

Installing a Dishwasher

How one plumber hooks up the common grease-gobbler

by Peter Hemp

Installing a dishwasher is a snap. Well, it can be if you've got the right tools, the cabinet space is big enough, the supply and waste lines are readily accessible and you do things in the right order. While this article focuses on how I install a new dishwasher in a new kitchen, there are a couple of conditions that can bedevil the person faced with taking out an old one. Let's look at these first.

Extracting a defunct dishwasher—Before removing any dishwasher, be sure to turn off the water and power prior to disconnecting the water supply and electrical hookups under the machine. In addition, the machine will probably be screwed to the underside of the counter, and perhaps the floor, through metal flanges attached to its chassis.

Some dishwasher installations go back 30 years, and there are still quite a few surviving appliances of this vintage. Two major obstacles commonly prevent their removal. The first obstacle can be a new floor. If somebody put down a layer of underlayment in front of the dishwasher, it's trapped, and either the floor goes or the countertop goes.

The second obstacle is a water supply that emerges from the floor under the dishwasher. The pipe stub prevents the machine from being slid out from beneath the counter. You can tell if yours falls into this category by looking under the kitchen sink. If there is *not* a rigid copper pipe running from the dishwasher to the hot-water supply for the sink faucet, you've probably got a pipe stub under the dishwasher. To make absolutely certain, remove the panel at the bottom front of the

appliance. Use a nut driver or a 4-in. crescent wrench for hexhead screws; for the nearly inaccessible Phillips head screws you'll need an off-set screwdriver. Panel off, use a flashlight to spot the supply stub. If you've got one, you'll have to sever it with a reciprocating saw or a mini hack saw. If the water heater is above the level of the dishwasher, drain it first.

Dishwasher removed, use an Ace EX-7 pipe nipple back-out (available at Ace Hardware Stores) to take out the remainder of the pipe stub, and cap the line with a plug. To prevent leaks, wrap the plug's threads with Teflon tape. As you look at its threaded end, wrap it clockwise with four layers of tape. Now cram the square end of the plug (along with some well-chewed bubble gum) into a 12-point $\frac{1}{16}$ -in. ratchet wrench socket. The gum will keep the plug from falling out as you feel around for the old fitting.

Angle stops and air-gap inlets—I work in the Bay Area in northern California, where the code requires that a new dishwasher have its own shut-off valve and an air-gap inlet. The shut-off is called an angle stop. The kind I use has two shut-off handles and two branches (photo 1), and it attaches to one stub-out (a capped pipe or tube).

An air-gap inlet is a "break" in the waste line that prevents waste water from back-siphoning into the dishwasher. The air-gap inlet is located on the edge of the sink, near the faucet. When I install an air-gap inlet, I

use only one brand and model—the Eastman CD-4 (U. S. Brass, 901 10th St., Plano, Tex. 75074; see photo 2). It works better than any of the other air-gaps I've tried.

Installing a new dishwasher—Let's imagine that we have a nice, clean opening for our new appliance, and that it is properly sized for the new machine. The width of the space should be $\frac{1}{4}$ in. to $\frac{3}{8}$ in. wider than the dishwasher, which is usually 24 in. wide. A dishwasher space needs to be at least 34 in. tall.

Taking care not to mar the kitchen floor, maneuver the machine in its carton to within 3 ft. of the cabinet opening. I slide the box on a 3-ft. by 2-ft. piece of carpeting, fuzzy side down. Cut the banding, remove the top of the carton and use a utility knife to cut carefully down each corner of the carton and across the bottom on all four sides.

Because most people are right-handed, the dishwasher will usually be to the right of the sink. Regardless of which side it's on, now look at the side of the dishwasher that will be next to the sink cabinet (photo 3). You're looking for gaps between the dishwasher components and chassis that will afford a route for the drain, power and water lines. Make measurements to ascertain where you can route the lines through the chassis to a $1\frac{1}{2}$ -in. hole that you will bore in the cabinet wall.

