

MSU Extension Publication Archive

Archive copy of publication, do not use for current recommendations. Up-to-date information about many topics can be obtained from your local Extension office.

Choosing and Using Your Automatic Washer

Michigan State University Extension Service

Constance Burgess, University of California; Ruth Beard, Ohio State University;

Georgianne Baker, Michigan State University

Reprinted September 1964

12 pages

The PDF file was provided courtesy of the Michigan State University Library

Scroll down to view the publication.

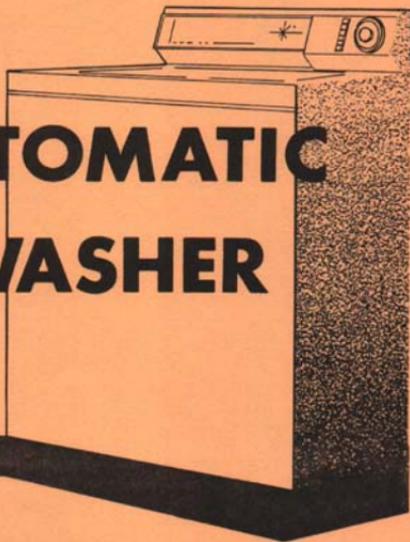
Extension Bulletin E-392
HOME AND FAMILY SERIES



FILE COPY
DO NOT REMOVE

Choosing and using

**YOUR
AUTOMATIC
WASHER**



Cooperative Extension Service
Michigan State University

WHERE TO FIND IT

OBVIOUS DIFFERENCES BETWEEN MODELS	1
The Price Tag	1
Types of Washing Action	1
Controls	3
Cycles	3
Washer Capacity	3
Dispensers	4
LESS OBVIOUS DIFFERENCES BETWEEN MODELS	5
Water Fill System	5
Water Consumption	5
Rinsing	5
Lint Removal	6
Water Extraction	6
COMBINATION WASHER-DRYERS	7
Special Advantages	8
Disadvantages	8
OTHER POINTERS IMPORTANT IN SELECTING A WASHER	8
Safety	8
Installation	9
Service and Warranty	9
IT'S UP TO YOU	9
REFERENCES	9

Acknowledgement is made to Miss Ruth Beard, Associate Professor of Home Economics, Ohio State University, for her counsel and help in preparing this leaflet.

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

ACKNOWLEDGMENT

This publication is reprinted with revisions by Georgianne Baker, Extension Specialist in Home Management, Michigan State University, from the California Agricultural Extension Service Publication HXT-27. The Michigan State University Cooperative Extension Service expresses appreciation for the permission to reprint the California publication.

SELECTING AN AUTOMATIC WASHER ISN'T EASY!

One out of every 10 households in the United States boasted a new automatic washer in 1962. This means that consumers spent 3/4 of a BILLION dollars for automatic washers in one year!

Selecting an automatic washer is not a simple matter. We still have only two types—the front-loading and top-loading models—but partly because of new developments in textile fibers and finishes, washer manufacturers are giving us more choices of cycles and features.

Since competition is keen among manufacturers of laundry equipment, it will pay you to look around if you're in the market for a new washer. We invite you to take a tour through the pages of this leaflet with us. We'll look first at some of the obvious eye-catching differences between automatics. Then we'll consider some of the more important differences that aren't so easily seen. We'll finish by looking at combination washer-dryers.

OBVIOUS DIFFERENCES BETWEEN MODELS

THE PRICE TAG

One of our first concerns in buying any piece of equipment is the price tag. More than likely you have a limit above which you cannot or should not go. Buying "on time" may make the payments easier, but the credit charges will add considerably to your price tag.

The lower priced models in each manufacturer's line usually will give you the basic necessities—washing, rinsing, and spin-drying the bulk of the family washload. If you are interested in good performance without the extras, you can find this among "stripped-down" economy models. You'll have fewer choices of cycles, fewer of the automatic features, but good service.

