



**American Water Works  
Association**

The Authoritative Resource for Safe Drinking Water<sup>SM</sup>

ANSI/AWWA C540-02  
(Revision of ANSI/AWWA C540-93)

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*AWWA Standard*

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**Power-Actuating  
Devices for Valves  
and Slide Gates**

**SUPERSEDED**



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# Foreword

*This foreword is for information only and is not a part of AWWA C540.*

## I. Introduction.

I.A. *Background.* This standard describes power-actuating devices that are externally mounted on gate, ball, plug, cone, globe, and butterfly valves, and on slide gates suitable for use in water utilities. This standard does not describe pilot and control apparatus used to actuate the operating device.

I.B. *History.* The first edition of this standard, published in 1987, was the result of 12 years of effort by the AWWA Standards Committee on Power-Actuating Devices for Valves and Sluice Gates. The committee was formed by AWWA in 1974 and charged with the development of standards on prime movers for valves and sluice gates, including electric motors and cylinders employing air, water, and oil. The second edition of this standard was approved by the AWWA Board of Directors on June 6, 1993, and added quarter-turn actuators. This third edition was approved by the AWWA Board of Directors on June 16, 2002. It added valve-type actuators and digital controls.

## II. Special Issue

II.A. *Discussion.* At the time this standard was approved, three AWWA standards reference C540 rather than include separate power-actuator sections. The three standards are AWWA C560, Standard for Cast-Iron Slide Gates; AWWA C504, Standard for Rubber-Seated Butterfly Valves; and AWWA C507, Standard for Ball Valves 6 In. Through 48 In. (150 mm Through 1,200 mm).

AWWA C540 describes only the design and performance of those actuating devices applied to systems with operating pressures normally encountered in water utilities. Purchasers of power-actuating devices should carefully review the requirements of this standard, evaluate the information to be provided to the manufacturer, and review the data to be supplied by the manufacturer. Such evaluations are essential to ensure proper application of the power-actuating device for the intended use.

Specific requirements for controls and accessories and other items not described in this standard must be included in the purchaser's specifications.

II.B. *Hydraulic fluid.* Caution should be used in the selection of a hydraulic fluid to be used in a cylinder actuator. In the event of a malfunction involving leakage of fluid into the water supply, it is essential that the hydraulic fluid not

impart any taste or odor or contain any organic or inorganic substance harmful to the water supply or the consuming public. If potable water is used as the hydraulic fluid, care must be taken to prevent backflow of this water back into the potable system.

**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. 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.

This standard includes certain options that must be selected and specified by the purchaser to completely describe and obtain the actuator desired. In addition to the factors in Sec. III.A, General Data, other factors to be considered when sizing an actuator are described in Sec. 4.2, Actuator Sizing. The following summarizes the options that must be selected and the data that should be covered by the purchaser in specifications covering actuators manufactured in accordance with this standard:

**III.A. Purchaser options and alternatives.** Data to be provided by the purchaser shall include the following:

1. Valve and slide gate characteristics
  - a. Size and type of valve or slide gate to be driven by the actuator.
  - b. Stem or shaft diameter at point of attachment.
  - c. Rising stem, nonrising stem, or quarter turn.
  - d. Pitch, lead, hand of thread, or keyway dimensions.
  - e. Direction of rotation of actuator handwheel to open valve or slide gate if other than counterclockwise (Sec. 4.3.6).
  - f. Number of starts and stops per hour for modulating service (Sec. 4.3.7).
  - g. Requirement for stem protector (Sec. 4.3.13).
  - h. Weight of gate and stem for slide gate.
  - i. Seating and unseating torque in foot-pounds (newton-meters), maximum dynamic torque in foot-pounds (newton-meters) and, when applicable, thrust in pounds (newtons).
  - j. Maximum torque and thrust capability of the valve or slide gate.
2. Operating requirements.
  - a. Type of service.
    - 1) Open–close. Give frequency of operation and travel time duty cycle.
    - 2) Throttling and Modulating. Give operating conditions, input signal to actuator, and starts per hour.

