.

*From a purely scientific viewpoint, this description may be overly simplified.

If a certain appliance needs all the electricity a wire can deliver, another appliance on the line is bound to drain off some of that electricity, and neither appliance will get enough current. That is why you need a lot of wires, or circuits as they are called, if you have a lot of appliances. That is also why some circuits are formed of larger wires than others. Their purpose is to care for the large appliances, or even a single appliance like an electric range or clothes dryer.

LOW HOUSEPOWER IS EXPENSIVE

Inadequate wiring not only interferes with efficiency of your appliances, it also costs you money. When voltage drops, electric servants are starved for electricity -- they become weaker and don't do as much work. Here's what happens if your voltage drops just 10% at the appliance because of inadequate wiring:



Requires $\frac{1}{3}$ longer to toast bread, uses $\frac{1}{4}$ more electricity, and produces drier toast.

Requires $\frac{1}{5}$ longer for a roaster to reach cooking temperature; and wastes more than 14 percent electricity.

You get $\frac{1}{3}$ less light from an incandescent bulb. A motor has 19 percent less power -- and may even burn out. But an appliance can also burn out if too much current goes through it -- as in the case of excessive voltage.

CIRCUIT PROTECTION

The electrical distribution center in your home can be either a fuse box or a circuit breaker. Of the two, the circuit breaker is more convenient and also more foolproof.

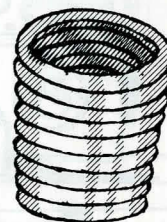
Overloading a circuit is one of the most common causes of a circuit breaker tripping or fuses blowing. When too many appliances are operating on one circuit, the wires can't take it. They heat up, may get so hot that they can set fire to the houses. The amount of current it takes to do this will blow the proper size fuse. A worn out cord or a faulty plug connection can also blow a fuse, or it could be that your load is so near capacity that every time a motor on the line starts, the fuse blows. Electric motors require three to seven times more electricity to start them than to operate them. A washing machine started in gear may use enough more current to blow a fuse.

There are two general types of common fuses -- screw-in and cartridge (see diagram on center pages of circular). Then there are some special fuses that are similar in appearance to the common screw-in fuse. One of these is a fusetrone. This is a time-delay fuse designed to prevent a blown fuse during a temporary overload, caused by a motor starting, yet it will guard against a sustained overload. Then there is a fusetat that requires a special adapter for each amperage size. It is tamper-proof because once the adapter is screwed into a normal plug it cannot be removed and that particular size fuse must be used. This avoids using too large



FUSESTAT

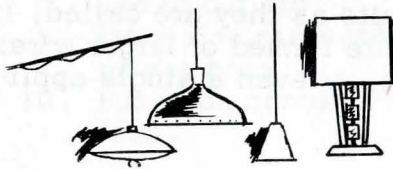
**FUSESTAT
ADAPTER**



a fuse or a fuse substitute to overcome overloads that blow the fuse. A fusetat may or may not be time-delay. A fusetrone time-delay differs from a fusetat in its base -- it does not require an adapter.

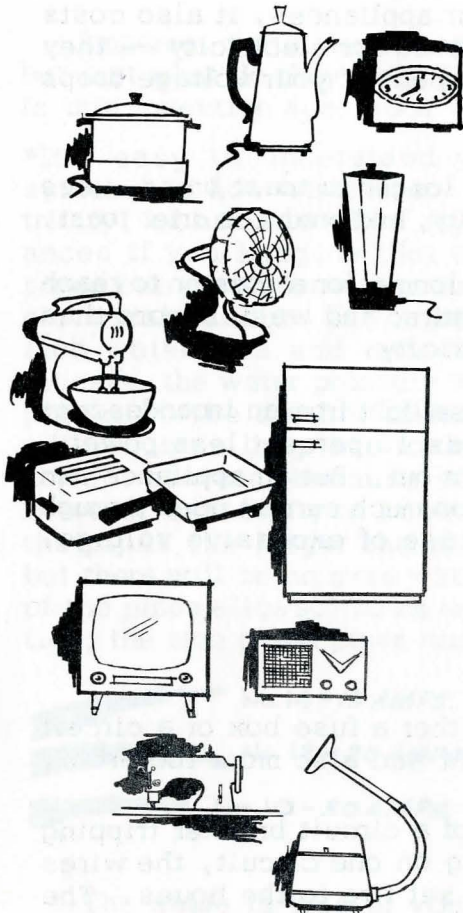
Typical Wattages of Some Lights and Appliances Normally Connected to General Purpose or Plug-in Appliance Circuits

