Manual of Water Supply Practices

M22

Sizing Water Service Lines and Meters

Third Edition

American Water Works Association

Contents

Chapter 1

Introduction

OVERVIEW

This is the third edition of AWWA Manual M22, *Sizing Water Service Lines and Meters*. The first edition was printed in 1975, and the second edition was printed in 2004. This new edition expands the ways to approach the sizing of water service lines and meters and offers improved methods for the sizing of dedicated irrigation meters.

M22 TARGET AUDIENCE

This manual is intended for use by

- Water utility managers
- Engineers
- Planners
- Technicians and field operations personnel
- Consultants involved with designing and constructing projects requiring water service
- Academicians

UPDATES

When the first edition (1975) of M22 was written, the primary guideline for projecting water demands was the fixture value method, which conservatively projected water demands based on then-existing fixtures and appliances. This method emphasized identifying the worst-case instantaneous peak demand that could occur for a given water account. In the last 40 years, fixtures, appliances, irrigation demands, and their implications for both meter and service-line sizing have changed drastically. The second edition (2004) of M22 included methods for developing locally specific demand profiles to enable meters and service lines to be sized based on current, local conditions that reflect changes in water use patterns that have occurred. This third edition (2014) expands on the 2004 approach and provides recommendations for future research that will systematically evaluate water demands for the purpose of more accurate meter sizing. A summary of the changes and recommendations is presented in the following sections for consideration in using Manual M22.

Summary of Content

This edition of M22 focuses on how to identify water demand patterns to accurately measure real demands and provides necessary information for final meter and line sizing decisions. Fortunately, water utilities seeking to right-size meters and service lines need not rely on old and potentially inaccurate data and methods. This manual emphasizes that utilities having more information about a specific sizing situation will result in the best sizing decision from the tap to the meter. The authors recognize that the water utilities and professionals who may be using this manual have varying degrees of familiarity regarding their local water demand patterns and peak demand profiles. This document is structured to encourage water utilities and water professionals to study and understand their own local water demands, to provide methods to identify real-time peak-demand requirements, and, with this knowledge, to approach sizing decisions and policies with adequate and current information.

The manual concludes with guidelines and tools for making meter and service-line sizing decisions. The manual also includes techniques for sizing both new meters and existing meters, which may need to be resized because of changing conditions or initial sizing decisions. These techniques may differ in particular for existing meters where accurate, real-time demand flow profile data can be collected to enhance meter sizing decisions.

Chapter 2: Consumer Water Demands, Trends, and Considerations

The manual is structured to establish water demand as the fundamental factor to consider when sizing water service lines and meters. Currently, more is known and understood about general water demand patterns and peak demands because of the increasing focus on demand management in the water industry. Many water demand studies have been conducted in recent years that indicate distinctly different water demand patterns between and among various user classes, land uses, and geographic regions. For example, peak demands can vary greatly depending on the regional location (e.g., semi-arid West versus the more temperate Northeast) and seasonal variation of a particular location. Some water service areas contain several microclimates, which may impact sizing decisions.

This chapter introduces a sampling of typical demand patterns in different utilities. Each water utility is encouraged to study its own customer water-use patterns to reflect any regional or local conditions that may influence sizing decisions or policies in its area. Water professionals will benefit from comparing sizing policies and decisions between water utilities with similar climates or service characteristics.

Chapter 3: Demand Profiling for Optimal Meter Sizing

In addition to better understanding general water demand patterns in a particular locale, measuring real-time peak demands may be an option when sizing both water service lines and meters. Chapter 3 reviews equipment and technology that are available to help water utilities and their constituencies better understand typical peak demand patterns and how water is used in their systems. The chapter also reviews how demand measurement equipment measures real-time peak demands and outlines general guidelines for using this equipment for meter sizing purposes. Several hundred utilities actively collect and use demand profile information to improve sizing decisions. Many water utilities have used demand profile information to downsize meters, reduce nonrevenue water, and bill for service more equitably in their water system. More equitable billing is achieved by right-sizing a higher percentage of meters so that water charges more accurately reflect water used. Current technology is helping water professionals to better understand the water demand conditions that are embedded in sizing decisions.

Chapter 4: Estimating Demands Using Fixture Values

To properly size water taps, meters, and service lines, the peak demands must be known for any specific tap. Chapter 4 reviews the best available methods. The fixture value method is still useful in cases in which demand profile data are not available or applicable. The method proposed in this chapter uses the first and second edition M22 tables and graphs but includes more current fixture values based on an operating pressure of 60 psi (414 kPa). The Distribution and Plant Operations Division members of AWWA have been collecting empirical measurements to generate a family of demand curves to replace the demand curves generated by Hunter's fixture unit approach. Both approaches are described in chapter 4 along with a method for sizing dedicated irrigation meters based on flow velocity limits recommended by the Irrigation Association.

Chapter 5: Service-Line Sizing

There is a distinction between service-line sizing decisions and meter sizing decisions. Service lines must be able to meet the instantaneous peak demand of a particular account and any possible successor account, preferably without impacting the level of water service to the customer. Meter sizing must primarily consider the accurate measurement for all expected flow ranges for the current account to ensure accurate billing of consumption. The difference is that the service line should be more conservatively sized in general (as local conditions warrant).

