



Choosing a Toilet

A head-to-head comparison for our readers
with nothing to go on

by Steve Culpepper

At first, the toilets in our house were merely sluggish. Then they got slower and slower until they didn't flush at all. But the toilets weren't clogged. Something was in the sewer line. So I rented a sewer snake, unscrewed the clean-out and fed the hungry snake down the chute. In it went—10 ft., 25 ft., 40 ft. Still, the pipe didn't drain. As I pondered the problem, my young son stuck his head out the window, his little fists full of his favorite action figures, the Teenage Mutant Ninja Turtles. "Turtles live in the sewer, Daddy," he said.

After the snake failed to hit paydirt, I retracted it and fed a garden hose down the sewer line. When the hose could go no farther, I turned up the pressure and just let the water eat. The hose had stewed in the sewer no more than five minutes when a dozen or so plastic Teenage Mutant Ninja Turtles, all horribly chewed by the sewer snake, bubbled to the surface. I coiled up the hose and broke the news to my son.

Gone are the days when we could flush toys—After our sewer was deturtled and the attendant blockage removed, our toilets flushed magnificently. What was amazing was that all those Teenage Mutant Ninja Turtles could ever have been flushed down the toilet at all. But those were the days of the 5-gal. flush. With that much water chasing after them, an entire flotilla of Ninja Turtles could've been flushed home at once—and might have been.

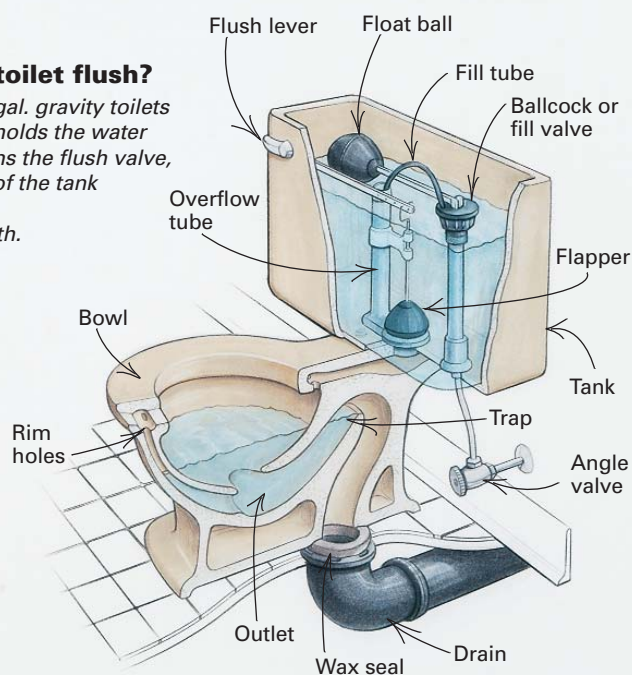
Times have changed since that unclogging. My son is in high school. The Democrats are in the White House. Toilet-flushing capacity dropped from 5 gal. to 3.5 gal., down to the current nationally mandated standard of 1.6 gal.

Our old 5-gal. toilets could flush turtles, cigars, feminine-hygiene products, bullets, Popsicle sticks and an occasional diaper with little effort. The new 1.6-gal. toilets sometimes struggle to flush our humble daily loads of human waste. However, the law's the law, as those who favor the law are fond of saying. And the law is the National Energy Policy Act of 1992, which requires that all toilets made or sold in this country meet new federal water-efficiency standards. To conserve water, those standards set the upper limit of a single flush at 1.6 gal. The law took effect in 1994 for residential toilets and in 1997 for commercial toilets.

How 1.6-gal. gravity toilets work—Regardless of price or style, all gravity toilets depend on gravity to pull the water—and waste—through the system (drawing above). When the handle is pushed, a flush valve opens, and the water in the tank drains into the bowl, either through rim openings, through the large siphon-jet opening

What makes a gravity toilet flush?

