Commercial Lavatory Water Savings Quick Guide

Hydrotek

Sensor Faucets and Flush Valves

Table of Contents

Introduction

Environmental conservation is becoming a stronger trend, and for good reason. For every action, there is a reaction, and the way we consume natural resources is having a noticeably adverse reaction to our planet. Our need for more resources only grows as our populations grow pointing to an unsustainable future. Realizing this, there has been a push to reduce our environmental footprint and many advances in technology has allowed us to reduce consumption without sacrificing our quality of life.

When it comes to consumption conservation in commercial buildings, water savings provides an easily perceptible and significant impact towards conservation efforts as well as to operational costs. It goes without saying that within commercial buildings, a large portion of the water consumption happens in lavatories. Since using lavatories is a necessary and inelastic part of the human biology, the key in saving water lies not in changing how often a lavatory is used, but changing how much water is consumed each time.

Water savings provides many ecological benefits, but it is the financial benefits that are the most readily significant. Many water conserving products may be initially more expensive, but that difference in cost is easily made back with the savings from reduced utility bills. There may even be discounts in the form of tax breaks for conservation compliance!

This quick guide will outline some of the quick and easy methods and products to consider to create a lavatory that will save on water use and your budget. We will also take a quick look at LEED, a building initiative by the US Green Buildings Council, and how to earn a few points that can translate into even more savings through tax credits.

First Things First

Before looking at products that reduce water consumption, making sure that the plumbing is maintained properly should be the premiere concern. Water wasted through leaks can easily can easily amount to tens of thousands of gallons a year! Here are a few things to check for:

Leaks

Usually the most common symptom of increased water usage, a small drip may not look like it's that much water, but it quickly adds up. A leaky faucet that drips at a rate of one drip per second can waste more than 3,000 gallons per year. Imagine a commercial lavatory with multiple leaks!

Faucet Leaks

Faucet leaks are generally easy to spot, but be aware that there are multiple places a faucet can leak from. It is generally best to start from one end and visually inspect the spout, handles, supply lines, and angle stop. If you identify a leak, fixing it can be as simple as replacing the faulty parts, or as complete as replacing the entire faucet. Before you go about a fix, take a look at our section on water efficient faucets.

Tank Toilet

For tank type toilets, the toilet flappers are usually the source of the leak. Visually, if water in the bowl is not completely still 15 minutes after a flush, it is a sign that the flapper is not sealing correctly. Sometimes, however, the leak can be so small that there are no visual symptoms. In that case, place a drop of food coloring into the tank. If after 15 minutes without flushing the water in the bowl changes color, you have a leak. Replacing the toilet flapper will fix the leak.

Flush Valve

Since flush valves are normally installed in buildings where there is more water pressure, detecting a leak is visually and audibly more simple than a tank toilet. If the water in the bowl is constantly perturbed, or if you can hear a constant hissing from the valve, there's a leak. As simple as it is to identify the issue, repairing it is usually a little more involved. Depending on the brand and type of flush valve, there are usually repair kits that replace the commonly worn parts in the valve.

Faucets

Hygiene has been an important factor to the increasing natural lifespan of our species and the prevention of the spread of disease. Since our hands are usually the first point of contact with the world around us, the value of having clean hands improves the quality of our lives and those around us. It goes without saying that one of the most critical times to wash our hands is after using the lavatory. As an inelastic necessity, the usage of water to clean our hands is nearly unavoidable so instead of encouraging less use, we need to change the amount of water used per wash.

Aerators

With most faucets, there is a device that attaches to the spout that controls the maximum amount of water allowed to flow and the type of flow. Installing a lower flow aerator can easily reduce the effective amount of water used per handwashing. While lower flow is noticeable to the user, a way to give the impression of more water is to use a spray pattern that increases exiting pressure of the water or an aerated flow, where air is introduced into the stream to give it more body. Aerators are easily accessible from a variety of sources and they are generally standardized in size.

Sensor Faucets

Providing extra measures in hygiene, sensor faucets, in theory, do not offer any savings over manual faucets when limited to the same flow rates. In practice, however, sensors remove the human variable in the equation of faucet use. The sensor eliminates the possibility that a person could forget to shut off the faucet or fails shut it off all the way. Sensors also eliminate the continuous running of water while someone is using the sink, but not actively using the stream (i.e. soaping of the hands).

Flush Valves

While there are a number of commercial establishments with tank toilets, flush valves are becoming more standard for several reasons. Flush valves have a much better recovery time allowing it to be used almost immediately after a flush, they can take advantage of the higher water pressures usually found in commercial establishments, and they are generally more durable for higher traffic use than tank toilets. As such, this part of the guide will focus on ways to save water using flush valves.