The 1962 price range for automatic washers was from slightly under \$200 to more than \$400 (1). Among the more expensive models you'll find more deluxe features, more trim, more automatic controls, more convenience.

TYPES OF WASHING ACTION

Tumbler or cylinder type front loading—A cut-away view of this washer would show you two cylinders one inside the other. These are placed horizontally, or nearly so, in the washer frame; therefore the opening is at the front. Clothes may be added during the wash cycle, but this may tend to put the load out of balance. This would be noticeable during the initial spin period. In some models water drips on the floor if the door is opened after washing action has started. The inner cylinder is perforated, allowing water to be forced through from the outer drum. The inner drum usually has

fins or baffles that lift the clothes as the drum revolves. Washing action occurs as the clothes are continuously lifted out of the detergent water and then fall back into it. Since the revolving wash action creates more suds than agitator action does, you should use a low-sudsing detergent, to avoid complications. Tumbler washers generally have only one speed for washing and spinning, although you may select a short spin period if you wish.

Only one manufacturer now produces front-loading automatics. Combination washer-dryers are of this front-loading tumbler type.



Front-opener.

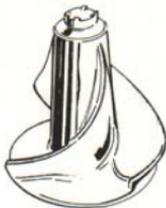
¹ See reference on page 9.



Top-loader



Pulsator - Frigidaire



Spiralator - Easy



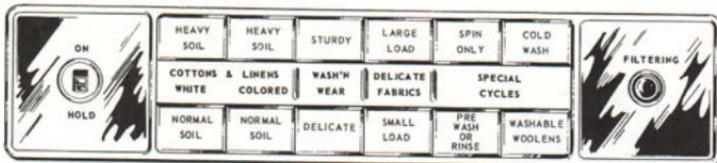
Blade-free agitator - Philco

Agitator type, top-loading — There are two tubs in this washer, also. The inner tub may be solid or perforated. Since the tubs are mounted vertically, the opening is at the top. Clothes can be added or removed at any stage of the cycle, but here again load balance may interfere with proper operation of the washer during the spin period. In fact, top-loaders appear to be much more sensitive to an off-balanced load than do front-loaders. Look for a control that will stop the cycle when the load is off balance.

With this type washer, the agitator is attached to a center post. The typical agitator has blades or fins. The wash action occurs as the agitator moves back and forth about 70 times a minute. Some manufacturers recommend removal of the agitator for cleaning and storage. Thus it would be wise for you to check the ease of removing and replacing the agitator.

One manufacturer features a 3-ring agitator, or pulsator, that is attached near the top of the post and moves up and down to provide washing action (Frigidaire). Another agitator, called an oscillating spiralator (Easy), rotates alternately clockwise and counterclockwise. Some agitators move in a circle; one rocks around, creating high-speed waves to move the clothes (Philco).

All agitator-type washing action creates some tangling of such articles as apron strings, full-length hose, long curtains. Tangling can be lessened in any washer by following the manufacturer's directions for loading. Articles that tangle can be put in mesh bags. Some manufacturers provide two-speed controls for the agitator—gentle and brisk. The slower speed will prevent some tangling and wrinkling.



Control panel

CONTROLS

The control panels of some deluxe models have many dials, knobs, or pushbuttons, although at least one manufacturer returned to simplified controls in 1963 (Norge).

Some manufacturers add color as a guide to selecting the proper combination of controls for each load. Example: pink for wash-wear, blue for heavy soil, green for regular soil, et cetera. Whatever the system, you should be able to use the controls easily.

To simplify the control panel, some of the more expensive models feature "programming." You push or turn only one control, and the washer does the rest for you. If you select delicate fabrics, for example, the washer automatically provides the proper speeds, water temperatures, and rinsing and spinning times. In addition, laundry aids will be dispensed at the proper time in the cycle. Although programming is simpler to operate, it adds more automatic devices to the washer. In general, the more automatic an appliance is, the more things there are to get out of order. Some washers with program selectors provide less flexibility—a disadvantage if you wish to vary some portion of the cycle.