- Class 1—60 starts per hour, maximum
- Class 2—100 starts per hour, maximum
- Class 3—600 starts per hour, maximum
- Class 4—1,200 starts per hour, maximum

b. Operating-cycle requirements. Travel time or speed, in seconds or inches per minute (centimeters per minute), from fully open to fully closed positions, or the reverse under all operating conditions. State plus and minus limits (Sec. 4.2.1.2).

c. Maximum unbalanced heads or differential pressures against which the valve or gate must open or close, and maximum pipeline pressure (Sec. 4.2.1.2).

d. Ambient temperature and humidity ranges.

e. Installation location: outdoors, indoors in a pit, in a vault, or in any hazardous location if applicable, as defined by the National Electrical Code. If submergence is expected, give depth and length of time of submergence.

3. Mounting and options.

a. Actuator orientation in relation to valve or slide gate.

b. Type of actuator (Sec. 4.3 or 4.4).

c. Sec. 4.3.1, 4.3.1.2, and 4.3.1.4 describe equipment that is required to be provided with electric-motor actuators. The purchaser must describe any additional materials required for specific applications.

d. Actuator mounting: directly mounted or remotely mounted on a floorstand and coupled with extension shafting.

e. Special coating system (Sec. 4.5).

f. If an agent of the purchaser is to visit the plant (Sec. 5.5).

g. Special shipping requirements (Sec. 6).

III.A.1. Specific actuator and equipment data. The purchaser shall include the following supplementary data for specific actuators and driven equipment:

1. Electric-motor actuators.

a. Supply voltage with maximum and minimum variation, phase, and frequency.

b. NEMA\* enclosure design rating, if other than NEMA 4, watertight (Sec. 4.3.7 and 4.3.10). For special corrosion-resistant applications, contact the supplier before specifying enclosure type.

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\* National Electrical Manufacturers Association, 2101 L St. N.W., Washington, DC 20037.

- c. Number of heaters, their locations, and their supply voltages if required (Sec. 4.3.10).
- d. Position-indication requirement (Sec. 4.3.12) and need for stem protector (Sec. 4.3.13).
- e. Electrical controls: Specify the following features desired and deviations from Sec. 4.3.14.

- 1. Whether or not the controls are to be integral to the actuator, pedestal-mounted, remotely mounted, or supplied by others.
- 2. If required, extra reversing-starter auxiliary contacts.
- 3. A standard reversing contactor is controlled through the use of an integral transformer that provides 120 V. If a transformer is not required, its deletion and the voltage required must be specified.
- 4. If the control circuit does not use seal-contacts in push-button circuits.
- 5. If push buttons are to be remote mounted, the requirements must be specified.

6. If indicating lights are required.

7. The number of limit-switch contacts used for interlocking and position indication in the open, closed, and intermediate positions must be defined.

f. Process-control signal (Sec. 4.3.14.2).

- 1. For analog input, indicate signal (e.g., 4-20 ma).
- 2. For contact closure, indicate voltage and source or dry contact.
- 3. For digital serial communication, indicate digital communications protocol (e.g., Device Net, Profibus, Modbus, etc.).

g. Number of feedback and auxiliary devices; if required, function, wattage, and resistance (Sec. 4.3.14.3).

2. Cylinder and vane actuators.

a. The material references in Sec. 4.4 of AWWA C540 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 components of actuators wetted by the line content. In such 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 delay delivery.

b. This standard allows the use of galvanized tie rods (Sec. 4.4.7.8). Electrogalvanizing is allowed. Users should be aware that electrogalvanizing offers limited corrosion protection. If corrosion resistance is a concern, then the user should require stainless-steel rods.

c. Driver medium: air, water, or oil (Sec. 4.4.8).

d. Driver-medium properties if differing from those in Sec. 4.4.8.3, 4.4.8.4, or 4.4.8.5.

e. Minimum and maximum pressure of driver medium when the valve or slide gate is to be operated (Sec. 4.2.1.2 and 4.4.7.5).

f. If required, adjustable flow-control devices and opening and closing speeds if other than specified (Sec. 4.4.7.2).

g. Need for special auxiliaries, such as tail, rod fail-safe, or spring-return actuation, and so forth.

h. Controls and special devices, such as solenoid valves, additional speed control valves, manually operated valves, interconnecting pipes, limit switches, and positioners.

i. Material of construction (Sec. 4.4.3, 4.4.4, 4.4.5, and 4.4.6).

j. Pneumatic actuator prelubrication (Sec. 4.4.8.3.1[1] and 4.4.8.3.1[2]).

