

Knife Gate Valves



American Water Works
Association

Knife Gate Valves

AWWA Reference Standard C520-19



**American Water Works
Association**

Knife Gate Valves

Copyright © 2020 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 scanning, recording, or any information or retrieval system. Reproduction and commercial use of this material is prohibited, except with written permission from the publisher.

Disclaimer

The authors, contributors, editors, and publisher do not assume responsibility for the validity of the content or any consequences of its 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/M72.

Managing Editor/Project Manager: Melissa Valentine
Technical Editor: Dianne B. Rose
Cover Design: Mike Labruyere
Manager, Publishing Operations: Gillian Wink
Production: Innodata
Senior Specialist - Manuals: Willadee Hitchcock
Manuals Coordinator 2: Janet Greifinger

Library of Congress Cataloging-in-Publication Data

Names: MacConnell, Mark, author.

Title: M72 - knife gate valves / Mark MacConnell.

Other titles: Knife gate valves | AWWA manual ; M72.

Description: First edition. | Denver, CO : American Water Works Association, [2020] | Series: Manual of water supply practices ; M72 | Includes bibliographical references and index. | Summary: "This manual presents the general practice for selection and installation of manual and automated knife gate valves for use in water and waste-water applications. This document is intended to provide information and guidance on typical knife gate valves and their intended application"-- Provided by publisher.

Identifiers: LCCN 2020045228 (print) | LCCN 2020045229 (ebook) | ISBN 9781647170271 (paperback) | ISBN 9781613005675 (ebook)

Subjects: LCSH: Water-pipes--Valves--Handbooks, manuals, etc.

Classification: LCC TD491 .M18 2020 (print) | LCC TD491 (ebook) | DDC 628.1/5--dc23

LC record available at <https://lcn.loc.gov/2020045228>

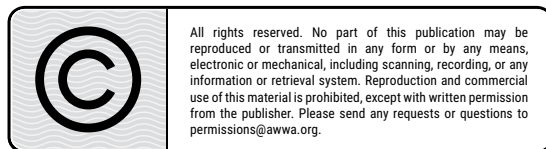
LC ebook record available at <https://lcn.loc.gov/2020045229>

Printed in the United States of America

ISBN 978-1-64717-027-1

eISBN 978-1-61300-567-5

DOI <https://doi.org/10.12999/AWWA.M72ed1>



**American Water Works
Association**

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

Committee Personnel, xi

Chapter 1	Introduction	1
	History, 1	
	Purpose, 2	
	Body Style, 3	
Chapter 2	Principles of Operation	9
	Definitions, 9	
	Function, 11	
Chapter 3	Types of Construction	13
	General Construction, 13	
	Body Construction, 13	
	Gate Packing and Stem Seals, 14	
	Yokes, 16	
	Stem, 17	
	Gates, 17	
	Valve Seat Configurations, 17	
	Methods of Seating, 19	
	Metal-Seated, 20	
Chapter 4	Optional Equipment	23
	Manual Override, 23	
	Lockout Mechanism, 23	
	External Gate Guards, 25	
	Fail-Safe Operation, 26	
	Position Indication, 27	
	Chainwheels, 27	
	Flush Ports, 28	
Chapter 5	Unloading, Inspection, and Storage	29
	Unloading, 29	
	Inspection after Unloading, 29	
	Operation after Delivery, 30	
	Specifications, 30	
	Short- and Long-Term Storage, 30	
	Storage Location, 31	
	Storage Position, 31	
	Flange Covers, 32	
	Storage Inspection, 32	

Chapter 6	Installation and Testing	33
	Installation Training, 34	
	Installation Orientations, 35	
	Preferred Direction of Flow, 37	
	Bolt Tightening, 38	
	Packing Adjustments, 38	
	Large Valves, 39	
	Valve Misapplication and Maintenance, 40	
	Witnessed Testing, 40	
	Piping Tests, 40	
	Field Commissioning – Dry, 41	
	Field Commissioning – Wet, 41	
Chapter 7	Operation, Maintenance, and Safety	43
	General, 43	
	Safety Concerns, 43	
	Maintenance Procedures, 44	
	Preventive Maintenance Schedules, 44	
	Recordkeeping, 44	
	Index, 45	
	List of AWWA Manuals, 49	

Figures



- 1-1 Typical bonnetless knife gate valve, 2
- 1-2 Typical bonnetless knife gate valve with drilled-through bolt pattern (left) and tab-less wafer body (right), 3
- 1-3 Semi-lug bonnetless knife gate valve with two-piece body and stanchions, 4
- 1-4 Typical bonneted double-flanged knife gate valve, 5

- 2-1 Cross section of a typical bonnetless knife gate valve with two-piece yoke and handwheel, 10
- 2-2 Exploded view of a typical bonnetless knife gate valve, 10

- 3-1 Bonneted knife gate valve with adjustable packing, 15
- 3-2 Bonnetless knife gate valve with live loaded packing, 15
- 3-3 Resilient-seated knife gate valve, 18
- 3-4 Bidirectional resilient-seated lugged-body knife gate valve, 19
- 3-5 Metal-seated lugged-body knife gate valve, 20
- 3-6 Perimeter resilient-seated semi-lug split body knife gate valve, 21

- 4-1 Handwheel manual override on electrically actuated bonnetless lugged knife gate valve, 24
- 4-2 Mechanical lockout device, 24
- 4-3 Swivel-type lockouts, 25
- 4-4 Gate guard safety screen, 26
- 4-5 Proximity sensor for manual or automated knife gate valves, 27

- 6-1 Knife gate valves in use at wastewater plant, 33
- 6-2 Knife gate valve suggested orientations in horizontal pipelines, 35
- 6-3 Installed slurry knife gate valve with cylinder actuation, 36
- 6-4 Installed tapping outlet knife gate valve, 36
- 6-5 Unidirectional knife gate valve in the reverse flow condition, 37
- 6-6 Traditional packing gland configuration, 38
- 6-7 Transverse seal packing configuration, 39
- 6-8 Example of properly supported installation on each side of the valve, 39

Tables



- 1-1 Typical service application requirements, 6
- 1-2 Typical applications and characteristics for various valves, 6

Preface



This manual presents the general practice for selection and installation of manual and automated knife gate valves for use in water and wastewater applications. This is a manual of recommended practice, not an AWWA standard. This document is intended to provide information and guidance on typical knife gate valves and their intended application. Questions about specific installations or applicability to specific applications not addressed in this manual should be directed to the manufacturer or supplier.

