ANSI/AWWA C520-19
(Revision of ANSI/AWWA C520-14)

American Water Works Association
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AWWA Standard

Knife Gate Valves, Sizes 2 In. (50 mm) Through 96 In. (2,400 mm)

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AWWA Standard

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Committee Personnel

The AWWA Standards Committee, Knife Gate Valves, which prepared and approved this standard, had the following personnel at the time of approval:

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Foreword

This foreword is for information only and is not a part of ANSI/AWWA C520.*

I. Introduction.

I.A. *Background*. Knife gate valves are generally used for isolation of pipes in water and wastewater treatment plants. Knife gate valves can be metal or resilient seated, bidirectional or unidirectional.

I.B. *History*. The need for standardization of knife gate valves was recognized by the American Water Works Association (AWWA) in 2007, resulting in the formation of a standards committee. Subsequent revisions of C520 were approved by the AWWA Board of Directors on June 20, 2010, and June 8, 2014. This edition was approved on Feb. 1, 2019.

I.C. *Acceptance*. In May 1985, the US Environmental Protection Agency (USEPA) entered into a cooperative agreement with a consortium led by NSF International (NSF) to develop voluntary third-party consensus standards and a certification program for direct and indirect drinking water additives. Other members of the original consortium included the Water Research Foundation (formerly AwwaRF) and the Conference of State Health and Environmental Managers (COSHEM). The American Water Works Association and the Association of State Drinking Water Administrators (ASDWA) joined later.

In the United States, authority to regulate products for use in, or in contact with, drinking water rests with individual states.† Local agencies may choose to impose requirements more stringent than those required by the state. To evaluate the health effects of products and drinking water additives from such products, state and local agencies may use various references, including

1. Specific policies of the state or local agency.

2. Two standards developed under the direction of NSF‡, NSF/ANSI 60, Drinking Water Treatment Chemicals—Health Effects, and NSF/ANSI 61, Drinking Water System Components—Health Effects.

3. Other references, including AWWA standards, *Food Chemicals Codex, Water Chemicals Codex*,§ and other standards considered appropriate by the state or local agency.

* American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.

† Persons outside the United States should contact the appropriate authority having jurisdiction.

‡ NSF International, 789 North Dixboro Road, Ann Arbor, MI 48105.

§ Both publications available from The National Academies Press, 500 Fifth Street NW, Keck 360, Washington, DC 20001.

Various certification organizations may be involved in certifying products in accordance with NSF/ANSI 61. Individual states or local agencies have authority to accept or accredit certification organizations within their jurisdiction. Accreditation of certification organizations may vary from jurisdiction to jurisdiction.

Annex A, "Toxicology Review and Evaluation Procedures," to NSF/ANSI 61 does not stipulate a maximum allowable level (MAL) of a contaminant for substances not regulated by a USEPA final maximum contaminant level (MCL). The MALs of an unspecified list of "unregulated contaminants" are based on toxicity testing guidelines (noncarcinogens) and risk characterization methodology (carcinogens). Use of Annex A procedures may not always be identical, depending on the certifier.

ANSI/AWWA C520 does not address additives requirements. Thus, users of this standard should consult the appropriate state or local agency having jurisdiction in order to

1. Determine additives requirements, including applicable standards.
2. Determine the status of certifications by parties offering to certify products for contact with, or treatment of, drinking water.
3. Determine current information on product certification. In an alternative approach to inadvertent drinking water additives, some jurisdictions (including California, Maryland, Vermont, and Louisiana at the time of this writing) are calling for reduced lead limits for materials in contact with potable water. Various third-party certifiers have been assessing products against these lead content criteria, and a new ANSI-approved national standard, NSF/ANSI 372, Drinking Water System Components—Lead Content, was published in 2010. On Jan. 4, 2011, legislation was signed revising the definition for "lead free" within the Safe Drinking Water Act (SDWA) as it pertains to "pipe, pipe fittings, plumbing fittings, and fixtures." The changes went into effect on Jan. 4, 2014. In brief, the new provisions to the SDWA require that these products meet a weighted average lead content of not more than 0.25 percent.

