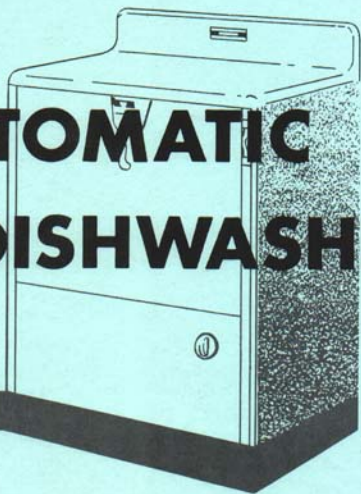




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Choosing and using

• **YOUR  
AUTOMATIC  
DISHWASHER**



Cooperative Extension Service  
Michigan State University

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The author is Constance Burgess, Extension Home Management Specialist, University of California.

## ACKNOWLEDGMENT

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## IS THERE A DISHWASHER IN YOUR FUTURE?

Don't say no. The last 5 years have seen major developments in this field. One out of every 14 U.S. households now has an automatic dishwasher. Housing developments often include this as standard equipment. We predict that the next 5 years will find a much larger proportion of families owning one.

### START LOOKING NOW

We agree that first things should come first. So, whether or not you're in the market for an automatic dishwasher now, do some looking around. Visit your friends who own one, listen to the sound it makes, and ask if you can help operate it. Talk with dealers about features, installation, dishwasher requirements. Then, if or when the time comes to buy one, you'll know better what to look for and how to choose.

Take time to figure out what you would expect of a dishwasher. Most important, it should do a good job of cleaning the dishes—they should come out dry and spotless. It should do this with a minimum of noise and as little expense as possible. You, of course, must be willing to supply water that is hot enough and soft enough to do the job right. More about that later.

### MODELS ON THE MARKET

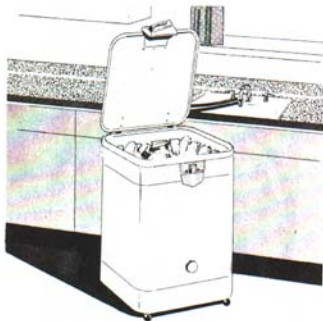
All dishwasher manufacturers produce one or more models that require plumbing installations. Most manufacturers now also produce one or more portable units. A number of manufacturers are making a "convertible" model that combines features of both basic dishwasher types—the installed and portable. Let's consider the differences between them.

**Installed**—has a permanent connection to hot water and to a drain. Free-standing installed models do not require cabinet work, while under-counter models do, because they have no cabinet walls. Fronts come in a variety of colors and finishes, while tops are usually either standard counter finishes or maple wood chopping tops.



Undercounter dishwasher.

**Portable**—comes equipped with casters and hose connections to the hot water faucet and to the sink drain. Most models have the same features as plumbed-in units. During use a portable is rolled up to the sink, otherwise it requires floor space against a wall elsewhere in the kitchen. Because of recent developments in portables, sales of this model are rapidly overtaking sales of installed models.



Portable dishwasher.

## TYPES AVAILABLE

Most top-opening models are loaded from the top, but not all front-opening models are loaded from the front. You will need to decide whether you want a top-opening or front-opening dishwasher, also whether you prefer to load it from the top or the front.

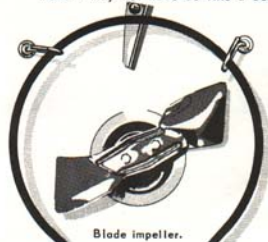
**Convertible**—designed to be permanently installed in the kitchen but meanwhile functions as a portable. This dishwasher has added sides, top, hose connection and casters which will be removed when it is no longer used as a portable.

**Top-loading**—may be portable or installed. Most installed top-loaders have hinged countertops. This means that there can be no wall cabinet above unless it is built high enough to give clearance. A few installed top-loaders have pull-out drawers. Since dishes are put in or taken out from the top, it may be necessary to remove all or part of the upper rack during loading. Most models now come with top racks that fold back to permit easier loading.

**Front-loading**—may be portable, convertible or installed. The door opens down and the racks roll out separately. Make sure that the portable is well balanced to prevent tipping when the loaded racks are pulled out.

