

Appendix A. Water-Saving Devices and Measures

Most conventional plumbing fixtures use far more water than is needed to do the job. There are now many devices available that can be installed in existing plumbing fixtures to use water more efficiently. The water-saving devices and methods outlined below are by no means an exhaustive listing but rather a collection of the most commonly used devices and those that will probably enjoy greater use in the future.

Water-Saving Toilets

The conventional toilet, which consumes more water than any other fixture in the home, uses five to seven gallons of water per flush. There are devices, however, that can be placed in a conventional toilet tank to reduce the volume of water per flush. These devices include tank inserts and other objects that displace a portion of the water in the tank; there are also flush-modification devices that allow the toilet to use less water when liquids are flushed and more water when solid wastes are flushed.

One of the simplest and most inexpensive—yet quite effective—tank inserts is a plastic bottle filled with water and weighted with pebbles. (See Figure 16.) When placed in the tank, the amount of water saved is equivalent to the volume of the plastic bottle or bottles used. Savings of up to 30 percent have been reported through the use of weighted plastic bottles. Of course, the most attractive feature of this method is that it can be prepared from materials found around the house. Many of the communities that recommend this method of saving water as part of their water conservation programs provide the public with detailed instructions on how to install the bottles.

Another tank insert device is the flexible panel or dam insert. (See Figure 17.) This device is to be wedged into the tank on either side of the flush valve, thus damming off a portion of the tank and retaining that water when the toilet is flushed. Dam inserts can be adjusted to allow different rates of consumption. Savings of over 30 percent have been reported; however, these inserts are more complicated to install than the bottle.

Even greater savings can be realized by replacing the tank of the conventional toilet with a pressurized tank. This tank provides a complete flush with only 2 to 2-1/2 gallons of water. This represents a savings of about 50 to 60 percent of the water used by conventional toilets. (See Figure 18.)

The most widely used water-saving toilet is the shallow trap toilet. (See Figure 19.) In appearance, the shallow trap toilet differs from the conventional design only in the size of its tank, which is smaller. The water-saver toilet requires less water in its bowl, and in turn, a significantly smaller tank. It uses only 3 to 3-1/2 gallons of water per

