

Raker

Appliance Repair Professionals, Inc.

Dishwashers

Manual 13

Harry D. Raker

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ISBN 0-976228-69-6 (Volume 13)
ISBN 0-976228-60-2 (27 Volume Set)

WARNING

SAFETY PRECAUTIONS

Safety is very important when working on any appliance .

Disconnect power before servicing any appliance.

Always keep the work area and your shoes dry.

All appliances have sharp edges and should be handled carefully.

Before working on any gas appliance extinguish all open flames and before attempting any gas associated repair, cut off the gas feed.

Always sniff for gas leaks and soap bubble test any parts that may have been disturbed by repair work.

To minimize any potential buildup of gas in case there is a leak, always have the room open to the outside.

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DISHWASHERS

Introduction

Dishwashers crept into the marketplace in the 50's with Kitchen-Aid leading the way.

Initially, only the high-income customers could afford dishwashers. Kitchen-Aid was a name marketed by the Hobart Corporation. Hobart had been in the restaurant equipment business for many years and were the first successful makers of a domestic unit.

The early Kitchen-Aids were extremely well built and no doubt were very similar to those used commercially. Things have gone downhill since then. The original dishwashers from Kitchen-Aid easily lasted 25 years. Today Kitchen-Aid, along with all other brands are entirely plastic. A life span of 10-15 years is closer to average.

Typical GE Dishwasher (Fig 13-01)



Manual 13, Dishwashers

The overall design of dishwashers has changed little since their introduction. The dishes are washed and rinsed in pure hot water. A controlled amount of hot water is allowed to enter the washtub for several wash cycles. Dishwasher detergent is during those cycles and then drained at the end of each.

During the wash cycle, the water recirculates through a pump and is sprayed at the dishes under high pressure. A spray arm rotates in the bottom and top distributing the water all over.

The rinse cycles are identical to the wash except that no detergent is present. At the end of the last rinse all water is drained out.

The dry cycle allows the dishes to dry from the leftover heat of the hot water. In more expensive models, the drying time is decreased by a heating element in the well of the dishwasher. The better brands include a hot air blower that dries the dishes.

There are many variations of this basic pattern, but they all amount to the same simple idea. Theoretically, there isn't much to a dishwasher when compared to a washing machine. It doesn't agitate and spin a heavy load of clothes. Nevertheless, they still generate a lot of service calls. The calls are caused by the following failures:

1. Foreign objects continually get into the pumping system.
2. One side of the wash chamber is a door. The door is under constant pressure from the hot water. It is continually opened and closed, and it comes as no surprise, that it frequently leaks.

**Quick Disconnects
(Fig. 13-02)**



3. The motor is always mounted under or close to the pump system (Maytag is the only exception.). Leaking water often damages it.

The majority of dishwashers are built into a 24" cabinet. The water, drain and wiring are all permanent. Years ago portables were very popular. When in use, portables connect to the sink faucet.

The hose and quick disconnect caused a great deal of service problems. They leak and blow off the sink adapter. (The disconnect has a pressure release that must be used prior to disconnecting.) The hose system is expensive and nasty to replace. Many of the faucet disconnects are rebuildable in the field.



Replacing a Dishwasher

Many customers ask about installation of a new dishwasher.

A replacement requires disconnection and reconnection of the power supply, water and drain line. The water line is the most time consuming. It must be done in copper and often requires sweat soldering a new line.

Uncle Harry's
Trick of the Trade # 222

Never use a rubber hose to supply hot water to a dishwasher.



Once the unit is in place it must be adjusted to line up in the cabinet and then screwed into position. A normal installation takes about two hours. For years, plumbers have been charging \$100.00 for the job. Some retailers discount the installation as low as \$50.00 to get a sale.

Compared to repair work an installation is a loser. It takes too long for the money and is physically tiring. If delivery and removal of the old unit are involved it really turns into a bad deal.

Running a New Copper Line (Fig. 13-03)



Dishwasher detergent

Dishwasher detergent is totally different from laundry detergent. It was developed specifically for use in a dishwasher. It is far more caustic than normal detergents. Far more important, it includes a **suds-retardant chemical**. If a homeowner accidentally uses hand or laundry detergent instead of dishwasher detergent, the dishwasher will flood! The high-speed impeller of the dishwasher will churn up an enormous cloud of soapsuds and cause soapsuds to pour out of every opening.

Dishwasher detergents cause overflows for other reasons. The suds retardant chemicals lose their effectiveness under certain conditions.

1. If they are very old. Some fail after only six months, but all fail after a few years.
2. If they have ever been frozen.

Uncle Harry's
Trick of the Trade # 223

Beware of a hard to find leak. It may only be bad detergent. Ask carefully worded questions about the detergent.

Dishwasher detergents are designed to be used in very hot water, ideally 140°F. Being energy conscious, many homeowners set back their water heaters to below 130°F. By the time the water gets from the water heater to the dishwasher, it may be too cold to correctly dissolve and rinse the detergent.

"My dishes are not coming out clean"

Dishes and glasses that have been improperly washed and rinsed have a characteristic look. A clear glass held up to sunlight will have milky, faint, gray streaks that are very difficult to remove. In other cases, there may be tiny granules stuck to or even imbedded in the glass surfaces. In many cases, these characteristic stain patterns are permanent and cannot be removed from the glass. Both of these cases are a result of either:

1. Too low a temperature of water.
2. The water is not hitting with enough force to generate good washing and rinsing.

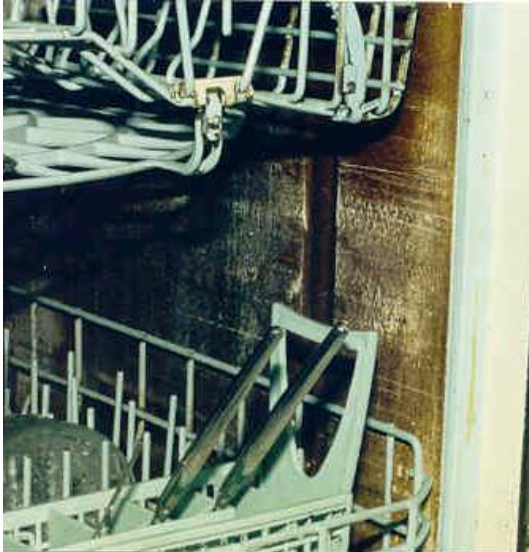
Diagnosing poor cleaning requires a check of the incoming water temperature as well as mechanical conditions within the dishwasher. In some cases, the dishwasher may be working properly but doing a poor job solely because of the lack of high-temperature water. Newer detergents have been modified to work somewhat better in colder water.

Iron Staining

Some areas of the country have high concentrations of iron in the water.

The iron gradually stains the inside of the dishwasher, turning it brown. The stains are very hard to remove and frustrate homeowners.

Badly Stained Dishwasher (Fig. 13-04)



Uncle Harry's Story Time

I once found a dishwasher that had been connected to the cold water line instead of the hot. The only heating came from the element submerged in the water. Believe it or not it had been that way for seven years!

The supplemental element was heating to a barely acceptable temperature and providing very marginal washability.

Where the dishwasher is remote from the water heater, advise the customer to run a hot water faucet several minutes before turning on the dishwasher. This will heat up the water lines. Otherwise, the first wash will be in cold or lukewarm water.

Few homeowners are aware of the many rust removal products that are available. Citrus liquids such as Tang are also effective in removing the stains.

Uncle Harry's
Trick of the Trade # 224

Carry a rust remover on the truck (such as Maytag's Rust Rover) and impress your customer by cleaning their dishwasher. It only takes five minutes to throw in 1/4 cup of rust removal chemical turn the unit on. It will come out sparkling clean!

In order for a dishwasher to work properly requires the following:

1. A supply of hot water at 130°F or higher.
2. Sufficient water in the sump to keep the pump system full.
3. Enough pump pressure to beat the dirt of the dishes.

Lacking any one of these three requirements will result in:

"My dishes are not coming out clean."

Universal Components

Many dishwasher components are universal. They are:

1. The water valve.
2. The recirculating pump and motor.
3. The drain system.
4. The spray arm and tower.
5. The high-level safety switch.
6. The electrical connection box.
7. The door safety switch.
8. The door gasket.
9. The door hinges and springs.
10. Soap dispensers.
11. The wiring harness
12. The timer and selector switch.
13. Heating and drying systems.
14. The dish racks and tracks.

1. The Water Valve

Dishwasher water valves have a lot in common with the washer water valves. However, there are two differences:

1. A dishwasher water valve is a single valve only controlling hot water.
2. The connection to the valve is not a rubber hose, instead, it is copper.

Valve failures follow different patterns on dishwashers. The clogging of the inlet strainer, commonplace on washing machines, is much rarer on dishwashers. Most of the sediment develops on the cold-water side rather than the hot water side. The hot water supply goes through the water heater first and it collects most of the grit and deposits.

Water Valve Failures

1. A Bad Coil

Finding a bad water valve coil is common on a dishwasher; it is rare on a clothes washer. It is best diagnosed by connecting a voltmeter to the prongs of the valve of the dishwasher, while it is in operation. If the meter shows 110 VAC and no water is flowing, (assuming that water pressure is on), the valve is bad.

Uncle Harry's

Trick of the Trade # 225

Some coils fail after **10-30 minutes** of operation. Unless you know this pattern, it can be very difficult to diagnose.

Use the hair dryer technique as described on gas valve diagnosis (Trick of the Trade # 62).

The valve may work fine all the way through the wash cycles and fail when it reaches rinse. No doubt one of the fine wires in the coil is broken and open circuits when the valve body gets hot enough. It will re-connect when it cools down and shrinks.

If you suspect a coil problem it may help to have the customer turn the dishwasher on well before your arrival. When you arrive it will already be hot. Leave the voltmeter connected on the valve's leads and listen to the flow of the water while watching the meter.

Uncle Harry's
Story Time

I've seen coil failure drive an intelligent homeowner nuts on more than one occasion. One customer replaced a \$100.00 timer only to find that the failure persisted. After he described accurately the sequence of the failure to me, I told him immediately that he had a bad water valve. He was very reluctant to believe me. He kept the old valve for analysis. He planned to heat it up ;and check continuity while it was hot.

I haven't heard from him so it must be fixed.

2. Dribbling

Some valves may allow a trickle of water to flow when off. The dishwasher may fill up overnight.

3. Flooding

A flooding water valve is also possible, but rarely occurs. Again, this is due to the lack of grit in hot water.

4. Overfilling

Lastly, and rarest, is a water valve that allows **too much** water to come in during the fill cycle. Dishwashers are "time fill" devices like icemakers. They do not have a water level switch controlling the water height like a washing machine. Many do have a level switch, but it is purely a high level **safety**.

The quantity of water is controlled by the **length of the fill time**. A valve that allows too much flow in the allowed time is corroding internally and requires replacement.

Uncle Harry's

Trick of the Trade # 226

A dishwasher that is overfilling and operating on the high limit safety will tend to leak at the door seals. The door system is not designed to seal more than **one inch of water covering the bottom of the dishwasher**.

In some cases, the water will get deep enough to hit the bottom of the spray arm. The turning spray arm will then make waves and splash water under the door seals.

