M14

Backflow Prevention and Cross-Connection Control Recommended Practices





M14

Backflow Prevention and Cross-Connection Control

Recommended Practices

Fourth Edition



Manual of Water Supply Practices—M14, Fourth Edition

Backflow Prevention and Cross-Connection Control: Recommended Practices

Copyright ©1973, 1989, 2004, 2015 American Water Works Association

All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording, or any information or retrieval system, except in the form of brief excerpts or quotations for review purposes, without the written permission of the publisher.

Disclaimer

The authors, contributors, editors, and publisher do not assume responsibility for the validity of the content or any consequences of their use. In no event will AWWA be liable for direct, indirect, special, incidental, or consequential damages arising out of the use of information presented in this book. In particular, AWWA will not be responsible for any costs, including, but not limited to, those incurred as a result of lost revenue. In no event shall AWWA's liability exceed the amount paid for the purchase of this book.

If you find errors in this manual, please email books@awwa.org. Possible errata will be posted at www. awwa.org/resources-tools/resource-development-groups/manuals-program.aspx.

Project Manager/Senior Technical Editor: Melissa Valentine

Senior Manuals Specialist: Molly Beach Senior Production Editor: Cheryl Armstrong

Library of Congress Cataloging-in-Publication Data

Asay, Stuart F., author.

Backflow prevention and cross connection control: recommended practices / Stuart F. Asay. -- 4th edition. pages cm. -- (Manual of water supply practices; M14)

Revision of: Recommended practice for backflow prevention and cross-connection control, 3rd ed., 2004. Includes bibliographical references and index.

ISBN 978-1-62576-045-6 (alk. paper)

1. Backsiphonage (Plumbing) -- Prevention. 2. Cross-connections (Plumbing) III. Title. IV. Title: Recommended practice for backflow prevention and cross-connection control. V. Series: AWWA manual; M14.

TH6523.A87 2015 696'.1--dc23

2014037357

Printed in the United States of America

ISBN: 978-1-62576-045-6 eISBN: 978-1-61300-309-1



This AWWA content is the product of thousands of hours of work by your fellow water professionals. Revenue from the sales of this AWWA material supports ongoing product development. Unauthorized distribution, either electronic or photocopied, is illegal and hinders AWWA's mission to support the water community.



American Water Works Association 6666 West Quincy Avenue Denver, CO 80235-3098 awwa.org

Contents

List of Figures, v	
List of Tables, vii	
Preface, ix	
Acknowledgments, xi	
Dedication, xiii	
Metric Conversions, x	v
Chapter 1 Introduction Purpose of Ma Responsibilities Health Aspect	es, 2
Legal Aspects,	
Chapter 2 Backflow Basic Hydraul Types of Backs Assessing Deg Assessing Oth	v Prevention Principles
	Programs, 28 n, 33 rrces, 33
Means of Prev Backflow Prev	v Prevention Assembly Application, Installation, and Maintenance 41 renting Backflow, 42 rention Devices, 42 ontrolling Backflow, 59 61
Authority and Purpose of a C Assessing the	Responsibilities, 66 Cross-Connection Control Survey
Typical Hazar Hazards Posed	Hazards and Proper Protection

