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Heating Prepared Foods In Microwave Ovens

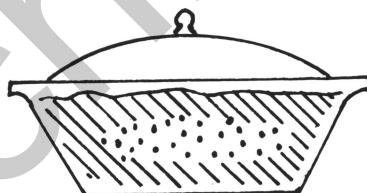
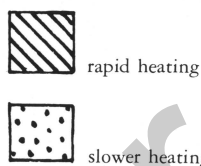
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This guide discusses the microwave heating-to-serving temperature of cooked or ready-to-eat foods that are frozen, refrigerated or at room temperature. The rate of heating varies somewhat between ovens, but there are some general rules for figuring heating times. Any suggested heating times given here are for 600 to 650 watt ovens¹ at full power setting.²

For more information on cooking in microwave ovens, see UMC guides GH 4495, "Selecting a Microwave Oven" and GH 4496, "Cooking Foods in Microwave Ovens."

Microwaves cause rapid movement of food molecules, resulting in heat. Microwaves penetrate into foods, but the greatest heating is near the surface. In addition to the general process of heating with microwaves, one needs to understand several food- and appliance-related factors affecting time and uniformity of heating.



Total Time

Heating times are affected by food- and appliance-related factors.

Amount of food. Doubling the amount of food nearly doubles the heating time. Also, food in flat, thin shapes will heat faster than food in a chunky shape.

Starting temperature. The colder the food, the longer the heating time. Heating frozen food requires two steps,

Moisture content	Food type	Relative heating time
75-90%	Vegetables, soups, casseroles, sauces, and sauced foods	Most
50-60%	Meat, fish, poultry	Less
20-35%	Breads, cakes	Least

first thawing and then a final heating.

Moisture content of food. Since water is really what is being heated, the more moisture a food contains, the more heating time it will require.

Fat and/or sugar content in food. Foods that are high in fat and sugar heat faster than those that are low in fat and sugar.

Power setting. Lower power settings require longer heating times; a medium power setting doubles the time suggested for full power.

General Heating Times

To heat 8 ounces (1 cup) of high-moisture food (75-90 percent) to a serving temperature of about 140°F (60°C):

- From room temperature (70°F or 21°C) microwave for about 1 minute.
- From refrigerated temperature (38°F or 3°C) microwave for about 1½ minutes. Food at refrigerator temperature heated in a cold dish will take longer than

*This guide has been approved by the Family Economics and Management Department of the College of Home Economics, University of Missouri-Columbia.

¹Prepared foods also can be heated by microwave in combination microwave-conventional ranges. You will, however, need to increase the heating times for small amounts considered here (8 ounces or 1 cup).

²Power settings are achieved by using different wattage outputs or by cycling full power off and on. Most manufacturers use the latter method.

if heated in a dish at room temperature.

—From frozen state. Frozen foods must be defrosted³ or thawed before heating. If food contains ice crystals or is colder than 38°F or 3°C, microwave for slightly longer than for refrigerated foods.

To heat 8 ounces of refrigerated liquid or high-moisture food to boiling, microwave 3 minutes.⁴ (NOTE: Many coffee and tea cups hold only 6 ounces.) Boilovers are more likely to occur in cylindrical containers than in containers that are wider at the top than at the bottom. Allow room for expansion when boiling liquids, especially milk products.

Use the suggested times as guidelines in determining specific times required for foods. By keeping the amounts and starting temperatures of foods and dishes constant, the same heating time will produce the same results each time.

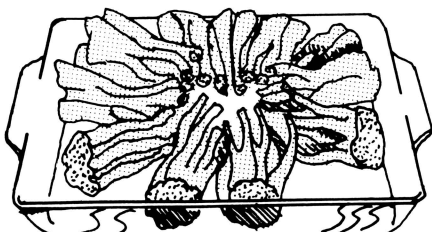
Uniform Heating

The most uniform heating occurs in flat (not more than 1½ inches thick), doughnut-shaped foods. The greatest amount of heating takes place within ¾ inch of the surface. This heat is then transferred by conduction to the interior of large or dense food items. Covering with a glass lid or plastic wrap will capture steam and make for more even and faster heating.