One manufacturer has introduced a compact control with no moving parts on a washer model called "Solid State Imperial" (Whirlpool). This control tends to increase flexibility by providing almost unlimited control over agitator and spin speeds.

CYCLES

Examine the control panel to see what cycles are represented. You'll want to know how many settings are available, especially for unusual fabrics or soil. You have many choices, the number often closely tied to the price tag. Economy models offer fewer choices, deluxe models more.

What kinds of clothes do you usually have in your washer loads? Are there some rough-and-tumble preschoolers, or some grease monkeys in your family? Do you normally wash mostly cottons and only

a few synthetics? If so, you need a washer for heavy duty, but not necessarily one that offers special cycles for synthetics or light soil. An economy model may be the answer for you.

If your family is the white-collar type, that uses finer fabrics with only light soil, you may need a washer that offers a variety of cycles, temperatures, and speeds. This more deluxe washer will make a bigger hole in your budget, but it will give you more choices with automatic controls.

We hear less now about cold-water wash than we did a few years ago. A research study (2) at Ohio State University showed that better washing results for most items are obtained with hot water.

WASHER CAPACITY

Most manufacturers list their washer capacities at 9, 10, or 12 pounds of dry clothes. A few use indefinite terms such as "standard," "family size," or "extra large." Some merely say that the washer will take a certain number of sheets at one time.

Laundry methods are not included in this publication, but you should recognize that weight of clothes is only one of the important factors in making up your loads. Size of pieces makes a difference in water circulation. Such articles as Turkish towels and bathmats absorb and retain much more water than light-weight smooth-surface items such as synthetics.

We recommend that you plan to wash mixed loads with not more than two double sheets in any load. This will generally give you better results than one load of all sheets, another of all towels, and the like. The exception would be loads that require special handling, such as synthetics. To avoid overloading, it is advisable to plan on a pound or two less than the rated capacity of the washer. Good washing results can be obtained only when the articles have a chance to turn over, circulate in the wash water, and rub against each other.

DISPENSERS

New developments in fabrics and laundry aids brought new problems to washer manufacturers. Laundry products, such as chlorine bleach and fabric softeners, should not be put into the washer at the beginning of the cycle. Dispensers on some models release the proper amount of the product at the proper time during the wash or rinse cycle. Some dispensers are automatic, others are not.

Detergent dispenser—Current models of washers vary widely in their methods of dispensing detergents. Some manufacturers do not offer any device, even on their top-price models. Others have hand-operated dispensers. A few offer automatic dispensers on all of their models. Some offer them as an optional feature. One has a dispenser that operates only with a liquid detergent.

In our opinion a detergent dispenser is not one of the more important features. If the washer you select has this device, make sure that the dispenser is easy to use and clean. Some dispensers are not effective for small loads, because the water doesn't get up high enough to use all of the detergent.

Some of the new detergents do not require a dispenser. "Premeasured" detergent tablets or plastic pockets can be dropped into the tub along with the clothes.

Bleach injector—A device for adding bleach to the washer is not important to families who use little or no bleach. Many manufacturers offer no bleach dispenser, even at the top of their line.

If a bleach reservoir is provided, it may hold a pre-measured amount of liquid bleach for one load or a supply sufficient for several loads. Some provision is made to dilute the bleach before it comes in contact with the clothes. Often the bleach does not enter the washtub until the detergent solution has had a few minutes to act on the clothes. This is often referred to as "timed" bleach injection. This delay permits the optical whitener in the detergent to take effect and still leaves ample time for the bleach to act. When chlorine bleach is added at the same time as the detergent, the effect of the whitener appears to be limited.

A bleach injector on a washer might possibly encourage the use of bleach more frequently than is necessary, especially when the reservoir holds a large supply. The bleach might lose strength before the dispenser is empty. It is possible, too, that the bleach may be released at the wrong time.