LIGHTING



Ceiling or Wall (each bulb).....	40-150 watts
Floor Lamps (each).....	150-300 "
Fluorescent Lights (each tube).....	15-40 "
Pin-to-Wall Lamps.....	50-150 "
Table Lamps (each).....	50-150 "
Ultra Violet Lamp.....	385 "

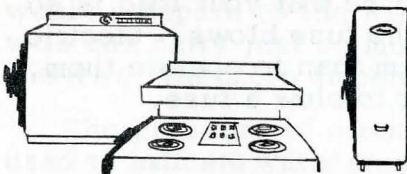
APPLIANCES



Baker (portable).....	800-1000 "
Bottle Warmer.....	95 "
Broiler-Rotisserie.....	1320-1650 "
Casserole.....	1350 "
Clock.....	2 "
Coffee Maker or Percolator.....	440-1000 "
Coffee Grinder.....	150 "
Corn Popper.....	1350 "
Deep Fat Fryer.....	1350 "
Egg Cooker.....	500 "
Electric Bed Cover.....	200 "
Electric Fan (portable).....	100 "
Electric Roaster.....	1650 "
Food Blender.....	230-250 "
Hair Dryer.....	235 "
Hand Iron (steam or dry).....	1000 "
Heating Pad.....	60 "
Heated Tray.....	500 "
Ice Cream Freezer.....	115 "
Ironer.....	1650 "
Knife Sharpener.....	103 "
Lawn Mower.....	250 "
Mixer.....	100 "
Portable Heater.....	1000 "
Radio (each).....	100 "
Record-Changer.....	75 "
Refrigerator*.....	150 "
Sandwich Grill.....	660-800 "
Saucepan.....	1000 "
Sewing Machine.....	75 "
Shaver.....	12 "
Skillet.....	1100 "
Television.....	300 "
Toaster (modern automatic).....	up to 1150 "
Vacuum Cleaner.....	125 "
Ventilating Fan (built-in).....	140 "
Waffle Iron.....	up to 1100 "
Warmer (Rolls, etc.).....	100 "
Waxer-Polisher.....	350 "

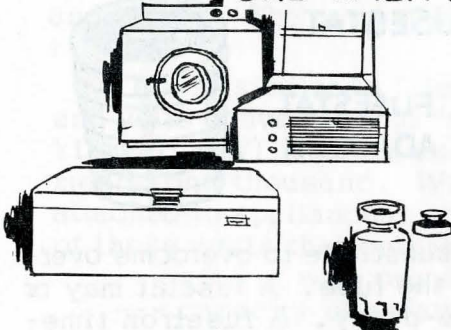
*Each time the refrigerator starts it takes several times this wattage for an instant.

ONE EACH (230 or 240 VOLT) FOR:



Electric Clothes Drier.....	4500 watts
Electric Range.....	8000-16,000 "
Electric Water Heater.....	2000-4000 "
Room Air Conditioner* (1/2 or 3/4 ton)...	1200-1600 "
Water Pump*.....	700-1500 "

ONE EACH (115 or 120 VOLT) FOR:



Automatic Washer*.....	700 watts
Built-in Bathroom Heater.....	1000-1500 "
Dishwasher-Waste-Disposer.....	1500 "
Electrostatic Air Cleaner.....	60 "
Home Freezer*.....	350 "
Mechanism for Fuel-fired Heating Equipment*... 800	"
Room Air Conditioner* (1/3 ton).....	750 "
Summer Cooling Fan*.....	250-750 "
Waste-Disposer alone* (without Dishwasher)...	500 "
Water Pump*.....	700 "
Workshop or Bench* (Total wattage will vary)	"

*The wattage of motor-operated equipment will vary, depending on the size of the motor. Individual circuits are necessary, however, in order to avoid frequent "blackouts," poor TV and radio reception, constant dimming or flickering of lights when the equipment is operating; to assure continuity of service from such devices as the home freezer and the heating plant, and to permit the use of plug-in and major appliances at the same time.