Sample Water Valves (Fig. 13-05)



Replacing a Water Valve

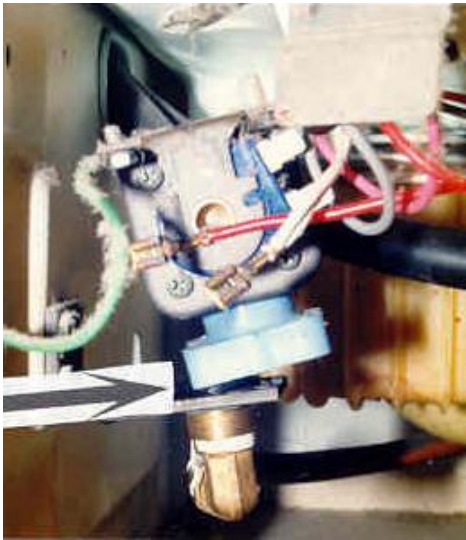
There are dozens of different dishwasher water valves. Most of the variations are in the mounting brackets.

Uncle Harry's
Trick of the Trade # 227

Always reuse the mounting bracket from the old valve. A Whirlpool valve (part # 4171000) will fit 95% of all dishwashers.

When replacing a valve avoid changing the piping. Working with piping is more time consuming and can create leaks. Simply remove the four screws holding the bracket to the valve and use the a new valve body.

Replacing a Valve, Short-Cut Method (Fig. 13-06)



On older Kitchen-Aid and Maytag models a double-coiled valve was used. Both coils control the flow, and act as a double safety. **Both** need to be open to allow water to flow. The double valve design has now been eliminated for economic reasons, and a single is being used.

It is sometimes a stretch to get the short rubber tubing fitted on a stubby single valve.

Uncle Harry's
Trick of the Trade # 228

Uncle Harry carries a double valve in stock. This takes care of the occasional poor fit of the smaller single valve.

2. The Pump and Motor System

After the water fills for its prescribed time, the timer advances and turns on the pump motor. The motor rotates impellers within the pump housing and generates water pressure. Water fills the housing and begins squirting out the holes in the spray arm. The squirting water performs two functions:

1. The force of the water leaving the spray arm creates a jet propulsion reaction and causes the spray arm to rotate backwards. As the arm rotates, water is sprayed inside the cabinet.

Uncle Harry's

Trick of the Trade # 229

Water is sprayed in all different directions, **except down**. Any spray arm with a crack on the lower half will cause a leak at the door.

It's critical to understand the spray pattern inside the closed cabinet. All of the holes in the spray arm direct water upward. None of the water is directed horizontally or down. A correct spray pattern is important because the hinged bottom of the door is **not** a watertight seal. On most dishwashers, it is simply an **overlap**. On some brands the bottom overlap is the hot air outlet.

Careful inspection of the spray arm and spray arm hub is important in diagnosing a door leak.

The water in the pump is recirculated during each wash cycle. It is common for food, glass, and utensils to get caught in the inlet of the pump. Many models have filtering screens to strain the debris as the water is recirculated. In some cases, particularly Kitchen-Aid and GE, these strainers become clogged. Low pressure and poor washing result.

Many brands have small blades to chop up the left over food as it flows through the pump system. Some designs are more successful than others.

Most pump designs include two impellers, a lower one for draining, and an upper one for spraying the water. A common motor shaft drives them both. The exceptions, Maytag and GE, will be covered under specific brands.

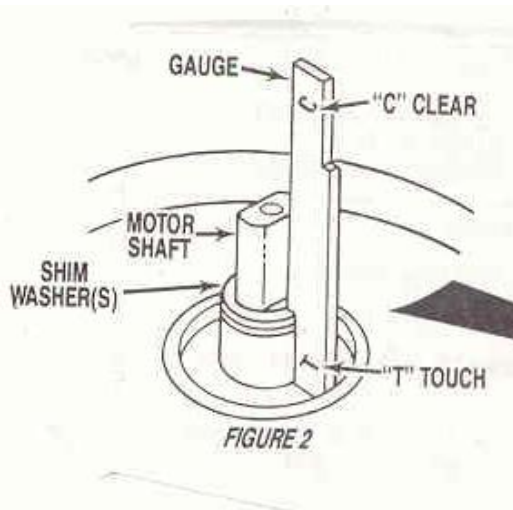
The wash impeller housing is not a typical source of service calls. Instead, calls tend to come from the drain impeller mounted below. The drain impeller is a smaller, closer intolerance pump. It forces the water and debris down the drain line.

Debris in the pump housing will damage the drain impeller and result in noise or poor performance. Beneath the drain impeller is a rotating seal that holds back water. A seal failure will cause leakage, rust, corrosion, and motor failure. The drain seal comes in a kit with a new drain impeller.

Taking apart the upper and lower pump system is straightforward. Just remove screws and sections as needed.

Uncle Harry's
Trick of the Trade # 230

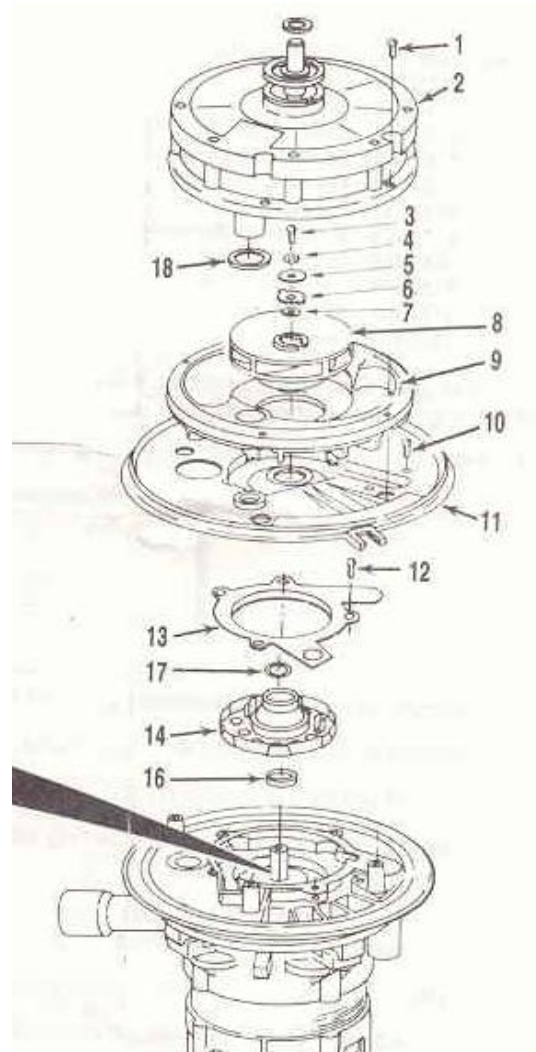
Always line up the pump parts in the sequence they were removed. This saves time and thinking on reassembly.



Some impellers may stick on the motor shaft. A rust release agent will help. Some old models may require heating with a torch to ease removal. Newer designs are made of plastic and don't corrode.

Reassembly takes time because of the tight clearances. Shims are often provided to adjust the positions of the impellers. Kitchen -Aid in particular is tricky to get exactly right.

Exploded View of Kitchen-Aid Shims (Fig. 13-07)



3. The Drain system

Water exiting the pump is connected to the plumbing by a 5/8" rubber hose. A layman might think,

"Well, why bother discussing the drain hose? It's just a piece of hose."

Typical Air Gap (Fig. 13-08)



The drain hose is a **frequent** source of service problems. It actually consists of the following components:

3. An air gap mounted on the sink
4. The connection to the disposer or the drain pipe.
1. The rubber hose itself.
2. Any connections between sections of rubber hose.



Air Gaps

First a little theory. Current plumbing code requires that all dishwasher drain lines pass through a sink-mounted air gap before entering the drainage system. The air gap acts as a check valve and eliminates the possibility of sewage water backflowing into the dishwasher from the drainage system. Older installations may not include an air gap. They may only have an elevated loop in the drain line.

A clog in the air gap is the easy to check. Most modern air gaps are plastic and can be easily disassembled and checked for a clog. The older copper ones need to be replaced if they are clogged.

Clogged Air Gap (Fig. 13-09)



A clogged air gap will cause one of two problems. The air gap will flood all over the sink or water will back up in the dishwasher.

Uncle Harry's

Trick of the Trade # 231

Air gaps make a distinctive noise when they operate. Listen for the water flow and gets used to the sound. A clogged one sounds different. It is possible to hear the air whistling out of the gap as water approaches and jams.

The Disposer Fitting

In many homes the air gap empties into the side of the disposer. A clog at the disposer inlet fitting will cause the air gap to overflow onto the countertop.

Fat and food are constantly thrown up against the inlet fitting. Frequent use of the dishwasher flushes out any build-up. If the dishwasher is seldom used the build up will plug the inlet and solidify. Single and elderly people are prone to this problem because they don't use their dishwasher frequently.

The Dishwasher / Disposer Fitting and Kinked Line

(Fig. 13-10)



Removing the rubber line and cleaning out the jam with a screwdriver easily cure the clog.



The Drain Hose

The drain hose itself clogs. Sometimes a kink is very obvious. Other times the clog will be hard to locate. Clogs form in the following spots:

- a) Any sharp bends.
- b) Any change in diameter.
- c) At any fitting.

On some clogs, it is difficult to decide whether to take apart the pump or the drain line. It not always easy to remove a drain line to test it because they wind through the cabinet. The pump may be old and rusted.

A Temporary Drain Line (Fig. 13-11)



Uncle Harry's Trick of the Trade # 232

If nothing is obvious, the easiest way to narrow the problem down is to connect a temporary drain hose. Connecting a temporary line is often faster than removing and reinstalling the actual hose of disassembling the pump. Run a line from the dishwasher pump motor to a bucket.

A temporary hose will quickly indicate which way to proceed. When tested, if the bucket fills quickly, the built-in line is clogged. If the water only trickles into the bucket, there is a pump problem.

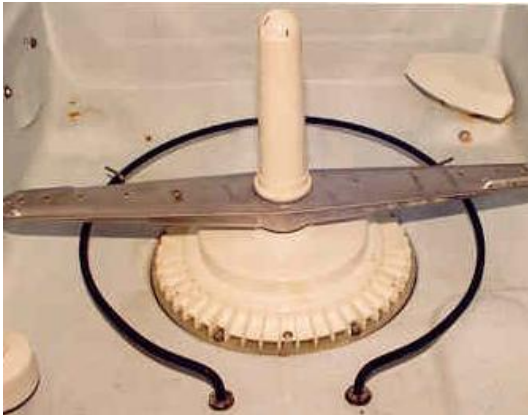
If the hose is at fault, repair or unclog it as needed. Sometimes, the hose may be enclosed in a cabinet and be inaccessible. It may be much easier to run a new drain line and leave the old one behind.

4. The Spray Arm and Tower

Correct operation of the spray arm is critical to good cleaning. There are three failures:

1. Food will clog the holes in the spray arm.
2. The spray arm will crack and lose pressure.
3. The spray arm bearing will bind and not allow free rotation.

Sample Maytag and Whirlpool Spray Arms
(Fig. 13-12)



The spray arm sits on top of the spray arm support or spray tower. The tower is critical to good spray arm operation. It must seal to the arm so that all of the water squirts out of the arm. It must allow smooth rotation of the arm.