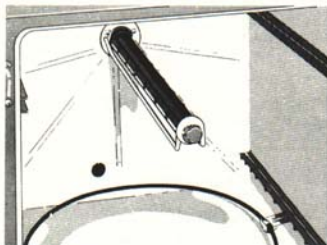
**Washing Action**—Each manufacturer designs a spray system that he thinks will do the best job of distributing water to all parts of the dishwasher. He may use only one system or a combination of several. The three main types in use today are:

- (1) **Blade impeller**—usually located in the center bottom of the tub. The impeller resembles a small fan with several blades. As the motor operates this, the blades turn at high speed. This sends the spray in all directions at great force. Impeller models may not have as fine a screen to



filter food particles, therefore more particles may be recirculated. However, if you have hard water, there is less chance of the mechanism getting plugged by water deposits, since water is not forced through tiny holes. Examples — Philco, Kenmore, Westinghouse.

- (2) **Revolving horizontal tube**—attached in the upper part of the dishwasher. Water jets through tiny holes along the tube as it revolves at high speed. Example — Frigidaire.



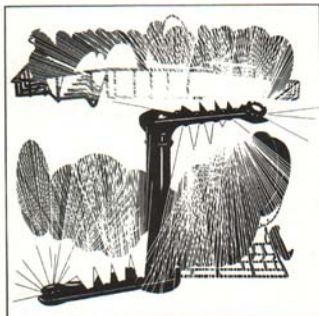
Revolving tube.

- (3) **Revolving wash arm**—attached to the center bottom or up on the sides of the tub. Water jets out through holes on the wash arm. As the arm swings it distributes the water up and around the tub. Examples — Kitchen Aid, Whirlpool, Tappan. Variations of this type are the revolving split-level "Z" arm, the center tower and the double rotors that provide spray action at both top and bottom of the tub. Examples — Hotpoint, Waste King, G.E.



Revolving wash arm.





Rotating Z-arm.

#### OTHER POINTS TO CONSIDER

**Heating element**—Some models have a built-in water heater or booster. Others have a heating element that is used solely during the drying cycle. Be sure you know which one you are buying.

**Drain**—there are two types.

**Pump Drain**—water is pumped out of the dishwasher into the sink drain line by means of a built-in pump. Found on most models, including all portables.

**Gravity Drain**—requires a separate drain directly from the dishwasher down through the floor. This makes the dishwasher itself less expensive to buy but will add to installation costs. Found only on built-in models.

**Number of washes**—A better job may be done by models that have two separate washes, each with fresh water and fresh detergent. Some detergent cups are metered, so the correct amount is released for each wash cycle.

**Number of rinses**—Varies from 1 to 4. These may be quick sprays or longer full (or flush) rinses, that agitate or recirculate the water.

**Capacity**—usually has been stated in terms of standard place settings. But this official standard of NEMA\* has recently been revised to include serving pieces and is now described as "table" settings. NEMA specifies that 95% of this standard load must be perfectly clean when washed in 150° F. water. A table setting includes: 1 cup and saucer, 1 - 10½ inch dinner plate, 1 - 8 inch salad plate, 1 - 5 inch des-

sert bowl, 1 - 12 ounce 5¼ inch straight-sided tumbler, 1 dinner fork, 1 salad fork, 1 knife, 2 teaspoons. Serving pieces included are: 1 medium oval platter, 1 oval serving bowl, 1 round serving bowl, 1 - 14 ounce gravy boat, 1 - 7 ounce creamer, 2 serving spoons, 1 serving fork, 1 gravy ladle. Remember that this standard does not allow for odd-shaped pieces, mixing bowls, utensils. A dishwasher rated "10 place settings" in capacity by the old standard, actually handles only about the average number of table dishes plus utensils and food preparation items for five or six people.

**Special cycles**—Manufacturers offer a variety of cycles, usually a wider choice in the higher priced units. All have a normal cycle, most now have a prerinse. Extras may include: a short rinse and dry, for dusty dishes not used recently; utility cycle for utensils, which may use more vigorous action and usually has a shorter drying period; short cycle, which may use less water; heavy cycle for extra soil or grease; plate warming. We suggest that you check to see what happens in each of these cycles; then you'll know whether you want to pay the price it adds.

