How to Install a Toilet

Reinforce the floor and use the right components for years of trouble-free service

BY PETER HEMP

Do the cautionary words to the left sound a little harsh? I haven't actually seen that warning included in the directions that accompany new toilets, but it wouldn't be out of place. The blister packs and directions tucked away in the box routinely include details and components that will work for a while but won't stand the test of time. I guess the manufacturers haven't had to pull up a toilet that began to seep after a few years. I have—lots of them.

A toilet failure is really a shame because with just a little bit of additional work, you can add years of service to the toilet and protect the structure that supports it. After going through the process many times, I've worked out a good method for installing a close-coupled toilet in new wood-frame construction. This is the garden-variety two-piece toilet that's in about every residential bathroom in the country. Close-coupled toilets are easier to install than one-piece toilets simply because they are easier to handle. You install the bowl first, then attach the tank. But you can also use the advice presented here to install any kind of toilet, be it a one-piece Kohler or a temperature-controlled Toto.

A good installation begins with the floor framing

The first commandment of toilet installation: The toilet shall not move. By this, I mean it has to be connected to the floor as firmly as possible, and the floor has to be sturdy enough not to deflect when someone is sitting on the throne. This means that the ideal floor framing takes into consideration the placement of the toilet. If I get my way, the toilet's drain is centered between floor joists that are 12 in. o.c. with a pair of blocks flanking the drain line (top photo, facing page).

Framing doesn't always turn out this way, of course. And I will admit to having remodeled more than a couple of bathroom

floor joists with my chainsaw to make room for drain lines. But I head off any joists that have to be removed and put blocking on both sides of the toilet flange. This blocking helps to distribute the weight of the toilet.

Trim the pipe and install the flange

When I became a plumber, toilet drains were made almost exclusively of cast-iron pipe. But now, most new homes are plumbed with ABS or PVC plastic. I used 4-in. ABS pipe in the demonstration job shown in these photos. Where I live in the Bay Area, you can also use 3-in. pipe for replacing existing 3-in. drain lines. But inspectors require 4x3 closet bends for connecting the toilet to 3-in. lines.

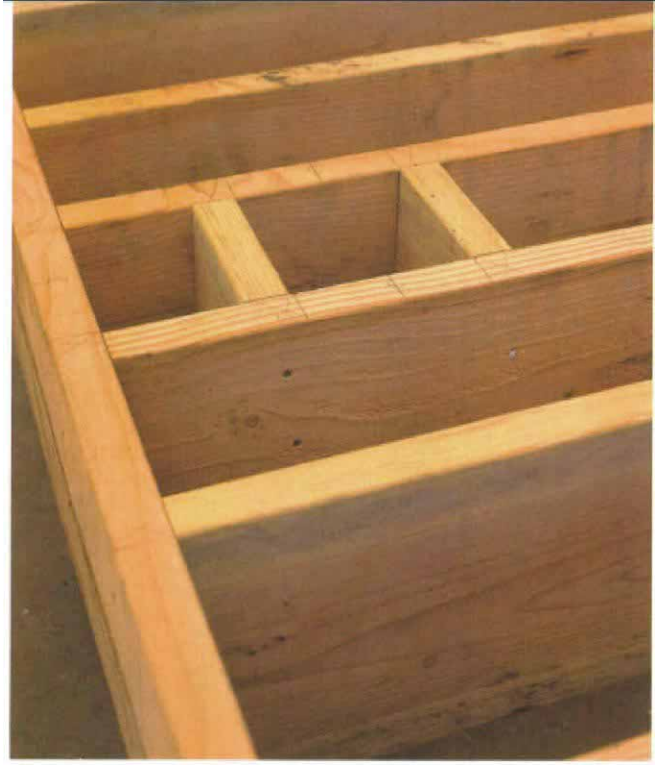
During installation, the toilet's drain line extends above the floor, where it is capped with a plastic plug to make a watertight seal for the leak test. When it's time to install the toilet, I knock out the plug with a hammer and trim the pipe flush to the finished floor (bottom photo).

