Arizona Department of Water Resources

Conserving Water Today for Arizona's Tomorrow

Water Metering

Introduction

To ensure effective water-resource planning, water providers and planners must have a clear understanding of water-use practices.

The best way to measure water use, including the amount produced (supply) and amount delivered (demand), is with water meters.

Whether at the point of receipt or source, metering offers a variety of water system benefits. It is essential in evaluating actual volume used, associated costs, infrastructural soundness and accounting errors.

Metering all service connections offers an opportunity to advise customers of the actual costs and volume of water used; otherwise, customers have little incentive to use water efficiently.

Metering also provides a direct method of identifying high water users who can then be targeted in conservation efforts. Further, meters help establish average water use by type of user (residential, multi-family, commercial, etc.), providing data that can be used to direct conservation programs.

Meter Regulation in Arizona

The State of Arizona requires that a large provider located inside an Active Management Area (AMA) meter water deliveries to all municipal service connections on its system except connections to fire services, dwelling units in individual multifamily units, mobile homes in a mobile home park with a master meter, and construction users. While providers outside of the AMAs are not required by the state to meter their water delivery, they may be subject to regulations by the city, town, or county in which they are located.

Please see www.azwater.gov for questions regarding specific regulatory requirements for municipal, industrial and agricultural water users.

General Information

Water meters are devices used to measure the volume of water used in a water supply system.

Meters are located at the water source, well, or throughout a water system to determine flow through that portion of the system. The type of meter selected is based on different flow measurement methods, the type of end user, the required flow rates, and accuracy requirements.

Meters are typically designed for cold, potable water. Specialty meters include hot water meters, which are designed to withstand higher temperatures and meters for reclaimed water, which have purple register covers to signify that the water is non-potable.

Meters generally measure and display total usage in gallons or cubic feet.

In North America, standards for the manufacturing of water meters are determined by the American Water Works Association (AWWA). AWWA publications cover all aspects of water meters, including meter types, selecting the right meters for various customer classes, installation, testing, and maintenance. For more information, please visit www.awwa.org.

Metering is considered a good practice in water supply management because it encourages:

- Accurate accounting of water produced and delivered
- Calculation of unaccounted-for water
- Enhanced detection of leaks and waterline breaks
- Charging for water based on actual use
- Identification of high water users who may need assistance in reducing overall water use
- Monitoring water system efficiency and potentially postponing the need for system expansion

Selecting a Meter

Proper meter selection involves consideration of both the size and type of meter.

Meter Size
Meter size is described in terms of the size of pipe for which the meter was originally intended. Often meters are sized to match the diameter of the service line but this may not be the best practice as actual flows tend to be lower than the maximum flows the service lines are designed to accommodate.

Proper meter sizing depends on the types of flows and water demands, as well as variations in daily and season flows.

Meter Types
The type of meter chosen should be based on the expected range of flow rates, allowable pressure loss and local safety requirements, such as maintaining fire-service flows.

There are two basic types of water meters: Positive Displacement and Velocity; each type has several variations.

Meters should be the right size for the application and in the right location. Meters should be sized for the flow rate, not the pipe size.

Positive Displacement Meters operate by directing water through compartments of known volume which are repeatedly filled and emptied. The flow rate is calculated based on the number of times this process occurs.

Positive Displacement meters are sensitive to low flow rates and are typically used for houses and small businesses. These meters are available 2”and smaller and are not generally practical in large applications requiring high flow rates or low-pressure loss. The types of Positive Displacement meters include: Nutating Disc and Oscillating Piston.

Velocity Meters operate by directing water through a known cross-sectional area with a measured velocity that can be equated into a volume of flow. Velocity meters are typically good for high flow applications and are available 2” and larger, with the exception of the Multi-jet which is available ⅝”–2”.

The types of Velocity meters include: Turbine, Multi-jet, Propeller, Ultrasonic, Venturi, Magnetic and Orifice.

Compound Meters typically have Positive Displacement and Velocity meters installed together to measure high and low flows. Compound meters are typically 2" and larger.

