

M28

Rehabilitation of Water Mains

Third Edition



**American Water Works
Association**

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Third Edition



**American Water Works
Association**

Manual of Water Supply Practices — M28, Third Edition

Rehabilitation of Water Mains

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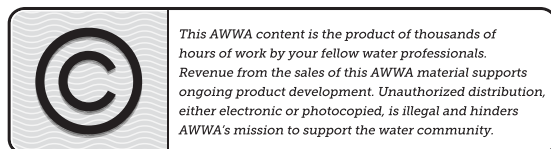
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Contents

List of Figures, v

List of Tables, vii

Foreword, ix

Acknowledgments, xi

Chapter 1	Pipeline Renewal Methods	1
	Distribution System Water Quality Improvement, 2	
	Hydraulic Improvement, 3	
	Structural Improvement, 5	
	Water Main Condition Evaluation, 6	
	Prioritization, 6	
	Costs and Benefits, 7	
	Rehabilitation Solutions, 7	
	Selection of Rehabilitation Solutions, 7	
	Reference, 10	
Chapter 2	Preconstruction Activities	11
	Advance Planning Considerations, 11	
	Preparation of Plans and Specifications, 12	
	Water Main Rehabilitation Contracts, 12	
Chapter 3	Maintaining Service	15
	Bypass Piping, 15	
	Community Relations, 18	
	Summary, 18	
	References, 18	
Chapter 4	Pipeline Cleaning Methods	19
	Flushing, 19	
	Air Scouring, 20	
	Mechanical Cleaning Techniques, 20	
	Fluid-Propelled Cleaning Devices, 21	
	Metal Scrapers, 25	
	Cleaning by Power Boring, 29	
	Ball Cleaning, 32	
	References, 32	
Chapter 5	Cement–Mortar Lining	33
	Cement–Mortar Lining, 33	
	Reference, 37	
Chapter 6	Spray-On Polymer Lining	39
	Definition of Polyurea Materials, 40	
	Reference, 46	

Chapter 7	Cured-In-Place Pipe Lining Techniques	47
	Classification of Systems, 47	
	Reference, 51	
Chapter 8	Sliplining	53
	Sliplining and Modified Sliplining, 53	
	Sliplining, 53	
	Modified Sliplining Techniques, 58	
	Symmetrical Reduction Systems, 60	
	Folded and Formed Systems, 62	
	Expanded PVC Systems, 64	
	Liner Termination Fittings, 64	
	References, 75	
Chapter 9	Internal Joint Seals	69
	Fitting Procedure for Internal Joint Seals, 70	
	References, 10	
Chapter 10	Pipe Bursting	77
	History, 77	
	Process Overview, 77	
	Water Main Pipelines Replaced By Pipe Bursting, 81	
	Differences Between Pipe Bursting, 83	
	Project Execution Recommendations, 85	
	Replacement Pipe Materials, 86	
	Conclusions, 87	
	References, 87	
Chapter 11	Reinstatement of Service Laterals	89
	Lateral Reinstatement for Spray-Applied Linings, 89	
	Lateral Reinstatement for Nonspray-Applied Linings, 90	
	Pavement Coring and Grouting, 94	
	Pipeline Robots for Lateral Reinstatement, 94	
	Reference, 95	
Chapter 12	Cathodic Protection Retrofits	97
	Pre-design Field Testing, 97	
	System Design, 99	
	Testing and Maintenance, 100	
	Reference, 100	
Chapter 13	Program Management	101
	Customer/Community Relations, 101	
	Project Notifications, 102	
	Communication Needs, 104	
	Responding to Problems, 105	
	Contract Documents, 106	
	Post-Construction Activities, 107	
Appendix A	Structural Lining Design Issues	111
Index		115
List of AWWA Manuals		119

Figures

- 1-1 Pipe with tuberculation caused by corrosion, 3
- 1-2 Selection of rehabilitation techniques to resolve water quality problems, 8
- 1-3 Selection of rehabilitation techniques to resolve flow, pressure, and leakage problems, 9
- 1-4 Selection of rehabilitation techniques to resolve structural problems, 10