Next, I install the closet flange, a fitting that links the toilet to its drain line. There are three common types of closet flanges: solid plastic; steel rim with a plastic hub; and cast iron. The all-plastic flange and the combo plastic-hub/steel-rim flanges are cemented to the drain line and then screwed to the floor. This is a snap because there are plenty of countersunk holes for the screws and because the outer rings of these two types of flanges are large enough to achieve good bearing on the subfloor. Nevertheless, it's important that the drain-line hole in the subfloor be accurately cut and not too big. It's also best to have the finished floor in place before installing the closet flange. If the edge of the flooring abuts the toilet, it creates a crevice that is tough to clean. No matter what kind of flange you use, its lip should be securely fastened to the subfloor with stainless-steel or brass screws (photo top left, p. 80).

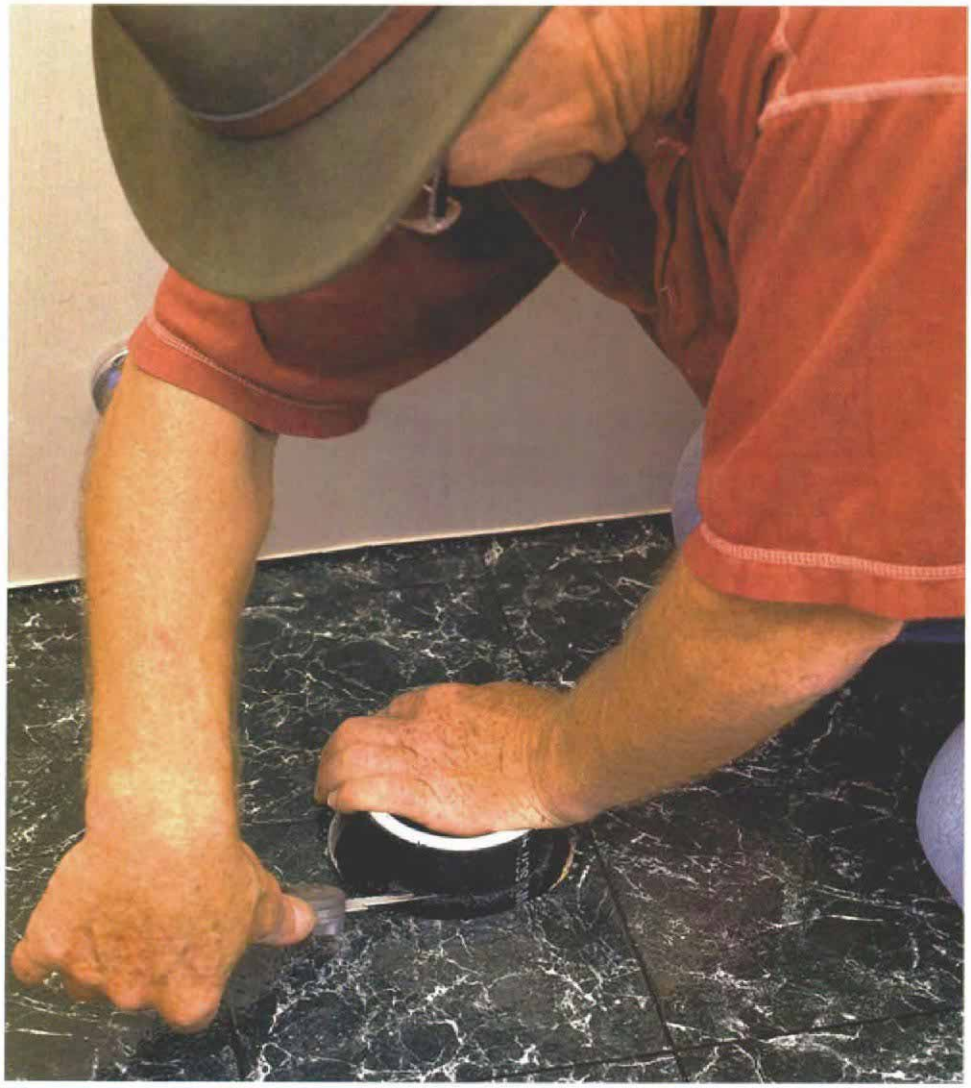
Closet bolts anchor the toilet

The second commandment of toilet installation: **Don't use hardware that can corrode in wet locations.** This hardware includes closet bolts, the long, machine-thread bolts that fit into slots in the toilet flange and anchor the toilet to the floor. Chances are good that the bolts included with the toilet are brass-plated steel. Check them with a magnet. If they stick to it, don't use them. Same goes for the washers and nuts. Your local plumbing supply will have brass bolts and nuts, and stainless-steel washers. If you can find them, get the extra-long, 3-in. by 5/16-in. dia. closet bolts.

Most instructions say to slide the bolts into the flange, put a wax ring on the toilet's out-



A sturdy base begins with the floor framing. A pair of blocks nailed to joists on 12-in. centers create a chase for the toilet's drain line. The blocking and closely spaced joists will minimize deflection in the subfloor. For standard toilets, the center of the drain line should be 12 in. from the finished wall.



Trim the drain line. The author uses a small handsaw with a reciprocating-saw blade to cut the plastic drain pipe flush with the floor. The white ring atop the pipe is the remains of the test plug.

Drawing facing page: Dan Thornton

Affix the closet flange with noncorroding screws. Rotate the outer ring of the closet flange until the narrow portions of the slots on both sides of the ring are equidistant from the wall. Then attach the flange with brass or stainless-steel screws.