For lighting and lighting only.











Most homes built after two 15 ampere lighting and appliances circuits even certain motors in on these points.

To convenience laundry, dining room before 1940.

Most homes built after 1940 in Appliance Code require the one Plug-in circuit forced to subscribe to serve some washer, dishwasher comes overloaded the plug-in appliances.

Each of the motors listed at the 15 branch circuit you have an electric drier, you are each one. The otherwise. Home appliances have or Plug-in Appliances carrying more plug-in equipment.

BASIC CIRCUITS and THEIR USES....

GENERAL PURPOSE CIRCUITS	FOR PROTECTION THEY NEED FUSE OR	CIRCUIT BREAKER (Ratings imprinted on handle.)	YOU CAN CONNECT ALL AT ONCE
<p>General use in living and bedrooms; in kitchen, laundry and dining area.</p> <p>Homes built before 1940 still rely on one or more General Purpose Circuits for ALL appliance use. In many instances, major appliances have been plugged into, overworked wires.</p>	 <p>One 15 amp. plug fuse per circuit</p> <p>(20 ampere fuse or breaker permitted only when No. 12 wire is used.)</p>	 <p>One 15 amp. breaker per circuit</p>	<p>1650-1800 watts</p>
PLUG-IN APPLIANCE CIRCUITS			
<p>Two outlets only (no lights) in kitchen, laundry area -- seldom found in homes built before 1940.</p> <p>Homes built since 1940 have one or more Plug-In Appliance Circuits, but some do not. And, often, a Plug-In Appliance Circuit has since been converted to a Major Appliance Circuit, for a new appliance, like an automatic clothes washer, or home freezer. Then, it becomes a shared circuit each time it is shared with any of the appliances shown on the list at left.</p>	 <p>One 20 amp. plug fuse per circuit</p> <p>(Only No. 12 wire is permitted for 20-amp. plug-in appliance circuits.) Modern practice is to use 3-wire circuits. These are each protected by two plug fuses, like those shown above at left -- or by a double-handled breaker:</p>  <p>3-wire circuits are rarely found in older homes.</p>	 <p>One 20 amp. breaker per circuit</p>	<p>2300-2400 watts on 2-wire circuits</p>
INDIVIDUAL EQUIPMENT CIRCUITS			
<p>Major appliances and other equipment should have its own, individual circuit, in order to do its best work. If a major appliance, like an electric range, water heater or clothes dryer, is not sure to have a separate circuit for itself, it could not have been installed properly. However, in many homes, other major appliances have been connected to General Purpose Appliance Circuits which were already serving their share of lighting and other equipment.</p>	 <p>2 Cartridge Fuses or</p>  <p>2 Plug-Fuses per circuit</p> <hr/>  <p>One Plug-Fuse per circuit</p> <p>Ratings of fuses and circuit breakers serving individual equipment circuits will vary -- depending on what piece of equipment is to be served. Most of the 115 or 120 volt major appliances shown here are served by 20 ampere circuits.</p>	 <p>1 Double-Handled Fuse per circuit</p> <hr/>  <p>One Breaker per circuit</p>	<p>Nothing more than the appliance or equipment served by each circuit</p>

A circuit breaker serves the same purpose as a fuse. Its appearance is similar to a flip switch. When the cause of the trouble is corrected, the breaker may be reset and the electric current is started again.

Do not use fuses of incorrect rating or fuse substitutes in an effort to prevent blowing a fuse! When your electricity is cut out, don't replace fuse plugs or reset circuit breakers without checking up on and correcting the trouble that caused the blowout. If you do not know sizes of wires in your circuits use fuses of 15 ampere rating.