AWWA Manual 14 iii

BACKFLOW PREVENTION AND CROSS-CONNECTION CONTROL

Appendix A Example Notices and Letters, 93

Appendix B Testing Procedures or Methods, 99

Appendix C Industry Resources, 181

Appendix D Incidents Tables, 183

Glossary, 187

Index, 193

List of AWWA Manuals, 203

AWWA Manual M14

Figures

- 1-1 Examples of backflow prevention equipment locations, 4
- 2-1 Example of barometric loop in a piping configuration, 12
- 2-2 Backsiphonage backflow due to high rate of water withdrawal, 14
- 2-3 Backsiphonage backflow caused by reduced pressure on suction side of booster pump, 15
- 2-4 Backsiphonage backflow caused by shutdown of water system, 15
- 2-5 Backpressure backflow caused by carbon dioxide cylinder, 17
- 2-6 Backpressure backflow caused by pumping system, 18
- 4-1 Common symbols used for backflow prevention devices, 43
- 4-2 Dual check device, 44
- 4-3 Dual check device with atmospheric port, 45
- 4-4 Atmospheric vacuum breaker, 45
- 4-5 Hose connection vacuum breaker, 46
- 4-6 Pressure vacuum breaker assembly, normal flow condition, 48
- 4-7 Pressure vacuum breaker assembly, backsiphonage condition, 48
- 4-8 Spill-resistant vacuum breaker, normal flow and backsiphonage conditions, 50
- 4-9 Check valves open, permitting flow, 51
- 4-10 Backpressure, both check valves closed, 51
- 4-11 Negative supply pressure, check valves closed, 51
- 4-12 Typical double check valve assembly applications, 52
- 4-13 Reduced-pressure principle backflow prevention assembly, both check valves open and the differential relief valve closed, 54
- 4-14 Both check valves closed and the differential pressure relief valve open can be used for service protection or internal protection, 54
- 4-15 Backpressure: both check valves closed and the differential pressure relief valve closed, 54
- 4-16 Backsiphonage: both check valves closed and the differential pressure relief valve open, 55
- 4-17 Typical reduced-pressure principle backflow prevention application, 55
- 4-18 Double check detector backflow prevention assembly, 57
- 4-19 Type II double check detector backflow prevention assembly, 57
- 4-20 Reduced-pressure principle detector backflow prevention assembly, 58
- 4-21 Type II reduced-pressure principle detector backflow prevention assembly, 58
- 4-22 AG on tank, 59
- 4-23 AG on lavatory, 60
- 4-24 Typical AG applications, 60
- 4-25 Additional typical AG applications, 61
- 6-1 Cross-connection control, water treatment plants, 87
- 6-2 Service-containment and area-isolation water treatment plants, 88
- B-1 Double check valve assembly test, 101
- B-2 Double check valve assembly test—back pressure condition, 102
- B-3 DCVA—Step #1, 103

- B-4 DCVA Step #2, 104
- B-5 DCVA—Step #3 and DCVA Step #3A, 105
- B-6 Pressure vacuum breaker, 107
- B-7 PVB—Step #1, 108
- B-8 PVB—Step #2, 109
- B-9 PVB—Step #3, 110
- B-10 RPZ—Step #1A, 112
- B-11 RPZ—Step #2, 113
- B-12 RPZ-Step #3, 114
- B-13 RPZ—Step #4, 115
- B-14 RPZ—Step #5, 116
- B-15 Spill-resistant pressure vacuum breaker, 117
- B-16 Step 1, 118
- B-17 Step 2, 119
- B-18 Step 3, 120
- B-19 Sample test report form, 124
- B-20 Ground wire installation, 127
- B-21 Major component parts of five-valve differential pressure gauge test equipment, 139
- B-22 Differential pressure gauge test kit, five-valve model, 140
- B-23 Differential pressure gauge showing hose connections to test the components of an RPBA, 140
- B-24 Differential pressure gauge showing hose connections to test the #1 check valve of a DCVA, 141
- B-25 Differential pressure gauge showing hose connections to test a PVBA air inlet, 141
- B-26 Differential pressure gauge showing hose connections to test a PVBA check valve, 142
- B-27 Differential pressure gauge showing hose connections to test both the check valve and air inlet of an SVBA, 142
- B-28 Test 1—CV#1, 171
- B-29 Test 3—CV#2, 172
- B-30 Two-valve differential pressure test kit, 176
- B-31 Two-valve test kit, 176
- B-32 Three-valve test kit, 178
- B-33 Reduced-pressure field test with three-valve test kit, 179

Tables

- 2-1 Means of backflow prevention in the United States, 22
- 2-2 Selection guide for backflow preventers in Canada, 22
- 6-1 Recommended protection for solar domestic hot-water systems, 84
- 6-2 Recommended protection at fixtures and equipment found in water treatment plants, 86
- 6-3 For service protection (containment), 89
- 6-4 Containment protection, 90
- 6-5 Typical backflow prevention devices, 90
- 6-6 Irrigation and hose connection protection, 91
- B-1 Safety-related publications, 129
- B-2 RPBA/RPDA test reporting, 133
- B-3 DCVA/DCDA test reporting, 134
- B-4 PVBA/SVBA test reporting, 137
- B-5 Approved minimum test result values, 137

This page intentionally blank.

Preface

This is the fourth edition of the AWWA Manual M14, *Backflow Prevention and Cross-Connection Control: Recommended Practices*. It provides both technical and general information to aid in the development, implementation, and management of a cross-connection control and backflow prevention program, and an understanding of backflow prevention and cross-connection control concepts. This manual is a review of recommended practice. It is not an AWWA standard calling for compliance with certain requirements. It is intended for use by water suppliers and municipalities of all sizes, whether as a reference book or a textbook for those not familiar with backflow prevention and cross-connection control.

This manual reviews regulatory provisions established to protect the potable water supply. To achieve this goal, products and measures are discussed to assist in the determination of controlling hazardous cross-connections. For fundamental knowledge and a thorough understanding, this entire manual should be carefully studied. Readers will also find the manual a useful source of information when assistance is needed with specific or unusual connections to the potable water supply.

This fourth edition of M14 includes updates to regulatory concerns and products that protect the water supply, and new material on establishing programs to control cross-connections, including surveying of piping systems to identify and monitor such connections.

This page intentionally blank.