#### INSTALLATION

**Proper grounding**—Dishwashers are used with water and operated with electricity. Therefore they must have a ground-wire connection. If you buy an installed unit, this will be taken care of properly by a competent serviceman when he connects your dishwasher.

Portables cannot have a permanent ground-wire connection, so it is especially important to provide for safe grounding. Portables come equipped with a 3-prong plug, one wire of which is a ground wire. If you have only a 2-hole outlet in your wall, you can get an adapter which allows you to use the 3-prong plug.

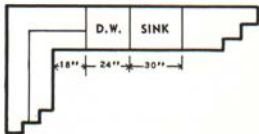
There are disadvantages to adapters, however. Many are not actually grounded because proper connection isn't made to the screw. Instead of using an adapter, we recommend that you convert a 2-hole receptacle to a ground-type receptacle with three holes. This can be done very simply at a cost of only a few dollars.

**Electrical connection**—The National Electric Code requires that a dishwasher be connected to a separate 15-ampere circuit. Most have heating elements that range from 600 to 1200 watts, some have 1350 watts or more.

\* National Electrical Manufacturers' Association.  
See reference page 9.

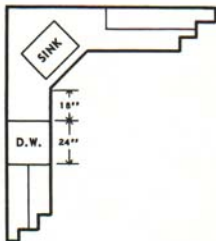
**Location**—The dishwasher may be on the right or left of the sink. The right-handed homemaker works normally from right to left. She will probably want her dish storage, and therefore her dishwasher, to the left of the sink. If installation is near a corner turn, be sure to allow a 15- to 18-inch space beyond the dishwasher, as shown:

This allows you to stand beside the dishwasher to unload it, with no reaching across to the cupboards.



Installation near corner turn.

If you have a corner sink, allow the same 18-inch clearance between the corner and the dishwasher.



Installation near corner sink.

## WATER REQUIREMENTS

**Pressure**—Water pressure preferably should be between 40 and 70 pounds per square inch. It should be not less than 15–20 pounds and not more than 120 pounds per square inch. Pressure is important in giving the correct amount of water but has no effect on regulating the force of water within the dishwasher after it starts operating. Force is determined by the dishwasher's washing action.

**Temperature**—Water should be delivered to the dishwasher at around 150° F. Before starting your dishwasher, open the hot water faucet and clear the pipe of cold water unless your model includes a quick rinse for this purpose. Hot water is more sanitary and permits faster drying. Some models have a booster heater for providing higher temperatures. To be effective, the cycle operation on these models should not continue until the booster raises the temperature to the desired level. This booster should not be confused with the lower-watt heating element on many models which is used only for the drying cycle or as a plate warmer.

**Softness**—Soft water (less than 3 grains\* hard) is preferred. However, dishwasher detergents are formulated to counteract hardness up to 10 grains, provided the water is up to recommended temperature. If your water supply is very hard, do not try to use a dishwasher unless you have an installed tank-type softener. With hard water you will need to use more detergent. A rinse additive will help overcome streaking or spotting when water is hard.<sup>1</sup>

**Iron**—Water containing more than 1/10 p.p.m. of iron will stain dishes. It may cause iron staining even though a tank-type water conditioner is used.<sup>2</sup> (See chart, page 6.)

**Probable amount**—Average total 8–10 gallons—some use only 7 gallons a load, others up to 15 gallons. A dishwasher uses water only from the hot water line.

**Type fill**—(a) Meter. Water comes in until a certain predetermined weight (as of 2 gallons) is in the tub. Even if water pressure is low or high, the correct amount is always metered into the dishwasher.

(b) Time fill. Operates by a valve which is set for a definite period of time at a certain pressure to give the correct amount of water.

Example: 15 to 20 pounds per square inch pressure at 1½ minutes gives about 2 gallons. If your pressure is lower than this, you may have trouble because not enough water will be present to do the job at the end of the 1½ minutes when the valve closes.

\*One grain (g.) hardness = 17.1 parts per million (p.p.m.).

<sup>1</sup> See reference on page 9.

