

21st-Century

New features flood the market,
and basic toilets keep getting
better and better

BY NENA DONOVAN LEVINE

While the convenience and hygiene of indoor plumbing are obvious, the improvements in toilets in recent years may not be. In part, this is because people view the bathroom, and the toilet in particular, as taboo subjects for social conversation. The other reason is that most people can't test, I mean *actually* test, toilets before purchasing one. It's nearly impossible to get a good sense of how well they work by admiring toilets on a showroom floor, no matter how many golf balls, sponges, or other items are loaded into them. In this respect, commodes are a unique consumer product: There are few sources of good comparative information for something that needs to work flawlessly multiple times every day and that consumers expect to last forever.

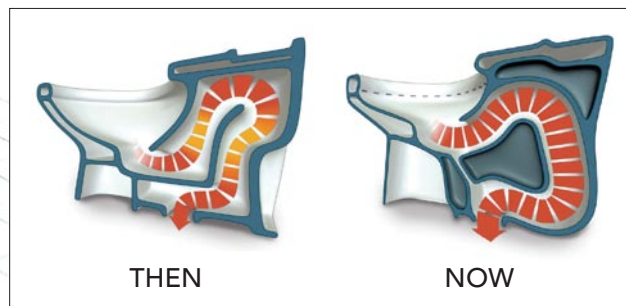
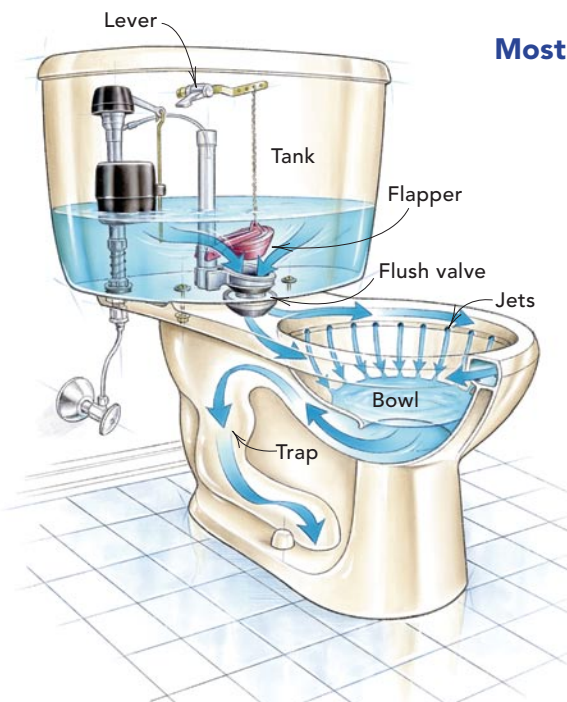
I recently had the chance to survey the wares of all the major toilet manufacturers at the Kitchen/Bath Industry Show in Las Vegas. And although researching toilets may be a dark job, at K/BIS it's sure not lonely. These days, crowds of serious folk, including former rocket scientists, contemplate, design, test, and manufacture water closets. They are eager to discuss their data and discoveries. Beyond the inner circle of designers, end users also were less squeamish than I expected and were willing to share their experiences. I found that today's toilets are better designed, better built, and better for the environment than those made just five years ago. Here, then, a perennially neglected fixture gets its due.

A great idea gets a bad start

When ultra-low-flush toilets debuted in the United States in the 1980s promising to conserve water by halving the amount used for each flush, consumers were underwhelmed. Homeowners complained of clogged toilets and bowls that didn't clean properly. Nothing much had changed by 1994 when federal standards mandated that manufacturers limit toilets to 1.6 gal. per flush (gpf). These early low-flow models

Most toilets rely on the simple principle of gravity

The majority of today's toilets rely on the same technology that powered old-fashioned chain-pull toilets. These gravity-fed toilets must have the tank above the bowl to generate rushing water. Toilets designed to flush with 3.5 gal. had a deep bowl with a high, tight curve in the trap way (drawing bottom center). This constriction created plenty of siphoning power when more than 3 gal. of water rushed through the bowl. With just 1.6 gal., however, it became a chokepoint. American Standard's Champion (\$290) (photo right) scores high marks for consistent clog-free performance, thanks to a wider trap way with minimal curves (drawing bottom right).



Toilets

Why replace a perfectly good toilet?