Old 5-gal. toilets and new 1.6-gal. gravity toilets work the same way. The tank holds the water above the bowl. The lever opens the flush valve, which lets the water rush out of the tank into the bowl, either through rim holes, a siphon hole or both. In the bowl, the pressure of the water rushing down the drain creates a vacuum or siphon effect that draws the waste with it. Meanwhile, an automatic valve refills the emptied tank.



across from the drain at the bottom of the bowl or through a combination of both. The gravity-fed speed of the water pushes the waste through the trap and into the drain.

But not all gravity toilets work the same way. For instance, there are different ways of ensuring that only 1.6 gal. of water is used in a single flush. A few toilets use tank dams that fit around the flapper and allow only 1.6 gal. of water to flow into the bowl. Some toilets rely on an adjustable ballcock to cut off the flow of water after 1.6 gal. has flowed. On others, the flapper valve closes early. And still others include a plastic bucket-type device inside the tank that lets only the top 50% to 75% of water in the tank pass through during a flush. That height increases the head pressure of the water going into the bowl and results in a brisker flush.

However, most of these tanks hold more than 1.6 gal. of water, and most of the ways manufacturers control the flow of water from tank to bowl are open to adjustment. James Sargeant is a registered plumbing designer, master plumber and director of the Wisconsin Plumbing Bureau. He's a member of the American National Standards Institute (ANSI) Toilet Adjustability Committee and is also in charge of codes and standards for the Kohler Company. "Some plumbers have the notion that when they get the toilet from the factory, they have to adjust something,

which wreaks havoc," according to Sargeant. "What they're adjusting is the water action. On a 1.6-gal. water closet, the bowl and trap way are a finely tuned design system to go with a specific amount of water. That's not just Kohler, that's all toilets. They're well-engineered bowls."

Despite the best efforts of engineers, designers and manufacturers, plumbers and the general public still haven't gotten used to 1.6-gal. toilets and aren't happy with the way they flush.

What this country needs is plunger lessons

Complaints against the 1.6-gal. toilet include sluggish or incomplete flushing; a small "water spot," as the area of the toilet-bowl water surface is called; staining; and the need to double-flush or triple-flush. Critics say that if a 1.6-gal. toilet is flushed more than twice, it uses more water than the now-illegal 3.5-gal. toilets.

"In my opinion, it wouldn't be using more water if we went back to the 3.5-gal. flush because my customers are flushing more than two or three times anyway," according to Seattle plumber Hill Daugherty. "Everybody with a low-flush toilet has a plunger. The high-end houses have a decorative one, and the low-end houses have a regular plunger."

Terry Love of Love Plumbing & Remodel in Redmond, Washington, says, "Most customers who get 1.6-gal. toilets for the first time have to

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learn to use a plunger, and believe it or not, a lot of people don't know how to use a plunger."

According to Love, there's a right way to plunge a toilet. "Put the plunger in with water in bowl, and after a series of short, quick strokes, pull up until everything sucks down. Usually people do big strokes up and down. Using that method, some blockages won't move."

If you don't like the way 1.6-gal. gravity toilets flush, you can't necessarily buy your way out of the problem. From plumbers around the country, I'm told that high cost isn't a guarantee that a 1.6-gal. gravity toilet will work well. Often, higher cost is really associated with fancy design, casting or color more than with the quality of function. According to Rex Cauldwell, a plumber in Copper Hill, Virginia, "The brands that work well have nothing to do with the price of the commode. We're talking about some \$75 toilets that flush better than \$250 toilets."

Daugherty agrees, sort of. "With a lot of high-end toilets, you're paying for design. You can spend \$1,400 or buy a lower-end toilet that will do the same thing."

Although plumbers and the public complain about the way new toilets flush, plumbing regulators say that the latest generation of 1.6-gal. toilets works just fine. What the public needs isn't more water but more education, they say. We



A toilet for women who live with men. Kohler offers the Peacekeeper accessory on its toilets. There is no flush valve with the Peacekeeper; the only way to flush the toilet is to lower the seat. Photo courtesy of Kohler.

have to learn that toilets are only for No. 1, liquid waste, and No. 2, fecal waste.