Although bleach is helpful occasionally when used properly, it does not take the place of hot and soft water, detergent, and adequate rinsing. Liquid chlorine bleach is fast-acting and potent. It should be used for cold water soaking or in the hot detergent water, never in the rinse. Wise use of chlorine bleach calls for a more thorough job of rinsing than usual. A dispenser probably does a safer job of diluting and adding bleach to the clothes than would be done by hand.

Other dispensers—Some top-of-the-line models have automatic dispensers for a water conditioner and/or fabric softener. Farther down the line, these dispensers may be optional. Few economy models offer them.

The advantage of automatic dispensers is that they save a trip to the washer to add the products at the appropriate time. You must decide whether they are worth the cost they add to the price tag.



Detergent and bleach dispensers

LESS OBVIOUS DIFFERENCES BETWEEN MODELS

WATER FILL SYSTEM

Each washer is designed to use a certain amount of water. If the water supply in your area gets low or the pressure is uncertain, you will want to select your washer with this in mind. There are basically two types of water fill:

Time fill — A timer determines the amount of water entering the tub by controlling the length of time the water runs. This type is found more often on less expensive models. Time fill requires a minimum water pressure of around 15 pounds per square inch to fill the washer within the pre-set time period. Under low water pressure conditions the washer may have to be manually operated.

Meter fill — The amount of water is regulated by a device that permits the water to run until it reaches a certain level. Meter (or "positive") fill does not depend on either a timer or water pressure. Washing action will not begin until the correct amount of water is in the tub.

WATER CONSUMPTION

As a buyer, you are interested in the total amount of water your washer will use and the amount of hot water per load. Most automatics now require between 27 and 48 gallons for one complete cycle. In general, agitator-type washers use more water than the cylinder type. Deluxe models are apt to use more than economy models. Wash-and-wear cycles will likely use more than the regular cycles because of additional cold water brought in before the first spin.



Water savers



From 1/3 to 1/2 of the total amount of water used will be hot, if hot water is used only in the wash part of the cycle. If hot water is used also in a warm rinse, then up to 2/3 of the total water used per load may come from the hot-water tank. If you wash several loads in succession, demands on your hot-water tank will be heavy. You'll need a fast-recovery-type water heater, or you should space your loads far enough apart to give water that is sufficiently hot.

Some washers provide ways of saving water, such as those that can be set for half loads. If you have a suds-saving device, you can direct the wash water from one load into an adjoining tub and reuse it for another load. There are disadvantages here, however. The water will no longer be clean and it also will be somewhat cooler than may be desirable. You will need to add more detergent (a) to insure adequate cleaning and (b) to prevent redepositing of the soil from the first load onto the clothes in the second load. Suds-savers come with some models; on others they are available at extra cost.

RINSING

Adequate rinsing is a "must" for satisfactory laundering. There are basically three types of rinses (3):

Spray rinse — as the tub spins, fresh water sprays in but does not collect in the tub. This is effective for flushing off surface soil and suds.

Deep rinse — similar to the wash cycle in that water comes in up to the normal level and is agitated. No detergent is added, however, and the water is either warm or cold, seldom hot.

Overflow rinse — in this case enough water is present to fill the tub and to overflow at the top as more water keeps coming in. Soil and suds float over the top along with the water during the entire rinse period.

You will profit by placing high priority on a washer that does an especially good job of rinsing. Washers vary in the number and kind of rinses they offer. Among current models you can find anywhere from one to nine rinses. At least one deep or overflow rinse is desirable, preferably more.

³See reference on page 9.

LINT REMOVAL

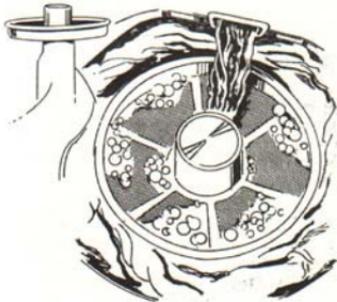
Lint is a constant problem. During the washing process it is loosened from clothes and may redeposit on other clothes.