Uncle Harry's

Trick of the Trade # 233

Testing a spray arm

To provide a reference point set the spray arm so that the arms line up with the sides of the dishwasher. Run the dishwasher a few seconds (full of water) and quickly open the door. The arm should be rotating and coming to a stop. (You may get a little wet performing this test.) If the arm is in the same spot, there is a problem with either the arm, the tower, or the water pressure.



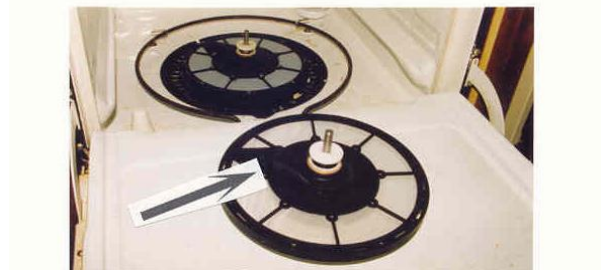
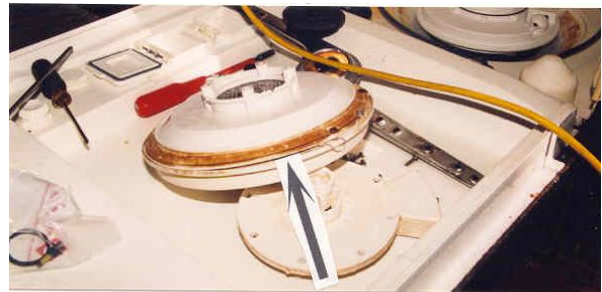
Many models have a secondary arm built into the top of the dishwasher or into the rack itself. The secondary arm is seldom a problem and does little washing. Occasionally the line supplying water to the upper arm leaks. This is a weak spot on some Kitchen-Aid models.

Careful visual inspection of the arm and tower will usually locate the problem.

Split Towers

On a few models of Kitchen-Aid and Whirlpool there is a pressure chamber built into the top of the arm support. The chamber is heat welded plastic and splits. When it does poor washing results.

Two Split Tower Supports (Fig. 13-13)



5. The Water Level Safety Switch

The level safety is a small float mounted above a micro-switch. If the water level in the base of the dishwasher gets too deep, the float activates the micro-switch and shuts off the water valve. The float is not activated under normal operation. It acts only as a high-limit.

A Jammed Float (Fig. 13-14)



The float mechanism fails and shuts off the water for three reasons:

1. The float will get stuck in the up position because of sludge buildup underneath.
2. It will stick in the upright position because a fork or other object is jamming it.
3. The control micro-switch will fail or corrode.

Uncle Harry's
Trick of the Trade # 234

Anytime a dishwasher is not getting any water first check the float switch.

6. The Electrical Supply Box

According to the National Electrical Code, a dishwasher is supposed to have its own 20 amp circuit. Power enters the dishwasher at a small metal connection box. In the box, #12 copper is connected to the dishwasher wiring.

Uncle Harry's
Trick of the Trade # 235

Burned up wiring in the connection box is a very common source of service calls.

Burned Out and Repaired Wiring (Fig. 13-15)



If the complaint is,

"My dishwasher smoked and went dead,"

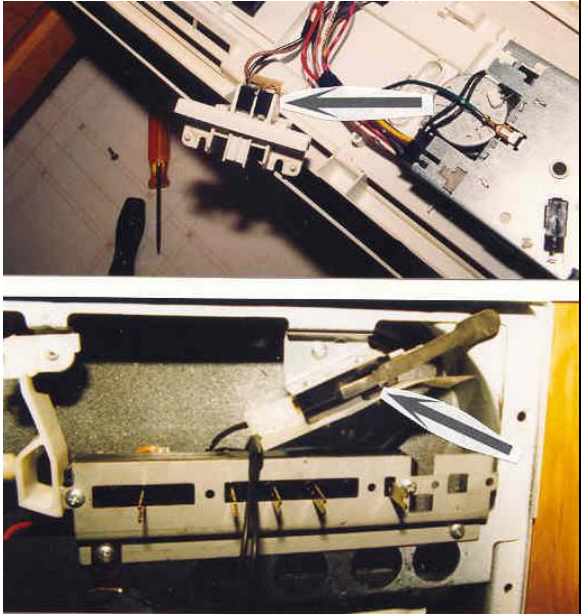
the connection box is the first place to check. Chop back the bad wiring and install fresh wire nuts to clean up the connections.



7. The Door Safety Switch

The door safety switch is a micro-switch mounted in the door. A plunger or the latch mechanism operates it. The full current of the dishwasher goes through the door safety switch and it frequently fails. Either the micro-switch or the wiring connected to it will burn out.

Whirlpool Door Switch Set and Typical Kitchen-Aid Door Switch (Fig. 13-16)



In many cases the plunger or arm that operates the micro-switch will be damaged, missing, or bent. Door switches come in numerous configurations.

The current design Whirlpool door latch includes a pair of identical microswitches. These switches have been a frequent source of service calls.

“My dishwasher won’t start. It just went dead.”

8. The Door Seal

A leaking door is a **red-flag caution area** for the appliance service tech.

It is a common dishwasher problem and can quickly lead to trouble.

Uncle Harry's

Trick of the Trade # 236

Leaks around the door are not usually the result of a bad gasket.

It's a bit embarrassing to replace a door gasket and still have a leak. The sources of door leaks are:

1. A mounting bracket or mounting screw interfering with door closure.
2. Bad door latch device.
3. A bad spray arm or spray tower.
4. Too much water in the dishwasher.
5. Improper loading of dishes in the dishwasher. A large plate can ricochet water against the lower overlap.

6. Old or incorrect detergent.

7. A twisted door.

8. Sprung door hinges causing misalignment.

9. Holes in the door panel, such as loose soap and rinse agent dispensers.

The door is designed to divert small leaks back into dishwasher. A small amount of water dribbling down the gasket will not cause a leak. The leak must be fairly significant to show. A gasket need to be replaced if one of the following occurs:

1. It has become old and hard and lost its rubberiness.
2. It is visibly torn or deformed by a damaged door.
3. It is coming loose from its mounting clips and water is creeping behind it.

A thorough investigation of the gasket surfaces should uncover the reason for the leak. On some designs it's helpful to take off the outer door cover and watch the dishwasher operate with the cover off.

Watching the splash patterns and water depth are helpful in confirming or directing a diagnosis.

It's very important that other sources of leaks be eliminated before replacing a door gasket. A valiant effort should be made to determine exactly **where** the door is leaking before replacing a gasket.

Replacing a Door Seal (Fig. 13- 17)



9. Door Springs and Hinges

Broken door springs are probably the most common dishwasher call. The ends of the springs snap off and result in a very heavy door. The springs supply a counterbalance to the weight of the door. Door springs are not interchangeable from brand to brand although one set will frequently cover a lot of models within one brand.

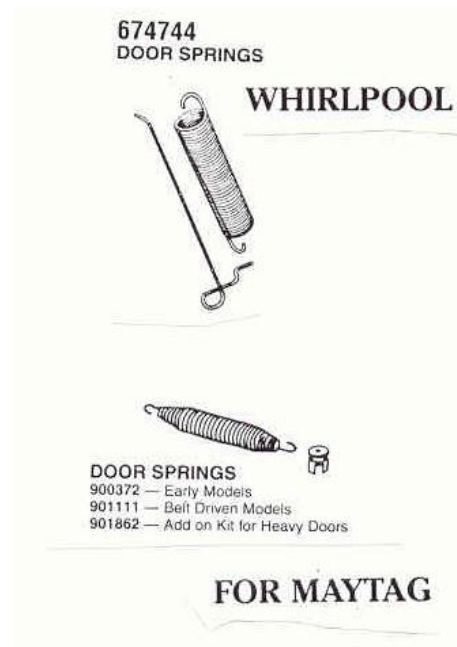
Always replace the door springs as a set. It's safe to assume that if one breaks, the other one is close to breaking. If a door spring replacement is postponed for several months, the weight of the door crashing down will eventually ruin the door hinges. The door hinges will buckle from the weight and allow the door to fall all the way to the floor. The can also occur when children climb onto an open door.

Door Springs (Fig. 13-18)

Uncle Harry's Story Time

A customer called to have the hinges replaced on a fairly new Kitchen-Aid. Company with small children had stayed a few days. One of the children had broken the door by climbing on it. I ordered the hinges and replaced them.

About six months later, she called again to order another set. The same company had come back for a second visit, and brought the same child.



Door Hinges

On most brands, the door hinges are separate from the door. However on a few brands the hinges are part of the inner door liner. In the latter case, broken hinges necessitate rebuilding the entire door.

Some dishwashers are installed with a trim kit. The trim kit holds panels of wood that match the cabinets in the kitchen. This increases the weight of the door considerably and stretches the springs. Doors with trim kits have more frequent spring and hinge problems.

Broken Hinges (Fig. 13-19)



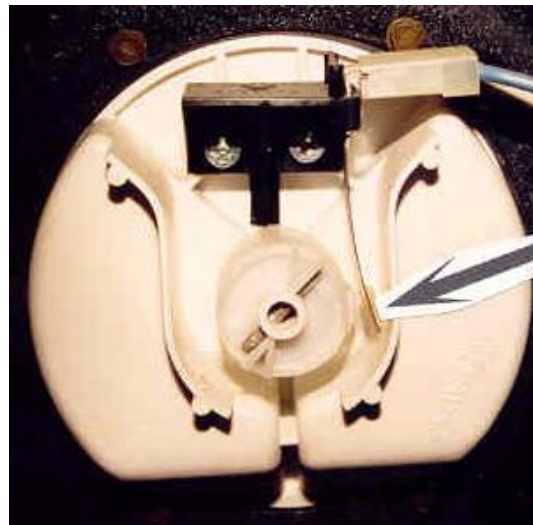
10. Soap dispensers

Soap dispensers are another popular source of service calls. Soap dispensers usually have either one or two doors that are opened at predetermined points in the wash cycles. When the dispensers fail, the doors don't open and dispense the soap.

In order to gain access to the soap dispenser, the outer shell of the door needs to be removed. Soap dispensers operate two different ways. On newer model dishwashers, the door is opened by plastic linkage tied to the rotation of the timer. The earlier design, which creates more service calls, operates on a bi-metal heater.

A Flexed Maytag Bi-Metal (Fig. 13-20)

The bi-metal device holds the door closed, when it is at room temperature. Part of the way into the main wash cycle, the bi-metal is connected in series with the wash motor. The 5-7 amps. of motor current is enough to heat up the bi-metal and bend it. The bending motion releases the door and a spring flips it open.



Dispensers also fail because of soap build up and bad bi-metal heaters. Sometimes, a visual inspection will tell you what's wrong. On Kitchen-Aid, in particular, the wires often burn off at the soap dispenser connections. On occasion they create a lot of smoke in the process.

Burned Kitchen-Aid Bi-Metal
(Fig. 13-21)



Testing Soap Dispensers

If nothing is obvious, operate the soap dispenser manually with a screwdriver or your fingers. Test if it will open and close manually. If the soap dispenser passes the visual test and the manual operating test, go to an operational check.

The dispenser only operates at one particular point in the timer rotation. Finding the timer segment that opens the soap dispenser is tricky. There are three ways to find the spot.

1. Set the timer at the beginning of the main wash cycle and wait.
2. Clamp an Amprobe around one bi-metal wire and rotate the dial until the meter shows the motor current.

