

MICROWAVE APPLIANCES

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Microwave ovens offer another cooking appliance option to supplement conventional cooking appliances. Fast cooking has been the main advantage. Cooking on older models is completely time-controlled. Features on newer models allow both time-and temperature-controlled cooking.

Microwave ovens are available in counter-top models, built-in models that may include dual ovens and range top, and the all-in-one combination oven that combines microwave and conventional heat in one oven.

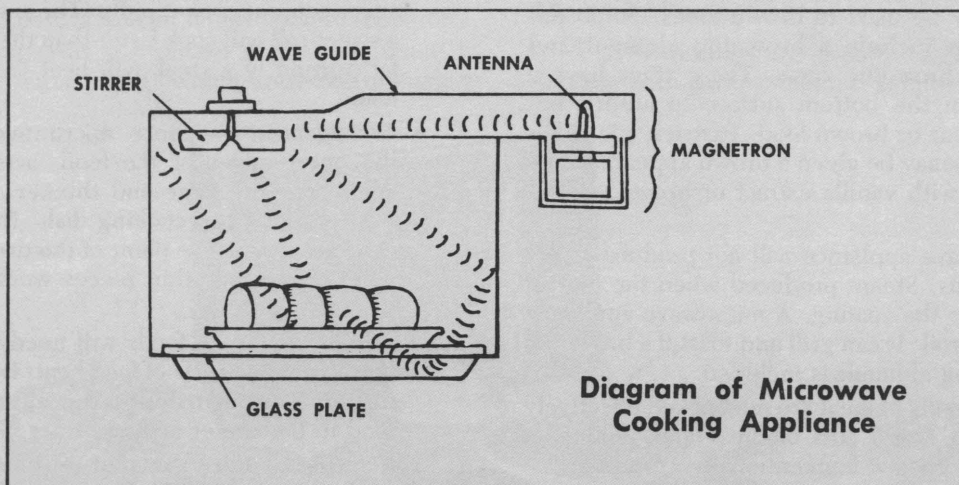
Microwaves

Microwaves are high frequency waves of energy, much like radio and television waves. Microwaves are nonionizing, a form of energy that causes a rise in temperature rather than a chemical change. The two frequencies approved by the Federal Communications Commission (FCC) for use in microwave ovens

are 2450 and 915 mega-Hertz. MHz, the symbol for mega-Hertz, means one million cycles per second. Most microwave ovens operate on a frequency of 2450 (MHz). This frequency has a shorter wave length that produces more uniform heat.

Microwaves are generated by a magnetron tube and sent to the oven cavity through a *wave guide*. A *stirrer* or similar device is used to distribute the waves evenly. Some ovens use a turntable to rotate food within the oven. As microwave energy is absorbed by food, moisture and fat molecules in the food begin to move rapidly. This friction causes heat.

Because microwaves create heat within food, the controls regulate the length of time that microwaves are produced rather than the temperature of the oven cavity. Some controls are labeled with familiar cooking terms such as bake, simmer, roast, etc., or high, medium and low power. Each of these settings cycle the magnetron tube off and on for a certain number of



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seconds of each minute of cooking time or reduce the power output of the magnetron tube.

Utensils Used for Microwave Cooking

Nonmetallic cooking utensils, such as oven proof glass, most ceramics, paper and heat-tolerant plastics, are suited for use in a microwave appliance. They allow microwaves to pass through them. Plastic pouches or cooking bags can also be used in microwave ovens. Most metal utensils are not suitable for microwave cooking. Metal reflects microwaves, preventing cooking and sometimes causing damage to the magnetron tube. Some models are designed so that TV dinner trays and other shallow metal dishes may be used. Aluminum foil may be used to shield areas of food that may cook too quickly. It is best to follow the manufacturer's recommendations that accompany the oven.

To test a dish for use in your appliance:

- Place a cup of water in the dish you are testing.
- Place the dish in the oven and heat for one minute.

If the water gets hot and the dish does not, the dish can be used. If the dish gets *very* hot, it is *not* acceptable for microwave use. Some acceptable containers may be warm to the touch.

Small amounts of food can be covered loosely with waxed paper or a paper towel to prevent splatters. When cooking large items that require a long time in the microwave appliance, some heat from the food can be transferred to the covering material and the utensil. A potholder may be needed to remove these items after cooking.

Limitations of Microwave Cooking

Microwaves do not brown food. Foods such as meat that contain fat will brown some when heated by microwaves. Appliances such as a toaster or conventional oven may be used to brown foods. Some microwave models include a browning element and others provide browning trays. These trays have a special finish on the bottom surface to absorb microwaves and sear or brown food. Pastries, pie shells and some meats may be given a brown appearance by brushing them with vanilla extract or brown seasoning sauces.