BEFORE A FUSE BLOWS

Fuse replacement can be easier and faster if wiring circuits in your home are identified at the fuse box.

Many electricians make this identification when they install the fuse box. But if your electrician failed to do it, you can do it yourself. Here's how:

First, turn on all your lights. Then take out one fuse -- or trip one breaker.

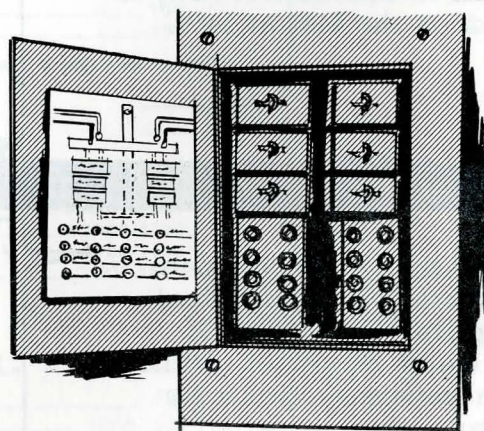
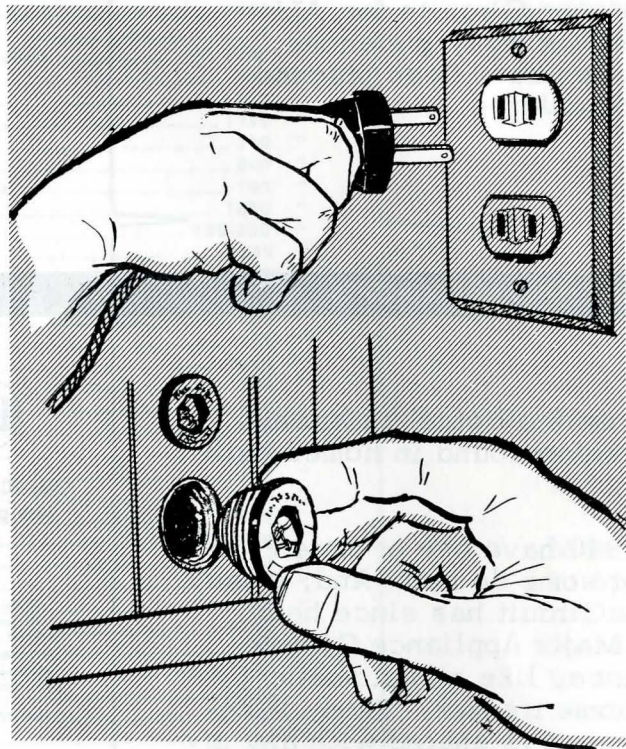
Then go through the house, listing all lights which have gone out. Use a small table lamp to check appliance outlets.

Replace the fuse which was removed. Then take out another; and go through the same procedure as before.

After doing this with all fuses, you'll have a record of all circuits. List this information beside the fuses. Or write it down on a separate card and tape it to the inside of the fuse box cover.

Remember that two fuses are required for 240-volt appliances. Your range circuit usually will be marked.

If your clothes dryer, water heater and air conditioner are connected to separate fuse boxes and they are not marked, pull the handle of each box to the "off" position to see which appliance it controls.



WHEN A FUSE BLOWS!

If you use fuses in your circuit box, keep a box of proper size spares on hand.

Now if the current goes off in any particular part of the house, you can locate the fuse easily. After it is blown the fuse window will be darkened with soot. To replace the fuse, after correcting the cause of trouble:

Step I. Open the service switch by pulling the handle on the right side of box down. This cuts off all the circuits so that there will be no danger of an electric shock while you are replacing the blown fuse. Keep a flashlight handy so that you can see when you disconnect the lights.

CHANGING A FUSE



RESETTING CIRCUIT BREAKER



RETURN TO
"ON" POSITION

Step II. Unscrew the blown fuse. Use only one hand and stand on a dry board to avoid shock or making your body a complete electrical circuit.

Why not keep a box of extra fuses of the correct size right at the fuse box for convenience when a new fuse is needed?