Water Efficient Valves

As plumbing technology improved, flush valve manufacturers started to develop higher efficiency flush valves that took advantage of better water pressures to assist in the flush cycle of a toilet or urinal. Nowadays, you'll be hard pressed to find a flush valve that flows more than the federally mandated 1.6 gallons per flush (gpf) for toilets and 1.0 gpf for urinals. If you have an older flush valve, it might be from a time where 3.5 gpf or more was the norm, and reducing the amount to the federal mandate will save you 54% water per flush!

Although the federal mandate of 1.6 gpf for toilets is quite a bit of water savings as it is, there are more options that afford even lower flow rates. High Efficiency Toilets (HET) is generally a term used for the combination of the flush valve with the fixture that has a maximum average water consumption of 1.28 gpf or better. For the extreme saver, 1.1 gpf flush valves are also available for toilets.

Urinals have the advantage of not dealing with any solid waste, so there are options that provide for some rather extreme water savings. The federal mandate is set at 1.0 gpf, but there are urinal flush valves that can flush a urinal with as little as a pint (0.125 gpf). That's almost an 88% water savings from the federal mandate.

Dual Flush

It goes without saying that while there are urinals, an overwhelming majority of toilets see dual use. It would seem that a full flush is overkill for only liquid waste, especially if number ones are the majority of the use. Enter the dual flush flush valve. The dual flush features allows the user to choose a lower flush rate for liquid waste to save water. Most commercial fixtures can handle the reduced flow rate for liquid waste, but double check with the manufacturer to be sure.

LEED

LEED is a certification program created by the US Green Buildings Council (USGBC) to raise awareness and transform the way we design, construct, and maintain buildings to create a positive impact on the occupants (or potential occupants) of the buildings and on the environment. To create interest in this program, the USGBC provides several incentives to have buildings certified through the LEED program. Those incentives may include expedited review/permitting processes, tax credits, grants, and more. In this section we will discuss the baseline and what it takes to qualify for points in the Water Efficiency.

Please note that the measures outlined in this guide and the calculations provided in this section provide an estimate in the lavatory use only. While credits may be earned for lavatory efficiency, LEED certification looks at the water use of the entire building as a whole.

LEED v4 Baseline

As technology improves, so too do the standards that govern it. With higher efficiency fixtures and fittings, the USGBC decided that it was time to revise the LEED baseline in 2014 to tighten the criteria required to earn credits. The baseline is provided in the following table (abridged for public commercial lavatories only):

Toilet (water closet)	1.6 gpf
Urinal	1.0 gpf
Public lavatory faucet	0.5 gpm at 60 psi

Water Efficiency Credits

The baseline will give you the basis for LEED certification, which offers possible financial benefits as well as a better potential impression of the building. However, there are even more potential benefits to save more water. Reducing water use by certain percentages can earn you LEED credits, which can be used toward higher levels of certifications. Higher LEED certifications levels provide even lower operating costs and in some cases can even raise the value of the building. The following table outlines the credits available and the percentage reduction required from the v4 baseline:

Percentage Reduction	Points (BD&C)	Points (School, Retail, Hospitality, Healthcare)	Points (ID&C)	Points (CI Retail)	Points (CI Hospitality)
25%	1	1	2	2	2
30%	2	2	4	4	4
35%	3	3	6	6	6
40%	4	4	8	8	8
45%	5	5	10	10	10
50%	6	--	12	--	11

BD&C: Building & Construction | ID&C: Interior Design & Construction | CI: Commercial Interiors

Calculating Your Savings

While the lavatory is where the common commercial building consumes the most water, there are other building systems that can make up a significant portion of water consumption. This means that designing a lavatory that saves 25% in water may not translate to 25% reduction across all indoor use needed for that credit point. Determining the typical lavatory water use and understanding the ratio of usage within a building system is important to determining the measures needed to meet your savings goals.

