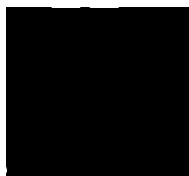


American Water Works Association

ANSI/AWWA C504-00

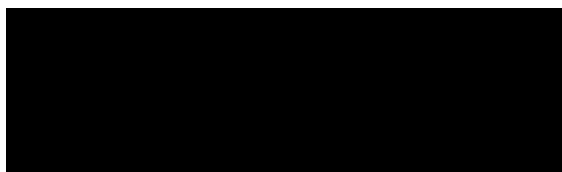
(Revision of ANSI/AWWA C504-94)



AWWA STANDARD

FOR

RUBBER-SEATED BUTTERFLY VALVES



Effective date: Dec. 1, 2000.

First edition approved by AWWA Board of Directors May 27, 1954.

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AMERICAN WATER WORKS ASSOCIATION

6666 West Quincy Avenue, Denver, Colorado 80235

AWWA Standard

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Foreword

This foreword is for information only and is not a part of AWWA C504.

I. Introduction.

I.A. *Background.* Rubber-seated butterfly valves have been in use for at least 55 years in pipelines carrying liquids and gases. Manufacturers of butterfly valves developed tight-closing, rubber-seated types for cooling water systems and power stations. Since 1940, most new valves installed for this type of service have been rubber-seated butterfly valves.

Since the late 1940s, rubber-seated butterfly valves have gained increased acceptance for use in water treatment plants and water supply and distribution lines because (1) they provide tight shutoff; (2) are relatively easy to operate, even with large pressure drops across the valves; and (3) require relatively little space for installation.

I.B. *History.* The need for standardization of butterfly valves was recognized by the American Water Works Association (AWWA) in June 1953.

The committee appointed for the task of standardization developed AWWA C504, which was approved as tentative and published in September 1954. Four years later, in 1958, the tentative standard was accepted as a standard.

The 1954 tentative standard was written to describe the then-available types of standard rubber-seated butterfly valves that had been in successful operation for at least five years prior to 1954. The standard established three pressure and two velocity classifications, standards for materials, laying lengths, minimum body and disc designs, and actuator sizes for valves having rubber seats in the valve body.

Since the publication of AWWA C504 in 1954, butterfly-valve designs have been improved and refined. In September 1962, a new committee was charged with the task of reviewing AWWA C504 and recommending revisions to the standard in order to make it compatible with then-current valve designs.

Generally, modern butterfly-valve designs for water service include cast-body construction in 25-psi (172-kPa), 75-psi (517-kPa), and 150-psi (1,034-kPa) pressure classes; flanged, mechanical-joint, and wafer bodies; rubber seats in valve bodies or on the valve discs; and operating conditions (limited by the design shutoff pressure and velocities of water flow) that produce torques considered maximum for the shaft

size used. These modern practices were the basis for the revisions included in the 1966 edition of AWWA C504.

Revisions in the 1970 edition were initiated to minimize the corrosion of seating surfaces, to provide more adequate requirements for stainless steel, and to provide for painting of all valve interiors with asphalt varnish.

Revisions in 1974 and 1980 provided fine-tuning of the provisions of the standard. Major changes included addition of provisions concerning the connection between shaft and disc and the use of carbon-steel shafts with stainless-steel journals.

Revisions to the 1987 edition included using the word “actuator” rather than “operator” and provided definitions of valve classifications. Major changes included the addition of certain sprayed-metal seat surfaces and nonmetallic cylinder components as acceptable materials. Appendix B (now appendix A), Installation, Operation, and Maintenance of Rubber-Seated Butterfly Valves, was added.

Revisions to the 1994 edition included the deletion of appendix A for calculating torques, the addition of soft metrication, reference to actuator requirements given in AWWA C540, introduction of Class 250 valves, and adoption of additional materials and material requirements.