Testing with an Amprobe (Fig. 13-22)



3.

Uncle Harry's Trick of the Trade # 237

Pull a wire loose from the bi-metal heater and rotate the timer in the main wash cycle until the motor quits running. The disconnected bi-metal breaks the circuit. Reconnect the wire and watch the soap dispenser operate.

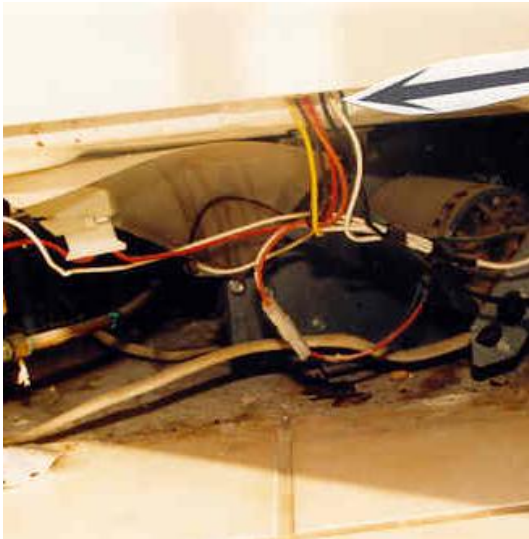
On some brands the bi-metal is available separately; on others, it is part of the whole soap dispenser.

11. The Wiring Harness

The wiring harness warrants special mention. All of the door circuitry enters through a cable at the bottom of the door and bends every time the door is opened and closed. As a result of all this flexing, a break can occur at the flex point. (Remember Kenmore wig-wag wiring?)

A quick diagnosis can often be made. A broken wire in the door cable will result in a dead dishwasher. If such is the case and nothing else is obvious, ask the customer if they smelled anything or heard anything, when the dishwasher failed.

Flex Point on a Frigidaire (Fig. 13-23)



Uncle Harry's

Trick of the Trade # 238

Sniff down where the wiring harness bends. Often there will be lingering odors, providing evidence of arcing or sparking of the wires. Tugging on the cables individually will usually expose the culprit, much like it does on a wig-wag assembly.

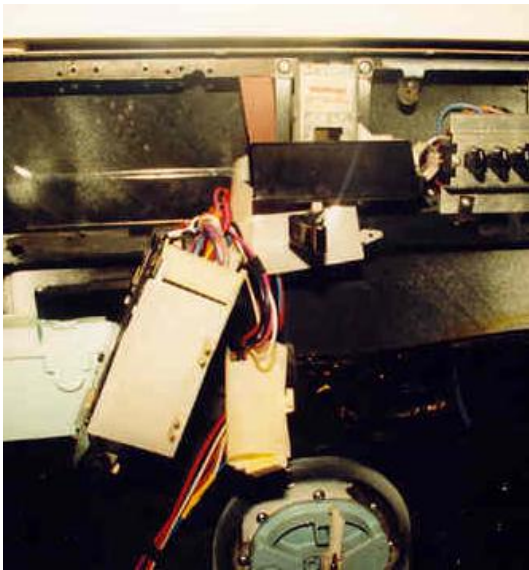
Install a 12" piece of wire and splice it away from the flexing area. Do not splice the wiring near the flex point or it will quickly break a second time.

12. The Timer and Selector Switches

Timer failure is less common on dishwashers than on the other appliances studied. A few brands have their own peculiar failures that will soon be covered. Timer failures are diagnosed in exactly the same way that they are on a washing machine. For instance:

1. Will not advance.
2. Dead spots.
3. The motor starts and stops if the timer dial is jiggled.

Replacing a Kitchen-Aid Timer (Fig. 13-24)



Selector switches are seldom a source of trouble. But when they are, the problems are easily found. The selectors gum up and the buttons will not operate. Another problem is a dead spot at one selection.

Diagnosing models with hidden timers.

Expensive models hide the timer. They use timers with two drive motors, one fast and one slow. The slow motor advances the timer through the normal cycle. The fast one is used for rapid advance and cancel. Because the timer is buried within the cabinet, the shaft is not exposed for manual advancing and testing.

Uncle Harry's
Trick of the Trade # 239

Pushing cancel for a few seconds to advance the timer, following quickly by a normal selection, can speed up diagnosis. Alternating back and forth between the buttons will test each part of the entire cycle.

Control Panel of Hidden Timer, "Water Heat" Kitchen-Aid (Fig. 13-25)



13. Heating and Drying Systems

Dishwashers have two types of heating systems, one for air and the other for water. The most common type is a cal-rod element submerged in the water-filled well of the dishwasher. The element is used to supplement the heat from the water heater. It also heats the air for drying.

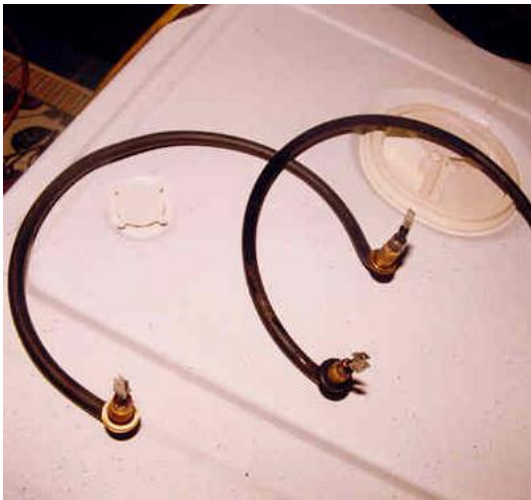
Upper end models have a "sanitize cycle." The sanitize cycle is used to kill bacteria on the dishes. During the sanitize cycle, the dishwasher pauses to allow the water temperature to get up to 180°F. When the water is hot enough a thermostat checking the water closes and resumes the cycle.

Heating Element Failure

Heating elements don't fail often. Even when they do, customers ignore the loss of the drying heat and seldom call for service.

Some Kitchen-Aid models include a heating system that can't be ignored. First the timer is hidden behind the door panel and cannot be operated manually.

Replacing a Heating Element (Fig. 13-26)



Second, the cycle always begins with “water heat”. The first wash cycle pauses until the water temperature reaches 180°F. If the heating element fails, the dishwasher will not complete the cycle. With a hidden timer the customer is unable to bypass the water heat pause segment on the timer.

The heating element can be tested with an ohm meter and easily replaced. Better yet test for the presence of 110VAC at the element and then check for current flow. No current means a bad element.

Uncle Harry's
Trick of the Trade # 240

Kitchen-Aid heating elements are designed to heat the water 1°F per minute. Use a thermometer at ten minute intervals to test for proper heating.

The cal-rod heater also provides heat for the drying cycle. A melting plastic spoon lying on the cal-rod heater can cause an awful odor during dry. The customer will be certain that the whole dishwasher is shot.

A more effective drying method used on better brands is forced hot air. A small blower and heating element unit mounted below the wash chamber generate the hot air. The blower forces pre-heated air into the dishwasher chamber. The small blower motor fails with frequency. This is particularly true on Kitchen-Aid. A bad blower will make a lot of noise during dry.

The miniature heating system has a thermostat, heating element, and a high-limit safety that controls the temperature of the air. Blower units are easily replaced through the service panel on the front of the dishwasher.

14. Dishwasher Racks

Dishwasher racks don't represent a significant source of service calls, but questions are often asked about them. Following is a list of rack problems:

1. Sometimes rack rollers break off causing the racks to fall. Customers can order and do that repair on their own.
2. The upper racks slide on tracks that are bolted to the wall of the cabinet. If a mounting bolt comes loose, it can cause a leak on the outside of the cabinet.
3. Racks deteriorate and lose their coating. The steel underneath rusts and puts rust spots on the dishes. Maytag and Whirlpool both provide a blue plastic rack touch-up paint. It works fine if the rust is only spotty. Racks cost more than most customers are willing to pay (\$75.00).

Kitchen-Aid Rack Rollers (Fig. 13-27)



Special Problems by Brand

Kitchen-Aid

Kitchen-Aid set the industry standard for several decades. Their first dishwasher was introduced in the late 40's. Since then the design has gone through many evolutionary changes. In the late 80's, Whirlpool Corporation bought the Kitchen-Aid brand from Hobart. Gradually, the original high quality of Kitchen-Aid has been cheapened and today Kitchen-Aid and Whirlpool are internally very similar.

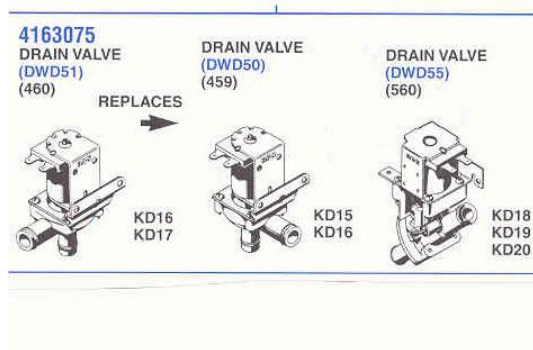
An Early Cast Iron Spray Arm
Kitchen-Aid (Fig. 13-28)



Drain Valves

The earliest Kitchen-Aids utilized a non-reversing pump motor. A solenoid operated dump valve controlled draining. Food and debris are frequently caught in that drain valve.

Kitchen-Aid Drain Valves (Fig. 13-29)