These toilets are here to stay, so we'd better get used to them—Patrick Higgins is a licensed plumber and chairman of the ASME/ANSI Plumbing Fixture Committee. Higgins has a great deal of personal and professional experience with 1.6-gal. toilets.

"I've lived with 1.6-gal. flushes for about eight years," according to Higgins. "Every six months, I retrofit a different-style toilet off the shelf into my office bathroom, and I've yet to run into one I don't like. Kohler, Briggs, American Standard, Mansfield, Gerber. Someone's bringing a Toto by next week. In my office bath now, I've got a combination water closet and bidet—that's a Geberit and it works like a gem. I've looked at all of them. It's a matter of getting used to the product and not using the toilet as a wastebasket."

One reason that people still harbor ill feelings against 1.6-gal. toilets is that the early models were not up to the duty. Although manufacturers saw the new ultra-low-flush regulations coming, they were caught with their pants down when

the government finally acted. Some early 1.6-gal. efforts were lamentably short of the mark. Cauldwell said he once got a letter from a major toilet manufacturer "apologizing for the fact that their 1.6-gal. toilet didn't work well but that they were required to make it."

Sometimes the problem is in the pipes—

A number of plumbers warned me that installing a 1.6-gal. gravity-flush toilet in an old house could lead to clogs and backups. Often, older waste pipe is 4-in. or greater dia. cast iron, which is a lot rougher on the inside than modern plastic pipe. When the cast-iron pipe was installed, toilets flushed anywhere from 5 gal. to more than 7 gal. of water. But now that they're down to 1.6 gal., that's often not enough water to power the waste through.

"Houses that have 4-in. to 6-in. cast-iron drains are a problem," said Daugherty. "When you put a 1.6-gal. toilet in with that diameter pipe, it just barely makes the bottom of the pipe wet. As a retrofit in a house with old plumbing, it's lousy. Now I run high-use fixtures, like the washing machine, just after the toilet. The washing machine will help move that waste down the line."

Washington, D.C., plumber Ken Goldman believes that retrofitting 1.6-gal. toilets is the biggest source of problems plumbers have with the new



These toilets are popular in Japan. The Toto Prominence toilet with the Zoë Washlet seat offers a warm-water spray, a prewarmed seat and a fan with filter to help clear the air. Photo courtesy of Toto.



It flushes more or less. The Kohler Eco Lite offers two different flushes. Depending on the type and size of the load to be flushed, one handle flushes 1.1 gal. of water, and the other flushes 1.6 gal. of water. Photo courtesy of Kohler.



A right angle for a tight spot. Eljer's Triangle Ultra 1.5-gal. toilet is built for corner installation. With its triangular tank at a 90° angle, the Triangle Ultra fits neatly in a corner. Photo courtesy of Eljer.

fixtures. "We're using plumbing fixtures that were designed for the 1990s and putting them in plumbing systems that were designed for the 1920s," Goldman said.

Power-assist toilets blast the waste away—

If old pipes are your problem, you may be interested in the power-assist toilets that many toilet makers now offer. These are toilets that use compressed air to force the waste down the trap.

Although a few power-assist toilets require compressors, most use the pressure of the home's water supply to get the job done—with the help of a pressure tank. The Sloan Valve Company's Flushmate Flushometer (800-533-3450) is the industry leader in toilet pressure tanks. New on the market is the PF/2 Energizer System (W/C Technology Corp.; 888-732-9282).

Both work similarly: Water from the supply line is forced into the air-filled pressure tank at the house pressure of 60 psi or so, which compresses the air and exerts force on the water in the tank. When the flush button is pushed, the water jets into the bowl.

