Technical Water Meter Selection Guidelines

energy.gov/eere/femp/technical-water-meter-selection-guidelines

Federal Energy Management Program

Need guidance?

The Federal Metering Guidance can help you prioritize metering for specific applications.

This section provides guidelines on the appropriate selection of water meters to help improve water management, as well as high-level information on the various considerations involved in determining what type of meter to select. These include:

- Metering technology options
- Applications
- Installation considerations
- Relative costs to own and operate.

Managing water-efficient facilities and operations requires the application of water meters and timely data analysis. These actions provide critical data that allow facility managers to implement follow-on actions and develop a water balance that can help target water efficiency measures.

A key component of this approach is selecting water meters that best fit the specific application needs.

Common Water Metering Technologies and Key Criteria for Selection

The following table provides a comparative summary of water flow meter types. Descriptions of the meters are found in the Water Metering Technology Options section below. Keep in mind that this table is a composite summary and that meter specifications and prices vary by manufacturer, model, and options/configuration.

Water Flow Meter Types

Meter Operating Design	Positive Displacement	Differential Pressure			Velocity	
Criteria*	Nutating Disk	Orifice	Venturi	Turbine	Vortex Shedding	Ultrasonic

Water Flow Meter Types

Meter Operating Design	Positive Displacement	Differential Pressure			Velocity	
Criteria*	**Nutating Disk**	**Orifice**	**Venturi**	**Turbine**	**Vortex Shedding**	**Ultrasonic**
Accuracy	Good	Moderate to Good	Good	Good	Good	Moderate to Good
Turndown Ratio	10:1	<5:1	<5:1	10:1	20:1	10:1/20:1
Repeatability	Good	Good	Good	Low	Very Good	Good
Installation Ease	Easy	Easy	Moderate	Challenging	Moderate	Very Easy
Pressure Loss	Moderate	Moderate	Low	Moderate	Low	None
Recalibration Needs	Infrequent	Frequent	Infrequent	Frequent	Infrequent	Moderate
Capital Cost**	$	$	$$	$$	$$	$$ - $$$
Installed Cost**	$$	$	$$	$$	$$	$
Maintenance Cost**	$	$$$	$$	$$	$	$

*Hover over the blue items to see definitions.
**Capital, installed, and maintenance costs respectively are relative to each meter type.

Water Metering Technology Options

The following is an introductory summary of each type of meter presented in this guideline.

Positive Displacement Meters

Differential Pressure Meters

Velocity Meters

Selection Considerations

Selecting the right water meter requires identifying and addressing the considerations unique to each application. Several of the primary considerations are called out below.

Each Meter Needs to Address a Known Objective

- Objectives can focus on operational improvements or support water management initiatives and goals
- Determining the objective for applying meters up front helps ensure that the proper meter performance requirements are identified. For example, water data recording in hourly or even 15-minute intervals is important if the objective is to identify operational improvement opportunities but is not important for tenant billing or goal tracking
- Operational improvements that reduce water use can be identified using analyzed metered data. Examples of resulting opportunities include understanding when and where water is used, and locating leaks, unnecessary off-hours consumption, or even cooling tower operating issues
- Water conservation programs and goals require metered data to monitor consumption and costs and review and report progress. Examples of metered water data applications supporting management purposes are tenant billing, goal tracking and benchmarking, and water bill verification.

Identify and Address the Physical Considerations for Each Meter's Application

- Determine the expected range of water flow and pipe sizes
- Determine the accuracy requirements over the flow range
- Identify any physical installation requirements for meter location, straight lengths of pipe, available communications, and any other applicable requirements
- Communication interoperability—consider standardization on communication between meters and other data acquisition systems
- Determine how the data will be collected and processed. Does the metering equipment vendor offer this function or service? What effort is needed to create a process to collect, store, and archive the data?

Cost Considerations over the Meter Lifetime

- Capital costs to purchase the meters are based largely on the type of meter selected and its capabilities. Do not over-specify the meter's performance requirements such as accuracy, resolution (the smallest increment in which a meter can detect a change, which can be useful when recording higher-frequency data such as five-minute time intervals), and data storage
- Installation costs not only include labor costs, but also may include significant materials costs and even limits on service interruptions that may require off-hour installations

- All meter types require monthly and annual inspections. Monthly inspections address operational observations such as leakage, noise, and vibration. Annual inspections address recalibration in general, and meter-type-specific items such as wear on orifice edges, wear and buildup on orifice meters, or wear and damage to the impellor blades on velocity meters
- Data analysis and data storage costs are components of the lifecycle cost for a water meter. For meters to be effective, the data must be analyzed in support of the original meter objective.

Cybersecurity

Ultimately, data security will be a function of the selected meter and site metering system's communications system. Identify and involve an interdisciplinary team including operational technology and site information technology staff for issues of data security and system cybersecurity to ensure any solution is appropriate, relevant, and compatible with existing IT security systems.