

*Raker*

**Appliance Repair Professionals, Inc.**

Dishwashers

Manual 13

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# **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

**D**ishwashers 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

**D**ishwasher 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.

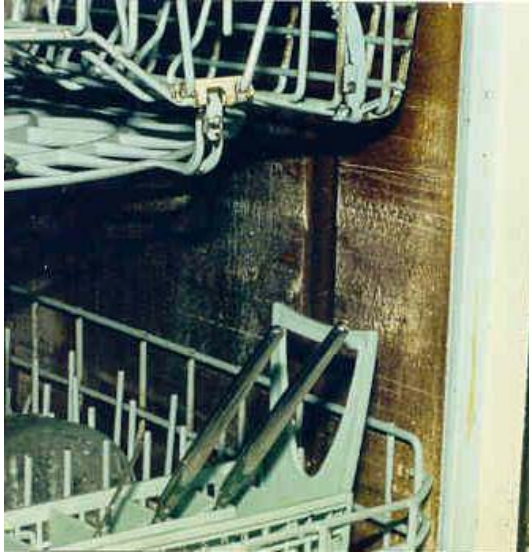
Diagnosing poor cleaning requires a check of the incoming water temperature as well as mechanical conditions within the dishwasher. In some cases, the dishwasher may be working properly but doing a poor job solely because of the lack of high-temperature water. Newer detergents have been modified to work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

### **Iron Staining**

**S**ome 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

**D**ishwasher 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

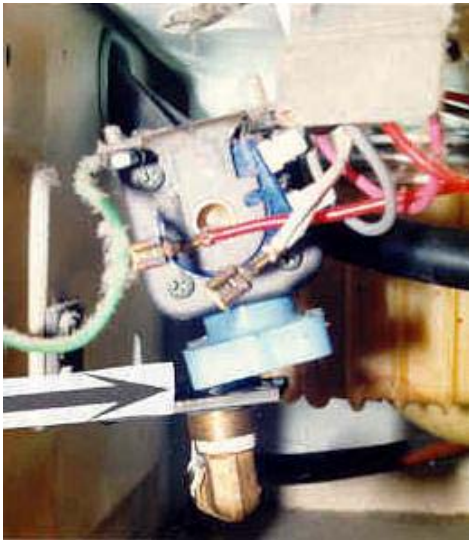
There are dozens of different dishwasher water valves. Most of the variations are in the mounting brackets.

*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.

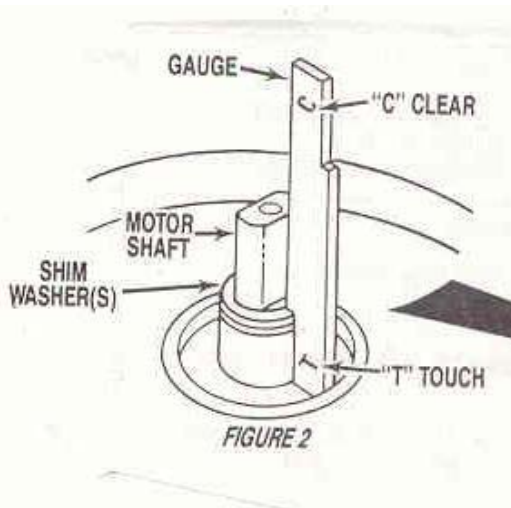
The wash impeller housing is not a typical source of service calls. Instead, calls tend to come from the drain impeller mounted below. The drain impeller is a smaller, closer intolerance pump. It forces the water and debris down the drain line.

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)**