## DETERGENTS AND RINSE ADDITIVES

**Detergents**—Certain detergents are especially made for use in dishwashers. These are highly alkaline, and therefore not suitable for hand dishwashing. Regular detergents are not suitable for use in dishwashers. Each ingredient has a definite role to play, such as:

**Sodium silicate**—effective on fats, holds soil in suspension, inhibits corrosion and tarnish of metals.

**Sodium phosphate**—ties up the hardness minerals, calcium and magnesium.

**Chlorinated trisodium phosphate**—found in some brands, such as Cascade, All, Finish. Enables rinse water to "sheet off," reduces water spotting.

**Sodium carbonate**—increases washability and improves soil suspension, so there is less redepositing of soil on dishes.

**Wetting agent**—helps penetrate soil more quickly. Low foamer.

Ingredients vary in content and amounts. Therefore, one dishwasher detergent may be more satisfactory than another for certain types of water. Those containing chlorinated phosphates result in less spotting, but should not be used if there is iron in your water supply. Don't skimp on the amount of detergent you use just because you may be doing a small load of dishes. Remember, you are still using the full quota of water. You may wish to try different types until you find the one best suited to your water condition and temperature.

**Rinse additives**—Some models have a dispenser which automatically ejects a liquid "wetting agent" during the final rinse. A wetting agent conditions the water so it will slide off the dishes quickly. This helps prevent spotting or streaking, especially in hard water areas. Most rinse ejectors hold a large enough supply of the liquid to last for several weeks.

### HOW TO USE

#### *Is prerinsing necessary?*

Manufacturers' instructions may suggest brushing dishes to remove large food waste items, or rinsing of certain foods. This is particularly important if dishes will not be washed until later. The hot dishwasher and specially designed dishwasher detergent will remove greasy soil, so rinsing can be done with cold water. In spite

of improved filtering systems in the dishwasher, some foods are fine enough to go through the screen and will redeposit on dishes. Redepositing of soil is most likely to occur with such foods as mashed potatoes, other starchy mixtures, peanut butter, sometimes even orange juice. Egg, lipstick, and burned-on foods also need rinsing or soaking.

#### *Proper loading*

Method of loading is determined chiefly by rack design. More and more manufacturers have designed racks for random loading, but it is often desirable to follow a pattern. Here are suggestions:

- 1) Place articles to avoid interfering with free water circulation. Don't overload.
- 2) Alternate large and small pieces.
- 3) Turn inner surfaces toward the water source and slant dishes so water will run out or off. Glasses, cups turned down.
- 4) Flat pieces, such as plates, saucers, platters go on the lower rack. Cups, glasses, odd pieces often on the top rack.
- 5) Make sure that aluminum pans are not under the detergent cup. (See chart, page 6.)
- 6) Load silverware in special rack with handles down unless the manufacturer has specified that the silver can be loaded with handles up.

#### *What you can't wash—*

Bulky or odd-shaped pieces that take lots of space may have to be washed by hand or in a separate load. Some items should never be washed in a dishwasher, i.e. soft rubber, wooden pieces or items with wooden handles, hand-painted china, other dinnerware that does not have a dependable glaze, antique glassware, fragile stemware, antique silverware with cemented handles. Kitchen knives may lose their keen edges from excessive heat. Plastics vary—many will not stand the temperatures and/or the strong detergent solution. Melamine and other thermosetting plastics can be washed safely and will not be affected by high temperatures.

#### POTS AND PANS

Dishwashers can be used to remove the major part of the heavy soil on pans. Unless the dishwasher has a special cycle just for pots and pans, you will need to remove them before the drying period. Then you probably will have to do some follow up scrubbing or polishing of the pans.

## SOLVING YOUR PROBLEMS

If your dishwasher is not giving you the results you hoped for, it may not be the fault of the equipment. Check your instruction book once more to be sure you are following directions. Common stains on dishes and treatments include:

STAIN OR FILM	PROBABLE CAUSE	HOW TO TREAT	TREATMENT SAFE FOR
Dishes not clean. Particles of food baked on. Dishes feel grainy.	Not enough scraping or pre-rinsing. Improper loading. Interference with water circulation. Detergent didn't dissolve.	Check dishwasher directions. Clean strainer with sudsy water and a brush. Set water heater higher. Set $\frac{3}{4}$ cup chlorine bleach on bottom rack. Run through wash cycle only. Place bowl with pint of vinegar in and finish rinse and dry cycles.	Not on silverware, cutlery, metals.
White or grey film on all items, and on inside of dishwasher. Water spots.	Hard water deposits due to calcium or magnesium in water supply. Water too cool.	Wash dishes, but omit drying cycle. Repeat wash cycle, adding 1 pint vinegar. May need to install a water softener. Set water heater higher. Try a rinse additive.	Glassware and dishes. Not on silverware, cutlery, metal.
Dull appearance on china due to reddish-brown stain.	Tea or coffee.	Add 1 teaspoon liquid chlorine bleach to regular detergent cycle.	All china and glassware, no metals.
Dishes have brownish stain. Glasses amber colored. Stain does not wipe off.	Iron in water. May be using a chlorinated phosphate dishwasher detergent.	Place $\frac{1}{4}$ to $\frac{1}{2}$ teaspoon oxalic acid crystals in detergent cup, no detergent. Put through a complete cycle except for drying. Then use dishwasher detergent and repeat complete cycle to remove traces of oxalic acid. Do not use a chlorinated phosphate if there is iron in your water supply.	Glassware and dishes. Not on silverware, metal utensils, plasticware.
Pitted and/or discolored aluminum utensils.	Effect of concentrated detergent. Water not hot enough to dissolve detergent. Check water temperature.	Pitting is permanent. Do not place utensils under detergent cup. Do not use detergent if caked—keep package tightly closed.  Clean with mild abrasive (like Bon Ami) or another detergent.  Use cream of tartar in wash; remove before dry cycle and polish with steel wool soap pads.  Wash by hand.	Removing stains.  Brightening aluminum in the dishwasher.  Colored aluminum cups, covers; ice cube trays.



## POSSIBLE MECHANICAL DIFFICULTIES

PROBLEM	PROBABLE CAUSE	HOW TO HANDLE
Very noisy and/or excessive vibration	Floor not level. Improper loading. Strainer may not be in place. Small object may have fallen into pump well.	Level the appliance or the floor if necessary.  Follow directions for loading. Check strainer placement.
Leaks	Floor not level. Water pressure too high or valve permitting too much water in machine. Leaks common in portables around lid. Door gasket may be worn. Rusting of tub.	Level the appliance or the floor.  Have serviceman check water input and replace gasket if needed.
Detergent left in dispenser.	May be interference with water circulation. Detergent cup may have been wet, or did not unload. Detergent may have become caked in box, making it hard to dissolve.	Follow directions for loading. Be sure cup is dry and clean before putting in detergent. Keep detergent box closed tightly.
Water not held in machine.	Drain valve leaks or is held partly open by some object or food.	Check to see if a food particle is holding it open.
Water comes in too slowly or dishwasher doesn't fill completely.	Water pressure too low. Inlet valve may be clogged.	Have control adjusted on time-fill or valve fixed.
Food backs up from disposer into dishwasher.	May be faulty connection if dishwasher and disposer are on same drain. Clogged sink drain.	Call plumber.  Connect to separate drains or have an air-gap type of pipe which does not permit this.

## QUESTIONS TO ASK YOURSELF

### Does a dishwasher really save time?

Yes, according to research done at several of our land-grant universities. A study<sup>3</sup> showed that an average of 73 minutes a day was spent on all dishwashing activities done by hand, including cleanup. With a dishwasher the same families averaged only 35 minutes. If you have a small family, you can store rinsed dishes in the dishwasher and wash them only once a day.

### Are dishes more sanitary?

Yes, hotter water and more powerful detergent are two big factors, plus hot-air drying. A study<sup>4</sup> done in 42 homes showed that the average bacterial count per dish was: hand dishwashing — 390, dishwasher — less than 1.

### What about installation costs?

This depends upon your own situation — the amount of plumbing, wiring and/or construction involved. Undercounter models require permanent connections. While portables do not have permanent connections, they must be connected to an individual 15-ampere circuit and properly grounded. Hoses, faucets, and faucet-adapters may need to be figured into the cost.

### What about operating costs?

Chances are that you'll use more water with a dishwasher, and it'll all be hot water. Detergent costs may be up a little, not much. Electricity may average from 2–5 cents per load, based on the 3¢/kwh. rate.