Secure the closet bolts to the flange. Slide the closet bolts into their slots, and orient the T-shaped head of the bolts so that they are perpendicular to the slots. Then tighten each bolt with corrosion-proof washers and nuts.

Wax-ring choices. Variables such as drain diameter and floor thickness influence your selection. The thick ring on the left accommodates the thickness of a new bathroom floor without resetting the closet flange. The other two rings are for 4-in. and 3-in. drain lines.

Wax goes on top, funnel goes down. Closet bolts secured and the wax in place, this closet flange is ready for its toilet bowl.

let and then lower the toilet onto the flange. There are better ways to do both. First, take the extra step of affixing the closet bolts to the flange (photo top right). This will ensure that the closet bolts won't spin when you bolt down the toilet.

A wax doughnut seals the toilet to the closet flange

The bolts will keep the toilet firmly on the floor, but they won't keep sewer gases out of the room, or prevent seepage from the toilet from rotting the subfloor and the framing. That's what wax rings are for (center photo).

Wax rings have been around for centuries. The English, who invented what has become the modern toilet, used beeswax to seal the connection between toilet and pipe. But as the newfangled toilets gained popularity, they outstripped bees' ability to make wax. Modern wax rings are made of vegetable and petroleum waxes, with polyurethane additives.

Wax rings work fine if they're installed properly. If they aren't, the toilet will leak. And using a plunger on a toilet to clear a blockage in the drain pipe can rupture a wax seal. My guess is that future plumbers will use a new generation of seals (photo bottom left, p. 83). For now, wax rings are the standard.

Check the toilet for defects, then set the wax

If you didn't look over the bowl when and where you purchased it, it's now time to give it a good inspection before you install it. Keep the original cartons and paperwork in case you need to exchange a defective fixture. With toilet bowls, the main problems that you want to avoid are a deformed inlet, the opening between the bowl and the tank; a crooked foot; or a deformed horn on the bottom of the bowl.

Contrary to what you might read on the box, the bowl wax should not be pressed onto the bottom of the toilet bowl. It should be installed on the closet flange (bottom photo). Often, the plastic funnels are not perfectly round and require some manipulation to get them to fit into the flange. You can't do this if the wax is stuck to the bowl. Waxes mounted to bowls can twist during installation, causing a partial blockage of the drain line.