IF YOU'VE RESISTED switching out your thirsty 3.5-gal.-per-flush (gpf) commodes, consider the following:

- Toilets are by far the biggest water users in a household, consuming 30% to 40% of total volume.
- Residential 1.6-gpf toilets reduce water consumption by an average 2 gal. per flush compared to 1980s toilets; that's between 15,000 gal. and 20,000 gal. of water per year in a household of four.
- Replacing a 1.6-gpf fixture with a dual-flush toilet reduces water consumption by another 30%.
- High-efficiency toilets, such as the American Standard FloWise, use 1.28 gal. for every flush, a 20% savings over today's standard toilets.
- Water conservation reduces the need for water-use restrictions and cuts down on the volume of wastewater requiring treatment. Government/utility-company rebate programs can reduce the cost of a new water closet significantly.
- Conservation works: After completing a 1.6-gpf toilet-replacement program, Santa Monica, Calif., reduced average total water demand by 15% and reduced wastewater flow by 20%, saving the city \$6 million in a single year.



Perfect for bedroom suites. Self-closing seats mean you'll never be awakened by a banging toilet seat again. Kohler's Cachet Quiet-Close Seat sells for about \$50.

differed from their high-flow cousins in one respect only: the volume of water used per flush. The unhappy results sullied the rollout of the entire 1.6-gpf effort. To shake the nasty reputation, low-flush toilets had to be reinvented from the ground up.

Improving an old design

The vast majority of today's residential toilets rely on the same basic principles as indoor toilets of 125 years ago. A holding tank above the bowl stores water. Depressing the lever on a gravity-fed toilet raises a flapper at the bottom of the tank; gravity moves water from the tank to the bowl. The water enters the bowl forcefully through jets under the rim and/or through a siphon hole in the bottom of the bowl. The rushing water cleans the bowl sides and starts the contents of the bowl moving into the trap way. As the water level in the bowl rises, it crests the curve in the trap way and pours into the drain, initiating the siphonic action that pulls the bowl contents through the trap way into the drain.

To update the gravity-fed design for consistent, successful 1.6-gal. flushes—or even less water on some new high-efficiency toilets—engineers

re-examined the trap way and tried different diameters and shapes. Sales literature often hypes the trap-way diameter, but whatever it measures, it should be fully glazed to provide smooth performance. Continuing the slippery coating throughout the trap way keeps things moving toward the drain.

Evaluating the importance of the trap-way diameter is more difficult. On U.S. toilets, the minimum trap-way diameter today is 1½ in., and until recently, few fixtures exceeded 2 in. Lately, however, manufacturers have marketed toilets with 2⅜-in.-dia. trap ways. While bigger certainly sounds less clog-prone, changing the size of the trap way requires a careful balancing act with the other parts of the toilet because enlarging the trap way reduces siphonic pull.

To counter the reduced siphoning power, designers have focused on the shape of the trap way's curve. A certain degree of curve is necessary to allow the water at the drain end of the trap way to form a seal, preventing sewer gases from entering the room. The goal is to find the minimum curve sufficient to maintain the water seal while reducing choke points to maximize the water's pull (drawing p. 64).

American Standard's Champion and Eljer's Titan (\$350) are two of the best gravity-fed commodes,

NEW FLUSHING SYSTEMS GO BEYOND GRAVITY

PRESSURE ASSIST

A plastic tank within the toilet's porcelain tank holds water under air pressure to create a more forceful flush than gravity alone. These toilets stay cleaner than gravity-fed toilets because the water spot—the surface area of water in the bowl—is larger. They work well when older plumbing inhibits toilet performance.



More power, no sweat. The pressure-assist Mansfield Eco-Quantum (\$310) is condensation-free because of its tank-within-a-tank design.



POWER ASSIST

With an electric pump to move the water when the toilet is flushed, the tank can be below the bowl.



Where's the toilet? Kohler's Hatbox (\$1,994) is easy to mistake for a hamper. With an electronic flush and a self-closing seat, it's as quiet as a hamper, too.





Button one or button two? The Toto Aquia (\$395) dual-flush toilet uses two flush volumes, 1.6 gal. or 0.9 gal. Users push the large button for a full flush and the small one for a water-conserving flush.

tank. The toilet's water supply provides the pressure to compress the air in the tank, and when the incoming water reaches the fill line, the tank is pressurized and ready for the next flush. At the flush, the air under pressure blasts the water down into the bowl, creating a noise that can startle unsuspecting flushers. The toilet bowl in a pressure-assist toilet is designed specifically to handle the incoming water without splashing, so pressure-assist units can't be matched with your existing toilet bowl.

This flushing action is very efficient because up to 80% of the flush water is used to push the bowl contents through. You'll notice that the waste leaves a pressure-assist toilet almost immediately. In gravity-fed systems, only half the flush water may push, while up to half precedes the bowl contents to initiate the siphon.

Sloan Flushmate produces the pressure-assist systems used by a number of toilet makers, including American Standard, Gerber, Kohler, Mansfield, and St. Thomas Creations.