When heating foods that are not flat and doughnut-shaped, a more uniformly heated product is achieved by:

- Using a lower power setting. This will result in less heat being built up in the outer layer and more time for heat to move toward the cooler food in the center.
- Using a final standing time. After the power is off, heat in the outer layer will move toward the cooler food in the center, equalizing the temperature of the entire food item.
- Stirring midway during the heating time. The most effective stirring involves replacing the cooler food at the center with the hotter food at the sides.
- Shielding food with foil, if permitted by the manufacturer. This will prevent heating of the covered portion.

More uniform heating of several foods on one dish will occur if the foods are similar in amount, shape and moisture content. Less heating will occur in the center of any arrangement. Use the following adjustments when heating unlike foods together.



Placement. Place foods with the shortest heating time (low moisture, high fat, high sugar) in the center of the plate, with the smallest or narrowest part of a food nearest the center.

Size and shape of portion. Reduce size of portion or make two portions; change shape of food (for example, depress center of mashed potatoes).

Initial temperature of the food items. Have faster-heating foods at lower temperatures than foods that take longer to heat.

If suggested adjustments cannot be used, consider heating some of the food items in separate side dishes or adding faster heating foods to the plate after some heating is done.

Heating Several Foods for a Meal

Heat foods in succession if:

- Different heating times are necessary. Low-moisture foods require short heating times and should be microwaved last.
- Final standing times are involved. Large and dense items like casseroles and baked potatoes may require larger final standing times than other foods.

Heat several foods at one time if:

- Oven space is available. Use of a special shelf/rack increases available space.
- Little standing time is involved.
- Food items are similar. However, when double loading is possible, such as with a shelf/rack, the food placed on the shelf or rack will heat faster than the food placed directly below it.

SPECIAL FEATURES OF MICROWAVE OVENS

Temperature-Sensing Probe

The temperature-sensing probe is a power shut-off device that allows the power to remain on until the sensed temperature reaches the preselected temperature or one necessary to maintain a preselected temperature. In most models, temperature change can be observed directly on the panel.

Power Setting

Medium or half power occurs at defrost on a two power setting oven and at the halfway point on ovens with

³Defrosting or thawing is accomplished by using a lower power setting or by manually alternating the heating (on) and standing (off) times. The length of the "on" and "off" times should vary with the quantity and shape of the food. On the defrost setting, ovens are on ⅓ to ½ of the base time cycle.

⁴Three or more cups of liquid can be heated faster on most surface units than in a microwave oven.

Heating Foods in a Microwave Oven (2450 MHz)

<i>Food Item</i>	<i>Form</i>	<i>Moisture Content (%)</i>	<i>Remarks and Suggested Techniques for Avoiding Problems</i>
Meat, fish, and poultry Piece	Thick (chops, steak, chicken)	50-65 Loin and rib cuts and pork sausage are slightly lower.	Maximum thickness is 1½ inches. Interior temperatures of rare steak should reach 120°F (49°C), not 140°-160°F (60°-71°C).
	Thick and sauced	Sauced items are higher (sauces may be 80 percent or more moisture; lower if made with milk).	Heat with sauce over meat or in a container that keeps sauce close to meat for even heating. Heating for the last one-third of the allotted heating time on a lower power setting, or cycling "off" and "on," will result in more even heating of the meat.
	Thin (sliced beef, ham) Thin and sauced		Overheating will result in a very dry product. Heat with sauce over meat or in a container that keeps sauce close to meat for even heating.
	Formed as sausage or wieners		Wieners can be heated in a bun or wrapped in a paper towel or napkin, or they can be heated with sauces. A single wiener can be easily overcooked at the ends.
Main dish	Cut and ground in pasta or rice	70-80 (Macaroni and cheese are lower.)	If cheese is a topping, add it the last few seconds or use a low power setting so it doesn't toughen. When heating pasta or rice, depress the center before adding sauce. If sauce contains large pieces of meat such as meatballs, place them around the outer edge of the dish.
	Sauced and over pasta or rice	70-80	
	Sauced as in stew, stroganoff	70-80 (Sauces made with milk are a little lower.)	
	Pot pies	55-65	
Sandwiches	Sliced meats	50-60 (filling)	Sandwiches can be heated on napkin or paper towel to absorb moisture. Most should be heated uncovered or with only a paper towel over them. Heat sandwiches only until bread is warm to the touch. (The filling will be hot.) Overheating will cause the bread to dry and become hard.
	Sliced cheese	40 (filling)	