II. Special Issues.

II.A. *General.* Conditions under which a valve is to be operated must be evaluated carefully by the purchaser. The evaluations must include the determination of the hydraulic characteristics of the system in which the valve will be installed and the operation of the valve, including (1) the maximum transient and static differential pressure across the valve gate and (2) flow through the valve under the most adverse operating conditions. Torque and thrust requirements for valve operation

vary considerably with differential pressure across the valve, fluid velocity, and fluid temperature. Knife gate valves are not intended for throttling service.

Shutoff direction is important in the installation and use of a knife gate valve. The valve's performance and sealing characteristics vary with direction of sealing. A manufacturer may designate a recommended high-pressure sealing side for long-term reliability.

Installation: Knife gate valves may have protrusions in the bonnet area that may come in contact with oversize mating flanges. The top works of the valve may be significant and should be considered when designing the piping system. While knife gate valves are commonly provided with port flange bolt patterns (number of bolts, bolt size, bolt circle, etc.) that dimensionally match ANSI/AWWA C207, ANSI/AWWA C606, ASME B16.1, ASME B16.5, ASME B16.42, MSS-SP44, or ASME* B16.47 flange bolt patterns to facilitate installation, they are not designed to handle the same torque requirements of a Class 150 flange. With a lower nominal pressure rating, narrow face-to-face dimension, and thinner body flanges, a knife gate body may distort if subjected to the full torque values of a Class 150 flange, causing irreparable damage. Refer to manufacturer's recommended flange torque values and recommended installation instructions.

Use of nontraditional flanging arrangements may exceed normal knife gate design criteria. Refer to manufacturer's recommended installation instructions.

Gasket selection has a bearing on potential flange torques. Refer to manufacturer's recommended installation instructions.

Manual Actuation: Due to long linear travel during gate stroking, large knife gate valves require many rotations of handwheels or chainwheels with high rimpull force. This may be impractical and may fatigue operating personnel. It may be advisable to specify 2-in. nuts on input shaft of bevel gear actuators to allow use of powered torque devices.

However, powered devices may over-torque valves and/or actuators at the ends of the stroke if the devices are not properly sized. When powered devices are employed, torque-limiting devices or declutching mechanisms set at 300 ft-lb (406 N-m) should be considered.

Permeation: The selection of materials is critical for potable water, wastewater, and reclaimed water service and distribution piping systems in locations where there is a likelihood the piping system will be exposed to significant concentrations of

* ASME, 2 Park Avenue, New York, NY 10016.

pollutants composed of low-molecular-weight petroleum products or organic solvents or their vapors. Documented research has shown that piping system materials, such as polyethylene, polybutylene, polyvinyl chloride, and asbestos cement; and elastomers used in gaskets and packing glands, are subject to permeation by lower-molecular-weight organic solvents or petroleum products. If a potable water, wastewater, or reclaimed water piping system must pass through such a contaminated area or an area subject to contamination, consult the manufacturer regarding permeation of pipe walls, valve components, jointing material, and other piping system components *before* selecting materials for use in that area.

II.B. *Chlorine and Chloramine Degradation of Elastomers.* The selection of materials is critical for water service and distribution piping in locations where there is a possibility that elastomers will be in contact with chlorine or chloramines. Documented research has shown that elastomers such as gaskets, seals, valve seats, and encapsulations may be degraded when exposed to chlorine or chloramines. The impact of degradation is a function of the type of elastomeric material, chemical concentration, contact surface area, elastomer cross section, environmental conditions as well as temperature. Careful selection of and specifications for elastomeric materials and the specifics of their application for each water system component should be considered to provide long term usefulness and minimum degradation (swelling, loss of elasticity or softening) of the elastomer specified.

II.C. *Advisory Information on Product Application*. This standard does not describe all possible applications or manufacturing technologies. The purchaser should identify special requirements and required deviations from this standard and include appropriate language in purchase documents. Refer to Sec. III.A in this foreword. Other advisory information is as follows.

1. The maximum anticipated fluid velocity through the valve, maximum nonshock operating pressure, water temperature range, and valve classification are used by manufacturers to calculate torque and thrust requirements, which then may determine valve operating-component design and actuator sizing. This information should be provided according to items in Sec. III.A in this foreword.