COUNT YOUR AMPS AND WATTS

How are you going to know when you are asking your electric wiring to carry too heavy a load? Just figure your wattage - and it isn't hard to do.

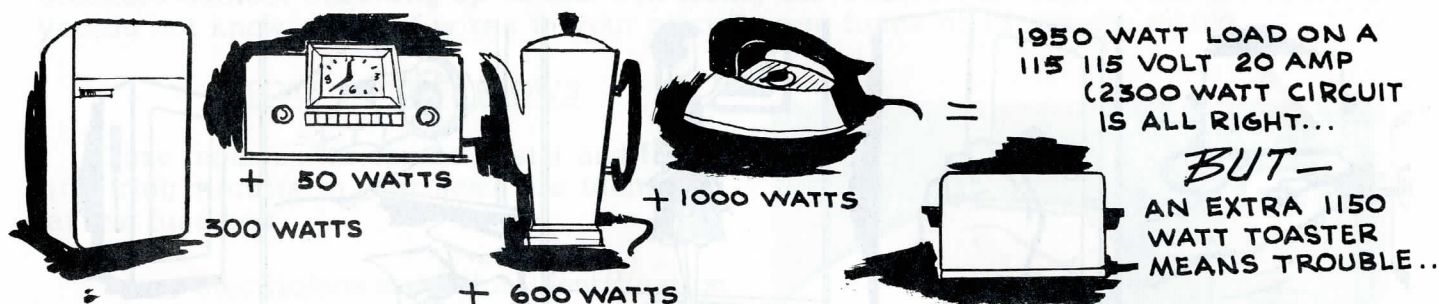
The size wire on a circuit governs the amperes and watts that can be used safely. Note the maximum electrical current that can be safely carried by rubber or thermoplastic covered wire:

Maximum Load for Electrical Wires

<u>Wire Size</u>	<u>Watts</u>	<u>Amperage</u>	<u>Recommended for</u>
No. 14 Gauge	1800	15 amperes	Lighting only (120V.)
No. 12 Gauge	2400	20 amperes	Appliance & power circuits (120V.)
No. 10 Gauge	7200	30 amperes)	Individual circuits
No. 8 Gauge	9600	40 amperes)	(240V.) for
No. 6 Gauge	12100	55 amperes)	ranges, dryers, etc.

Study the table on center pages of this circular to determine the wattage for the appliances you have (or better yet, check the label plate on the appliances themselves). Add to them the wattages of the appliances and lamps which might be plugged in all at one time. Then compare the total with the number of watts which you can connect all at once on that one circuit.

Suppose you are using a 20 ampere fuse circuit. You can readily see that if you have a circuit with 300 watts for the refrigerator, a clock radio with 50 watts, a coffeemaker with 600 watts, you have 950 watts (7.9 amperes). If you plug in an iron of 1000 watts, you have a total of approximately 1950 watts or 16.2 amperes. This could be all right on a 20 ampere fuse, but there might be times when the starting of the motor of the refrigerator would overload the circuit and blow a fuse. Now add a 1,150 watt toaster and there's immediate trouble -- power interruption.



The result is not dangerous -- IF the circuit has properly sized wire and is protected by a properly matched fuse or circuit breaker. If wires and safety devices are not matched and properly rated, the results of overloading could be serious. In addition to the annoyance of a drop in voltage, power decrease, dimming lights, and slow, lower temperature iron and toaster, there could be a fire hazard with overheating of the wiring buried in the walls.

Do you really want to know what your total circuit capacity is? And each circuit's capacity and area it serves? It's easy to determine, using a form like the one below:

ESTIMATE OF ELECTRICITY BEING USED						
Col. 1 Circuits	Col. 2 Correct Fuse Rating	Col. 3 Circuit Capacity	Col. 4 Rooms on Circuit	Col. 5 Appliances & Lights on Circuit	Col. 6 Watts for Each Use	Col. 7 Total Watts
No. <u>1</u>	<u>20</u> Amps	<u>2400</u> Watts	Living Room	Lights - lamps	700	1600
Wire				television	300	
Size No. <u>12</u>				radio, vac.	100	
				cleaner	500	
TOTAL CAPACITY OF CIRCUITS.....				TOTAL WATTAGE FOR ALL USES.....		
WATTS				WATTS		