Most manufacturers provide some means of removing lint from the water. This is often some type of filter, screen, or trap. These devices vary in size, appearance, and effectiveness. Washers with deep overflow rinses have an excellent means of lint disposal, since the lint that reaches the water surface is carried away in the overflow.

Washers that have a lint filter depend on water passing through the filter. Particles of lint collect in this filter as the water circulates. This is accomplished by two general methods:

Agitator design — Normal movement of the agitator sets up water currents. Some agitators are designed to produce more forceful action and will do a better job of directing the water through the filter than others. The filter may be built into the agitator or may fit on top of it. Location of this type of filter dictates its size, which is usually small to avoid interfering with the moving clothes. If you're buying a washer, consider whether all of the water can possibly pass through the filter. If not, some of the lint cannot be removed.

Pump action — This method usually is more effective in removing lint. A pump working continuously forces the water up between the two tubs and directs it back into the inner tub through a screen. This



Lint filter — pump type — General Electric

screen is either located at the point where the water comes back into the tub or is a separate device fitted onto the top of the agitator shaft. In the latter case the screen has to be removed for loading and unloading the washer. The continuous operation of the pump may cause it to wear out sooner than other parts of the washer; it also may mean that the agitator must be removed if you wish merely to soak clothes for a period.

WATER EXTRACTION

A high degree of water removal is an advantage when wet clothes must be lifted from a washer, especially if they have to be carried elsewhere and hung on a clothesline. It also saves on the cost of operating a gas or electric dryer. Let's examine tub construction for a moment, to understand how water is removed from the tub and clothes.

On page 1 we mentioned that cylinder models have perforated inner tubs. Water is removed from this type of tub by spinning at high speed. Centrifugal force sends the water through the holes into the outer tub, from which it is pumped down the drain.

An agitator model with a perforated tub generally stops or slows down to allow the water to drain off before going into the spin. If the tub is of solid construction, the spinning forces the water out through holes located under the rim.

Draining from the bottom has the advantage of carrying out more heavy soil, such as sand. It has the disadvantage of redepositing more lint and soil onto the clothes as the water moves downward.

Each washer is rated for maximum spin speed. The range for tumblers (including combination washer-dryers) is from 180-500 r.p.m.'s*, and for top-loading automatics from 500-710 r.p.m.'s (1). The amount of water extracted from clothes should be greater as the spin speed is increased. However, there seems to be more wrinkles in clothes as the spin speed increases. For this reason some manufacturers of agitator models are incorporating an additional spin speed control, usually around 350 r.p.m.'s. This slower speed is used especially when synthetic articles and delicate loads are being washed.

* Revolutions per minute.

¹ See reference on page 9.

COMBINATION WASHER-DRYERS

A relative newcomer to the field of laundry equipment is the combination washer-dryer. We're including a discussion of the "combo" in this leaflet because what we have been saying about washers applies also to combinations. There are, of course, some differences, some advantages compared to separate units, and some disadvantages.

First a word about the size and shape of washer-dryer combinations. Clothes dryers are of the cylinder or drum type. To combine a washer and a dryer, it is necessary to put both within this cylinder framework. Consequently, combination washer-dryers use the tumble-type washing action.

Space saving is one of the combo's big advantages: A few manufacturers are offering models that are no larger than a separate dryer or washer, about 25-27 inches. Most are somewhat larger, but still fit within a 30- or 32-inch space. Separate pieces set side by side require 50-58 inches.

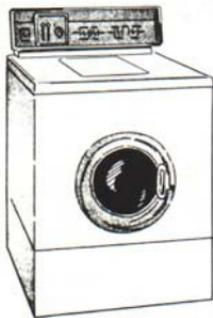
Makes and models— In 1963, one or more combination models are offered by about half the major manufacturers of separate washers*. Most manufacturers have some gas models and some electric, a few make only electric, and one makes only gas (1).

