Distribution System Requirements for Fire Protection

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American Water Works Association

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Distribution System Requirements for Fire Protection

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Contents

List of Figures, v

List of Tables, vii

Preface, ix

Acknowledgments, xi

Chapter 1 Fire Flow Requirements 1

Impact on Distribution System Design, 1
Community Governance, 2
Fire Flow Requirements, 2
Calculating Fire Flow Requirements, 2
Practical Limits on Fire Flow, 13
Nonpotable Water Sources for Fire Fighting, 15
References, 16

Chapter 2 System Demand and Design–Flow Criteria 17

Methods of Distribution, 17
Rates of Water Use, 18
Distribution System Appurtenances, 19
System Evaluation and Design, 21
Determining Design Flow, 21
Flow Metering, 22
Standby Charges for Fire Protection Systems, 22
Water Distribution Analysis Techniques, 22
References, 23

Chapter 3 Distribution System Storage. 25

Functions of Distribution Storage, 25
Elevated and Ground Storage, 27
Pumping for Distribution Storage, 28
Location of Storage, 28
Storage Reservoir Overflow Level, 28
References, 30

Chapter 4 Adequacy and Reliability of Distribution Systems 31

Determining Level of Reliability, 31
Application of Reliability Considerations, 33
Reliability of Major System Components, 34
Operations, 36
References, 37

Chapter 5 Automatic Fire Sprinkler Systems 39

Advantages of Sprinkler Systems, 39
Water Supply Requirements for Sprinklered Properties, 40
Types of Sprinklers for Commercial Buildings, 42
Standpipes, 43
Backflow Prevention for Fire Sprinkler Systems, 43
References, 45

Appendix A Agencies Involved in Fire Protection 47

Insurance Services Office Inc., 47
Insurance Organizations With Fire Protection Interests, 48
National Fire Protection Association, 48
National Fire Service Associations, 48
Fire Research Laboratories, 48
National Fire Sprinkler Association, 48
American Fire Sprinkler Association, 49
International Code Council, 49
Insurance Bureau of Canada, 49
Insurers' Advisory Organization, 49
National Research Council, 49
Underwriters Laboratories of Canada, 49

Appendix B Water Supply and Fire Insurance Ratings 51

Insurance Ratings, 51
References, 54

Index 55

List of AWWA Manuals 59

Figures

1-1 Typical occupancy classifications—nonmanufacturing, 6

1-2 Typical occupancy classifications—manufacturing, 7

1-3 Comparison of fire flow calculations, 12

1-4 Comparison of fire flow calculations, including three exposure buildings, 14

2-1 Typical small city distribution system, 19

3-1 System A—hydraulic gradient with no storage, 29

3-2 System B—hydraulic gradients with storage between pump station and load center, 29

3-3 System C—hydraulic gradients with storage beyond load center, 30

5-1 Sprinkler system design curves, 41

B-1 Water supply evaluation, 53

Tables

1-1 Fire flow durations, 3

1-2 Values of coefficient (F) construction class, 4

1-3 Occupancy factors for selected combustibility classes, 5

1-4 Factor for exposure (X_i), 8

1-5 Factor for communications (P_i), 9

1-6 Needed fire flow for one- and two-family dwellings, 9

2-1 Values commonly used in distribution piping, 20

3-1 Water use and storage depletion for maximum day in a typical city, 26

5-1 Hazard classification schedule, 42

Preface

Water distribution systems have been developed and operated for a variety of reasons. In the past, many communities recognized the need for safe, potable water that could be used for drinking and cooking. Governmental agencies or private enterprise promptly took on the responsibility of providing safe water to meet these basic human requirements.

The need for nonpotable water arose because of an increasingly sophisticated lifestyle. In many cases, the water systems established to provide potable water were augmented and enlarged to provide water for irrigation, car washing, industrial processes, and other purposes. It also became necessary to provide an adequate supply of water for fire protection and suppression. Systems that provide for fire protection needs have frequently been incorporated into the systems that provide potable water service as well as nonpotable service. As technology advances, many alternatives to this basic water supply configuration can be found. A notable alternative is the use of dual distribution systems.