With the bolts and wax in place, the toilet bowl can be set. Here's where the extra-long closet bolts pay off. They are tall enough to act as locating pins for the bolt holes in the bowl without the projecting horn on the underside of the bowl nudging the wax out of position. Once both bolt holes have found their respective bolts, let the bowl settle onto the wax ring. The third commandment now

comes into play: **Do not push on, sit on or wiggle the bowl downward as it is set.** To do so will overcompress the wax, leading to a potential leak. Instead, use a wrench, alternating six or seven strokes from one nut to the other, until the bowl is snug to the finish floor.

By the way, if your toilet includes plastic washers that act as retainers for the closet-nut caps, don't use them. These disks are time bombs. When someone sits on the bowl, their shifting weight compresses the soft plastic disks, which in turn causes the closet nuts to loosen. Then the bowl begins to move around, the wax seal fails, and seepage begins. Usually, the seepage goes on for a long time before it is detected and does a lot of damage. Just ask any termite contractor.

Instead of the plastic disks, I use stainless-steel clips (top photo). Ironically, the plastic disks were supposed to replace these clips. Most hardware stores still offer them, but make certain they are stainless steel.

If the closet bolts were installed in the proper plane, the bowl will be perpendicular to the plumbing wall. The holes in the bowl's foot are large enough to give you a little fine-tuning room if the bolts aren't perfectly positioned. Make this final adjustment just before the bowl is tight to the floor.

And just how tightly do you snug the nuts? If you overtighten them, you can crack the foot of the bowl. I suggest that you grasp the edges of the bowl and try to wiggle it. When the bowl remains motionless in spite of these efforts, call it done—for now. Usually the nuts will loosen a bit after the bowl has been in use for a while, and you might need to make a final tightening of the nuts.

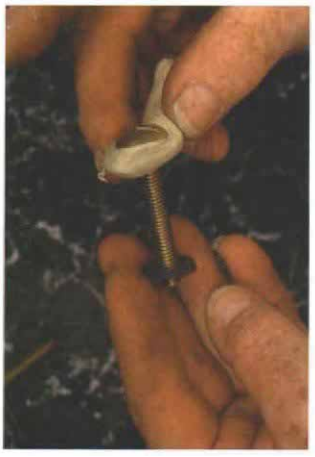
For those installers who will be living with the newly installed toilet, this is no great inconvenience; you can check the nuts a few days after the installation. The professional installer has to take more risks and tighten the nuts to a greater degree on the first and—it is hoped—only visit. Either way, before you trim the closet bolts, you should install the tank. Many toilet bowls somehow pass the factory-testing procedure and leak soon after installation. If you need to lift the toilet and try again, you can reuse the same bolts.

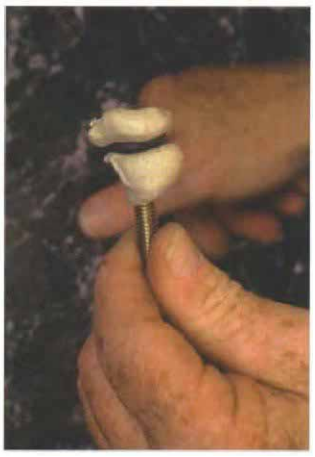
Installing the tank

The typical two-piece toilet has two fittings on the bottom of the tank (center photo). The small one is the supply inlet, the fitting that connects to the angle-stop valve on the wall behind the toilet. The larger one is the flush-valve lock nut. I check them both to make sure they are tight before setting the tank on the bowl. A big, sponge-rubber gasket fits over the flush-valve lock nut (photo

Stainless-steel clips retain the bolt caps. Before drawing the bowl tight to the floor, the author slips a retainer clip and a stainless-steel washer over the closet bolt.

