



**American Water Works  
Association**

ANSI/AWWA C541-08  
(First Edition)

The Authoritative Resource on Safe Water®

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*AWWA Standard*

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# Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates



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## Foreword

*This foreword is for information only and is not a part of ANSI/AWWA C541.*

### I. Introduction.

I.A. *Background.* This standard describes hydraulic and pneumatic cylinder- and vane-type-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 cover pilot and control apparatus used to actuate the operating device.

I.B. *History.* The first edition of the ANSI/AWWA C540 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 the ANSI/AWWA C540 standard was approved by the AWWA Board of Directors on June 6, 1993, and added quarter-turn actuators. The third edition was approved on June 16, 2002. It added vane-type actuators and digital controls. In 2004, the original single standard was split by the Standards Council into two separate standards, one for electric motor-actuated devices (C542) and this one (C541) for hydraulic and pneumatic cylinder and vane-type actuators. These two standards replace the ANSI/AWWA C540 standard. This first edition of ANSI/AWWA C541 was approved on January 27, 2008.

I.C. *Acceptance.* NSF/ANSI 60 Drinking Water Chemicals—Health Effects, and NSF/ANSI 61, Drinking Water System Components—Health Effects are not applicable to this standard.

### II. Special Issues.

II.A. *Discussion.* At the time this standard was approved, existing AWWA standards reference ANSI/AWWA C540 rather than include the new separate power-actuator standards, ANSI/AWWA C542, Electric Motor Actuated Devices for Valves and Slide Gates, and ANSI/AWWA C541, Hydraulic and Pneumatic Cylinders and Vane-Type Actuators for Valves and Slide Gates.

ANSI/AWWA C541 describes only the design and performance of those actuating devices applied to systems with operating pressures normally encountered in water utilities. Purchasers of hydraulic and pneumatic cylinder- and vane-type-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 hydraulic and pneumatic cylinder and vane-type actuated device for the intended use.

Specific requirements for controls and accessories and other items not described in this standard must be included in the purchase documents.

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.** 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.

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, Purchaser Options and Alternatives, other factors to be considered when sizing an actuator are described in Sec. 4.3, Actuator Sizing. The following summarizes the options that must be selected and the data that should be covered in the purchase documents covering actuators manufactured in accordance with this standard:

III.A. *Purchaser Options and Alternatives.* The following items should be provided or requested by the purchaser:

1. Standard used—that is, ANSI/AWWA C541, Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates, of latest revision.

2. Specific actuator and equipment data.

- a. Data Form Sheet (appendix A). This standard allows the use of galvanized tie rods (Sec. 4.4.4.8, 4.4.5.8, and 4.4.6.8). Electro galvanizing is allowed. Users should be aware that electro galvanizing offers limited corrosion protection. If corrosion resistance is a concern, then the user should require stainless-steel rods.

- b. Driver medium—air, water, or oil (Sec. 4.5.5.1).

- c. Driver-medium properties if differing from those in Sec. 4.5.5.2.

- d. Minimum and maximum pressure of driver medium when the valve or slide gate is to be operated (Sec. 4.5.3).

- e. If required, adjustable flow-control devices and opening and closing speeds if other than specified (Sec. 4.5.2).

- f. Need for special auxiliaries, such as fail-safe, spring-return pneumatic or mechanical override.
  - g. Controls and special devices, such as solenoid valves, additional speed-control valves, manually operated valves, interconnecting piping, limit switches, and positioners.
  - h. Voltage available for solenoid valves.
  - i. Control signal available for positioners.
  - j. Special communication protocol.
  - k. Major design features (Sec. 4.4.3, Sec. 4.4.4, Sec. 4.4.5, Sec. 4.4.6, and Sec. 4.4.8).
  - l. Pneumatic actuator prelubrication (Sec. 4.5.5.3.2).
  - m. Data by supplier: On request by the purchaser, the supplier should provide 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. 4.2).
3. 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. Lead, pitch thread, orientation, or keyway dimensions.
  - e. Direction of rotation of actuator handwheel to open valve or slide gate if other than counterclockwise (Sec. 4.4.7.4).
  - f. Weight of gate and stem for slide gate.
  - g. Seating/unseating torque in foot-pounds (newton-meters), maximum dynamic torque in foot-pounds (newton-meters) and, when applicable, thrust in pounds (newtons).
  - h. Maximum torque/thrust capability of the valve or slide gate.
  - i. Minimum hydraulic or pneumatic pressure available for sizing actuator (Sec. 4.3.1.3).
  - j. Failure mode on loss of power: fail open, fail close, or fail in last position on loss of air or hydraulic pressure, control signal, or both.
4. Operating requirements.

- a. Type of service.
    - 1) Open–close. Give frequency of operation and travel time duty cycle.
    - 2) Throttling/Modulating. Give operation conditions and input signal to actuator.
  - b. Operating-cycle requirements. Travel time in inches (linear) or degrees (rotary) per second (or minute) from fully open to fully closed positions and fully closed to fully open positions under operating conditions. NOTE: Unless otherwise specified by the purchaser, actuators will be provided with adjustable opening and closing times between 30 and 60 seconds.
  - c. Maximum unbalanced heads or differential pressures against which the valve or gate must open or close, and maximum pipeline pressure.
  - 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.<sup>®</sup> If submergence is expected, give depth and length of time of submergence.
5. Mounting and options.
- a. Actuator orientation in relation to valve or slide gate.
  - b. Type of actuator (Sec. 4.4).
    - 1) Oil cylinder per Sec. 4.4.3.
    - 2) Water cylinder per Sec. 4.4.4.
    - 3) Pneumatic cylinder per Sec. 4.4.5.
    - 4) Nonmetallic cylinder per Sec. 4.4.6.
    - 5) Quarter-turn actuator per Sec. 4.4.8.
    - 6) Vane actuator per Sec. 4.4.8.
  - c. Actuator mounting: directly mounted or remotely mounted on a floorstand and coupled with extension shafting.
  - d. Special coating system (Sec. 4.6).
  - e. If an agent of the purchaser is to visit the plant (Sec. 5.5).
  - f. Special shipping requirements (Sec. 6).

III.B. *Modification to Standard.* Any modification of the provisions, definitions, or terminology in this standard must be provided in the purchase documents.

**IV. Major Revisions.** This is the first edition of this standard.

**V. Comments.** If you have any comments or questions about this standard, please call the AWWA Volunteer and Technical Support Group at 303.794.7711, FAX at 303.795.7603, write to the group at 6666 West Quincy Avenue, Denver, CO 80235-3098, or e-mail [standards@awwa.org](mailto:standards@awwa.org).

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# Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates

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## SECTION 1: GENERAL

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### Sec. 1.1 Scope

This standard describes hydraulic and pneumatic cylinder and vane-type actuators for operation of valve and slide gates in utility systems.

1.1.1 *Actuator types.* Actuators described in this standard are divided into the following types (Figure 1.1):

1. Cylinder type producing a linear motion.
2. Quarter-turn cylinder type producing a rotary motion.
3. Quarter-turn vane-type actuator producing a rotary motion.

1.1.2 *Actuator function.* Actuators shall produce a rotary or linear motion to actuate 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. Electric motor actuators.

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

1. Piping, controls, and positioners for cylinder actuators.
2. The mechanism connecting a cylinder actuator to a valve or slide gate.