Master Meters are those that deliver water to an entire distribution system and are typically a type of Velocity Meter. The main meter at a commercial building, apartment building or mobile home park is referred to as the master meter for that complex and can be a Positive Displacement or Velocity meter.

Metering Large Flows

Velocity and Compound meters are normally chosen for large flows such as those at treatment plants. Propeller meters, a type of Velocity meter, are often used on large main lines or pump stations. Compound meters are used if accurate measuring at low flows is important but large flows also have to be measured. Utilities often use magnetic flow meters to measure untreated water and wastewater as there is no mechanical measuring element to get clogged or damaged by debris. Magnetic meters usually have the ability to measure flow in either direction. Turbine meters are commonly used for large flows when minimum flows are generally above 10–12% of maximum rating and maintaining high pressure is necessary.

Metering Medium Flows

For medium flows, such as apartment buildings, businesses and public buildings, 1"–2" Positive Displacement meters are normally used. In sizes of 2"–3", Positive Displacement, Multi-jet or Turbine meters are common. In sizes of 3"–4", the meter type depends on the average flow rate. Multi-dialed meters are common at large industrial and commercial meters.

Metering Small Flows

Positive Displacement meters are usually used in residential and small commercial applications.

Submeters

All water use should be metered. Although not usually a water provider's primary function, promoting separate metering has proven to lower water use.

Submetering water delivered to individual tenants and/or for specific uses such as separate commercial applications or outdoor and landscape use is an important tool in effective water management.

Submetering can save costs by allowing property managers and customers to identify and address specific inefficiencies. Submetering of separate applications may also save costs if discounted sewer fees are available for the water that is not returned to the sewer system (landscape uses and cooling tower evaporation).

Submetering is important as it creates awareness of water use and efficiency as tenants pay for actual use and leaks.

A sub metered system typically includes a master meter for the complex (multifamily or commercial) that is owned by the utility supplying the water. Additional meters, publically or privately owned, are installed to measure water use of individual tenants or particular uses.

Maintenance

Water meters get damaged and deteriorate with age. This may lead to inaccurate readings and most often the under registering of consumption. Inaccurate readings provide incorrect information regarding usage, make leak detection more difficult, and may result in lost revenue for the water provider. All meters should be tested for accuracy on a regular basis.

After determining accuracy, water providers should create a schedule and process to correct meter deficiencies. Meters should be recalibrated on a regular basis to ensure accurate water accounting and billing.

When considering repair or replacement, AWWA suggests that it may be more sensible to measure the life of a meter based on total consumption and not time.

Water quality and mineral content are also factors that contribute to the deterioration of meters, and local water quality conditions should be taken into account when developing a maintenance and replacement schedule.

It may not be desirable or even feasible to repair outdated designs; however, newer, modular models are easier and more cost effective to repair. Some water providers replace meters on a regular basis regardless of the functionality of the individual meters.

Determining the cost per meter repaired and purchased is important in establishing a maintenance and replacement program.

Cost

The cost associated with metering includes the investment costs to purchase and install meters, as well as the recurrent costs to read, test, maintain and replace meters. The price of meters varies considerably based on size and type.

Purchasing

There are a number of businesses and manufacturers that sell water meters in Arizona. Please refer to your local yellow pages or search the Internet using the key words “water flow meters.”

References

American Water Works Association. *Water Meters – Selection, Installation, Testing, and Maintenance*. 4th Edition. Denver: AWWA, 1999

American Water Works Association. *Water Transmission and Distribution, Principles and Practices of Water Supply Operations*. 2nd Edition. Denver: AWWA, 1996

Satterfield, Zane and Vipin Bhardway, National Environmental Services Center, West Virginia University, *Tech Brief*, Water Meters, Summer 2004, Volume 4, Issue 2

United States Environmental Protection Agency, *Water Conservation Plan Guidelines*, 1998

Vickers, Amy. *Handbook of Water Use and Conservation*. Amherst, MA: Waterplow Press, 2001

For More Water Conservation Information:

www.azwater.gov/ conservation

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