The American Water Works Association has published standards for materials used in the field of fire protection for many decades. However, it was not until the early 1980s that AWWA's Committee on Fire Protection developed the first edition of this manual, which addresses the planning, design, and maintenance of distribution systems that supply water for fire protection and suppression.

This manual provides specific guidance on the design, operation, and maintenance of water distribution systems as they relate to fire protection and fire suppression activities. When the governing body of a community makes a conscious decision to use the available water supply system for fire suppression purposes, this manual should be consulted, judiciously applied, and tempered as local conditions require.

This edition of the manual updates the information, clarifies some topics, and deletes material that is no longer essential. The manual still closely parallels the first edition prepared by the Fire Protection Committee.

As was the case with the first edition, this fourth edition does not intend to describe how firefighters should use water to control fires, but rather how water utilities should design and operate their systems to maximize fire protection benefits while delivering safe, potable water to customers. The emphasis is on public water systems and not on water systems exclusively designed for fire protection. Similarly, this manual does not intend to reproduce material available elsewhere in AWWA publications such as Manual M17, *Installation, Field Testing, and Maintenance of Fire Hydrants*, or Standards C502, Dry-Barrel Fire Hydrants, and C503, Wet-Barrel Fire Hydrants.

The adequacy of a water distribution system for fire protection depends on the fire flows required. Chapter 1 describes several methods for determining required fire flows. Once fire flow requirements are determined, these are added to the other water system demand requirements. Chapter 2 discusses the impact of fire protection on distribution system design. Chapter 3 focuses on distribution storage in terms of both sizing and location. Chapter 4 discusses reliability issues arising because systems must remain in operation even when individual components are out of service. Chapter 5 describes fire suppression sprinkler systems and their effect on water requirements, particularly because they affect how water is used for fire fighting.

Appendix A lists organizations involved in fire protection and describes the organizations and their roles. Appendix B describes the relationship between the water supply system and fire insurance ratings, because one benefit of supplying needed fire flow is an improved fire insurance rating for a community.

The water utility has important partners in fire protection. The water utility must work together with local fire officials, building code officials, and others to effectively and efficiently promote fire protection. Good communication between all involved parties is essential to protect property and life.

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Chapter 1

Fire Flow Requirements

> For centuries, water has been used to extinguish fires. The inexpensiveness and availability of water are the primary factors leading to its widespread use. But, not only must water be available for fire protection, it must be available in adequate supply. As a result, the question must be asked, how much water is necessary to be considered an adequate supply for fire protection? (Milke 1980)

Most municipalities are willing to incur the higher cost for distribution system sizing because of the reduction in loss that is possible by using the water system for fire protection. Water in sufficient quantity can cool the fire; the steam can deprive the fire of oxygen, and in the case of miscible or dense fluids, water can disperse the fuel. The key question for water utilities is how large must distribution system components be to provide sufficient water for fire protection. The remainder of this manual presents methods for estimating these requirements.

IMPACT ON DISTRIBUTION SYSTEM DESIGN

The decision to provide water for fire protection means that a utility must explicitly consider fire flow requirements in sizing pipes, pumps, and storage tanks. In larger systems, fire protection has a marginal effect on sizing decisions, but in smaller systems these requirements can correspond to a significant increase in the size of many components. In general, the impact of providing water for fire protection ranges from being minimal in large components of major urban systems to being very significant in smaller distribution system pipes and small distribution systems.

The most significant impacts are installing and maintaining fire hydrants, providing adequate storage capacity, and meeting requirements for minimum pipe sizes (e.g., 6-in. [150-mm] pipes in loops and 8-in. [200-mm] dead ends) in neighborhood distribution mains when much smaller pipes would suffice for delivery of potable water only. These requirements make designing distribution systems easier for the engineer but more costly for the water utility. Other impacts include providing extra treatment capacity at plants and extra pumping capacity at pump stations.