Heating Foods (chart continued from previous page)

<i>Food Item</i>	<i>Form</i>	<i>Moisture Content (%)</i>	<i>Remarks and Suggested Techniques for Avoiding Problems</i>
Side dishes			
Spaghetti, noodles, macaroni, rice		70	
Dressing	Moist Dry	70 35	
Vegetables		90 (Peas, corn, potatoes, lima and navy beans are lower, 75-80.)	Overheating will result in toughening and drying out of vegetables. Those heated in sauces or liquids can tolerate more overheating than plain vegetables. If the vegetable is mashed, depress the center of the mound.
Soup			
		90 (slightly less for soups, made with milk)	
Yeast and quick breads			
	Bread	35 (French bread, 30)	
	Plain buns	30	
	Biscuits	30	
	Muffins	30-38	
	Doughnuts	23-28	
	Sweet rolls, coffee cake	30	
	Pancakes, French toast	50	
	Cornbread, waffles	40	
Desserts			
	Cake (chocolate, spice, or white)	21-25	If cake is frosted, use low power or manually alternate short "on" and "off" times to keep frosting firm.
	Angelfood, sponge	31-34	
	Pie	47-51 (pecan, 19)	
	Cookies	4	
	Brownies	10-15	
Miscellaneous			
	Butter	15	To soften rather than melt, use low power or manually alternate short "on" and "off" times.
	Syrup	24-33	
	Baby foods	80-90 (dinners and vegetables) 75-80 (puddings and desserts)	
	White sauce	67-78, depending on thickness	

Composition of Foods. Handbook 8, 1963. U.S. Department of Agriculture.

graduated settings. The use of lower power settings will increase heating times.

Touch Programming

This feature includes a manual selection of power settings, and time and/or temperature combinations. Program options include:

- Heating time by preselected elapsed time.
- Heating time by preselected temperature.
- Time of day to start heating.
- Time of day to finish heating.
- Hold or rest period between settings.

In addition, some ovens allow the user to select a food group setting which automatically selects the appropriate power setting with time. Length of total heating time is determined by sensors affected by either temperature or the relative humidity of the oven exhaust.

Dishware

The choice of dishes depends on the food, whether it is dry, moist, or liquid, and the temperature to which it must be heated. Many dishes are designated for microwave use. Do a dish test⁵ if in doubt.

Nondisposable dishes which may be used include:

- Most glass and glass-ceramic dishes.** These can be used if they have no metal trim.
- Pottery and china.** Most pottery or china can be used if it has no metal trim. Use pottery and china to heat refrigerated foods, but do not freeze foods on them. They are likely to crack because of the fast change from 0°F (-18°C) to serving temperature.
- Plastic tableware.** Plastics vary considerably in their ability to withstand high temperatures. All can be used to thaw foods, and most can be used to heat foods to serving temperature. Fatty foods when heated to extremely high temperatures will distort many plastics.

Disposable dishes which may be used include:

- Cooking pouches.** Use special heat sealer units or use cooking bags fastened with rubber bands or string; do not use metal ties (these usually are covered with plastic or paper). When heating foods to temperatures that result in steam buildup, pierce the pouch before heating.
- Pressed paper or molded pulp plates or containers.** Such products absorb moisture, so they are good for heating all kinds of bread products. They can be used for heating moist foods for short times but not for heating liquid foods or fatty foods.
- Plastic-coated paper containers.** These products will not absorb moisture, are fairly rigid, and accept a variety of lids.
- Plastic plates or containers.** These are designed for one-time use. Some may distort under conditions of high heat.

Covers

Foods are covered during heating to prevent drying out and spattering as well as for faster and more even heating. When foods covered with plastic film are heated to high temperatures, pierce film to release steam buildup.

Covers and Their Functions			
<i>Cover</i>	<i>Prevent drying</i>	<i>Absorb moisture</i>	<i>Prevent spatters</i>
Glass—Glass Ceramic	X		X
Pottery—China	X		X
Plastic Film or Cover	X		X
Plastic-Coated Paper	X		X
Wax Paper	X		X
Paper Towel or Napkin	X	X	X
Cloth		X	X

⁵Dish test: If a dish is cool after the following test, you can use it in a microwave oven. Place a glass of water in the corner of the oven. Place the dish to be tested in the center of the oven; heat for 1 minute.