Determining Use

The first step in calculating typical lavatory water use is to identify the people who use the lavatory. For most commercial buildings, this is the count of all full time employees (FTE). For retail locations, customers are considered in the calculations though at a reduced rate. Please see the table below for the USGBC template for default fixture uses:

Fixture Type	Duration (sec)	Uses / Day			
		FTE	Transient	Retail Customer	Students[3]
Water Closet (Female)	--	3	0.5	0.2	3
Water Closet (Male)[1]	--	1	0.1	0.1	1
Urinal (Male)	--	2	0.4	0.1	2
Lavatory Faucet	30[2]	3	0.5	0.2	3
Shower	300	0.1	0	0	0

1. If urinals are not installed in the men's restroom, then usage rate is equal to Water Closet (Female)
2. For metering/sensor faucets, use 15 seconds for baseline calculations and 12 seconds for design cases
3. Only count students if your building is part of a school

Before we begin calculations, we must determine the male and female ratios in the building.

$$\frac{Male\ FTE}{FTE} = Male\ Ratio \qquad \text{and} \qquad \frac{Female\ FTE}{FTE} = Female\ Ratio$$

The formula to calculate water closet usage:

$$(\ FTE * Male\ Ratio * Water\ Closet\ (Male)\ ) + (\ FTE * Female\ Ratio * Water\ Closet\ (Female)\ )$$

For an example, the water closet use for a building with 100 total FTE where 75 of the employees are male and 25 are female is as follows:

$$(100 * .75 * 1\ uses\ per\ day) + (100 * .25 * 3\ uses\ per\ day) = 150\ uses\ per\ day$$

Since the majority of this building is male, to determine the urinal use we follow the form of the water closet formula:

$$(100 * .75 * 2\ uses\ per\ day) = 150\ uses\ per\ day$$

The formula to calculate faucet usage:

$$(FTE * Lavatory\ faucet\ uses\ per\ day)$$

For retail locations or schools, add the product of the number of retail customers by their default uses per day outlined in the table. Adding to the previous example of a commercial building with 100 FTE, let's say that 1 business in this building has about 30 retail customers per day:

$$(100 * 3\ uses\ per\ day) + (30 * 0.2\ uses\ per\ day) = 306\ uses\ per\ day$$

At this point, we can get an idea of how much water our lavatory uses. We'll use the LEED v4 baseline number of 1.6 gpf for water closet, 1.0 gpf for urinal, and 0.5 gpm for faucets. First we'll determine the total amount of water our water closets use per day:

$$(150\ uses\ per\ day * 1.6\ gpf) = 240\ gallons\ flushed\ per\ day$$

For urinals:

$$(150\ uses\ per\ day * 1.0\ gpf) = 150\ gallons\ flushed\ per\ day$$

For faucets:

$$(306\ uses\ per\ day * 0.5\ gpm * \frac{30\ second\ use}{60\ seconds}) = 76.5\ gallons\ per\ day$$

Note that the 30 second use is based on the typical duration a person uses a faucet in a lavatory. For metering/sensor faucets, that use number is 15 seconds for baseline and 12 seconds for design cases.

Adding all of the usage in the day reveals that a building of 100 FTE, where 75 are male and 25 are female, with 30 retail customers is expected to typically use 466.5 gallons of water per day.

Dual Flush Toilets

Having a single flow rate toilet makes calculations straight forward, but as dual flush toilets are very much a viable consideration for green buildings which flow rate do we use for calculations? The USGBC advises that there is a 1:2 ratio in terms of number of full-flush to low-flush uses per day. This ratio applies to male restrooms where urinals are not installed, but dual flush toilets are.

Using this ratio yields us the following formula:

$$\frac{\left[\left(\binom{Male\ full\ flush}{uses\ per\ day} * full\ flush\ rate\right) + \left(\binom{Female\ full\ flush}{uses\ per\ day} * full\ flush\ rate\right) + \left(\binom{Female\ low\ flush}{uses\ per\ day} * low\ flush\ rate\right)\right]}{Male\ \&\ Female\ total\ uses\ per\ day}$$

If we had 1.6/1.0 gpf water closets in the women's restroom, and 1.6 gpf water closets and urinals in the men's restroom:

$$\frac{[(1\ use\ per\ day * 1.6\ gpf) + (1\ use\ per\ day * 1.6\ gpf) + (2\ uses\ per\ day * 1.0\ gpf)]}{(4\ total\ uses\ per\ day)} = 1.3\ gpf$$

Water You Waiting For?

This guide is just a quick reference to get started down the road to having a more efficient building. With many high efficiency products that perform just as well as their older counterparts and with the financial benefits of lower maintenance costs as well as possible incentives, there is almost no excuse not to consider some of the options in this guide. Many of the measures are relatively cost effective, but even those that have a higher cost can be offset by the savings in a short time.

If you're looking for lavatory products that can help you save on water and potentially earn you credits toward a LEED certification, Hydrotek provides a range of products that can help you achieve those goals. For more information, visit Hydrotek's water conservation page at:

http://www.hydrotekintl.com/promotion/water-conservation/