The microwave appliance will not produce crispy coatings on foods. Steam produced when the food is heated moistens the coating. A microwave appliance will not fry or broil. It can grill and toast if a browning tray or browning element is included.

Less tender cuts of meat are not cooked effectively by microwaves. Large cuts of meat may not be as tender as when cooked conventionally.

Energy Consumption

Microwave cooking usually saves energy because most foods can be cooked in about one-fourth of the

time necessary to cook them by conventional heat. Some portable appliances such as electric skillets and coffeemakers prepare some foods more efficiently than a microwave appliance. Research on the energy efficiency of microwave cooking indicates that foods containing large quantities (more than one quart) of liquid or vegetables can be cooked more efficiently on a range surface unit than in a microwave oven. These foods include stews, soups and other foods that need to simmer.

Factors That Influence Microwave Cooking Time

- **Volume** — The more items cooked at one time, or the larger the item, the longer the cooking time because more food is absorbing the microwaves.
- **Starting temperature** — The colder the food is when it begins to cook, the longer it will take to heat or cook.
- **Density** — Dense or compact foods require a longer cooking time. A thick hamburger patty will take longer to heat than a porous bread or roll.
- **Standing time** — Allowing food to stand midway through or at the end of cooking time will let the heat penetrate toward the center without additional cooking in the outer areas. This is important when cooking large items such as roasts and when cooking other protein foods such as eggs. Variable cooking cycles mentioned under "Microwaves" make it possible to alternate cooking and standing time automatically. Standing must also be planned at the end of the cooking cycle since the molecules slowly stop moving and create some heat after the microwave power stops.
- **Fat and sugar content** — Foods with high fat or sugar content cook rapidly. The sugary filling of a sweet roll will cook faster than the rest and the fat portion of a steak will heat faster than the lean.
- **Arrangement** — Since microwaves penetrate the outer edges of the food, arrange thicker areas near the edge and thinner areas toward the center of the cooking dish. In the case of chicken pieces, the point of the drum stick, the wings and other thin pieces would be placed near the center.
- **Stirring** — Some foods will need to be stirred because the outside of food heats faster than the inside. This distributes the already warmed food to the cooler areas.
- **Rotating** — For foods that can't be stirred, the cooking dish should be rotated one-fourth turn halfway through the cooking time. If a food requires more than one rotation during cooking, the recipe will say so.

Type of Electrical Outlet Needed

Most portable microwave ovens operate on 120 volts and are equipped with a three-pronged grounding plug. Ovens use 1600 to 1750 watts and should be connected to a small appliance circuit. If connected to a general purpose circuit, other heating appliances, such as a toaster, fry pan or coffee pot, should not be used on the same circuit at the same time.

In addition to the electrical input needs of the appliance, consumers should also compare the amount of wattage converted to heat. Power is used by the magnetron tube, fan motor, oven light and timer. The wattage output may range between 200 to 700 watts. Lower wattage output often found in low priced, small units means slower cooking time. Wattage information is important to develop a sense of timing in microwave cooking.

Operating Features

Features include defrost cycle, browning devices, variable power settings, temperature probes and sophisticated timer controls, including digital clocks, computerized touch controls and traditional dials.

Automatic defroster — Even thawing is achieved by automatically turning the power on and off to alternate cooking and standing time. To avoid cooking the outside of foods and leaving the inside icy, models without this feature can still be used for defrosting by setting the timer for 30 seconds then allowing the food to stand for 30 seconds. Repeat this process until the food is thawed.

Browning devices — Browning units are either carlod or infrared. Portable microwave ovens are designed so that browning devices operate simultaneously with the microwave cooking operation. The browning unit draws 1000 to 1400 watts. The timer may be set so that the browning unit will automatically operate for a specified time at the end of the microwave cooking time or it may operate separately.

Browning grills are special utensils designed to absorb microwave energy which cause the utensils to

become very hot. After the empty utensil has been preheated for 2 to 5 minutes (longer preheat times may cause the grill surface to reach temperatures of 550° to 750°F or 287.8° to 398.9°C), food placed on and in full contact with the surface becomes browned. The cooking process is completed using standard microwave cooking techniques.