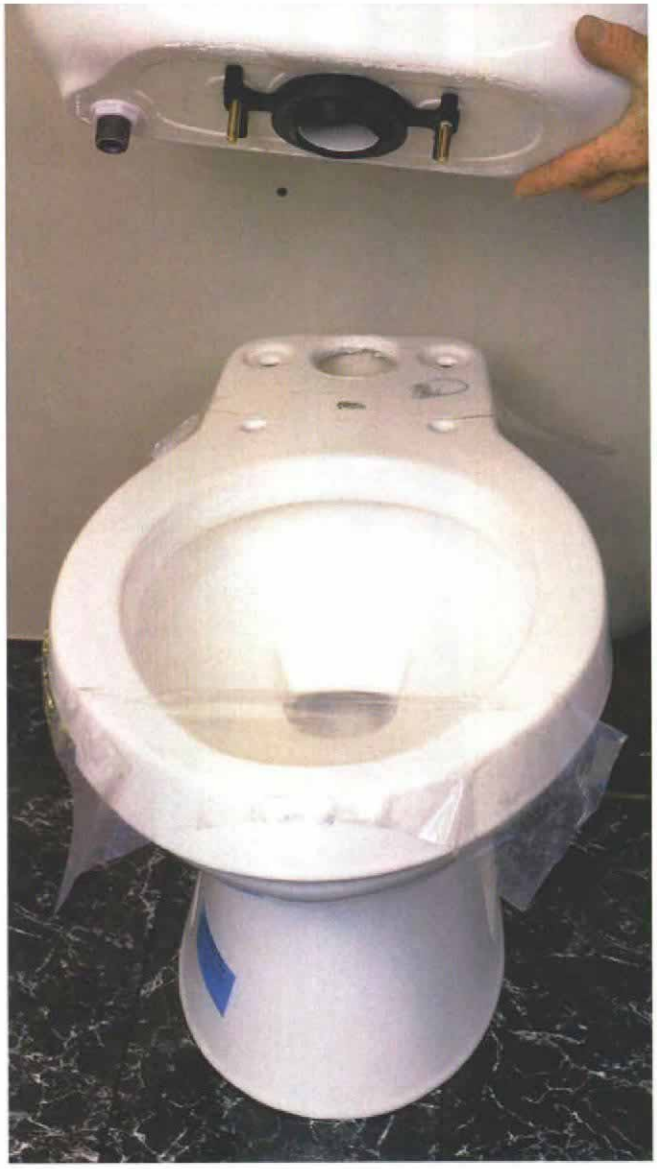
Tank-bottom connections. Using a portion of the shipping carton as a work surface, the author snugs tight the threaded connections. The wrench is on the flush-valve lock nut. The supply inlet is to its left.





Putty blobs add insurance. Plumber's putty can help to prevent leaks where the tank bolts pass through the bottom of the tank. The washer is sandwiched between the blobs.

Prep the bowl's inlet. A bead of silicone grease around the edge of the inlet can stop a leak before it starts.



Gasket weds tank and bowl. A soft, sponge-rubber gasket seals the joint where a two-piece toilet comes together. The tank bolts project through the ends of the gasket.

Tighten down the tank. Hold the tank bolts steady with a screwdriver and tighten the nuts from below with a socket wrench. Don't turn the screwdriver. Doing so can deform the rubber washers.

top right). Some toilets come with this gasket preinstalled. Others let you do the honors. Slip the gasket over the nut, and then insert the tank bolts and their washers. If your toilet has a tank float, take it out for this part of the job. You'll be able to reach the bottom of the tank more easily with it out of the way.

As before, make sure the bolts are solid brass. I wrap small gobs of plumber's putty around the bolts on both sides of the washers (bottom photos, p. 81). Next I run a bead of silicone grease around the bowl's inlet (photo top left). Pipe-joint compound will also work for this task.

Lower the tank into place, making sure the bolts drop through the holes in the bowl. Next, slide a brass or stainless-steel washer up each bolt, followed by the brass nut. Then align the tank to the wall so that it is as parallel as possible, and snug up the nuts with a socket wrench and a long screwdriver (bottom photo). Tighten the nuts slowly, using the wrench to turn the nuts. Alternate five or six revolutions per side, until the tank rests firmly on the bowl.

Time to hook up the water supply

There used to be a real art to hooking up the water to a toilet. A plumber had to custom-cut a supply tube from brass or copper tubing, and then bend it carefully to avoid kinks. Each supply tube was a little different, depending on the location of the angle stop.