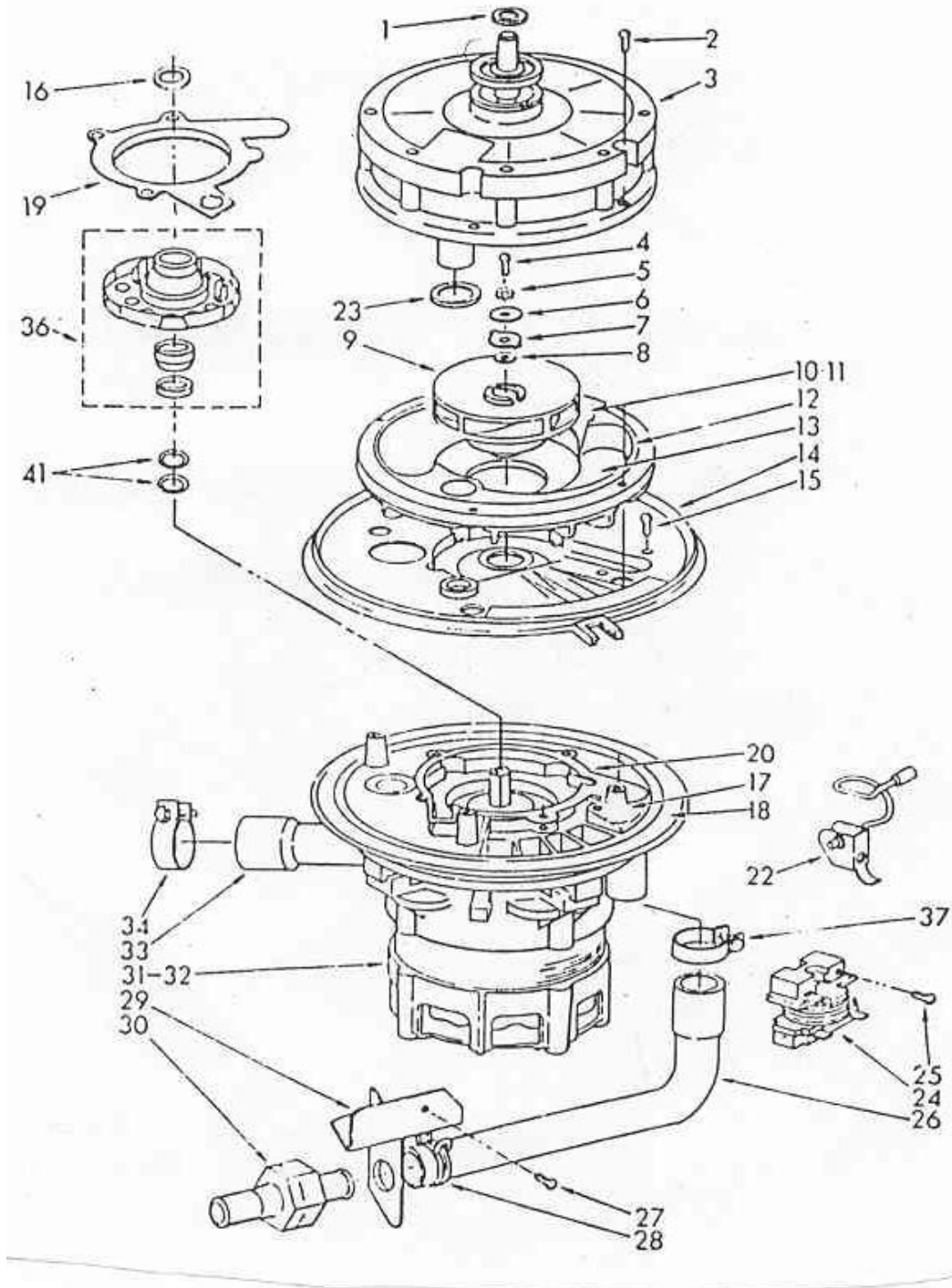


More recent models reverse the motor to accomplish draining. The logic is exactly like that of reversing washing machines. Item # 36 in the following exploded view is the dump impeller and the source of most problems. The seal below the impeller is also a key component. Three different impeller and seal kits are needed to cover the various designs.

Seal Kits for Kitchen-Aid (Fig. 13-30)

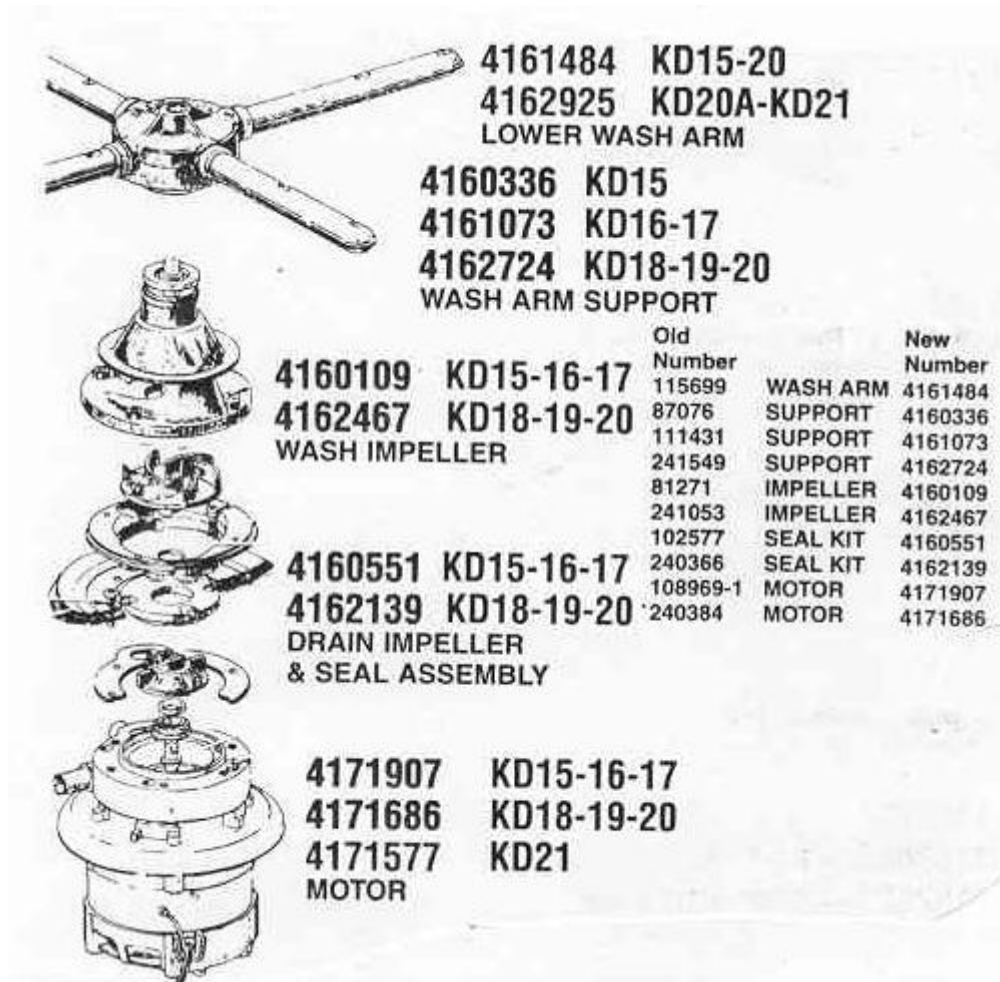


Pump Assembly on a Recent Kitchen-Aid
Aid (Fig. 13-31)



The older more classic design is shown in a second exploded view.

Pump Assembly for Earlier Design Kitchen-Aid (Fig. 13-32)



Specific Problems

For many years, Kitchen-Aid has had an unusual problem with the lower access panel. Design changes have eliminated the problem, but it lingers on in the older models. The panel will fall open and the homeowner cannot figure out how to reinstall it.

An Open Access Panel (Fig. 13-33)



Uncle Harry's Story Time

A very unhappy customer met me at the door, hands on her hips and tapping one foot. She had called to install the lower panel on her dishwasher. As I walked to the kitchen she told me her story.

“I know that you are going to install that cover in five minutes and charge me \$50.00. I can’t stand it! My husband has tried for three days to install that panel. He just can’t do it.

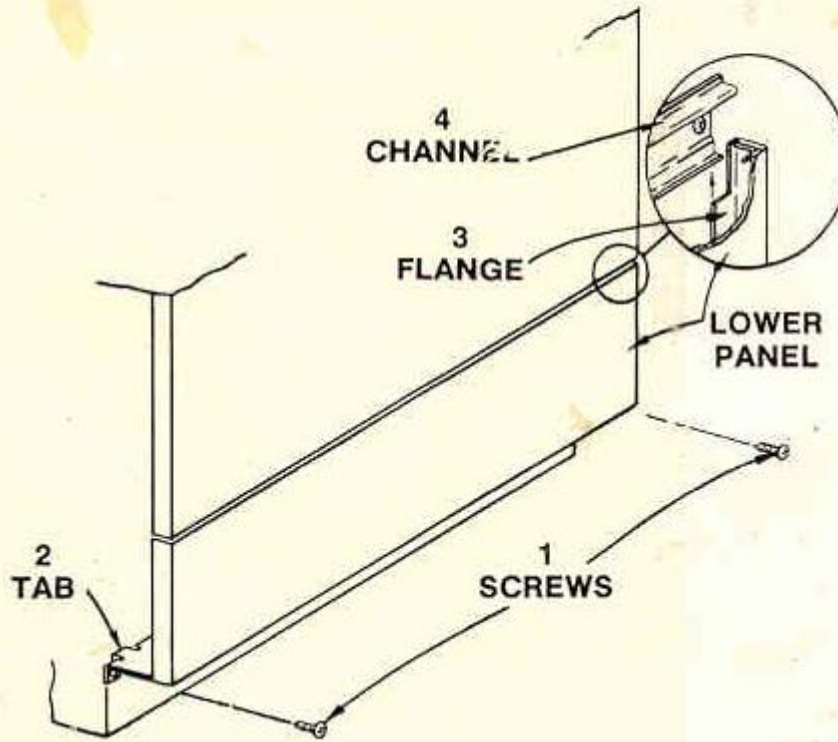
We called Kitchen-Aid and they tried to help us over the phone. They even faxed me the directions. We still can’t do it. My husband and I are tired of crawling around on the floor. We finally gave up and called you.”

What could I do? I bent the tabs back into their proper position and installed the cover. I showed her how to do it, collected my \$50.00 and left. She was still fussing, as I walked out the door.

Cover Installation Directions
(Fig. 13-34)

To Remove: Remove two screws (1). Pull out bottom of panel to unhook tabs (2) from frame. Slide panel down until flanges (3) clear channel (4).

To Reinstall: Line up panel flanges (3) to fit under lip of channel (4). Slide panel up until it stops and push up tabs (2) to hook over frame. Install screws.



A Dead Dishwasher

Kitchen-Aid has a chronic problem with the door switch. A plastic stud protrudes from the upper corner of the door jam and operates the door safety switch. When the prong breaks off, the dishwasher goes dead. A small kit is available to correct the problem. Nothing but the kit will fix it.

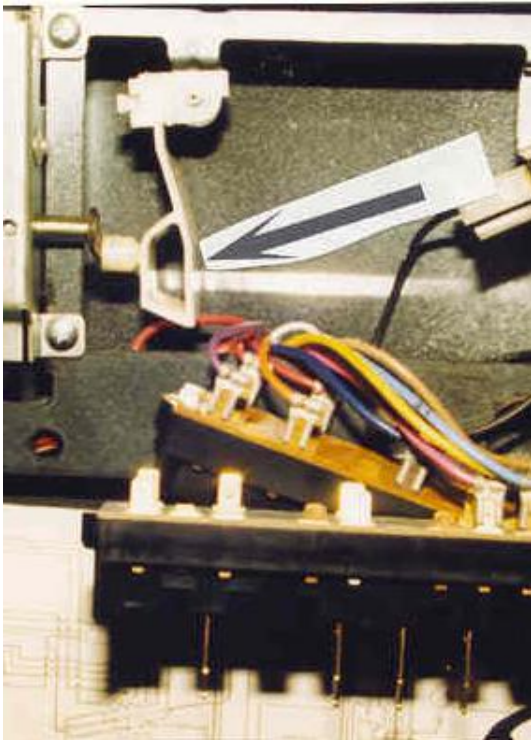
A Broken and Repaired Door Stud (Fig. 13-35)



Dishwasher Won't Cancel

On some models, Kitchen-Aid uses the motion of opening the door to reset the selector switches to off. Inside the door, a plastic linkage transfers the handle motion to the selector switch bank. The plastic arm in between breaks off and needs to be replaced. It is pop-riveted into position.