- 3-1 Bypass installation for residential and commercial water service, 17

- 4-1 Drag cleaning, 21
- 4-2 Foam pig, 22
- 4-3 A foam pig with hardened coatings, 22
- 4-4 Loose debris flushed ahead of the pig, 23
- 4-5 Pigs launched through a disassembled fire hydrant, 24
- 4-6 Scraper unit with specially tempered steel blades, 25
- 4-7 Several scraper units assembled together in the field, 26
- 4-8 A series of disks to act as a hydraulic piston, 26
- 4-9 A sandbag dam to create a pond for particle settling, 27
- 4-10 A spool piece installed at the entry and exit points for mechanical scrapers, 28
- 4-11 Rack-feed boring machine, 30
- 4-12 Cleaning pipe by power boring, 30
- 4-13 Cleaning head, 31

- 5-1 A cement–mortar lining machine for use in small-diameter pipe, 34
- 5-2 Introduction of a small lining machine, 34
- 5-3 A cement–mortar lining machine for use in large-diameter pipe, 35
- 5-4 A pipe ready to be returned to service four to seven days after cement–mortar lining, 36

- 6-1 Lining spray in progress, 43
- 6-2 Lining equipment vehicle, 44
- 6-3 Spray head retrieval pit, 44

- 7-1 Glass reinforced CIPP felt composite lining system, 48
- 7-2 Felt liner fed into the pipe utilizing the inversion process, 49
- 7-3 Curing of liner by heating of inversion water after liner is in place, 49
- 7-4 Cross-section of woven hose, 50
- 7-5 Forming of the liner, 51

- 8-1 Insertion of fused PVC for a 3,500 ft slipline, 57
- 8-2 Exit of the sliplined pipe from host pipe, 57
- 8-3 Liner prepared for reconnection, 58
- 8-4 Roller-based symmetrical reduction liner machine, 61
- 8-5 Fusing expansion head for symmetrical reduction process, 62
- 8-6 Site-folded HDPE liner, 64
- 8-7 Special liner grip fitting, 65
- 8-8 Special liner grip fitting, 66
- 8-9 Special multi-grip fitting, 67

- 9-1 Joint area is cleaned and prepared prior to installation of the seal, 71
- 9-2 A nontoxic lubricating soap is applied and the seal is carefully positioned with its retaining band, 72
- 9-3 An expansion ring is placed over each retaining band and a wedge is inserted between the band ends, 74
- 9-4 Completed section showing installed internal joint seals, 74

- 10-1 Typical pneumatic pipe bursting set up, 79
- 10-2 Typical static pipe bursting set up—step 1, bursting rod installation, 79
- 10-3 Typical static pipe bursting set up—step 2, bursting set up, 80
- 10-4 Typical static pipe bursting set up—step 3, pipe bursting, 80
- 10-5 Roller cutter used to cut through steel pipe and mechanical coupling, 81
- 10-6 Roller cutter beginning to split steel pipe, 82
- 10-7 Roller cutter splitting steel pipe while first cutter cuts barrel of mechanical coupling, 82
- 10-8 Roller cutter splitting not only steel pipe and barrel of mechanical coupling but also the ring sections of the fitting, 83

- 11-1 Internal tap connecting a structural or semistructural lining to a lateral pipe, 92
- 11-2 Various keyhole tools used to connect service laterals to a new water main, 93
- 11-3 Electrofusion saddle, with copper pipe and fittings, ready for installation with long-handled tools, 93
- 11-4 Keyhole core and replacement coupon, 94

- 12-1 Over-the-line electrical resistance testing, 98
- 12-2 Verifying voltage and current requirements for a cathodically protected pipeline, 100

- 13-1 A sample letter notifying consumers of work to be done, 103
- 13-2 A sample water shut-off notice to be handed out to each customer, 104
- 13-3 A sample caution notice to be posted at the work site, 106

Tables



- 1-1 Hazen–Williams roughness coefficient, 4
- 1-2 General comparison of hydraulic improvements, 5
- 1-3 Relative risk assessment, 7

- 6-1 Spray-applied polymer lining features and benefits, 41

- 8-1 HDPE modified sliplining methods, 59

- 9-1 Material details for internal joint seals, 70
- 9-2 Retainer band expansion pressures, 73

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Foreword

The water industry in the United States is faced with quite a challenge. Much of its buried infrastructure is aged and approaching the end of its useful life. Water system pipeline infrastructure primarily installed in the 1950s and 1960s or earlier has served its communities well. Across the country, water mains provide water to communities with day and night reliability except for the occasional water main interruption. However, that is changing as the pipelines have met or are already exceeding the expected life spans of the pipeline materials. Increasing failures of aged pipeline networks may reach a performance level unacceptable to customers and burdensome to the operators of the systems.