One benefit of a power-assist flush is that the water is contained inside the pressure tank, which is inside the china toilet tank. That insulation results in little or no tank sweating. Drawbacks include noise and price: Power assist generally adds \$100 or so to the cost of a toilet.

Water rushing from the pressurized tank can be quite loud and startling. However, Bruce Martin, the engineer who developed both pressure-assist systems (he sold the Flushmate technology to Sloan), said his new PF/2 Energizer is much quieter than the Flushmate. "It's as quiet as a gravity toilet," he said.

Currently, only about 5% of toilets sold contain any type of pressure tank. Martin said the price of power-assist toilets will decrease, thanks in part to competition and volume sales. For now, only specially designed toilets can accept pressure-assist units. Martin is working on an adapter unit to convert ordinary gravity toilets to pressure assist.

A breakthrough in the engineering of gravity toilets—

One of the more promising developments in gravity-flush toilet design is the new vacuum-assist technology, which was developed by Fluidmaster and is currently featured in the Vacuity toilet manufactured by Briggs Industries (800-888-4458).

Although on the outside the Vacuity looks like any other toilet, it solves several different problems that are common to many of the 1.6-gal. toilets. First, it contains two plastic tanks within the toilet tank that hold only 1.6 gal. of water between them. If it's modified to flush more, it won't flush, according to Oscar Dufau, Fluidmaster's product manager. The tanks also prevent the exterior china tank from sweating in hot, humid weather.

More important, the system allows the toilet to give a complete, clean flush using only the rim holes inside the upper toilet bowl. There is no siphon-jet hole in this toilet. With all the water that is coming out of the rim holes, the bowl stays cleaner.

The Vacuity is different from other gravity-flush toilets in another significant way. The Vacuity has two internal tanks and is configured in such



No floor drain required. This wall-mounted toilet, the Kimera by American Standard, discharges to the rear so that no floor drain is needed. The rear-discharge feature is useful for remodels, where installing a floor drain would be impracticable. Photo courtesy of American Standard.



Maybe the Queen's got one of these. The Nautilus II Water Closet is made in England, and it is sold in the United States by Burgess International for about \$3,000 in white. Photo courtesy of Burgess International.

a way that when you flush, a vacuum is created that powers the water into the bowl.

Although Briggs is the only U.S. toilet maker now using the Fluidmaster vacuum-assist technology, other U.S. companies are developing toilet prototypes that also use the technology. To keep the price of the unit at profitable levels, however, Fluidmaster has agreed to allow only four U.S. makers to license the technology.

Briggs lists its two-piece Vacuity toilet at near \$300. However, I called around southern Connecticut and found a supply house that could order one for \$217, plus \$12 for the seat.

Special toilets for specific needs—Within the wide range of 1.6-gal. toilets on the market are some fairly specific toilets and toilet accessories. These perform certain functions that you won't find on a run-of-the-mill fixture.

For instance, there is the ShowerToilet by Geberit (219-879-4466), a wall-hung fixture that contains a wand to give you a warm-water nether shower. The Geberit follows the shower with a flow of warm air. The Zoë Washlet by Toto (800-938-1541) is a high-tech toilet seat that contains a heating unit, a fan, an air purifier and a wand that sprays warmed water on your undercarriage (photo left, facing page). The Washlet also offers a prewarmed seat. And both the Geberit and the Toto offer fans that extract toilet air and pass it through a filter.

But that kind of luxury comes at a price. The Geberit ShowerToilet, which has the tank and

flushing mechanism inside the wall, sells for \$4,200 in white. Color models cost much more. And the one-piece Prominence toilet by Toto, including the Zoë Washlet with heated seat and a remote-control device for controlling the spray, sells for about \$1,200. Newer Toto toilets will come with an antibacterial glazing, which the company says inhibits the growth of germs and kills common types of bacteria.

Another specialized toilet option is the Peacekeeper by Kohler (800-456-4537). There is no flush lever or button on toilets equipped with Kohler's Peacekeeper technology (photo center, p. 74). Instead, it automatically flushes when the seat is closed, which makes it clear how it got its name. Here in Connecticut, Kohler's Wellworth toilet with the Peacekeeper installed retails for about \$273 in white.