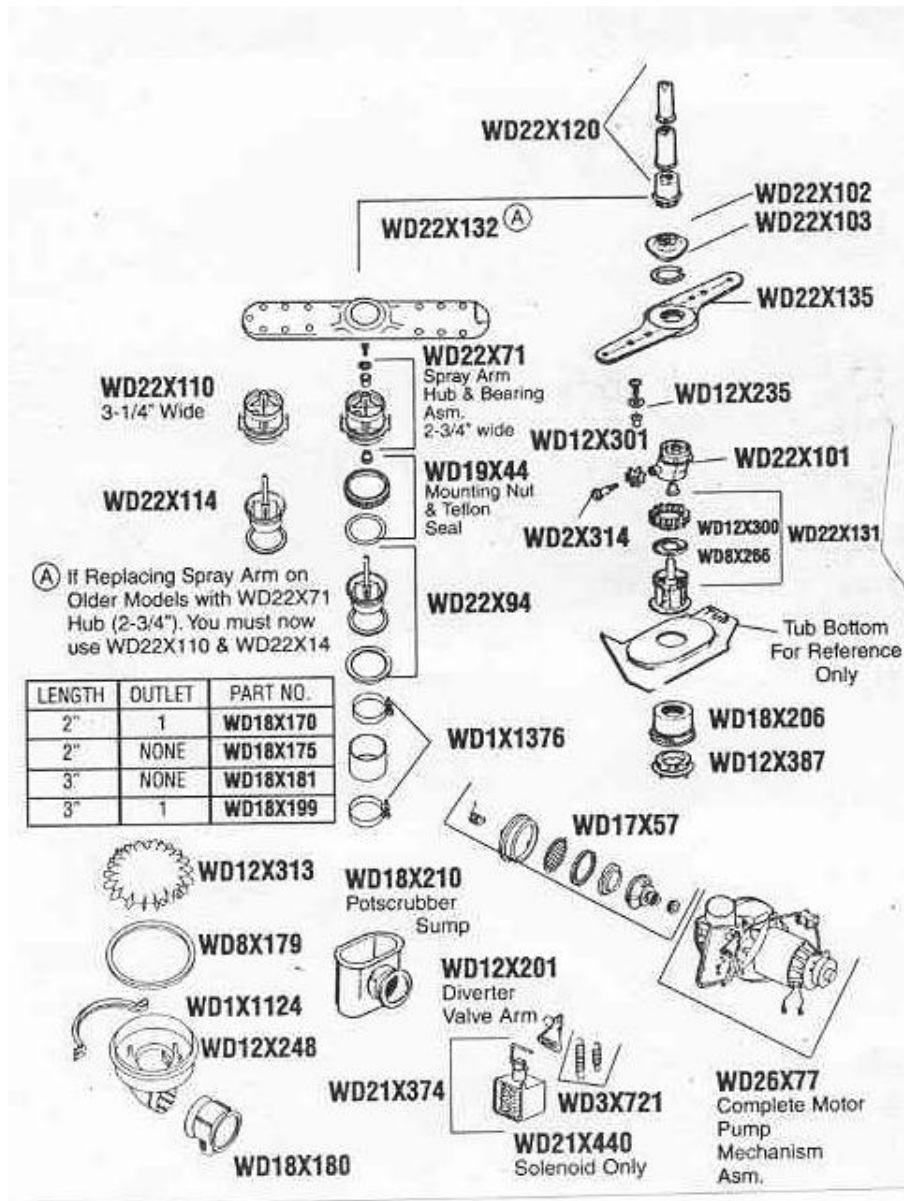
Plastic Arm (Fig. 13-36)



GE Dishwashers

For decades GE has used a horizontal motor and pump assembly, different from other brands.

Exploded View of GE Pump Assembly and # WD 26X77 (Fig. 13-37)



Diagnosing GE Pumps

Other problems with a GE dishwasher follow the standard patterns, but the pump requires special mention. The motor is non-reversing and uses a small solenoid (part # WD21X440) to control draining. The pump assembly has three key problems:

1. The rotating seal fails and water begins to leak.
2. The cooling fan breaks loose from the motor shaft and makes a loud scraping noise.
3. The motor binds after sitting for long periods.

Replacing a GE Pump Assembly from the Front (Fig. 13-38)



Uncle Harry's

Trick of the Trade # 241

A bound motor can be freed by turning the fan blade with your fingers. Of course, this is only a temporary measure. Obviously, if it happened once, it will bind again.

The first two repairs require removal of the pump and motor assembly.

Uncle Harry's

Trick of the Trade # 242

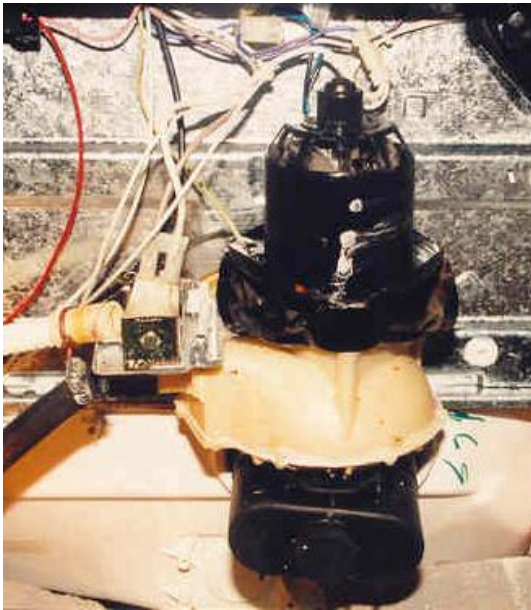
In spite of what many mechanics and the factory manuals say, it is possible to replace a GE pump assembly from the front, without removing the dishwasher from the cabinet.

A replacement takes about 30 minutes. The primary difficulty is clamping the rubber boot back onto the pump inlet. The clamping must be done by feel.

Repairing a Pump Assembly

Once the pump is removed it can be replaced or repaired. It is far wiser and faster to replace the entire unit.

View of Pump Assembly Taken from the Bottom (Fig. 13-39)



The cost of the motor itself is close to that of the entire unit. Replacing the motor requires a new seal kit and labor time. A new unit is fully warranted.

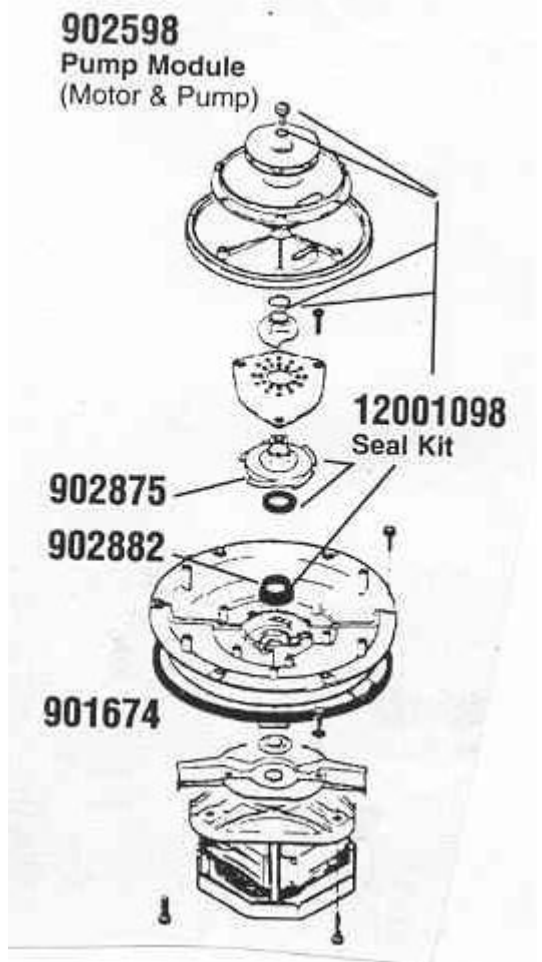
If the job is on a tight budget, and only leaking a seal kit alone (part # WD17X57) can be installed. The job is difficult and the shaft threads are left handed. Take time and be careful.

Maytag Dishwashers

As is Maytag's pattern, their dishwasher is totally different from all other designs. For many years, the motor was mounted off to the side and drove the pump module by a nylon belt.

This design, although more expensive, had certain advantages. It removed the motor from the area of leaking water and left more room for a larger pump. About 1990, Maytag changed to a design very similar to Whirlpool and Kitchen-Aid.

The Two Maytag Designs (Fig 13-40)



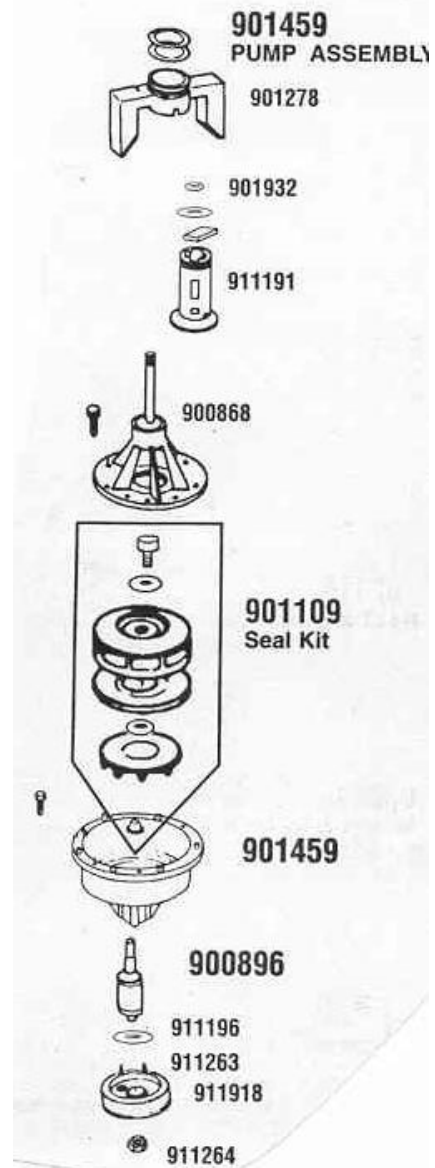
Motors:

Direct Drive:

- 900195 — Motor & Pump
- 900201 — Motor Only

Belt Drive:

- 901556 — Motor Only
(Use with 901459 Pump)
- 902598 — Motor & Pump
(repl 901556 & 901459)
- 99001068 — Pump



Specific Problems

The main weak spot on the belt driven design is the belt itself. It requires replacement about every eight years. As it ages, it stretches and gets noisy. An older belt turns a yellow brown and gets hard. **The belt is lubricated after it is installed.**

Occasionally, the pump module binds and fails. The lower drive impeller swells with age and drags on the housing. It is possible to rebuild, but far easier to replace.