On the downside, pressure-assist toilets are a bit louder than gravity-fed ones. Consider power-assist technology for a quieter (though not silent) powerful flush. Here, electricity powers a pump that pushes water into the toilet bowl. (Power-assist toilets plug into a standard GFCI outlet behind the fixture.) Kohler's Power Lite line includes the Purist Hatbox (drawing right, facing page) and the San Raphael. Both are also dual-flush models, a water-conserving choice. These quiet operators are great for bathrooms near bedrooms, especially when paired with a self-closing noiseless seat. Their silence, however, comes at a price: The less expensive San Raphael starts at \$914. A self-closing seat can be added to any toilet, with prices starting at about \$50.

European technology for greater water savings

Dual-flush toilets allow the user to choose the volume of water required to evacuate the bowl: 1.6 gpf for solid waste and 1 gal. or less for liquid or light waste. If all toilets in a four-person house-

but you can get an excellent toilet for about half the price. When I asked plumbers in four states which high-performance, low-cost toilet they like, the American Standard Cadet and the Kohler Wellworth were popular recommendations. The plumbers liked the toilets' dependable flushes, and they know they'll be able to get replacement parts in the future. The plain-vanilla version of each toilet lists for about \$175. A plumbing-supply store manager touted the Eljer Patriot (\$126). Although he's not a plumber, he has this model in his own home, and that impressed me.

Adding pressure improves the flush

The force of gravity limits the washing action in a gravity-fed toilet bowl. Old-school toilets increased the scouring action of the water by raising the tank well above the bowl, but we've become accustomed to using the wall space above the toilet, so we look for sleek, low-profile designs. The inventive people at Sloan Flushmate figured out how to use air pressure to enhance the scrubbing and evacuation power of each flush (drawing left, facing page). These pressure-assist toilets can solve problems in houses with older plumbing systems where gravity-fed 1.6-gpf toilets struggle to pull waste through the rough interior of cast-iron pipes or along shallow drain slopes.

In a pressure-assist toilet, water from the supply line enters a sealed plastic reservoir inside the

TOILET STYLES

Classic two-piece toilet

Two-piece gravity-fed toilets often outperform one-piece gravity-fed commodes because the taller tank height generates more flushing force.



Easy-cleaning toilet

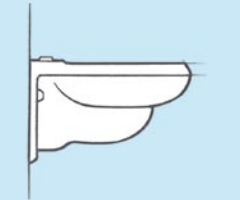
One-piece toilets are cast to create a single

unit, a more difficult casting process that raises the price compared to two-piece toilets. Characterized by their low profile, the seamless tank and bowl simplify cleaning.



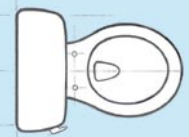
Toilet for small spaces

Wall-hung toilets work well in small bathrooms because the tank is in the wall. The sleek design makes for easy cleaning as well, especially of the floor.

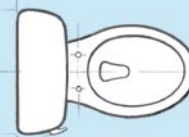


BOWL SHAPES

Round bowls have a shorter, slightly wider profile, and elongated, oval-shaped bowls are several inches longer and slightly narrower.



— 26¾ in. —



— 30¾ in. —

Toilets for big and small

SPECIALLY DESIGNED TOILETS accommodate people who are 40 lb. and those who are 400 lb. For toddlers, **Eljer's Kindergarten** (\$296, plus seat) has a 10-in. rim height and fits a 10-in. rough-in. When the child is ready for an adult-size toilet, switching it out is a snap (photo bottom left). This is just one of several toddler-size choices.

Even average-size adults should reconsider toilet height. The **Sterling Rockton** (\$245; photo bottom center) has a traditional toilet-bowl height of 15 in. above the floor (the seat adds another inch), but manufacturers now produce bowls to match the height of standard chair seats. Many adults find these 16-in.- to 16½-in.-tall bowls more comfortable.

At the other end of the scale, the **Great John** (photo bottom right) accommodates the overweight. Great John (\$1,800) is 6 in. longer than even elongated bowls and supports 2000 lb. The generously sized seat tops an ADA-compliant, 1.6-gpf commode. Molded "fins" on the underside of the seat hold it in place. Despite its considerable width, the seat opening is no larger than standard toilets.

Bowl height



hold are dual flush, water use per year should average 3000 to 4000 gal. less than with 1.6-gpf models. This translates to additional savings and less wear and tear on your septic system.

Toto's gravity-fed Aquia toilet (photo p. 67) dispenses either 1.6 gpf or 0.9 gpf. All the flush water rushes down the bowl sides, which are steeply pitched. This washdown design cleans and evacuates the bowl by maximizing the G-force. Rockton (photo below center) from Sterling, a Kohler company, is another gravity-fed dual-flush choice that combines the washdown capability of European toilets with the strong American siphon.

Other manufacturers of dual-flush toilets include Caroma, Duravit, Villeroy & Boch, and Vortens.