2. The direction of shutoff and whether it is uni- or bidirectional can affect valve design.

3. There is no standard for valve laying lengths for valves larger than 36 in. (900 mm). Laying lengths should be provided by the supplier on certified drawings (Sec. 4.1.1.1) for the contract.

4. Whether the valve is to be provided with or without a bonnet.

5. Some actuators may produce sufficient torque that may damage the valve if the valve is prevented from closing because of an obstruction in the pipeline. Preventive measures such as torque-limiting devices or shear pins and keys are beyond the scope of this standard.

6. Metal seated knife gate valves are typically designed as unidirectional valves with a single seat and a preferred direction of flow for pressure-assisted downstream shutoff of the system. The metal seated valve design makes use of the differential pressure across the valve gate to assist in obtaining a seal around the perimeter of the gate by forcing it against the metal seat. At lower differential pressures it is difficult to achieve an adequate shutoff given the rigidity of the mating metal seat surfaces. As the pressure differential across the valve increases, the seat leakage decreases as the rigidity of the metal mating seat surfaces begin to yield until an acceptable rate of 40 cc/in. of valve diameter/minute can be attained. The pressure differential where this leakage rate can consistently be achieved is typically 40 psi but can vary with different valve sizes. At pressures below 40 psi, the leakage rate of a metal seated knife gate valve cannot be predicted with any certainty.

II.D. *Advisory Information on Scheduling Requirements*. Valves made in accordance with this standard in large sizes are not "production run" products. They are custom designed and manufactured for the specific application. As a consequence of this, the valve manufacturers may require more time than usual for large valves to develop bid prices, prepare valve designs, submit shop drawing data, manufacture the valve, and shop test the valve. The purchaser should discuss schedule requirements with manufacturers in advance of placing orders or advertising for bids.

III. Use of This Standard. It is the responsibility of the user of an AWWA standard to determine that the products described in that standard are suitable for use in the particular application being considered.

III.A. *Purchaser Options and Alternatives*. The following information should be provided by the purchaser.

1. Standard used—that is, ANSI/AWWA C520, Knife Gate Valves, Sizes 2 In. (50 mm) Through 96 In. (2,400 mm), of latest revision.

2. Whether compliance with NSF/ANSI 61, Drinking Water System Components—Health Effects, is required.

3. Size of valve and quantity required.

4. Minimum design pressure.

5. Maximum nonshock shutoff pressure and maximum nonshock line pressure.

6. Required flow rate through valve.

a. Under normal conditions.

b. Under maximum-flow conditions.

7. Description of connecting piping: material, outside diameter (OD) and inside diameter (ID), and flanged-end connection.

8. Type of seat: metal to metal or resilient, unidirectional, or bidirectional, and shutoff requirement.

9. Type of shaft (stem) seal (packing).

10. Whether valve is bonnetless (gate and shaft exposed) or bonneted (gate and shaft enclosed) in a bonnet.

11. Materials.

a. If the purchaser requires a wetted component that was not tested and certified to NSF/ANSI 61 requirements, the certification may not be valid.

b. If one or more of the materials included in this standard are unacceptable, the purchaser should declare other acceptable materials that are included in this standard.

12. Type of installation: buried (specify depth and loadings) vault, submerged (specify depth and duration), indoors, or outdoors.

13. Actuator type: manual, handwheel, chain-wheel, manual with gear assist, electric, cylinder, or other; and service conditions.

14. Manual actuator.

a. Type: handwheel, chain-wheel, or wrench nut, or manual with gear assist with chain-wheel or wrench nut.

b. Direction to turn the handwheel, chain-wheel, or wrench nut to open valves. (Unless otherwise required in the purchase documents, the valve will open by turning counterclockwise.)

c. Position indicator.

d. Special devices or features if required: gate guards, extension shaft, floor stand, or handwheel diameter.

15. If required, configuration for vault, submerged, or in-plant service.

16. Type of power actuator when required (Sec. 4.5.1).

17. Description of fluid and temperature range, including considerations relating to anticipated problems with rubber components exposed to line content containing chlorine, chloramines, or other chemicals. If these problems are anticipated, the purchaser should identify the maximum expected concentrations of these chemicals and other factors, such as pH and temperature ranges, which may affect the corrosivity

of these chemicals. The purchaser should consult with the manufacturers and, if appropriate, specify special requirements for these components.