Cost— As with separate units, there are wide variations in combo prices. Average prices of washer-dryers however, are a few dollars less than average combined prices of comparable separate units. In general, you'll find more of the deluxe features as you go up the price scale. You have the advantage of being able to buy one piece at a time if you buy a washer and a dryer separately, of course.

Features— Many of the same features and controls appear on combinations as are shown on separate units. Some manufacturers offer pushbuttons, dispensers for laundry aids, and programing. There may be fewer rinses, but usually 3 to 5 are offered.

Water extraction—Here is an important point to check. In the past, combinations have been noted for a longer drying time, due in part to a slower water extraction speed. Some combos still have a spin speed between 180 and 300 r.p.m.'s. Consequently the clothes carry more water into the dryer than do those washed in a separate washer. Two manufacturers have recently stepped up the spin speed to 525 and 560 r.p.m.'s; others may follow suit.

Drying time—One objection to a combo is that you can do only one load at a time, while you could be doing two loads at once in separate pieces. Don't forget that your dryer is idle when you're washing your first load, whether it is a separate unit or part of a combo. And while you're drying your last load, the washer is idle in both cases. However, if you are doing several loads, you will gain some time by using separate units.



Combination washer-dryer.

*Easy, General Electric, Maytag, Norge, O'Keefe and Merritt, Philco, RCA, Whirlpool, Speed Queen, Westinghouse.

Special advantages of washer-dryers (4):

- We have already referred to the matter of saving floor space.
- The drying cycle automatically takes over after the washing cycle is done.
- You don't have to transfer the clothes to the dryer.
- You don't lose time in-between if you are not on hand when the wash is finished.
- Since washer-dryers are of the cylinder type, there may be less redepositing of soil or sand.

Possible and real disadvantages of combos:

- When your combo breaks down you may have both the washer and the dryer tied up. However breakdowns also occur with separate units. Since combos are more complex, you should expect as many service calls as for two separate pieces.
- We have referred to water extraction above.
- You are limited in the type of detergent you can use. Since any cylinder washer creates more suds, you'll need to use a low-sudsing detergent to avoid complications. You may have difficulty determining the exact amount of low-sudser you need, although this can also be true if you use a normal sudsing detergent.

OTHER POINTERS IMPORTANT IN SELECTING A WASHER

Whether you are buying a separate automatic washer or a combination, there are other important items for you to check:

SAFETY

Notice whether the manufacturer has taken necessary precautions for your safety. Proper grounding is essential for either a gas or electric model, to prevent any danger of electric shock. Most washers have a 3-conductor cord, that includes a ground wire. This cord has a 3-prong plug that should be connected to a 3-hole outlet that is part of a grounded house circuit. A licensed electrician will make the proper connection for your washer. The Underwriters' Lab-

⁴ See reference on page 9.

- It is more difficult to wash woolsens by the soak (without agitation) method, since the drum tumbles during fill. It can be done, however, but requires more handling of the article being washed.
- Some people do not find a front-loader as easy to load and unload as a top loader.
- Average life of a separate dryer under the original owner may be about 10 years. Average life of a separate automatic washer is about 6-8 years, depending on how hard you use it. Since a combination is even more complex than a separate washer, life expectancy is nearer only 5-6 years at present. And you can't trade in, and replace, only the half that gives out!

General — We have not attempted here to give the dryer side of the combo picture. There are two general methods of removing lint and moisture from the dryer of combos. One of these is by venting, the other by the water-condensation method. The type you select will depend in part on whether you can vent your unit to the outdoors without extensive ductwork. There is also a price difference between models. If you're interested in a washer-dryer combination, you might wish to send for our leaflet on dryers*.

*E-389, Choosing and Using Your Automatic Clothes Dryer, 1963, Michigan State University, East Lansing, Michigan.

actory Seal of Approval* should appear on the appliance name plate and/or in the instruction book. While this seal cannot guarantee performance, it tells you that the appliance has passed certain tests relating to fire and casualty hazards.