FIGURE 16. PLASTIC BOTTLES

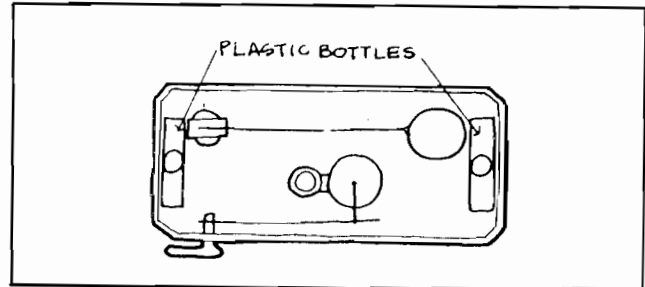


FIGURE 17. PANEL INSERTS

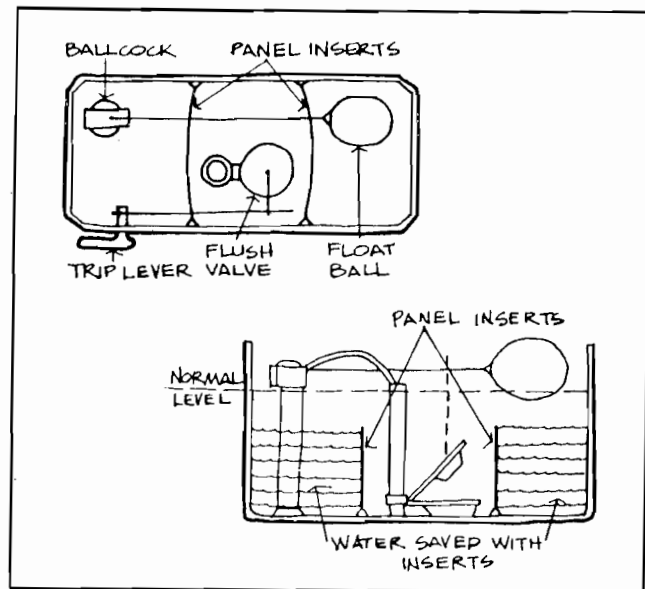


FIGURE 18. PRESSURIZED TANK TOILET

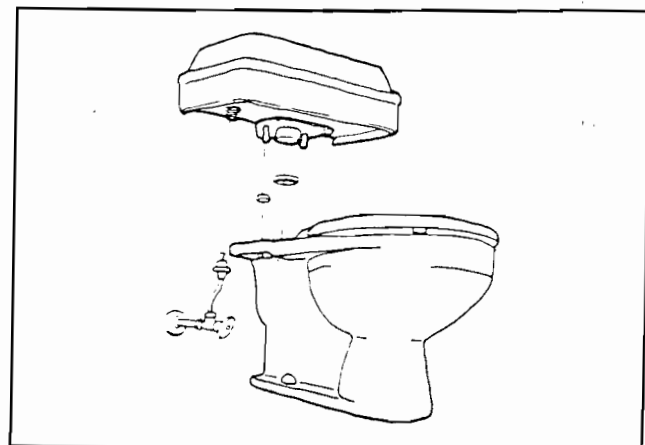


FIGURE 19. SHALLOW TRAP TOILET

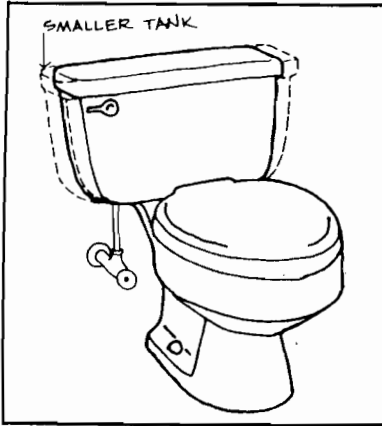


FIGURE 20. PRESSURIZED FLUSH TOILET

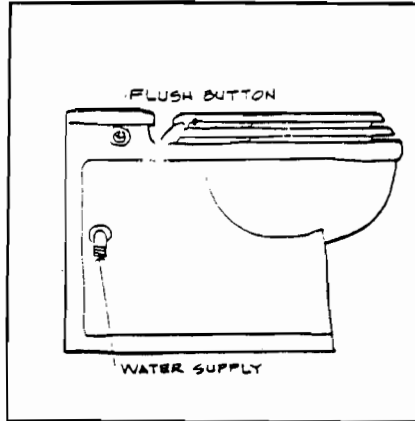
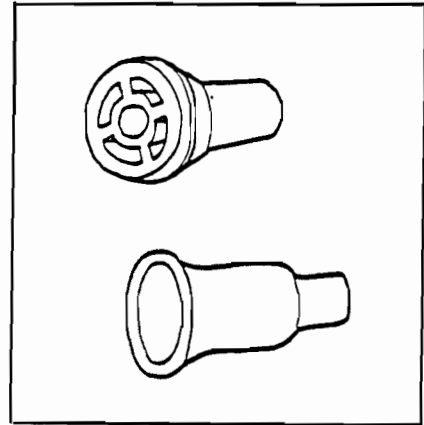


FIGURE 21. PLASTIC FLOW CONTROLS



flush. The pressurized flush toilet can save even more water than the shallow trap toilet. (See Figure 20.) Using both gravity and air pressure to flush waste, this toilet uses only about two quarts of water per flush, which represents a 90 percent savings over the conventional toilet. The pressurized toilet, however, costs considerably more than the conventional or water-saver toilet.

Flow Control Devices

Flow control devices limit the flow of water from faucets and showers. Usually, located somewhere in the water supply line ahead of the fixture, these devices are often no more than a molded plastic insert that reduces the diameter of the water line, thus diminishing the flow of water. (See Figure 21.) Depending on the flow-control device used and the pressure in the home, the rate of flow can be reduced to two gallons per minute (gpm) as compared to the flow rates of eight to 12 gpm that can be reached with these fixtures. In some cases, this means water savings of up to 75 percent in fixtures where flow controls are used. Similar savings can be realized when shower heads and faucets with built-in flow controls are installed.