When you add up the wattages of the appliances and lights you now have (Column 7), the total may surprise you. How does this compare with the wattage capacity shown in Column 3? And, don't forget new appliances are sure to come along. Obviously you are not going to have all these appliances and lights in operation simultaneously. Your capacity does not need to be as high as the total wattage owned. National Electrical Code suggests that capacity should be approximately 75% of wattage on all appliances owned. Of course there could be some variation in this according to types of equipment you are using.

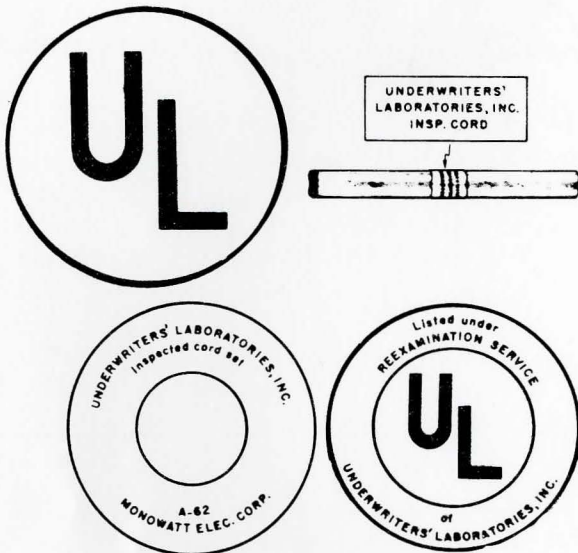
Most homes today need a 3-wire, 100-ampere, 24,000 watt service. What's yours?

GUIDES FOR SAFETY

Every standard electrical appliance has a name plate which gives essential information -- information that can help the consumer in buying and operating that specific appliance. There are certain facts found on all name plates -- such as the identification of the manufacturer, the model or part number designation, the kind of electrical current for which it is designed, amperes, volts, watts; and horsepower, if it's a motor.

But the name plate is of even further value to the user, for it can serve as a guide for safety in installation or indicate that the particular article of equipment has been tested for safety in usage.

Have you ever noticed a "UL" identification like any of those shown at the left?



One of these may be on the name plate or perhaps on a bracelet label on electrical cords attached to household appliances. Electrical appliances and parts bearing one of the UL labels have met the minimum requirements set in the National Code.

The Installation Form given on the name plate of some appliances is important as a guide to proper installation. Installation standards are also established by the Underwriters' Laboratories, Inc., for safety in installation wherever there is combustible material in the walls and cabinets. It is also a guide to one of the hidden qualities -- the amount and quality of insulating material in the appliance.

One of the prime safety factors in the use of electrical appliances is proper "grounding" of the appliance. By grounding, a path is provided for a "fault" current to get to earth. A fault current is a charge of electricity that has gotten into the shell or frame of the appliance where it should not be. Because of the danger from fault currents the electrical code requires that certain appliances be carefully grounded. This of course should be done by a competent electrician to assure the safety you should have.

The electrical industry maintains rigidly high standards in the manufacture of electrical devices. It is only through carelessness and lack of knowledge on our part that electrical accidents occur at all.

There is no guess work about what electricity does. Few people realize how small an electric current is needed to cause death or injury. The ordinary 115-volt lighting circuit can be as deadly as 40,000 volts. It is amperage that kills, not voltage. The normal adult can stand about 1/7th the current used by a 7 1/2 watt bulb. With more current the person freezes and cannot pull away. It isn't necessary to have two wires for current to flow. Any time you are grounded and touching a live wire, you complete a circuit and current flows.

Most metals are good conductors of electricity. Water is an excellent conductor, and the human body has a high water content. That is why certain non-conductors, such as rubber, are used as insulation to channel current and protect you.

Never use more than a 15 ampere fuse unless you KNOW your wiring is Size 12 or more.