Next, look to see whether your drain hose is already attached to the pump under the ap-

Connections under the sink. An angle stop is a valve that connects the domestic water supply with individual fixtures (photo 1). The one in the lower left corner has two outlets—one for the sink and one for the dishwasher. In the upper right corner of the photo, a $\frac{3}{8}$ -in. drain line from the dishwasher is connected to the air-gap inlet. A $\frac{3}{8}$ -in. drain line connects the air-gap to an inlet in the tailpiece draining the sink. Most of an air-gap inlet is hidden below the sink (photo 2). The portion above it is covered with the chrome cap to the left of the hole. If the air-gap clogs, water will escape through the holes in the cap. So it's important to place the air-gap below the sink's flood rim. The author used a chassis punch to cut this hole in a stainless-steel sink.



pliance (photo 4). Some manufacturers route this hose up the side, over the top and back down the other side of the machine, and they affix it permanently to the chassis with straps or clips. This is a precautionary measure that prevents the water used in washing cycles from being siphoned out of the machine. With this configuration you'll be connecting an additional piece of standard $\frac{5}{8}$ -in. dishwasher hose (hardware and plumbing supplies have it), and routing it to the air-gap inlet.

Other manufacturers reason that the air-gap inlet will prevent back-siphoning, and forego the wrap-over drain hose. If your new machine has no such hose already installed, and you see a naked pipe-stub (called a "barb") projecting from the pump housing, then you need to provide a length (usually 5 ft.) of $\frac{5}{8}$ -in. rubber-hose waste line.

In any case, the hose must be able to pass from the machine (and sometimes all the way around it) to the bottom of the air-gap inlet. The route should be direct, with gentle bends and no kinks. Hose is cheap. It's better to use 8 ft. of it than to settle for a kinked or spliced hose.

Most dishwashers are bolted to a wooden skid. Remove the bolts (sometimes these will be the threaded height adjusters—they'll need to be rethreaded into the bottom of the appliance), latch the door and carefully tilt the machine onto its back. Now you can remove the skid and tilt the machine back onto the carpet. Taking it very slowly, slide the ap-

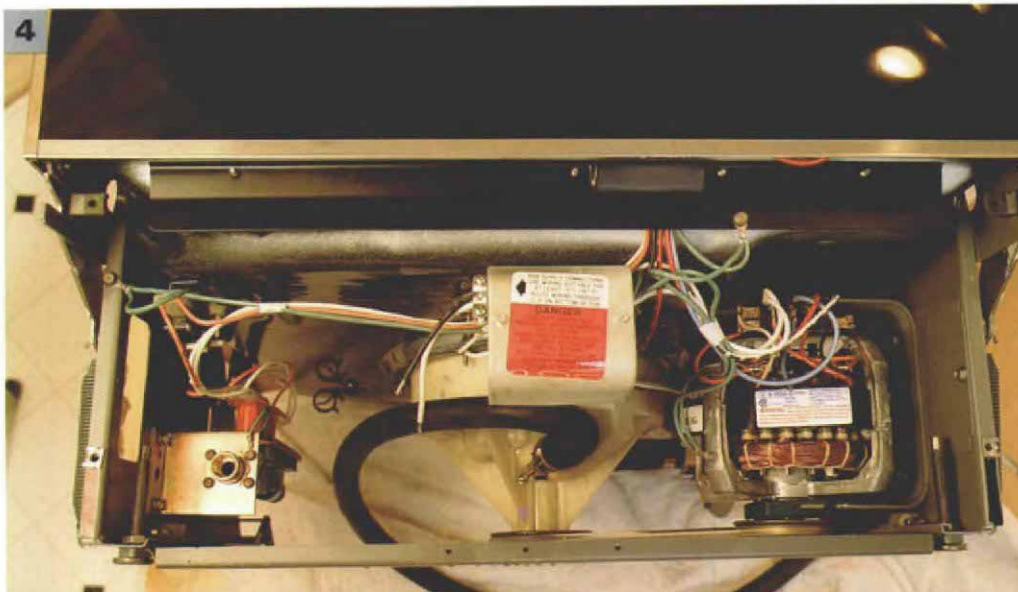
Drain hose and supply line. After cutting away the packing carton, the author unbolts the machine from its wooden skid (photo 3). At the lower right corner of the machine is a plastic blower housing. The drain line will pass through the notch to its left on its way through the sink cabinet. The drain hose (photo 4) is attached to the pump in the center of the photo. On the left, the brass inlet of the solenoid valve is ready for the elbow that will attach it to the water supply. Below the valve are the machine's adjustable feet. The author threads $\frac{3}{8}$ -in. tubing through a $1\frac{1}{2}$ -in. dia. hole in the side of the sink cabinet toward the supply el in the lower left corner of the dishwasher (photo 5).

pliance into the cabinet. Check to see if your hose can reach the hole in the side of the cabinet. If not, slide the machine back out and drill a new hole.