Find out whether the washer will stop operating if it overheats. All front-opening types and most top-openers stop if the door is opened during spinning. It is desirable for top-loaders to have an automatic lock on the lid during spinning, provided the spin doesn't stop when the lid is opened.



INSTALLATION

Water pressure between 20 and 120 pounds per square inch is necessary. You will need plenty of soft water, both hot and cold, and a drain.

Electrical connections are important. For an automatic washer you'll need a separate 120-volt circuit. It is recommended that the circuit be wired with at least a #14 wire and be protected by a 15-ampere time-delay fuse or circuit breaker. A gas combination model requires a 120-volt circuit similar to the one described above. An electric combo requires a specially wired 240-volt circuit. (This could be another disadvantage unless you already have 240 wiring.)

Most automatics no longer need to be bolted to the floor. All appliances should stand level, but it is doubly important that automatic washers be level for proper operating balance. Much of the noise when these appliances are in use is due to equipment not being properly leveled.

SERVICE AND WARRANTY

Any piece of equipment that has moving parts is going to require service. Automatic controls also need more service. Be sure to allow for this in your spending plan. Careful attention to your instruction book will help you to cut down on service calls. Don't ignore manufacturers' recommendations for proper loading, type of detergent to use, and care of your appliance. Each manufacturer spends thousands of hours testing his equipment before making recommendations for its use and care.

The manufacturer's guarantee or warranty is important. Before you buy, check with your dealer about servicing. Find out what you can expect in the way of service, who'll pay for it, who'll do it, and whom you should call. You need to count on prompt local service from trained servicemen to help make the guarantee or warranty effective.

IT'S UP TO YOU!

An automatic washer is a convenience. It is also a time and energy saver. But it is something of a luxury if your first consideration is money. Conventional type wringer washers are less expensive to buy and operate, they use less water, they require fewer service calls, and they last longer. Yet, less than one out of four washers sold is a conventional model.

Any washer may be a luxury for you if you have comparatively little washing to do and are handy to a self-service laundrette. Some people send their flat work and/or shirts to a commercial laundry.

An automatic washer may or may not be the answer for you. We have attempted to give you both pros and cons to help you make the best decision. From now on it's up to you.

REFERENCES

1. Electrical Merchandising Week 1962 Statistical and Marketing Section, January 1962
1963 Statistical and Marketing Section, January 21, 1963
Specifications for 1962 Washers, Dryers, and Combs
2. Ohio Farm and Home Research, 1957, Wash Water, Should It Be Hot or Cold?—Weaver
3. What's New in Home Economics, October, 1961. Talk by Dr. Max Fuller, Maytag Company
4. Consumer Reports, 1960, May and August Issues.
5. Forecast, November, 1960, New Buyer's Guide to Automatic Washers—Burke
6. Household Equipment—Peet and Thye, 5th Edition, 1961
John Wiley and Son's, Publishers
7. Equipment in the Home—Ehrenkranz and Inman, 1958
Harper and Bros. Publishers
8. Consumer Bulletin, June 1963

OTHER LEAFLETS IN THIS SERIES INCLUDE:

- Choosing and Using Your Automatic Dishwasher, E-388
- 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 Household Range, E-393

For additional information, see the following Michigan State University Cooperative Extension Service Bulletins:

Using Modern Laundry Aids, E-400

Problems in Textile Care, E-401

Easy Care—Do I Select It at the Store, E-402

Shop Labels as Well as Looks, E-403

To simplify information, trade names of products have been used. No endorsement of named products is intended, nor is criticism implied of similar products which are not mentioned.

Cooperative extension work in agriculture and home economics. Michigan State University and the U.S. Department of Agriculture cooperating. N. P. Ralston, Director, Cooperative Extension Service, Michigan State University, East Lansing. Printed and distributed under Acts of Congress, May 9 and June 30, 1914.