Not any more. Hooking up the water is the easy part now that manufacturers have figured out how to make flexible supply hoses that don't burst. Called overbraid hoses, these supply lines have woven brass or stainless-steel sleeves over flexible plastic cores (top photo, facing page). Install the angle-stop connection first because these threads are harder to start. Then hook up the $\frac{7}{8}$-in. coupling to the tank. If the hose is longer than necessary, you can make a loop out of the excess and tuck it behind the toilet.

Before turning on the supply, look in the tank and make sure that any tubing between the fill valve and the overflow tube of the flush valve is secured. There should be a little clip for this. Even secured tubes may come loose with the first filling of the tank. So be prepared to turn the water off abruptly.

It is a good idea to open the angle stop just a little bit at a time and fill the tank slowly until the fill valve shuts off automatically for the first time. Depending on the type of fill valve you have, you might need to adjust the water level to match the mark provided on the back wall of the tank. This mark might be just a scratch and the letters *WL* in the china. Or it may be a painted word: *Water Level.*

Now you should flush the bowl a half-dozen times, and check for leaks at all the connections. If you've got a leak at the tank connection or in the supply line, tighten the nuts. If water accumulates around the bowl's foot and nothing else is leaking, you've got a problem with the wax ring, and you'll have to pull out the toilet and start over again. Once you've got a leak-free toilet, use a small hacksaw to cut off the closet bolts and install the caps over them.

Finally, should you run a bead of sealant around the base of the toilet and the finish floor? Many inspectors will demand it before they sign off. If you've got a 100% watertight marriage of bowl wax and closet flange, a caulking bead does no damage. But adding one immediately can be an expensive maneuver. Seepage that would soon appear at the edge of the toilet and warn you of such circumstances will never appear. Instead, accumulating liquid finds its way into the layers of flooring and causes damage. □

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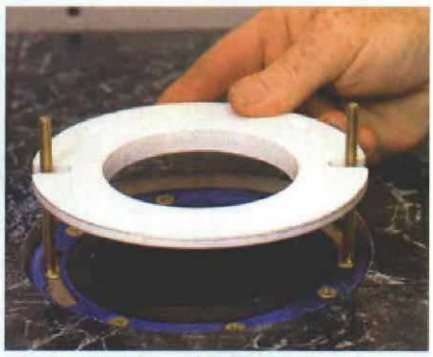
Flexible hoses make supply hookup a cinch. The angle stop (supply valve), which provides water for the toilet's tank, should be about 6 in. above the floor and 6 in. to the left of the drain's center line. Loop any excess supply line behind the toilet.

Sunken flanges, broken flanges



A spacer raises the flange height. If a new floor puts the closet flange below floor level, you can get back on top with a PVC closet-flange spacer.

Remodeled bathrooms often get new floors, which means the flange is below its correct level for a standard wax seal.

The typical way to deal with this is to use a thick wax ring (center photo, p. 80) or a couple of standard wax rings, one without the plastic funnel, stacked atop one with the funnel. A better way to accomplish the same thing is with a closet-flange spacer (top photo). The best way is to use an Ultra Seal (Predco; 800-323-6188), which can be adjusted up or down to deal with any floor thickness (photo bottom left).

An Ultra Seal is a reusable fitting made of PVC plastic. Its bottom fits into the drain line, where it is sealed by an O-ring. At the top, a rubber boot fits around the horn of the toilet. Unlike bowl waxes, an Ultra Seal can't migrate horizontally or be ruptured by water or air pressure from a toilet plunger. Ultra Seals aren't just retrofit devices: You can use them on new construction, too. They cost about $10.

If you're faced with a broken cast-iron flange, consider using a repair flange (#1012 Spanner flange; Donald O. Smith Co.; 800-262-5011; photo right). This slice of galvanized steel can save you a lot of trouble in the right circumstances.

—*P. H.*

A wax-free toilet seal. Ultra Seal connectors use O-rings and rubber gaskets to make a foolproof hookup between a toilet and its drain line. The grooves allow the O-ring to be adjusted for different pipes.

A fix for broken cast-iron flanges. You can repair a broken flange with a Span-It repair flange. Use the existing bolt holes to affix the new flange.