Waste and power lines—If the waste hose must be extended to reach the air-gap inlet, begin a splice with a piece of $\frac{1}{2}$ -in. rigid copper tube (type L or M) about $3\frac{1}{2}$ in. long. This copper pipe will have a $\frac{5}{8}$ -in. outside di-

ameter. Use a reamer or ultra-sharp pocket knife to remove any burrs. Then slide $1\frac{1}{4}$ -in. to $1\frac{3}{8}$ -in. stainless-steel, worm-drive hose clamps onto each piece of hose. Shove the copper tube an equal distance into each hose and tighten the clamps to complete the splice.

Now crawl far enough into the enclosure so that you can shove the end of the drain hose through the hole in the cabinet wall and make sure the hose is almost taut. If the pow-



er supply is going to be a line cord with a plug, it is awfully nice to have enough cord to plug into the outlet and still have your machine totally out of the enclosure. Because you have to provide this cord, you can select its length. Now is the time to thread the cord through the hole in the cabinet.

With the machine still atop its carpet and the drain and power lines started through the hole in the cabinet, inch the machine into its space while pulling on the lines through the hole in the cabinet. Once you get four or five inches into the enclosure, pull the carpet pad out from under the rear feet.

Side to side, up and down—Now that the little brute is all the way in, you should check for side clearance. It is very important that the door not strike any portion of the cabinet or counter edging before closing. If it does, eventually it will become permanently sprung, and leaks will appear at the door bottom. Try to get the dishwasher door flush with the cabinets.

Most machines have adjustable feet that screw up or down, with a nut that allows you to lock the feet at the desired setting. They're easy to reach in front, but excruciatingly difficult to reach in back. That is, unless you're installing a Maytag dishwasher. Their rear adjusters are operated by turning hex bolts at the *front* of the appliance. This can save you both aggravation and sliced fingers (sheet-metal chassis have sharp edges, so be careful in there). Shim shingles may also be used to adjust the rear feet.

Crank on the front feet until the two mounting tabs at the top of the machine touch the underside of the countertop. Drive a screw through each tab, securing the machine.

Supply line—Before you can hook up the water supply, you need to install a "dishwasher el" at the front of the appliance. This elbow attaches to the solenoid valve that regulates water intake. The elbow can be of two sizes. The most common is a $\frac{3}{8}$ -in. IPS (iron pipe size) by $\frac{3}{8}$ -in. compression. Or it could be $\frac{1}{2}$ -in. IPS by $\frac{1}{2}$ -in. compression. In both cases, the compression dimensions refer to the inside diameter of refrigeration tubing (not pipe), and you might find a printed, nasty threat amongst the installation papers stating that the machine with the $\frac{1}{2}$ -in. FIP (female iron pipe) solenoid valve connection should be plumbed only with $\frac{1}{2}$ -in. refrigeration tubing, or your warranty is void. The statement is true, but the facts are baloney. Any under-counter residential dishwasher can perform just beautifully on $\frac{3}{8}$ -in. tubing, provided you've got enough water pressure. Most dishwashers require a minimum of 35 psi to function properly, and excessive pressure (above 80 psi) is your dishwasher's greatest enemy. I have installed many machines that called for $\frac{1}{2}$ -in. tubing, but I substituted $\frac{3}{8}$ -in. tubing by using a $\frac{3}{8}$ -in. by $\frac{1}{2}$ -in. el at the solenoid. I've *never* had any call backs or performance problems. Of course, the water pressure is adequate

where I do my work. If it was below 50 psi, I'd go with the $\frac{1}{2}$ -in. tubing. Regardless of which diameter you choose, you need to supply the el fitting.

It is a good idea to purchase 6 ft. to 7 ft. of copper tubing for the water supply even though you will probably only use 5 ft. of it. The extra length allows you the leverage you need to put a bend in the tubing near its end, while still leaving a portion with a perfectly round cross-section. And you won't get a watertight seal without a round cross section.

I thread the supply tube through the hole in the cabinet, forming a gentle bend that leaves the end of the tube pointing straight out from the front of the machine (photo 5).