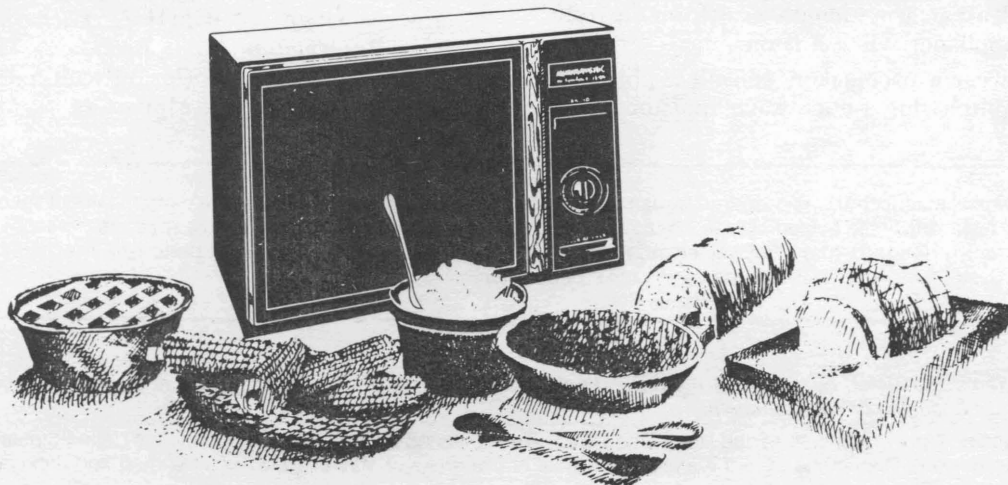
Power settings — Some models have only a full power setting. Others have full power and one or more lower power settings. Lower settings are more useful in thawing foods and in cooking protein foods. Lower power settings may be achieved by lowering wattage output. Some manufacturers achieve lower power settings by cycling full power on and off. The time base used in any complete off/on cycle is from 1 to 60 seconds. At a defrost setting, all ovens are on $\frac{1}{3}$ to $\frac{1}{2}$ of the base time cycle. At the lowest settings, the oven may be on as little as $\frac{1}{10}$ of the base time cycle. Changing power setting is usually done manually at the end of each time period. A programmed system which sequences power and time settings is available.

Temperature probe — A temperature sensing probe inactivates the timer, and power remains on until the temperature probe senses the pre-selected temperature. At that point the power is automatically turned off. When the item being cooked becomes cooler than the selected temperature, the power is turned on again.

Timer — This control automatically turns off the power after operating for a set time. Timers operate within the range of 5 seconds and 60 minutes. Most foods are cooked or require some attention within 10 minutes. Timers should be designed with the seconds clearly marked in the first 2 to 3 minutes. Compare the timer feature to determine which one is easiest for you to read and operate.

Warranty Protection

Full warranties are usually for 1 to 2 years and include both parts and labor. Limited warranties may



extend for 5 or more years and cover specified parts such as the magnetron tube. This part of the appliance is the most expensive to repair or replace.

Microwave Appliance Safety

Microwave appliances are produced with the safety of the consumer in mind. Regulations protect the user from unnecessary exposure to microwave energy. Microwave appliances must be equipped with at least two operating safety interlocks that will automatically turn off power to the magnetron tube when the oven door is opened.

Look for the seal of the Underwriters' Laboratories. They test microwave appliances for leakage as well as for the effects of shipment damage.

Operating the microwave oven according to the manufacturer's instructions is important. Proper use of the microwave appliance assures maximum safety to the user.

Follow these basic recommendations established by the Bureau of Radiological Health:

- Examine for evidence of shipping damage.
- Never insert objects (for example, a wire) through the door grill or around door seal.
- Never tamper with or inactivate the oven safety interlocks.
- Never operate oven when it is empty.
- Frequently clean cooking cavity, door, seals and filter with water and mild detergent. Do not use scouring pads, steel wool or other abrasives.
- Have appliance checked regularly by a qualified serviceman for signs of wear, damage or tampering. Every 18 months to 2 years is advisable.
- It is important to keep the door seal clean. Food can collect around the door and interfere with a tight seal. The seal may weaken and warp because of a build-up of grease. Grease conducts heat to the seal, causing damage.
- Switch control to "off" before opening the door.
- Stay at least an arm's length away from the front of the appliance while it is on.
- If you wear a pacemaker, consult a physician before purchasing a microwave appliance.

Before Calling a Serviceman

A service call often can be avoided by checking a few simple things.

If the oven will not operate, check:

- Cord. Is it plugged in?
- Electricity. Is the power on?
- Circuit box. Has circuit breaker tripped or fuse blown?
- Oven door. Is it properly closed?
- "On" button. Did you push it?
- Timer. If the timer is set for less than 2 minutes, the unit may not turn on. Turn the time a little past the 2-minute position and then back to desired time.
- Magnetron tube. It may become overheated. The unit is designed to shut off until cool. Wait.

If foods take longer to cook than the time specified in the cookbook, check the voltage at the receptacle. Low voltage means longer cooking time. (Use the oven on a separate, voltage-adequate circuit.)

Sparks inside the oven while cooking are caused by using metallic ware or ceramic trimmed in gold or silver. Metals should not be used in the microwave oven except for specified uses recommended by the manufacturer.

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