This chapter provides the framework for local water utilities to ensure service lines are sized to meet peak demands while considering all relevant factors, including system pressure, line size, material, head loss, elevation changes, and type of use. Sample calculations are included as a guideline to assist the users in their own calculations. Pipe flow friction loss tables are also included in appendix B.

Chapter 6: Meter Sizing

This chapter provides an overview of meter sizing criteria that could be considered in the sizing decision. The meter sizing process is discussed and outlined to ensure a thorough evaluation. Sample calculations are introduced for the fixture value method and for using real-time peak-demand profile data and are included as a guideline for engineers and others to use for local sizing decisions. Properly collected demand profile data can be an effective tool to size existing meters for specific conditions, but the fixture value method is often the best approach for new services.

Considerations When Sizing Water Meters and Service Lines

The following changes highlight the need to continually improve and update sizing methods.

Changes in Technology

Current water meters are technological products with high-tech reading capabilities. Technology exists to collect real-time water demand data (demand profiling). Technological changes have resulted in a more accurate characterization of actual water demand patterns by various user classes than was previously possible using fixture counts or monthly meter readings. Utilities can leverage these technological changes to customize meter and service line sizing based on relevant local information.

Demand Pattern Changes

Demand management has been institutionalized through national energy and water efficiency standards and codes and wider acceptance of water use efficiency. The result is that overall demands have decreased below those assumed in the fixture value method, and it is necessary to revise the fixture value method using modern data sets. This is an essential task that should be completed before the next update of this manual.

Policy Changes in Water Rate and Connection Fees

Water rate charges and connection fees are based on the meter size and service line size. As a result, sizing decisions are critical, and life-cycle cost and benefit implications from both the utility and customer perspective have heightened relevance.

Some utilities have separated meter sizing from the connection fee process. These utilities use demand-based approaches to connection fees and infrastructure charges for new customers. These approaches are independent of the meter and service line size and enable the utility and customer to focus on the expected annual demands at the site rather than the peak instantaneous demands needed for meter sizing.

Additionally, some combined water, wastewater, and stormwater utilities have removed the stormwater charge from the base, or fixed, charge in order to bill properties in a tailored fashion based on their land characteristics or stormwater management practices. Thus, the fixed charge based on meter size has decreased in these utilities. This trend may have an additional benefit in the case of oversized meters. Historically, some utilities lacked motivation to downsize oversized meters to obtain better low-flow accuracy because a higher fixed charge could be obtained from the larger meter. With a smaller fixed charge based on meter size, water utilities may be motivated to replace oversized meters with an optimally sized meter.

Growing Use of Residential Fire Sprinkler Systems

Jurisdictions have long had the opportunity to adopt requirements for residential fire sprinkler systems as prescribed under the National Fire Protection Association (NFPA) 13D Standard. While hundreds of local jurisdictions in the United States have done just that, the inclusion of a residential fire sprinkler requirement under the NFPA 13D Standard in the International Residential Code in 2009 spurred state-level requirements to implement these systems in the United States. Thus, the use of residential fire sprinkler systems is growing, and many water utilities need guidance to assist them in creating their own policies, procedures, and regulations regarding the use of these systems.

The design approaches for residential fire sprinkler systems include many unique aspects that differ from the traditional fire connections to commercial, industrial, and multi-unit residential buildings. For instance, while traditional fire-protection systems for commercial and industrial buildings are usually designed under the NFPA 13 or NFPA 13R Standard and frequently require a separate and distinct line for the fire supply, residential fire sprinkler systems under the NFPA 13D Standard provide several design options, including separate fire lines or a single, multi-purpose line that provides both the domestic water supply and fire supply from the water main. While this publication does not provide detailed design guidance on residential fire sprinkler systems, it identifies important implications of these systems to service line and meter sizing, and identifies appropriate references for readers to seek detailed guidance.

AWWA MANUALS RELATED TO METERING AND SERVICE LINES

AWWA publishes several manuals of water supply practices that are focused on water meters and service lines. Manual M22 is one of a suite of manuals that form AWWA's core metering and service line guidance documents. A brief summary of AWWA manuals related to metering is presented below.

- **M1, *Principles of Water Rates, Fees, and Charges*, sixth edition (2012)—**provides financial managers, water policymakers, and rate analysts with relevant information needed to evaluate and select water rate structures, fees, charges, and pricing policies.
- **M6, *Water Meters: Selection, Installation, Testing, and Maintenance*, fifth edition (2012)—**provides a complete manual of practice for water utilities on the selection, installation, operation, and maintenance of customer water meters and also provides sample record-keeping forms, a history of water-use measurement, and the development of modern water meters. M6 is heavily illustrated with photos, diagrams, and performance requirements.
- **M33, *Flowmeters in Water Supply*, second edition (2006)—**describes in detail the design and operation of commonly used flowmeters in water systems.