Personal-cleansing systems

A decade ago at trade shows, this category barely had a toehold in the United States. Now manufacturers are tripping over themselves to unveil their latest bidet-action toilets. If water is the optimal way to clean our bodies, why not aim it at those parts that need frequent attention?

There's lukewarm enthusiasm in America for bidets, the separate fixture used for that very cleansing routine. They add expense in purchase and plumbing, and they require additional floor area in the bath. However, bidet seats, such as Bemis's Purite, and the toilets with washing wands, such as Toto's Neorest series, are a way to achieve the same results. These fixtures are in an estimated 60% of Japanese homes, and manufacturers hope they will find similar acceptance here. The elderly, postsurgery/postpartum



This toilet doesn't need a floor drain. Saniflo's macerating toilets (\$600 to \$1,000) let you put a toilet in any room in the house without standard plumbing drains. Installation is easily reversible, allowing you to convert a room temporarily for a convalescing family member.

patients, and individuals who cannot perform conventional toilet rituals are logical, not to mention grateful, users.

More than a dozen companies making these toilets can be found at www.sanicare.com. In most cases, installing one requires only a GFCI outlet. Prices depend on the bells and whistles. At the low end of the price scale, consider retrofit seats such as the Purite (\$800) or Brondell's Swash 400 (\$470). A full-feature personal-washing system with more aesthetic (and high-tech) appeal, like Toto's Neorest series, will take a bite out of your wallet; prices start at \$3,200. (For more on this type of toilet, see "Feedback," p. 112.)

Need a toilet for the basement or a spare room?

Another product that works well in homes with elderly or infirm residents is Saniflo. A homeowner can install a working Saniflo toilet in a sickroom or a newly designated bedroom in less than a day.

Saniflo requires no floor drain.

PAPERLESS ALTERNATIVES

Installation doesn't require breaking into the floor and is completely reversible. When flushed, the toilet evacuates out the back into a box, where the waste and paper are quickly, quietly macerated. (Yes, that means what it sounds like.) The result is pumped through a 3/4-in. line into the household soil stack.

Thanks to the pump, the system works as far as 9 ft. below the sewer level and even up to 150 ft. away. The Saniflo system costs \$600 to \$1,000, depending on the toilet model. Complete installation, including the plumber's bill, might run \$2,000, according to John O'Reilly, a Saniflo spokesman.

Finding the right toilet

With so many factors to consider, picking the right water closet is no slam dunk. A buyer's first concern should be that the toilet clears waste from the bowl without fail. Low-flush toilets with great performance are relatively easy to find now, thanks to improved design and new flushing systems. Other features—price; aesthetics; how quietly the toilet flushes; how much room it requires; water-saving potential; and ease of cleaning the fixture—depend on the user's priorities. □

As part of her research for this article, West Hartford, Conn., kitchen designer Nena Donovan Levine interviewed a plumber sent to her Las Vegas hotel room when she claimed the toilet had clogged.



The lap of luxury. Toto invented the washlet (combination toilet and bidet) 40 years ago. Its latest model, the Neorest 600 (\$5,200), features washing wands with adjustable temperature spray, warm-air dryer, remote control, motion-activated seat and flush, dual flush, air cleaner, and heated seat.



Washlet toilets target a wider audience. One manufacturer's promotional video shows a woman in the kitchen washing dishes by wiping them with dry toilet paper and asks why people wouldn't use water to take care of personal hygiene. Now it's possible to convert any toilet with a GFCI outlet nearby into a washlet with easy-to-install retrofit seats, such as the Brondell Swash 600 (\$599).

The unit adds a washing wand, a heated seat, and an air dryer. Icons on a wall-mounted electronic remote control guide the cleaning process.

TOILET MANUFACTURERS

American Standard
800-442-1902
www.americanstandard.com
Bemis, 800-558-7651
www.bemismfg.com
Big John Toilet Seat
866-366-0669
www.bigjohn toiletseat.com
Briggs, 800-888-4458
www.briggsplumbing.com

Brondell, 888-542-3355
www.brondell.com
Caroma, 800-605-4218
www.caromausa.com
Duravit, 888-387-2848
www.duravit.com
Eljer, 800-423-5537
www.eljer.com
Gerber, 847-675-6570
www.gerberonline.com

Great John
877-268-2396
www.greatjohn.com
Kohler
800-456-4537
www.kohler.com
Mansfield
877-850-3060
www.mansfieldplumbing.com
Saniflo, 800-363-5874
www.saniflo.com

St. Thomas Creations
619-336-3980
www.stthomascreations.com
Toto, 800-350-8686
www.totousa.com
Villeroy & Boch
www.villeroy-boch.com
Vortens
800-471-5129
www.vortens.com