Replacing a Maytag Pump Module (Fig. 13-41)



Uncle Harry's
Trick of the Trade # 243

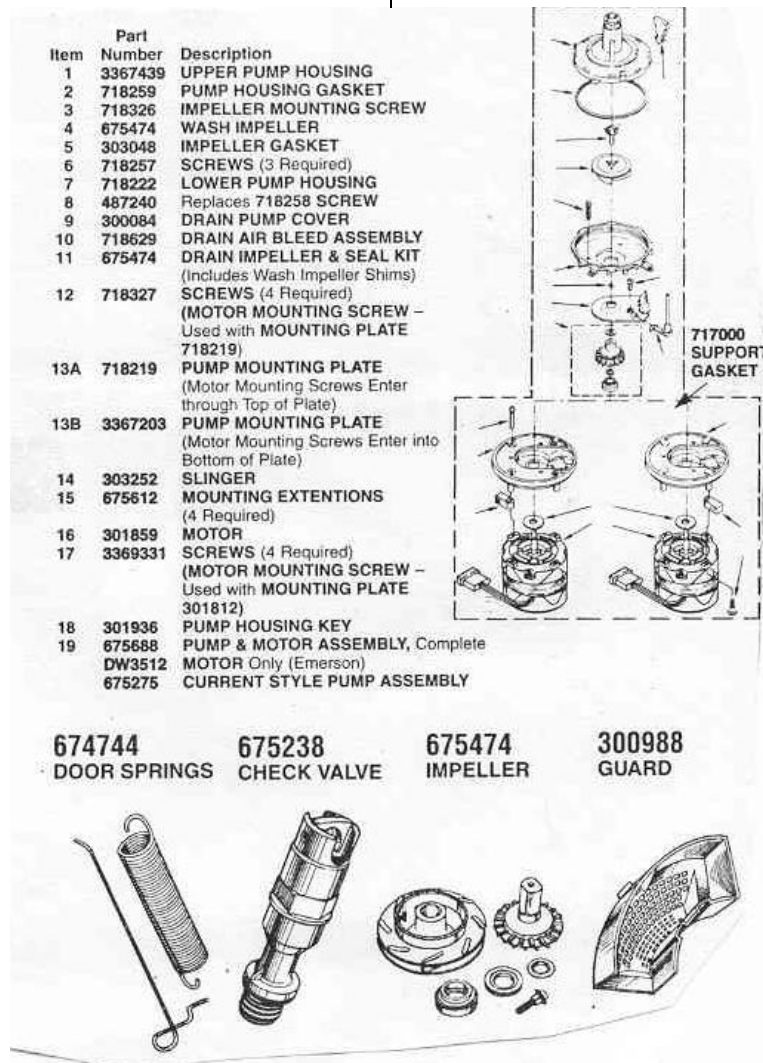
Rebuilding a Maytag pump module is a very nasty job. It is a job to be avoided. The parts typically bind on the drive shaft and need to be melted off.

Replacing a pump is relatively easy and can be accomplished in about 40 minutes.

Whirlpool Dishwashers

As mentioned, currently Whirlpool and Kitchen-aid are very similar in design. KitchenAid models are upscale and have a different spray arm and console but the motor and pump are basically the same as Whirlpool.

Whirlpool Motor and Pump Assembly (Fig. 13-42)



Replacing a Whirlpool Pump

A rusted up or bound motor is a common problem on older Whirlpools. The pumps seldom fail but the pump seals do leak water onto the motor.

Older Whirlpool pump assemblies were extremely easy to replace. The entire unit was held in place by three nylon tabs that were loosened by finger pressure. Complete replacement in 20 minutes is possible.

Whirlpool Thumb Tabs (Fig. 13-43)



Uncle Harry's Trick of the Trade # 244

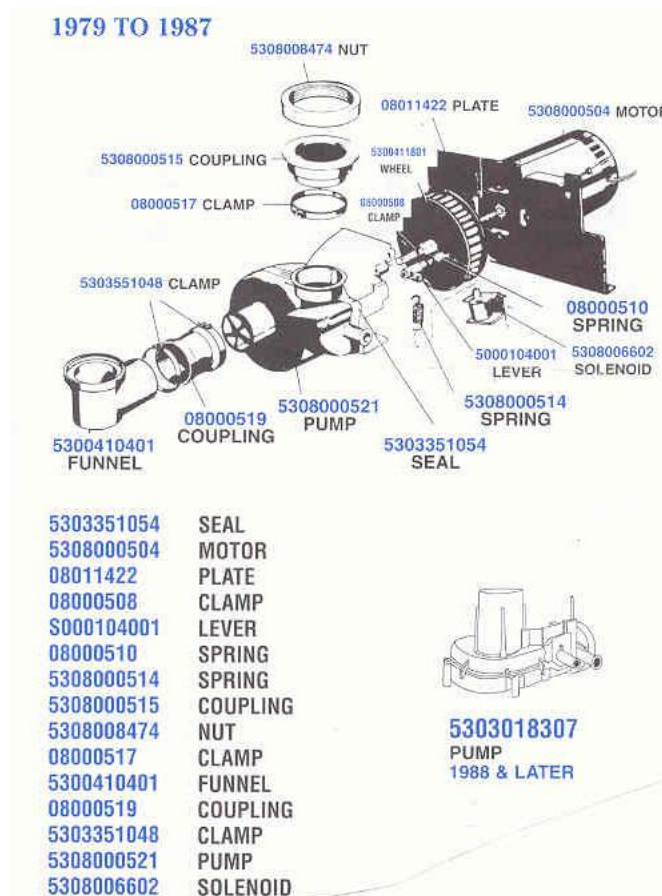
Reinstalling the pump and new rubber donut into the cabinet "well" can be tight. Smear a light coating of regular soap on the seal before pushing it into position. The soap will act as a lubricant for the rubber.

Very recently Whirlpool has radically modified their design and on some models adopted a horizontal motor like GE. Few have failed to date.

Frigidaire Dishwashers

Frigidaire dishwashers use a design that is similar to GE. The motor and pump are mounted horizontally and are removed as a unit. This design is not very popular and is seldom seen in homes.

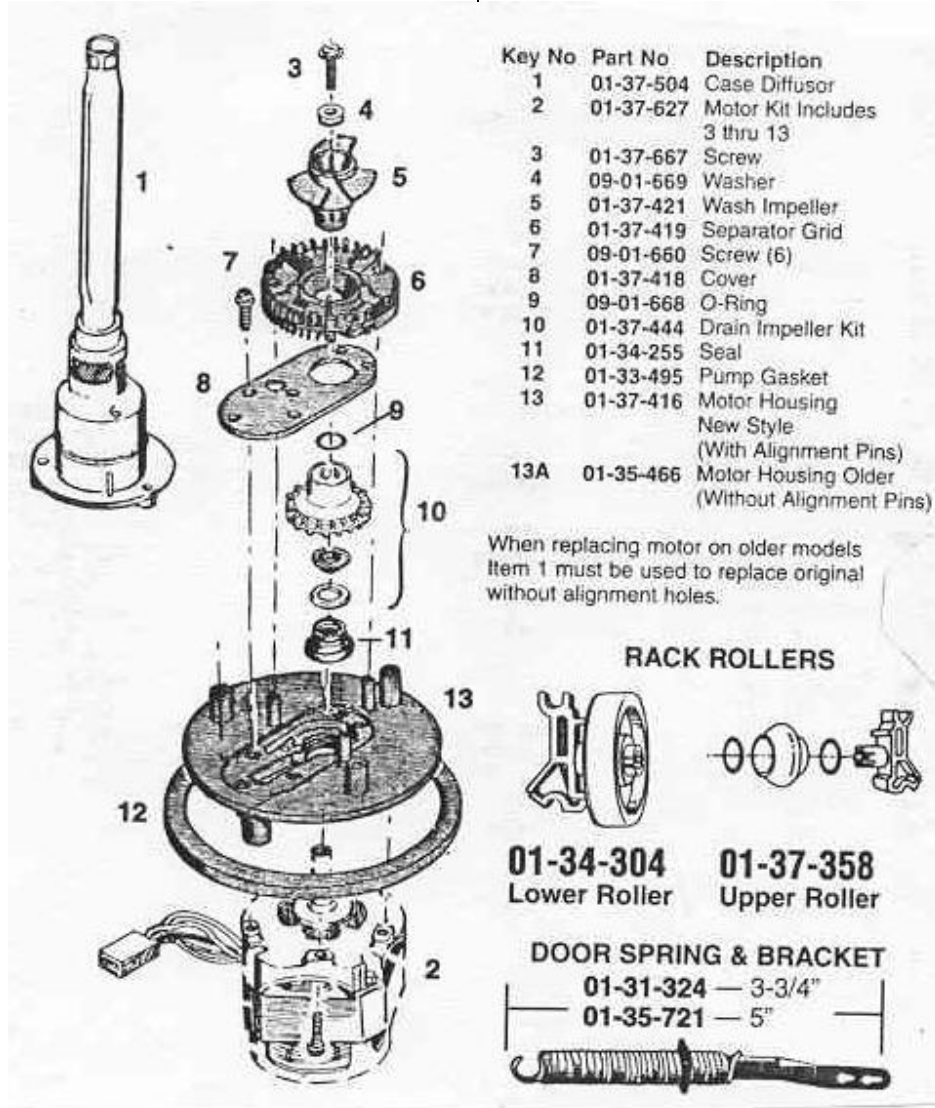
Frigidaire Pump Assembly (Fig. 13-44)



Waste King and Thermodor

Another seldom seen brand is Waste King. The Waste King design was sold under the Thermodor label. For many years their claim to fame was a stainless steel cabinet. The design is similar to all the modern reversing brands like Whirlpool and Maytag.

Exploded View of A Waste King (Fig. 13-45)

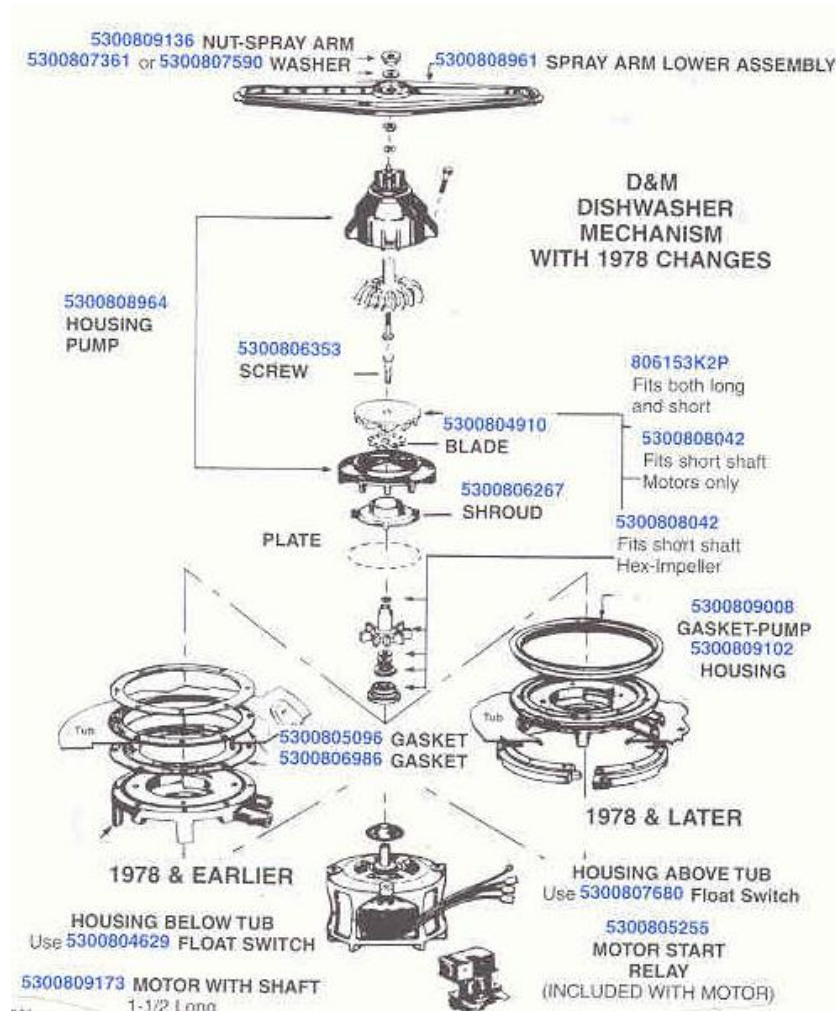


D& M Dishwashers

D & M is a brand that has never put its own name on an appliance. For many years Sears used D&M for all its dishwashers. Today Sears uses both D&M and Whirlpool. D&M was also sold by many other manufactures such as Magic Chef and Kelvinator. Few companies are large enough to design and manufacture their own dishwasher and prefer to buy from a subcontractor.

