

Leaking Shower Diverters

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Background

A study was recently conducted by Taitem Engineering¹ (Ithaca, New York) to evaluate the water and energy wastage associated with leaking shower diverters. A shower diverter is a device used in combination tub/shower units that is activated by the end-user when desired to re-direct the flow of water from the tub spout to the showerhead. If the diverter leaks when it is in the shower mode, the water flowing from the tub spout simply flows down the drain – wasting both water and the energy used to heat the water. When a shower diverter (sometimes called a tub spout diverter) works properly, water flows from the tub spout OR the shower – but not both.

The Taitem Engineering study surveyed 120 shower diverters found in both apartment suites and private homes (the age of the fixtures was not disclosed). They found that 34% of the diverters leaked more than 0.1 gallons per minute (gpm) – or 0.38 litres per minute (Lpm). The largest leak identified was 3.0 gpm (11.4 Lpm) and the average flow rate of all leaks greater than 0.1 gpm was 0.8 gpm (3.0 Lpm).

The Taitem study also concluded that, as expected, once a diverter leak is fixed, a portion of the water that had been leaking from the tub spout would be directed to the showerhead, i.e., increasing the flow rate from the showerhead. The reason for this is because the building's supply piping is able to supply water at a much higher flow rate than is actually used by the showerhead (unless it is a very high flow rate showerhead) and, therefore, there is backpressure in the supply piping during a shower event. If a leaking diverter is fixed, the total flow rate from the showerhead/tub spout is reduced and the backpressure in the supply piping is increased, thus possibly resulting in an increase in the flow rate from the showerhead. As such, not all of the water wasted by leaking shower diverters would be saved by fixing/replacing the leaking diverter. However, eliminating leaking shower diverters will result in some level of water and energy savings, and the slightly higher flow rate from the showerhead may improve end-user satisfaction with the shower.

A follow-up study was conducted by Gauley Associates Ltd. in Ajax, Ontario, Canada in early 2014 to measure the leakage rates of aging shower diverters in two large apartment buildings and to compare these results with the findings outlined in the Taitem report. This report outlines the results of the Canadian study.

Building Descriptions

The first building included in the study contained 220 suites and was constructed in 1978; the second building contained 200 suites and was constructed in 1983. A small number of suites in these buildings contained two washrooms. As such, a total of 453 shower diverters were investigated as part of the study. Based on the age of the buildings, it is expected that most of the diverters have been operated a minimum of 10,000 times (e.g., 30 yrs x 1 shower/day x 365 days/yr = 10,950).

¹ <http://www.taitem.com/wp-content/uploads/Diverter-Valve-Tech-Tip-2011.7.20.pdf>

On-site Work Plan

In each washroom with a combination tub/shower unit, a plumbing technician turned on the bathtub faucets and engaged the shower diverter. If a shower diverter leak was observed, the technician measured the approximate flow rate of the leak by holding a typical 2-cup (500 ml) measuring cup under the tub spout for 15 seconds (in some cases the technician used a 4-cup measuring cup). For each diverter examined, the technician would note either:

- No leakage observed
- Few drops (insignificant, too little to accurately measure)
- The actual flow rate of the observed leak
- Flow rate exceeds 0.5 gpm or 2.0 Lpm (i.e., overflows 2-cup measuring cup in 15 seconds)

Results

The following table presents the findings of this study.

Item	Number	Percentage
Number of diverters inspected	453	100%
No leakage observed	119	26%
Insignificant leakage (few drops)	213	47%
Measurable leakage	121	27%
Large leaks (> 0.5 gpm / >2.0 Lpm)	25	5.5%

- The average leakage rate of all diverters with measurable leakage (not including diverters with insignificant leakage) was 0.34 gpm or 1.3 Lpm²
- The overall average leakage rate of all 453 diverters inspected was 0.09 gpm or 0.34 Lpm

Comparison between Canadian Study and Taitem Study

Taitem Engineering	Canadian Study
• 34% of inspected diverters had measurable leakage	• 27% of inspected diverters had measurable leakage
• Avg. rate of measurable leaks = 0.8 gpm (3.0 Lpm)	• Avg. rate of measurable leaks = 0.34 gpm (1.3 Lpm)

While the percentage of leaking shower diverters in both studies is similar (34% vs. 27%), the average leakage rate of leaking diverters in the Taitem study was more than twice that identified in the Canadian study (0.8 gpm vs. 0.34 gpm / 3.0 Lpm vs. 1.3 Lpm). The reason for this difference is not known.

The Taitem study also concluded that when a leaking diverter is fixed, about 30% of the water that had been leaking from the tub spout will be forced through the showerhead because of the increased back pressure, while the remaining 70% will be 'saved'.

² This rate assumes that the leakage rate for diverters that caused the measuring cup to overflow was equal to a rate that would just fill the measuring cup in the 15-second measuring interval and is, therefore, a conservative rate estimate.

Energy Savings

Reducing water lost through leakage, especially water that has been heated, results in not only water savings but also energy savings. The Taitem report identifies that for every 0.1 gallon (0.38 L) of recovered tub diverter leakage, the customer saves about \$4.60 if the water is heated by electricity and about \$1.70 if the water is heated by natural gas. Naturally, payback periods are shorter for larger leaks. In fact, payback periods are less than 5 years for leaks greater than 0.5 gpm (1.9 Lpm) if the water is heated by electricity and for leaks greater than 1.2 gpm (4.5 Lpm) if the water is heated by natural gas (note that these estimated payback periods assume an installed cost of \$100 per diverter).

Conclusion

Both the Ontario and Taitem studies found a wide range in leakage rates for aging tub spout diverters. When leakage rates are small, e.g., less than 0.5 gpm (1.9 Lpm) when the water is heated by electricity or less than 1.2 gpm (4.5 Lpm) when the water is heated by natural gas, payback periods may be greater than 5 years. Larger leakage rates, however, offer relatively short payback periods. The repair of leaking tub spout diverters may be an overlooked source of water and energy savings when completing plumbing retrofits, especially on older bathrooms.

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