Faucet aerators and spray taps also perform like flow controls. (See Figures 22 and 23.) The aerator, now attached to all new faucets, is designed to prevent splashing, but it also reduces the amount of water that flows out of the faucet by mixing it with the air. Spray taps deliver water in a broad pattern of droplets, similar to a small shower head. Most aerators provide a 50 percent reduction in flow, and some of the new, more advanced models

can reduce flow to as little as .75 gpm. Spray taps allow flow rates ranging from one to two gpm, as compared to the normal flow for faucets of two to 12 gpm.

Finally, there are water-conserving appliances available, like small capacity dishwashers, front-loading washing machines that use less water than conventional top-loading machines, and washers that allow adjustment for load size.

Saving Water Outdoors

Because most of the water used outdoors is used for lawn watering, the best method of conserving water outdoors is to use native plants that require little water or no water at all. Soil preparation and landscape design can also reduce outdoor watering. Soil conditioners can be blended with clayey soils to ensure more efficient irrigation. Landscape design techniques that reduce water use include contouring and land forming to prevent runoff.

When watering is necessary, a water-saving method, such as early morning watering to reduce evaporation loss, can be used. There are also various moisture indicators that can be inserted into the soil to test moisture and condition at the level of the roots, making unnecessary watering less likely. These devices range from an ordinary stick to an electrical sensing probe. One such device consists of a hand-held indicator attached to a metal rod that is inserted into the ground; when a weak electric current is passed through the rod, the soil moisture may be read on the moisture indicator. (See Figure 24.) Another device used to measure soil moisture is the Tensiometer. (See