Conventional pipeline replacements of older pipeline infrastructure have not occurred fast enough, largely owing to financial constraints. Failures are now impacting major transmission mains. As a result, communities now are faced with an almost insurmountable challenge to perform the inevitable task of replacing these key and critical water main pipelines. Coupled with reductions in revenue and a slowly recovering economy, the task is especially daunting. Water main rehabilitation may offer part of the solution by renewing more pipe at less cost.

Water main rehabilitation is not a new concept. Cement-mortar lining of water main pipelines is one of the oldest rehabilitation methods. The oil and gas industry was the first to develop systems and techniques beyond cement-mortar lining to rehabilitate critical pipeline networks without the use of conventional open-trench construction. The wastewater industry was the next utility group to firmly adopt pipeline rehabilitation techniques. The expansion of various technologies among these pipe-focused industries created numerous companies, processes, and materials as many groups scrambled to "build a better mousetrap." The fervor that resulted saw the installation of millions of feet of pipeline rehabilitation products in communities across the country and overseas.

The water industry, particularly in the United States, is the last to fully realize the economic, social, and community benefits of rehabilitation. Conventional construction has its place and continues to be utilized on a widespread scale; however, water main and water service rehabilitation has been steadily increasing in use and effectiveness. Companies that were engaged in the wastewater pipe rehabilitation process expanded their technologies to develop products that could withstand the internal pipeline pressures as well as be approved for potable water use. The number of rehabilitation projects being performed is expected to grow as the price of raw materials has risen and competition for limited space in public right-of-ways has increased with other buried utilities (including systems that have moved from aerial to burial).

The second edition of the M28 *Water Main Rehabilitation* manual, published in 2001, provided an expanded exposure of the technologies present at the time. The intent of the manual was to provide an overview of the processes used, considerations for what rehabilitation process to use, and suggestions for a successful project. This third edition of the manual continues with the same intent. It updates technologies since the last edition, expands categories to encompass available, proven processes, and provides exposure to other rehabilitation considerations such as keyhole technology and cathodic protection. The goal of the manual is to provide engineers, contractors, and decision makers with an overview of the processes used for water main rehabilitation. It is recognized that different pipe installations and types will warrant different rehabilitation options. These considerations are explained in detail including a decision flow chart to aid in the process and get the user to a narrow, more situation-specific set of options for their project.

It is recognized that the water main rehabilitation industry is continually offering new technologies to assist communities with rehabilitating their water pipeline infrastructure. This manual specifically addresses only those technologies with a proven track record within the water industry that can be employed by a water utility to successfully rehabilitate water mains. No attempt was made to evaluate one method of water main rehabilitation over another, and no attempt was made to evaluate relative costs between competing systems. It remains for the user of the manual to decide which system will best suit a specific project. In 2011, the AWWA Water Main Rehabilitation Committee decided to not consider any more new and upcoming technologies for chapter discussion. Because the field is up and coming, there are always new technologies that have been tried overseas that are taking hold here in the North American market.

The chair of the committee, Jon Turner, would like to thank the Executive Committee in place at the time of the manual preparation and to thank contributing authors responsible for new material supplied to continue to provide an up-to-date water main rehabilitation manual for water industry professionals.

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Pipeline Renewal Methods

Pipeline renewal is typically accomplished by one of two approaches: rehabilitation or open-trench construction, although other trenchless methods are also used. Trenchless technology is a type of subsurface construction work that requires little or no surface excavation and no continuous trenches. This chapter provides guidance in selecting between rehabilitation and open-trench construction and in determining which rehabilitation method is most appropriate for meeting goals.

The renewal of water mains is performed for three primary reasons:

1. **Water Quality Improvement:** to improve the quality of the water received by the consumer
2. **Hydraulic Improvement:** to increase the hydraulic capacity of the pipeline
3. **Structural Improvement:** to reduce leakage, decrease repair frequencies, lessen risk of property damage, and improve reliability.

Compared with conventional open-trench replacement, pipeline rehabilitation methods are often less expensive and less disruptive to the community; however, rehabilitation is not appropriate for all situations.

As described in other chapters in this manual, many different water main rehabilitation techniques exist, offering a variety of benefits. The best choice of method for each situation will depend on several factors, including: (1) the reason for the rehabilitation, (2) comparative costs, (3) site conditions, and (4) expected life-cycle performance.

This chapter provides guidance in selecting a pipeline renewal method, including a series of decision trees that can be used to help determine which types of methods should be considered.