Information contained in this manual is useful for operators, technicians, and engineers to gain a basic understanding of the use and application of manual and automated knife gate valves. There are many variations of knife gate valves that may exceed the scope of this manual and require special consultations with the manufacturer to determine the associated application requirements. The valves' operational and design information is generic, and actual data from the intended valve manufacturer should be obtained before making the final selection of any type of knife gate valve and its options. This manual supplements information on the knife gate valves listed in ANSI/AWWA Standard C520 of latest edition: Knife Gate Valves, Sizes 2 in. (50 mm) Through 96 in. (2,400 mm).

AWWA standards are available for purchase by calling (800) 926-7337 or online at <https://www.awwa.org/publications>.

Manufacturers graciously provided valve illustrations and other documentation. AWWA does not endorse any manufacturer's products, and the names of the manufacturers have been removed from the material provided.

Metrification Note: Valves are listed in their current US designation (in.) and the equivalent nominal metric designation (mm). To obtain the actual metric equivalent, use a conversion factor of 25.4 mm per inch.

Committee Personnel



The AWWA Standards Committee on Knife Gate Valves, which developed this manual, had the following personnel at the time of approval.

Mark MacConnell, *Chair*

General Interest Members

Michael Altland, Mott MacDonald, Iselin, N.J.

Frank Blowers, Beaver Water District, Lowell, Ariz.

Anthony Holmes, Jones Edmunds & Associates, Inc., Winter Haven, Fla.

Christine Kirby, Lockwood, Andrews & Newnam, Inc., Houston, Tex.

Producer Members

David Gambetta, Lined Valve / Henry Pratt / Mueller, Woodland, Wash.

Paul Gifford, Mueller Co., Chattanooga, Tenn.

Jerome Grant, DeZURIK, Sartell, Minn.

Bruce James, Iconix Waterworks, Milton, Ont.

Al Libke, DeZURIK, Sartell, Minn.

Michael Long, Elite Valve, Oakville, Ont.

User Members

Jeffrey Archer, Denver Water, Denver, Colo.

Mark Johnson, Massachusetts Water Resources, Chelsea, Mass.

Mark MacConnell, Burnaby, B.C.

Ronald Masek, City of Houston, Houston, Tex.

Jim Young, City of Richmond, B.C.

Chapter **1**

Introduction

AWWA knife gate valves are a versatile design manufactured in wafer, lug, and flanged body configurations from various materials. Designs are available with nonadjustable packing in bonneted-style valves and adjustable packing glands in nonbonneted-style valves. AWWA designs provide superior performance and reliability over conventional valve designs because of requirements for low- and high-pressure valves used in various applications associated with the waterworks industry. Knife gate valves are used in liquid and suspended solids handling. They are also used for flow isolation as well as throttling/control duties under certain operating conditions in modified configurations available from some manufacturers.

Most knife gate valve applications involve relatively low pressures, typically 150 psig (10 bar) or less; however, special designs are used up to 300 psig (20 bar) and higher (e.g., ASME Class 300). Because of some standard constructional features, knife gate valves in metal-seated configurations and selected packing material can handle major temperature fluctuations that may seriously damage or hamper the function of other valve designs or resilient-seated valves.

HISTORY

Simple gate valves date back to ancient times in Greek and Roman water and irrigation systems. These gates were mostly operated by manual levers or screws.

The first modern knife gate valve, simply known as the gate valve, was produced in Germany in 1881. Knife gate valve mass production started around 1928, primarily for the pulp and paper industry. The name “knife” gate valve has been used in conjunction with the thinner, round, beveled leading edge of the gate to distinguish this valve from the common wedge gate valve. The first generation of knife gate valves came with a bottom-draining pocket. Soon after, standard valves from most manufacturers were made without a bottom pocket and only in rising stem configurations. The name “pulp valve” was commonly associated with today’s knife gate valve, which at the time was available in diameters of 3 in. (75 mm) up to 24 in. (600 mm).

During the initial manufacturing years of the early 1900s, the valve was available only with cast iron bodies. Leakage was common in these earlier models, which only employed metal-seated configurations. (Newer models now offer unidirectional and bidirectional resilient seating at low and high pressures with zero leakage capabilities.)

A degree of control functionality was then incorporated into the valve. Many knife gate valves are operated with lever, handwheel, chainwheel, and bevel gear manual actuators (see Figure 1-1). Powered actuators, either cylinder or electric, are also used regularly in many industrial applications for knife gate valves, including the paper, oil, gas, and power industries.

PURPOSE

This manual will explain fundamental concepts and operation of knife gate valves, providing users with a technical background to understand, specify, and install knife gate valves in applications for which they are intended. The information in this manual should be used in conjunction with data from valve manufacturers to select valves and their associated actuation for a given application.

For isolation and control applications, actuator sizing parameters such as thrust will be explained in detail so that the sizing methodologies recommended by valve manufacturers can be applied. It is also important to understand how certain valve



Source: Elite Valve

Figure 1-1 Typical bonnetless knife gate valve