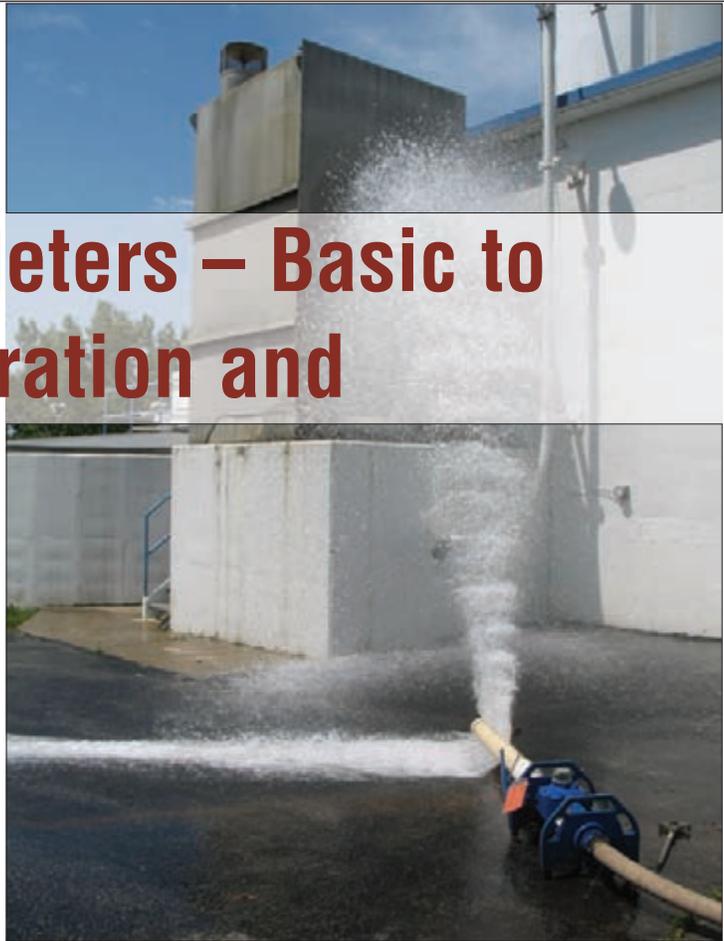


Accurate Water Meters – Basic to Sound Utility Operation and Accountability



Testing a large master meter does require some space to do it in. It cannot be normally conducted inside a building. The design of a facility ought to include consideration how master meters will be tested.

Many articles and technical papers have been written on the subject of water meter accuracy. Still, I believe it is important to review this topic as many water systems in Kansas are plagued by the inaccuracy of water meters which in turn, contributes to loss of revenue for those systems. The accuracy of water meters is one of the most important operational issues of a public water system.

Yes, water meter accuracy is important. While working with public water systems, Kansas Rural Water Association often finds systems that still have many of their original meters in service. In some cases, the homeowners' meters and rural water patrons' meters are forty years old! And yes, KRWA often finds those meters do not function at low flow rates. Regardless of the make or model of the meter, it is inevitable that the accuracy of every water meter will be affected by a variety of factors, one being length of time in service. With forty years of use, local governing bodies and operators could consider it's time for an investment in new meters.

Accurate water meters = conservation

KRWA provides technical assistance to any public water system upon request, however, a special focus of KRWA's work in partnership with the Kansas Water Office, is to provide assistance to those water systems identified as having unaccounted for water loss of 30 percent or more. In many of the projects, it is KRWA's experience that trying to correct high unaccounted for loss requires that we begin with verifying the accuracy of master meters and then, the accuracy of customer meters. It serves no purpose to search for possible leaks on a pipeline system when the utility does not know for sure that the amount of water being reported as

produced or purchased is correct. That may be an over-generalized comment but the statement holds true for many systems that have chronic water loss. Water meter accuracy is of the utmost importance for the process of conducting a thorough water audit. When water meter accuracy has been verified, only then can a water system get ahead of the water loss battle. In addition, accurate meters generate revenue that otherwise is lost.

The degree of accuracy

All meters are subject to wear and eventual failure, similar to any other mechanical device. Over a period of time, meters lose accuracy. How quickly a meter loses accuracy depends on other factors other than just age. The installation, the quality of water and possible buildup of minerals inside the meter, the rate of flow – all have an influence on meter accuracy.

The only way to determine whether a meter is operating accurately is to test it. It is very difficult for a small or medium-sized water system to establish a maintenance program to test meters locally; it involves time, personnel, and somewhat expensive equipment. From the viewpoint of



Use of a "non-intrusive meter", similar to that used by the Division of Water Resources to test raw water meters, is necessary when there is no test port available. In the test above, the pipe had full flow.