FIGURE 22. AERATOR

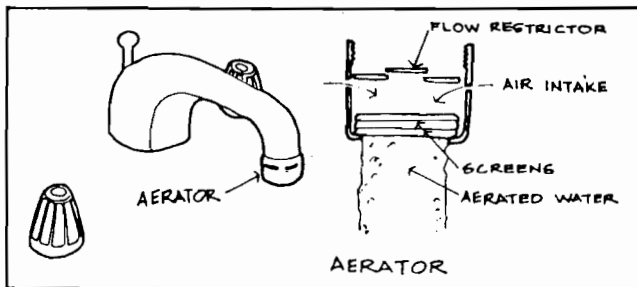


FIGURE 23. SPRAY TAP

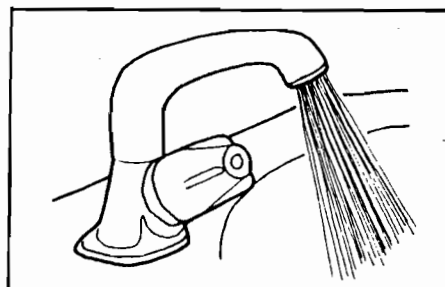


FIGURE 24. ELECTRICAL SENSING PROBE

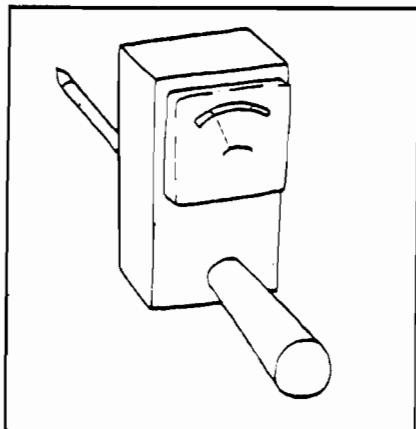


FIGURE 25. LIQUID TENSIO METER

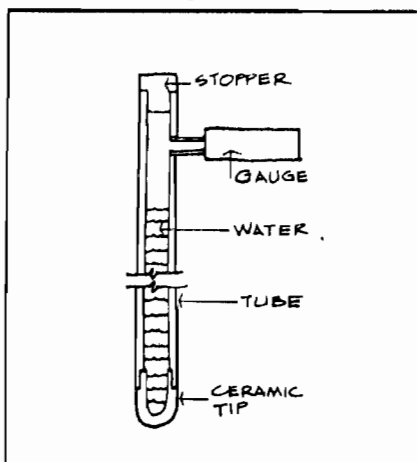


FIGURE 26. TOILET TANK FLUSHING MECHANISM

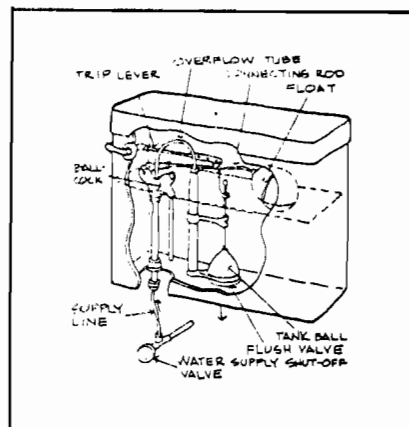


Figure 25.) Designed for long-term installation in the ground, these devices can be used to override timer-controlled lawn sprinklers. This permits watering only when the level of moisture in the soil is below an optimum range. These sensing devices are particularly useful for PUDs or similar developments with large lawn areas.

Since it would be difficult to convince every homeowner to invest in sensing devices, Denver, Colorado, instituted an innovative program aimed at achieving a similar reduction in lawn watering. Experts there have found that many lawns in the area were using twice the water needed. To reduce overwatering, the Denver Water Department calculates the daily evapotranspiration (ET) rate—the rate of water loss from the soil by evaporation and from plants by transpiration. The ET rate is derived from such factors as amount of sunshine, wind velocity, rainfall, relative humidity, and high/low temperatures. When analyzed, these variables tell how much water has evaporated and how much water must be replaced to maintain lawns. The results of these calculations are made available to the public in newspapers, on TV and radio, or by calling a hotline number. Many stations have included it in their weather reports during the summer months as they do wind-chill factors in the winter.

Sprinkler systems tailored to the contours of the land can also reduce irrigation. For example, impact-type sprinkler heads are best suited for large, flat areas. Because these sprinkler heads operate on high water pressure, they are able to cover broad areas and are less affected by wind than low-pressure heads. Low-pressure, sprayhead sprinklers are best suited for slopes and clayey soils, which require a slower application of water.

Repair and Maintenance

In addition to the water-saving devices and fixtures that communities have used in their water conservation programs, there are also various repair and maintenance procedures that can reduce residential water use. Included in this category are leak detection, repair of worn parts in fixtures, insulating hot water pipes, and reducing household water pressure.

Leakage control. Studies have shown that leakage can account for as much as five to 10 percent of total in-house

water consumption. The two most common sources of leakage are faucets and toilets. Leaking faucets are, of course, easily detected and usually indicate worn washers, which can be corrected by washer replacement. Leakage in toilets is also prevalent and in some cases can account for up to 200 gallons of water loss per day. Toilet leakage is more difficult to detect by visual inspection of the fixture, but it can be effectively detected by use of a colored dye tablet. Such leaks are usually the result of worn valves, poor tank ball seating, or a misaligned tank float. (See Figure 26.) Toilet leakage can be effectively controlled by either replacing worn parts or adjusting the float rod. When leakage control is part of a community's conservation program, dye tablets, along with instructions on their use and repair of worn parts, are often distributed free of charge to the public.

Insulating hot water pipes. When hot water pipes are insulated with one of the many materials available—fiberglass, polyurethane, etc.—they are able to maintain the temperature of the water for a longer period of time. This cuts down on the amount of water that must flow through the pipes before the water is hot enough to use. Insulation obviously also saves energy.

Pressure reduction. In service areas where water pressure reaches up to 80 pounds per square inch (psi), pressure reduction valves can be installed at the home water supply inlet to reduce the water pressure. The pressure reduction valve can reduce water pressure to 50 to 60 psi, which is about all that is needed for residential use. Less pressure can mean significant water savings.

New and Future Technology

There are many innovative devices that may prove useful in the future. Among the more promising are water-recycling systems that allow more than one use of water before it is discharged from the system, air-assisted toilets and showers, vacuum toilets, composting and incinerator toilets, detergent flush toilets, and mineral oil recycling toilets. Many of these fixtures are expensive and require more costly maintenance than their conventional counterparts. Future development and refinement, however, should make the cost and performance of some of these innovative devices more acceptable.