### Which is a better buy—portable or installed?

You'll probably pay less for a portable than for an installed model. However, recently added features are narrowing the gap between the two. Typical examples<sup>5</sup> from the lines offered by two major manufacturers in one recent year are:

	No. of models	Price range
Mfr. A — portables	3	\$175 — 260
installed	3	\$270 — 350
Mfr. B — portables	2	\$230 — 280
installed	5	\$293 — 375

You can pay as much as \$400 for a portable or as little as \$150.

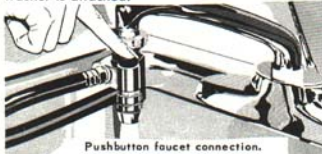
### What about a convertible model?

The convertible model generally has more deluxe features than regular portables. It may be priced with the more expensive installed models.

Other points to consider — are you renting your home or do you own it? Probably you won't want to pay the installation costs in a rented home. Remember, you can't take a permanently installed model with you if you move.

Are you planning to remodel the kitchen soon? If so, the convertible, which can be used now and later permanently installed, may be the best choice.

Portables and convertibles tie up the water supply and the sink area during use. You'll need to plan your work so you can be away from the sink at this time. However, many portables and convertibles now come equipped with a pushbutton faucet connection in case you need hot or cold water while the dishwasher is attached.



Pushbutton faucet connection.

Are there important differences in drying methods? Yes there are. As dishes stand in the rack after the wash period, water droplets tend to condense and roll off the dishes. In this way, the water does not have a chance to dry on the dishes and leave little spots of hardness minerals behind. Some manufacturers provide especially for this water condensation by keeping the dishwasher vent closed during the first part of the dry cycle. Most manufacturers accomplish the actual drying by using a heating element to heat the air. In most impeller models, the fan revolves, sending the heated air over the wet dishes. A few impeller models have no heating element and rely solely upon air movement for drying. This slows down the drying process.

In some cases the booster heating element (see page 4) raises the temperature of the final rinse water. The new gas dishwasher supplies the final rinse at approximately 180° F. One manufacturer provides a model which uses the principle of condensation to dry the dishes. Another has located both the heating element and a blower outside the tub. During the drying period the hot air is blown into the tub.

### NEW IDEAS IN DISHWASHERS

Some kitchens are very limited in storage space for a dishwasher, either portable or built-in. To solve this problem, an electric dishwasher has been designed to be built into the unused space under the sink. This model fits into a 24-inch wide space underneath a six-inch deep sinkbowl. The plumbing fits to the right or left in a 12-inch area. The dishwasher is front loading with two pull out racks that will hold 10 NEMA place settings. Example: General Electric.

The gas industry now offers a full line of gas kitchen appliances. The latest addition is a gas dishwasher. Water enters through two revolving radial wash arms mounted on the sides of the tub. A thermostatically controlled gas heater is installed underneath the tub as a part of the dishwasher. This heater provides wash water at 160° F. and rinse water at 180° F. These temperatures insure sanitizing of dishes. A wetting agent is automatically added to the final rinse. Example: Preway.



Undersink Dishwasher

### IT'S UP TO YOU!

A dishwasher saves you time and energy, but it doesn't do the whole job. You still have to organize your work around the sink and plan for efficient use of the dishwasher. When you are weighing convenience against cost, don't forget to count such costs as installation, operation, and occasional repairs. You may want to consider the cost of installing a water softener, too. A dishwasher should last you for many years, and it will provide you with more sanitary dishes. Only you can decide whether you can afford a dishwasher. If you can, we know you'll like it.

### REFERENCES

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6. *Standards for Household Electric Dishwashers* - National Electrical Manufacturers' Association, April, 1961; *Electrical Merchandising Week*, January 21, 1963.

**OTHER LEAFLETS IN THIS SERIES INCLUDE:**

*Choosing and Using Your Automatic Clothes Dryer, E-389*

*Choosing and Using Your Refrigerator, E-390*

*Choosing and Using Your Food Freezer, E-391*

*Choosing and Using Your Automatic Washer, E-392*

*Choosing and Using Your Household Range, E-393*

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