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 all direct and indirect drinking water additives. Other members of the original consortium included the American Water Works Association Research Foundation (AWWARF) and the Conference of State Health and Environmental Managers (COSHEM). The American Water Works Association (AWWA) 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:

*Persons in Canada, Mexico, and non-North American countries should contact the appropriate authority having jurisdiction.

1. An advisory program formerly administered by USEPA, Office of Drinking Water, discontinued on Apr. 7, 1990.
2. Specific policies of the state or local agency.
3. Two standards developed under the direction of NSF, ANSI*/NSF[†] 60, Drinking Water Treatment Chemicals—Health Effects, and ANSI/NSF 61, Drinking Water System Components—Health Effects.
4. Other references, including AWWA standards, *Food Chemicals Codex*, *Water Chemicals Codex*,[‡] and other standards considered appropriate by the state or local agency.

Various certification organizations may be involved in certifying products in accordance with ANSI/NSF 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 ANSI/NSF 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.

AWWA C504-00 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 all parties offering to certify products for contact with, or treatment of, drinking water.
3. Determine current information on product certification.

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

*American National Standards Institute, 11 W. 42nd St., New York, NY 10036.

†NSF International, 789 N. Dixboro Rd., Ann Arbor, MI 48105.

‡Both publications available from National Academy of Sciences, 2102 Constitution Ave. N.W., Washington, DC 20418.

and the operation of the valve (on-off or throttling), including (1) the maximum transient and static differential pressure across the valve disc and (2) flow through the valve under the most adverse operating conditions.

Torque requirements for valve operation vary considerably with differential pressure across the valve, fluid velocity, fluid temperature, and upstream piping conditions.

Flow direction is important in the installation and use of a butterfly valve. Some valves' performance and sealing characteristics vary with direction of flow. Flow direction can affect the torque requirements and throttling characteristics of valves with offset discs or discs which do not have identical surface configurations on each side.

Hydraulic testing, flow capacities, and valve torques are based on the flow, upstream of a valve, being uniform and undisturbed, like the flow produced by a long length of constant-diameter, straight pipe. Piping configurations which produce a non-uniform or turbulent flow pattern upstream of the valve can increase torque requirements, create damaging vibrations, increase head loss, and increase stresses in valve components.

Some hydraulic systems can produce flow velocities much higher than the maximum of 16 ft/sec (4.9 m/sec) described in this standard. Typically high velocities can result from line breaks, during fire fighting or in surge relief applications. The effects of high velocities and asymmetrical turbulent flow conditions can result in high loads and torque requirements, which are unaccounted for in this standard. These design conditions should be clearly specified by the purchaser.

II.B 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 specifications. Refer to Sec. III.A in this foreword. Other advisory information is provided below.

1. The maximum anticipated flow velocity through the valve, maximum nonshock shutoff pressure, water temperature range, and valve classification are used by manufacturers to calculate torque requirements, which then may determine valve operating-component design and actuator sizing. This information should be provided according to items 5, 6, 7, and 27 of Sec. III.A in this foreword. NOTE: If this information is not provided, class B valve classifications will be provided and

actuators will be sized for the most severe conditions listed in this standard. This may result in a significant unwarranted expense.

Turbulence is also a factor that may affect torque requirements. Turbulence will be considered only if information on piping conditions is provided according to item 31 of Sec. III.A in this foreword.

2. This standard limits handwheel rim pull, but not handwheel diameter. A smaller handwheel may require a more expensive actuator requiring more turns. If a large-diameter handwheel is of concern because of clearance or other limitations, then the diameter should be limited to an acceptable dimension according to item 15 of Sec. III.A in this foreword.

3. This standard recognizes nonmetallic oil-hydraulic, water-hydraulic, and pneumatic cylinder actuators, but does not specify materials or design details for these actuators. The suitability for the application depends, to a large extent, on the quality of the manufactured product. The purchaser should be aware of the manufacturer's previous experience with similar applications. The purchaser may limit acceptability to a specific product or application according to item 17 of Sec. III.A in this foreword.