Kohler also makes the Eco Lite (photo right, p. 74), which replaces the standard single-flush lever with two levers. Depressing the smaller one gives a 1.1-gal. flush. Depressing the larger one gives a 1.6-gal. flush. The Eco Lite sells for about \$186.

The Triangle Ultra by Eljer (972-407-2600) is a 1.5-gal. toilet with a specially designed triangular tank that can help to solve your bathroom-space problems. With its 90° angled tank, the Triangle Ultra can fit into an odd corner of your bathroom. The Triangle lists for about \$339 in blue (photo left, p. 75). In white the price for the Triangle falls to \$269.

A few companies make wall-mounted, rear-discharge toilets (photo center, p. 75). These toilets come in especially handy during a renovation when there's no practical way of installing a standard floor drain. The tank and flushing mechanism for these toilets are concealed inside the wall. However, because they are wall mounted, they require extra-beefy support inside the wall.

In our grandfathers' day, many toilet tanks were mounted high on the wall above the bowl. Because of that height, the water came rushing down into the bowl with enough pressure to force nearly anything down the drain. These old-fashioned toilets now use 1.6 gal. of water and are still available. Barclay (847-244-1234) makes one in white that retails for about \$850.

For those who feel at home on a throne, there's the English-made Nautilus II (photo right, p. 75), which is sold in this country by Burgess International (313-292-7070). This is a real royal flush. A white Nautilus II sells for \$3,000; in black, the price increases to \$4,500. The mold for this lion-shaped commode is so complex that only 16 out of every 100 toilets survive the casting process.

For extremely specific toilet requirements, Toto makes a toilet that analyzes your urine, takes your blood pressure and then sends that infor-

mation to your doctor via a built-in modem. Unfortunately, you have to go to Japan to buy one.

What else goes into toilets?—To see what goes into toilets (before what normally goes into toilets goes into them), I visited several toilet plants. I saw a wide range of manufacturing styles, from toilets made by hand in Wisconsin to an assembly-line plant in Ohio to an automated toilet plant in Georgia.

Believe it or not, toilet making contains some highly guarded proprietary secrets. Although I could observe any part of the process, I could photograph only certain production areas. Secrets range from the brand of robot used to spray glazing on the unfired toilet to the way the rim holes are punched or drilled in the green-clay toilet bowl.

Each toilet starts with several molds, depending on the model. Each mold is filled with slip,

Toto makes a toilet that analyzes your urine, takes your blood pressure and then sends that information to your doctor via a built-in modem.

or liquid clay, and run through a dryer before being glazed and kiln fired. Afterward, the tank components are installed.

As important as the manufacturing process is, however, it's the research and engineering that go into the toilet and the final testing and quality control after manufacturing that make a truly good toilet.

Residential toilets must pass a series of ASME/ANSI tests, including a test in which 100 $\frac{3}{4}$ -in. dia. plastic balls are flushed; a granule test in which 2,500 tiny plastic granules are flushed; a test in which ink lines are drawn inside the upper rim and flushed away; a dye test; and a drain-line transport test.

Every manufacturer tests toilets coming off the line. However, many manufacturers have created their own tests in addition to the ASME/ANSI requirements. One company that has its own set of standards is Toto, the world's largest plumbing-products manufacturer. At the Toto toilet factory in Morrow, Georgia, an engineer

tests toilets in a remarkably real way. He doesn't actually defecate in them, but it's close. Using a proprietary ingredient that closely resembles human feces, the engineer measures out up to 400g of this faux waste and then molds it into its familiar tubular shape.

After plopping the artificial waste into the toilet, the engineer wads up toilet-paper balls and drops them in on top of the bogus poop. Standing there in the factory watching him do this, I felt like asking if he wanted to be left alone. The purpose of this realism is to ensure that the toilets meet or exceed ASME flush standards.