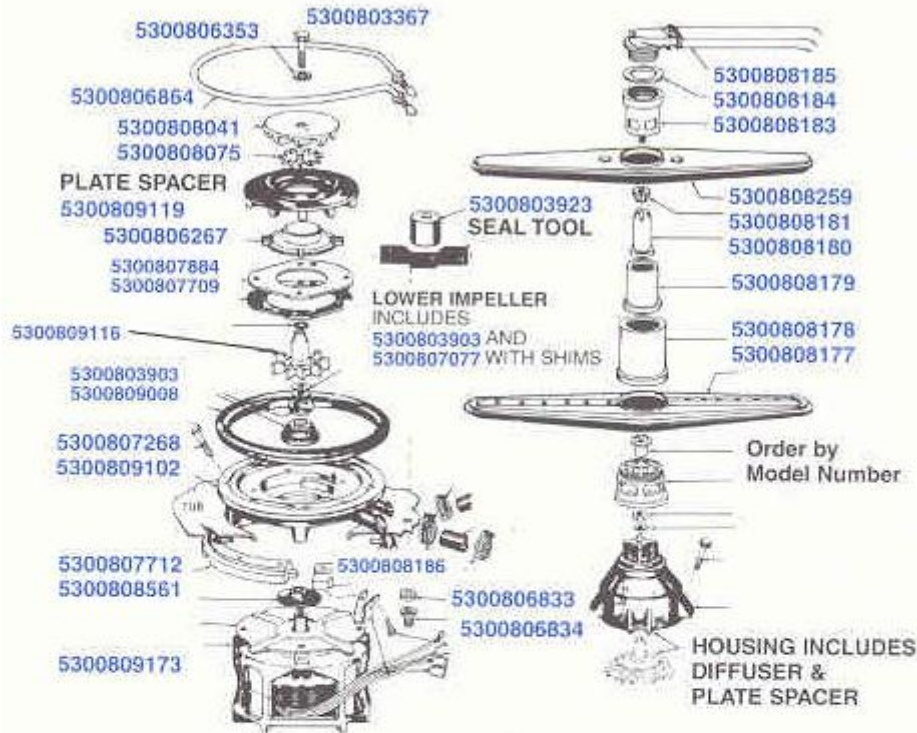
D&M has always been a reversing motor design like many other brands. It has always been marketed at the cheap end of the market. Fewer and fewer are found today.

D&M Exploded Views (Fig. 13-46)



**D&M Exploded View Late Model
(Fig. 13-47)**

MOTOR, HEATER & SPRAY ARM DETAILS



5300806353	Screw #10-32 x 2-1/4" Lg. Hex Hd. St. St.	5300806833	Grommet – Heater
5300806864	Heater	5300809119	Housing Pump (Includes Diffuser & Plate Spacer)
5300808041	Impeller – Upper	5300808175	Bearing
5300808075	Blade – Macerator	5300808176	Nut
5300806267	Covering	5300808177	Spray Arm Assembly
5300807884	Plate – Pump	5300808178	Tower Base
5300807709	Gasket – Pump	5300808179	Tower Section
5300808042	Impeller – Lower Kit (Includes 803903, 807077)	5300808180	Tower Tip
5300803903	Seal	5300808181	Nut
5300809008	Gasket – Pump	5300808259	Spray Arm – Upper
5300807268	Screw #10–Type 30 x 1" Lg. Hex Washer Hd. St. St.	5300808183	Distributor
5300809102	Pump Housing	5300808184	Gasket
5300807712	Clamp Ring (Includes Both Halves)	5300808185	Elbow & Tube Assembly
5300808561	Slinger	5300803923	Seal Installation Tool
5300806834	Nut 1/2" 20 Brass	5300808186	Hose Clamp – Recirculating
		5300808180K	Kit

In-Sink-Erator

In-Sink-Erator has always been a powerhouse maker of disposers. Late in the eighties, they began marketing a dishwasher. Maytag and GE were used as suppliers for the machines. In-Sink-Erator was purchased by Whirlpool. Soon afterward they began using the Kitchen-Aid design.

Today, except for the timer console, an In-Sink-Erator is a Kitchen-Aid. Interestingly, timers are a problem on some In-Sink-Erators.

Uncle Harry's
Trick of the Trade # 245

Be careful testing In-Sink-Erator timers, they are very slow cycling. If you are not aware of this feature, it is easy to conclude that a timer is not advancing properly,.

Conclusion

Dishwashers, like refrigerators, have a tremendous amount in common. Most of the problems center around clogging and other very easy to find problems .

The theory is very simple. It is merely a pump squirting hot water inside a box. If you keep your wits about you, difficult diagnosis problems are rare.

Flat Rate

Following is *Uncle Harry's* suggested pricing for typical dishwasher repairs. A complete set of flat rates is in the Flat Rate Book.

Whirlpool

Description of the Job	Price
1) Replace water valve (all brands)	\$135.00
2) Install door switch kit (4318273)	129.00
3) Install set of door springs (674744)	98.00
4) Replace motor and pump assembly (675688 or 675748)	240.00
5)	
6)	

KitchenAid

1) Clean air gap (all brands)	\$72.00
2) Replace air gap (all brands)	125.00
3) Rebuild drain impeller and seal	139.00
4) Replace spray arm	125.00
5) Replace support tower	135.00
6) Replace door switch activator (4163607)	98.00
7) Replace blower assembly (4162742)	148.00
8) Replace detergent dispenser	135.00
9) Replace bi-metal (4160824)	120.00
10) Install new motor and pump assembly	270.00
11) Install door gasket	125.00
12) Install door hinges (4161592 & 4161594	180.00
13)	
14)	
15)	
16)	

General Electric

Description of the Job	Price
1) Motor and pump assembly (WD26X77)	\$255.00
2) Repair stud on soap dispenser	98.00
3) Install water valve (WD15X93)	145.00
4) Rebuild spray tower support	140.00
5) Repair door springs	120.00
6)	
7)	
8)	

Maytag

1) Replace belt (902115)	\$96.00
2) Replace door springs (901111)	96.00
3) Replace detergent dispenser (901839)	128.00
4) Replace door latch assembly (902791)	135.00
5) Install new pump module (901459)	245.00
6) Replace water valve (901298)	145.00
7)	
8)	
9)	

D & M (Frigidaire)

1) Install door springs (530080971)	98.00
2) Rebuild pump impeller system (5300808042)	155.00
3) Replace door gasket (5303912631)	135.00

Examination

Manual 13

Dishwashers

(Note: More than one answer maybe correct.)

1. Dishwashers are
 - A. difficult to repair.
 - B. simpler than washing machines.
 - C. all different.
 - D. relatively easy to repair.

2. Replacing a dishwasher
 - A. requires running copper piping.
 - B. is a profitable job.
 - C. is desirable work.
 - D. takes about 30 minutes.

3. Dishwasher detergent
 - A. is interchangeable.
 - B. is dependent on water temperature.
 - C. can be kept for along time.
 - D. deteriorates with age.

4. Dishwasher fill valves
 - A. never dribble.
 - B. overflow.
 - C. split with age.
 - D. fail like washer valves.

5. A intermittent valve coil
 - A. can be troublesome.
 - B. may take time to find.
 - C. can be located with an ohmmeter.
 - D. is obvious.

6. The dishwasher spray pattern
 - A. is dependent on a good spray arm.
 - B. is seldom an issue.
 - C. can cause a door leak.
 - D. varies with temperature

7. Pump impellers
 - A. get jammed with food.
 - B. come with a shaft seal kit.
 - C. rarely cause trouble.
 - D. always come right loose.

8. The following are part of the drain system
 - A. rubber hose.
 - B. the air gap.
 - C. the disposer inlet.
 - D. A, B,& C.

9. A water level control
 - A. prevents overflows.
 - B. gets jammed with utensils.
 - C. is used to set the water level.
 - D. usually causes partial filling.

10. Electrical connection boxes and door switches
 - A. are highly reliable.
 - B. can cause odors and smoke.
 - C. are a common cause of trouble.
 - D. cause dead dishwashers.

11. Leaks at the door
A. are caused by many things.
B. can be a problem area.
C. result from a worn spray tower.
D. A, B, & C.
12. Door hinges
A. result from broken springs.
B. can be bent back into shape.
C. buckle and bend.
D. are a snap job.
13. Soap dispensers
A. sometimes use a bi-metal element.
B. cause leaks.
C. fail to open.
D. gum up a lot.
14. To find the dispense timer segment
A. pull a wire and rotate the timer.
B. use an Amprobe.
C. wait for the right moment.
D. A, B, & C.
15. Splicing a wiring harness
A. should be avoided, install anew one.
B. is similar to repairing a wig-wag.
C. wastes too much time.
D. is done at the damage point.
16. Drying systems
A. use blowers.
B. can make noise.
C. can melt plastic.
D. A, B, & C.
17. Dishwashers today
A. all use reversing motors.
B. use solenoids and reversing motors.
C. will last 25 years.
D. get better and better.
18. Replacing a GE pump assembly from the front
A. is virtually impossible.
B. requires practice.
C. should be discouraged.
D. can be done in 30 minutes.
19. Always lubricate a Maytag dishwasher belt
A. after installing it.
B. with 40 weight oil.
C. before installing it.
D. none of the above.
20. Today's Whirlpool dishwasher
A. is similar to Maytag.
B. is now like GE.
C. is the same as it has been for years.
D. is like Kitchen-Aid.

Examination Answers

Manual 13

Dishwashers

1. B & D. Dishwashers are all very similar in design and very easy to repair.
2. A Replacing a dishwasher takes about 2 hours and is less profitable than service work.
3. B, C & D. Dishwasher detergent is sensitive to storage temperature, aging and operating water temperature.
4. B, C & D.
5. A & B. A blow dryer can be used to locate an intermittent water valve. An ohmmeter is not usually helpful.
6. A & C. A good spray pattern does not hit low on the door seal.
7. A & B. Pump impellers and seals tend to go bad and are often damaged by food and debris.
8. A, B C & D.
9. A & B. The water level control acts as a safety, not as a water level setting device.
10. B, C, & D. Burned out wiring in the dishwasher electrical connection box and door switches are common service calls.

11. A, B, C & D.

12. A & C Door hinge replacement varies with brands and is always moderately difficult.

13. A, B, C & D

14. A, B, C & D. Locating the correct segment on the timer can be done in several ways.

15. B & D. Splices should be kept away from any friction points.

16. A B & C. Noisy blowers are a common dishwasher service call.

17. B. Most dishwashers use a reversing motor, but a few like GE and Frigidaire use solenoids to control the drain valve.

18. B & D. Although it is difficult, the GE pump assembly can be replaced from the front in 30 minutes.

19. A.

20. A, C & D. With the exception of a very few models, all Whirlpool dishwashers use a reversing, vertically mounted motor like they have for many years. Only a small percentage of their models use a horizontally mounted motor like GE.