Use a tubing bender to make the 90° bend needed to align the supply tube with the el. As you cut the tubing end that will fit into the el, make sure to leave at least 1 in. of straight tubing so that the brass ferrule in the compression fitting will make a tight seal. Wrap the el's threads with a couple of layers of Teflon tape before you put on the compression nut. Follow this same procedure to hook up the supply line to the angle stop under the sink.

Under the sink—The air-gap inlet has two legs. One is $\frac{3}{4}$ in. in dia., the other is $\frac{1}{2}$ in. The $\frac{5}{8}$ -in. drain line from the dishwasher slips over the $\frac{1}{2}$ -in. leg, where it is held fast by a pipe clamp (photo 1). The other leg is attached either to the side inlet of the sink tailpiece (buy a chromed, all brass strainer, and a 17-ga. tailpiece), or the side inlet of a garbage disposal. In either case, the $\frac{7}{8}$ -in. hose (usually 3 ft. long) should be routed in the most direct, downhill path. This hose evacuates by gravity, so no bends are allowed in it.

I will sometimes put the air-gap inlet on the side of the sink farthest from the dishwasher if it allows me to have a better path for the $\frac{7}{8}$ -in. hose to the waste inlet. Picking the side for the air-gap inlet is easy with stainless-steel sinks because I can punch my own $1\frac{1}{4}$ -in. hole. I use a Greenlee #5004003 chassis punch, a device made for cutting large-diameter holes in sheet metal (Greenlee Tool Co., 4455 Boeing Dr., Rockford, Ill. 61109). Don't be tempted to put an air-gap inlet on a counter. Sooner or later it will clog, and water will pour out of the vent holes.

If you attach the $\frac{7}{8}$ -in. hose to the side inlet of a garbage disposal, make sure to remove the little plug inside the inlet, which will allow the drain water from the dishwasher to enter the disposal.

Testing—The lower panel is still off. We can see our $\frac{3}{8}$ -in. copper supply and dishwasher el connections and also our drain hose connections. Now, slowly crack open the hot water for the dishwasher. Turn on the valve just far enough to hear the water start to flow and then leave it on at this low setting until all the noise stops. Look at your water connec-

tions under the machine. If you have a drip or little squirt, shut the valve off and slightly tighten the connections. *Do not overtighten* the compression nuts on the angle stop and dishwasher el. These nuts must be really snug, but you can ruin them with too much torque. Now look at the packing nuts behind the handle on the double angle stop. If you have a drip, tighten the nut just one-quarter turn at a time, until the drip stops. Open the valve all the way.

If the power is connected, and all the freebies and styrofoam are out of the dishwasher, run the machine on the "rinse-and-hold" cycle. The front panel should be in place to prevent shock during these tests. If all goes well on that cycle, run it on the longest cycle. Sometimes a leak will appear only after the vibration of operation sets in. Occasionally the water-inlet solenoid valve will leak, even on a brand-new dishwasher. This valve usually has a green or orange plastic housing on its top. Give it a good visual inspection. You want to know right now if it is faulty, so you can let the factory rep deal with it.

Dishwasher addenda—Dishwashers have three main enemies. The first is water pressure above 80 psi, which can be alleviated with a pressure-reducing valve installed on the main water line. The next two enemies can never really ever be eliminated: large dinner parties and olive pits. After a large party and many helping hands moving too fast, an olive pit can find its way into the dishwasher. It goes through the machine and lodges in the top of the air-gap inlet. Now no water can get through, so it escapes past the door seal and floods the kitchen. Cheap air-gap inlets are particularly prone to this situation. The CD-4 might choke up a bit and drool into the sink, but usually most of the drainage gets into the disposal, not onto the floor. To rectify the problem, pop off the chrome top of the air-gap inlet and dislodge the pit.

In closing I'd like to say a couple of words about dishwasher pans—the kind that resemble big cookie sheets. Dishwashers sometimes develop slow, continuous drips that can damage floors. If you've got an expensive floor, you ought to get a pan.

To my knowledge, no one markets a ready-made dishwasher pan such as the kind available for water heaters. But your local sheet-metal shop can fabricate one for you out of economical galvanized-steel flat stock. If the dishwasher is over a crawl space, you can add a drain to your pan. If you are in a multi-unit building and have living space below you, even a holding-pan can save you some headaches. □

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