4.4.2. Data by supplier. On request by the purchaser, the supplier shall make available the following:

1. Certification of nonmetallic-cylinder-material confirmation tests (Sec. 4.4.6.9).
2. Certification of proof-of-design test (Sec. 5.2).
3. Certification of performance test (Sec. 5.3).
4. Affidavit of compliance (Sec. 6.3).
5. Drawings and manuals (Sec. 4.1).

III.B. *Modification to standard.* Any modification to the provisions, definitions, or terminology in this standard must be provided in the purchaser's specifications.

IV. **Major Revisions.** The major revisions to the standard in this edition include the following:

1. A general provision for quarter-turn vane-type actuators is now included.
2. The duty cycle of an actuator is more completely described.

3. Digital control interface has been added.
4. Torque switch modifications have been added.
5. The title has been changed to reflect the AWWA nomenclature changing sluice gate to slide gate.

**V. Comments.** If you have any comments or questions about this standard, please contact the AWWA Volunteer and Technical Support Group, FAX (303) 795-7603, or write to the group at 6666 West Quincy Avenue, Denver, CO 80235-3098, or by e-mail at [standards@awwa.org](mailto:standards@awwa.org).

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## *AWWA Standard*

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# Power-Actuating Devices for Valves and Slide Gates

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## SECTION 1: GENERAL

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### Sec. 1.1 Scope

This standard describes power-actuating devices for valves 3 in. (75 mm) in diameter and larger and slide gates in ordinary water service.

1.1.1 *Actuator types.* Actuators described in this standard are divided into the following types:

1. Electric-motor type producing a multiturn rotary motion or used to drive a gearhead drive for a quarter-turn application or electric-motor type with integral drive for quarter-turn applications, as defined in Sec. 4.3.1.2.
2. Cylinder type producing a linear motion.
3. Quarter-turn cylinder type producing a rotary motion.
4. Quarter-turn vane-type actuator producing a rotary motion.

1.1.2 *Actuator function.* Actuators shall produce a rotary or linear motion to activate a valve or slide gate in open–close, throttling, or modulating service.

1.1.3 *Excluded actuators.* The following types of actuators are not included in this standard:

1. Motor actuators using water, oil, or gas as the driver medium.

1.1.4 *Other exclusions.* This standard does not include the following:

1. Electric or electronic controls for electric-motor actuators contained within separate enclosures at a location remote from the actuator or actuator floorstand.
2. Piping, controls, and positioners for cylinder actuators.
3. Intermediate gearhead or mechanism (nonintegral to actuator) between electric power-actuator output and valve/gate stem or shaft.
4. The mechanism connecting a cylinder actuator to a valve or slide gate.

## Sec. 1.2 Purpose

The purpose of this standard is to define the minimum requirements for power actuating devices for valves and slide gates, including sizing considerations, design, verification, delivery, handling, and storage.

## Sec. 1.3 Application

This standard can be referenced in specifications for power-actuating devices for valves and slide gates. The stipulations of this standard apply when this document has been referenced and then only to power-actuating devices for valves and slide gates.

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## SECTION 2: REFERENCES

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This standard references the following documents. In their latest editions, they form a part of this standard to the extent specified within the standard. In any case of conflict, the requirements of this standard shall prevail.

ANSI<sup>\*</sup>/ASTM<sup>†</sup> D570—Standard Test Method for Water Absorption of Plastics.

ANSI B93.10—Static Pressure Rating Methods of Square Head Fluid Power Cylinders.

ANSI B93.29—Fluid Power Systems, Dimensions for Accessories for Catalogued Square Head Industrial Fluid Power Cylinders.

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<sup>\*</sup>American National Standards Institute, 25 W. 43rd St., Fourth Floor, New York, NY 10036.

<sup>†</sup>American Society for Testing and Materials, 100 Barr Harbor Dr., West Conshohocken, PA 19428.