18. If purchaser requires shop inspection or test observations to be performed by the purchaser or purchaser's agent, the extent of such inspections and observations shall be defined.

III.B. *Data to Be Provided by the Manufacturer or Supplier*. Sec. 4.1 describes the minimum data to be provided by the supplier. Because these valves may be custom designed and manufactured, purchasers may require more detailed or comprehensive data. Such data may include

a. Chemical analysis of materials for body, gate, and shaft.

b. Tensile strength, yield strength, hardness, and impact test data for body, gate, and shaft materials.

c. Weld procedures and documentation.

d. Laying length, sizes greater than 36 in. (900 mm) NPS.

e. Center of gravity.

Such requirements shall be clearly defined in the purchase documents. The appropriate submittal requirements per ASTM and ASME material and design standards should be referenced.

1. Details of federal, state, and local requirements (Sec. 4.2.1).

2. Records of materials tests (Sec. 4.2.2.4.1).

3. The providing of test records that are specified according to Sec. 4.2.2.4.1, 5.1.1, 5.1.2, and 5.1.3 of this standard. Test records required for ANSI/AWWA C541, Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates, and ANSI/AWWA C542, Electric Motor Actuators for Valves and Slide Gates, may also be requested. The purchaser may require records or may stipulate a breakdown of production test records or proof-of-design test records.

4. Other actuators: actuators other than those described in this standard or ANSI/AWWA C541 and C542 shall be specified by the purchaser in detail.

5. Valve and actuator arrangement and position.

6. Protective coatings if other than specified in Sec. 4.6 of this standard.

7. Hydrostatic body and bonnet test durations greater than 1 min. as required in Sec. 5.1.2.1.

8. Low-pressure seat test down to 0 psig (Sec. 5.1.3.1).

9. Copies of the "proof-of-design test" performed in accordance with Sec. 5.2.1.2.

10. Special markings to be applied to valve by manufacturer (Sec. 6.1.1).

11. Affidavit of compliance with applicable provisions of this standard notarized and signed by the valve and actuator manufacturer's person in responsible charge (Sec. 6.1.3).

III.C. *Modification to Standard*. Any modification of the provisions, definitions, or terminology in this standard must be provided by the purchaser.

IV. Major Revisions. Major revisions made to the standard in this edition include the following:

1. Added advisory information regarding chlorine and chloramine degradation of elastomers (Sec. II.B).
2. Added advisory information for metal seated valves (Sec. II.C.6).
3. Changed minimum pressure requirements (Sec. 4.3.1).
4. Increased manual actuator design factor (Sec. 4.4.1).
5. Seat leakage was modified (Sec. 5.1.3.2).

V. Comments. If you have any comments or questions about this standard, please call AWWA Engineering and Technical Services at 303.794.7711, FAX at 303.795.7603, write to the department at 6666 West Quincy Avenue, Denver, CO 80235-3098, or email at standards@awwa.org.

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Knife Gate Valves, Sizes 2 In. (50 mm) Through 96 In. (2,400 mm)

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard describes bonneted, bonnetless, cast, and fabricated steel; stainless-steel; and cast ductile-iron body knife gate valves with resilient or metal seats, including tapping knife gate valves, for use in water, wastewater, and reclaimed water systems with a pH range from 6 to 12 and a temperature range from 33 to 125°F (0.6 to 52°C). The minimum design pressure rating shall be 150 psig (1,034 kPa) for nominal sizes 2 to 24 in. (50 to 600 mm), and the minimum design pressure ratings for nominal sizes 30 to 96 in. (750 to 2,400 mm) shall be 25 psig (172 kPa), 75 psig (517 kPa), or 150 psig (1,034 kPa).

Sec. 1.2 Purpose

The purpose of this standard is to provide minimum requirements for stainless steel and ductile-iron body knife gate valves with resilient and metal seats, including tapping knife gate valves, for use in water, wastewater, and reclaimed water systems, including materials, design, testing, rejection, marking, and shipping.

Sec. 1.3 Application

This standard can be referenced in documents for purchasing of stainless-steel and ductile-iron body knife gate valves with resilient and/or metal seats, including