Which toilet should you buy?—According to Patrick Higgins, all toilets that pass the ASME standards tests should work the same. In theory, I guess that's true. But we all know that standards are only part of the story. The true test of whether a toilet—or anything—works as it should occurs in the real world.

I can't definitively tell you which toilets work and which don't. All the plumbers I talked to had wildly differing opinions about which is the best gravity-flush toilet. There are a few other things to consider before spending money on a new commode.

Thomas Pape, chairman of the Indoor Plumbing Committee for the American Waterworks Association Conservation Committee, suggests that homeowners buy rounded-bowl toilets instead of the elongated variety. "These just seem to work better than the elongated bowl," according to Pape. "That's especially true in a setting that might be abusive. You get a better vortex action out of a round bowl."

A new feature of modern toilets is the advent of one-piece toilets, which cost more than two-piece toilets because they're harder to make. Otherwise, there is no significant difference between one-piece and two-piece toilets. They all flush the same way. In fact, some plumbers argue that the higher-tank two-piece toilets actually flush better than the more expensive one-piece models because the water in the tank flows into the bowl from a greater height and therefore has greater head pressure to accomplish a thorough flush.

Another thing that separates cheaper gravity-flush toilets from the more expensive ones is color. Color adds a lot to the price of a toilet. For instance, if I'm willing to make do with a plain white Kohler Rosario one-piece toilet, I can buy it at my local home-supply store for \$296, plus the cost of a seat. If I want it in gray, that price increases to \$455. American Standard's one-piece Ellise toilet in white costs \$720. Make it black, and it increases to \$1,005. □

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Toilets that don't require sewers or septic tanks

Say you want to build a house on a big rock. You'll rely on solar collectors for electricity. Rain will supply your water. But you can't build a septic system. So your choices are either to buy a composting toilet or an incinerating toilet, to store waste in a tank or to hold it until you get off the rock.

If your concerns include the price of a septic tank and leaching field, the fate of the planet or a tight water supply, your best bet is probably a composting toilet, of which there are a variety on the market. These include BioLet (800-296-6026), Sun-Mar (800-461-2461), Phoenix (406-862-3854) and Clivus Multrum (508-725-5591).

A composting toilet works like the compost pile in your backyard. A carbon-rich material such as rice hulls or sawdust is added to the human waste. The materials then are mixed together in the composting unit, where they decompose together.

As to getting your composting toilet approved, the local health department usually has jurisdiction. Some jurisdictions recognize and approve composting toilets; others take them on a case-by-case basis.

Composting doesn't come cheap—Prices for composting-toilet systems are generally pretty steep. A midsize Phoenix system (photo bottom left), which includes two toilets and a basement-style composting unit, begins at about \$4,600 installed, with vents and chutes, according to Glenn Nelson, who designs composting systems.

Small, self-contained composting toilets, such as the BioLet XL (photo bottom right), sell for about \$1,600. This toilet uses a 110v household current to power a heater (the rate of composting doubles for every 18°F increase in temperature), has a mixer motor and fan, and has a use capacity of four people. It needs venting just like the big composting units.

The Incinolet (800-527-5551) is a self-contained unit that burns waste (top photo). For four-person use, a 120v, 1,800w Incinolet CF costs about \$1,500.—S.C.



It looks like a garbage can, but it's an electric toilet. An Incinolet uses electricity to incinerate human waste rapidly, leaving an odor-free ash that can be dumped with the trash. Photo courtesy of Incinolet.



A standard composting toilet. In the Phoenix system, a conventional composting toilet must be installed directly above the basement composting unit. Another type of toilet, the foam flush, can be installed at an angle away from the basement unit. Photo courtesy of Advanced Composting Systems.

An all-in-one composting toilet. This self-contained BioLet composting toilet contains an automatic mixer, a heating element to accelerate composting and a fan to draw odors up the vent. Photo courtesy of BioLet.