4. This standard permits the use of some plated components in metallic water-hydraulic cylinder actuators. The purchaser should be aware of the possibility of plating failure, particularly when the operating water is aggressive. The purchaser may limit acceptability to cylinders having components that do not depend on platings to resist corrosion according to item 17 of Sec. III.A in this foreword.

5. This standard permits several metallic seating-surface materials. This standard recommends seating surfaces of stainless steel or nickel-copper alloy in cases where valves are to be operated more frequently than once a month. The purchaser may require these alloys for specific applications according to item 12 of Sec. III.A in this foreword.

6. This standard also accepts sprayed mating-seat surfaces when the surfaces are applied under certain conditions. The suitability of this type of surface depends, to a large extent, on the quality of the manufactured product. The purchaser should be aware of the manufacturer's previous experience with similar applications. The purchaser may limit acceptability to a specific product or application according to item 12 of Sec. III.A in this foreword.

7. The material references for metals in Sec. 4.4 and 4.5 of this standard are based on successful experience. There may be instances where the water is very

aggressive, and the listed materials, particularly the bronzes, may not be suitable for surfaces in both the valve and, if applicable, the hydraulic cylinder actuators wetted by the line content. In these cases, alternative materials, such as low zinc and low aluminum (7 percent maximum zinc, 2 percent maximum aluminum), should be specified. The purchaser should recognize that alternative materials may increase costs and delivery time. Refer to item 12 of Sec. III.A of the foreword.

8. The requirements for elastomers are included in Sec. 4.5 of this standard. This standard does not require rubber parts to be specifically tested or to be specifically suitable for service with line content containing chlorine or chloramines. Standardized tests measuring resistance to chlorine- or chloramine-bearing waters were not available at the date of revision of this standard. If these or other chemical constituents are of concern, special requirements may be included in the specifications. Refer to item 32 of Sec. III.A in the foreword.

9. This standard does not require a minimum waterway area nor does it limit head loss across the valve. If this is of concern, limitations should be provided. Refer to item 30 of Sec. III.A of this foreword.

10. This standard allows a party other than the valve manufacturer to mount an actuator to a valve. Sections 5.2.1 and 5.2.2.1 require that the valve and actuator assembly be performance and leak tested as an assembly. The purchaser is cautioned that the valve manufacturer cannot assume responsibility for the valve's sealing and operating performance if the actuator is mounted by a party other than the valve manufacturer. If this is a concern, requirements on actuator mounting should be included in the specifications.

11. Electric actuators meeting the requirements of AWWA C540 can be supplied with or without an intermediate quarter-turn mechanism. If desired, the purchaser should specify a multi-turn actuator coupled to an intermediate mechanism according to AWWA C504.

III. Use of This Standard. AWWA has no responsibility for the suitability or compatibility of the provisions of this standard to any intended application by any user of this standard. Accordingly, each user of this standard is responsible for determining that the standard's provisions are suitable for and compatible with that user's intended application.

III.A. *Purchaser options and alternatives.* When placing orders for valves to be manufactured in accordance with this standard, the purchaser's specifications should include the following items:

1. Standard to be used—that is, AWWA C504, Standard for Rubber-Seated Butterfly Valves, of latest edition.
2. Size of valve.
3. Quantity required.
4. Type of body: flanged (short body or long body), wafer, or mechanical-joint ends.
5. Minimum acceptable valve classification.
6. Maximum nonshock shutoff pressure and maximum nonshock line pressure.
7. Required flow rate through valve.
 - a. Under normal conditions.
 - b. Under maximum-flow conditions.
 - When opening (consider factors such as fire flow).
 - When closing (consider factors such as line break).
8. The providing of test records that are specified according to Sec. 4.4.3, 4.5.8.5.8, 4.5.8.5.9, 5.2.1, 5.2.2, 5.2.3, and 5.2.4 of this standard. Test records required for power actuators under ANSI/AWWA C540, Standard for Power-Actuating Devices for Valves and Sluice Gates, may also be requested. The purchaser may require all records or may stipulate a breakdown of production test records or proof-of-design test records.
9. Description of connecting piping: material, outside diameter (OD) and inside diameter (ID), and flanged or plain end.
10. Detailed description of nonstandard end connections (Sec. 4.5.1 and 4.5.2).
11. Type of shaft seal (Sec. 4.5.7).
12. Materials.
 - a. The purchaser should state whether compliance with ANSI/NSF 61 Drinking Water System Components—Health Effects is to be required, in addition to the requirements of the Safe Drinking Water Act. If this certification is to be required, the purchaser’s specification shall read, “This product shall be certified as suitable for contact with drinking water by an accredited certification organization in accordance with ANSI/NSF Standard 61, Drinking Water Systems Components—Health Effects.”
 - b. If one or more of the materials included in this standard are unacceptable, specify the acceptable materials that are included in this standard.
 - c. If materials included in the standard are not suitable for exposure to line content or are otherwise unacceptable, specify materials that are suitable and acceptable. (Refer to item 7, Sec. II.B of this foreword.)

d. Metallic mating seats: Specify any limitations on acceptability of seat materials or sprayed seats for specific applications or specific products. Refer to items 5 and 6, Sec. II B of this foreword.

13. Type of installation: buried, submerged, or in-plant.

14. Actuator type and service conditions.

a. Type—manual, electric, cylinder, or other.

b. Service—open/close, or modulating.

15. Manual actuator.

a. Type—handwheel, chainwheel, or wrench nut.

b. Direction to turn the handwheel, chainwheel, or wrench nut to open valves. (Unless otherwise specified, the valve will open by turning counterclockwise.)

c. Position indicator:

—If it is required.

—Configuration for buried, submerged, or in-plant service.

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

16. Electric actuator (Sec. 4.5.8.6).

a. Type: multi-turn actuator coupled to an intermediate mechanism or integral quarter-turn unit.

b. Characteristics: operating voltage, control scheme, and time of operation (unless otherwise specified, fully open to fully closed, or the reverse, will be approximately 60 sec).

c. Position indicator: configuration.

d. Special considerations: type of service environment should be stated and appurtenances required.

17. Cylinder actuator.

a. Operating medium: air, water, or oil.

b. Medium pressure: maximum and minimum.

c. Characteristics: control scheme, opening and closing speed ranges, if different from the 30 to 60 sec required by ANSI/AWWA C540.

d. Position indicator:

—If it is required.

—Configuration.

e. Special requirements:

—Specify any limitations on acceptability or any special construction required.

18. Other actuators: actuators other than those described in this standard or ANSI/AWWA C540 shall be specified by the purchaser in detail.

19. Valve and actuator arrangement and position.

20. Protective coatings if other than specified in Sec. 4.6.2 of this standard.

21. If an affidavit of compliance is to be provided (Sec. 6.3).

22. If the manufacturer shall provide dimensions of the clearance required for the valve discs (Sec. 4.3).

23. If certified drawings are to be provided by the manufacturer (Sec. 4.2 and 4.3).

24. If valve-torque data are to be provided.

25. If shop inspection by the purchaser is required.

26. Maximum transient pressure and characteristics, if known.

27. Water temperature range.

28. If a leakage test in both directions is required.

29. If a leakage test with the actuator attached is required. NOTE: This may not be a standard practice for some manufacturers and, therefore, may result in increased cost and delivery time.

30. If a maximum head loss is required. This information should be provided for each size and class of valve. NOTE: Not all manufacturers may use the same test methods in measuring head loss. This should be discussed by the purchaser and the manufacturer.

31. A drawing or description of the piping arrangement sufficient to describe significant turbulent line flow conditions to which the valve disc may be subjected.

32. 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.

33. This standard requires flat-faced flanges. If other facings are desired, they must be specified by the purchaser.