This meter was registering inaccurately. Highly mineralized water can cause buildups such as this inside meters. This meter had not been tested for fifteen years.

ratepayers, water meters need to be tested to protect them against inaccuracy that could result in overcharges because of meter over-registration. The utility governing body and management should also have this concern. Likewise, when meters under-register, a revenue loss occurs and the shortfall has to be picked up by other ratepayers.

Some meters will under-register on low flows and over-register on higher flows.

The economic advantage to having accurate flow meters cannot be overstated. Consider that a 5/8-inch residential cold water meter will lose accuracy at .25 gpm, or less, first. Experience has shown that meters will generally lose accuracy at the low flow rate and it's at this low flow that the meter is more prone to not register at all. Realize also that some meters will

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Accuracy Standards

The American Water Works Association (AWWA) has established accuracy standards. Each meter manufacturer also has its own standards. As an example, a 2-inch Class II Turbine meter in good working condition is required to register within the range of 98.5% to 101.5% at a flow rates of 2 gpm (minimum rate), 10 gpm (intermediate rate), and 120 gpm (maximum rate). The 98.5% to 101.5% accuracy range is an accepted standard; any large meter operating outside these limits should be repaired and/or replaced.

On a typical 5/8-inch x 3/4-inch cold water residential meter, the suggested standards are 98.5% to 101.5% at a flow rate of 15 gpm (maximum rate). The same accuracy range applies at the flow rate of 2 gpm. But at the low flow rate of .25 gpm, the accuracy range is to 95% to 101%.

over-register just as easily as under-register. Some meters will under-register on low flows and over-register on higher flows.

Many water systems also have large diameter meters. In a water utility, even if only three to five percent of the water meters are in the large category, they could account for about thirty to fifty percent of the system's revenue. If the large meters are not tested and maintained for accuracy on a yearly basis, large amounts of revenue may be lost. Although it is very worthwhile to have an ongoing maintenance and testing program for all meters, priority should be placed on the larger meters, because of the large amounts of revenue those meters generate. This is of major importance to public wholesale water districts, or other systems that sell or purchase from others and utilities with larger commercial users.

KRWA suggests that all large diameter meters be tested annually. There's no law that requires this; it is just good management to do so.

A meter replacement program should be an important part of a water system's long range planning process. There is no requirement as to when meters should be replaced. A brand new meter, right out of the box, can be inaccurate, no matter the size or who the manufacturer is.

It's important to test a sampling of residential meters to determine an overall opinion of meter accuracy. Perhaps test some of the oldest meters in the system from different locations. If ten meters are tested and a significant number of these operate outside the set standards for that size meter, this is an indication that the system could have a high number of meters that need to be replaced. As a general rule, a program to replace ten percent of the meters on a yearly basis is a good starting place.

The proper installation of a water meter is critical to meter accuracy. The manufacturer of the meter can best answer specific questions and problems related to installations; your consultant or KRWA can also provide help in that regard.



Where there is a will there is a way to test a large meter. A 90-degree elbow was removed from the top of this pipe and a plate was installed, then a 2-inch tap was made so this meter could be tested.

Over the years, KRWA has seen many large meters installed improperly. The following is a listing of acceptable requirements for meter installations:

1. A meter should be located so it is readily accessible for reading, servicing, and testing.
2. Meters should be positioned on a horizontal plane for optimum performance.
3. Protect meters from freezing and other conditions that could damage the installation.
4. If meter is to be used for raw water in Kansas, make sure that the meter is on the Division of Water Resources' list of approved meters.
5. Ensure that meters are installed following the manufacturer's recommendations.

Large meter installations will follow nearly all the same requirements. The distance between the end of the meter and any other type of fitting is critical to accuracy. Tees,



In addition to this pile of small rocks (see pen for comparison), other pieces of metal up to several inches long were trapped in front of another large meter screen. Obviously this new water system was not pigged. The probability of additional debris being in the system is very high.



This accumulation of trash was caught by the screen of a large meter tested by KRWA. Such meters should be cleaned least annually and possibly more often.

elbows, valves, and reducers need to be installed ten (10) pipe diameters upstream of the meter and five (5) pipe diameters downstream of the meter. In addition, when a large meter is to be installed, it is essential that testing requirements be considered in the selection of the meter and the layout of the installation. If the meter does not have a test port built in, then test valves should be installed to permit field-testing of the meter.

Inaccurate water meters can be a major contributor to your water losses. The Kansas Rural Water Association can provide assistance in testing water meters as well as detecting and locating other water loss. It's not only water that is not being accounted for; it is also the financial integrity of the water system that is at stake.

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