

American Water Works Association

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(Revision of ANSI/AWWA C540-87)



AWWA STANDARD
FOR
POWER-ACTUATING DEVICES
FOR VALVES AND SLUICE GATES



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AMERICAN WATER WORKS ASSOCIATION

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Contents

SEC.	PAGE	SEC.	PAGE
Foreword		3.10	Electrical-Controls Enclosures 8
I History of Standard..... v		3.11	Drive Coupling..... 8
II Discussion v		3.12	Position Indication 8
III Information Regarding Use		3.13	Stem Protectors 8
of This Standard v		3.14	Electrical Controls..... 8
III.A General Data..... v		3.15	Stop Limiting Device..... 9
III.B Specific Actuator and Equipment			
Data vi		4	Cylinder Actuators — General
III.C Data by Supplier..... vii			Design
IV Modification to Standard viii		4.1	General..... 10
V Hydraulic Fluid..... viii		4.2	Materials—General 10
VI Major Revisions viii		4.3	Oil-Hydraulic Cylinders 11
		4.4	Water-Hydraulic Cylinders 11
		4.5	Pneumatic Cylinders 12
		4.6	Nonmetallic Water-Hydraulic
			and Pneumatic Cylinders 13
		4.7	Cylinder Application 14
		4.8	Driver Media..... 14
		4.9	Quarter-Turn Cylinder Actuator 15
		5	Painting and Coatings
1 General		5.1	General..... 16
1.1 Scope..... 1		5.2	Internal Surfaces..... 16
1.2 Items Not Covered by This		5.3	External Surfaces 16
Standard 1			
1.3 Definitions..... 2		6	Testing
1.4 References 2		6.1	General..... 16
1.5 Data to Be Furnished by Actuator		6.2	Proof-of-Design Tests 17
Manufacturer..... 4		6.3	Performance Tests..... 18
1.6 Inspection and Testing..... 4		6.4	Test Certification..... 20
1.7 Affidavit of Compliance..... 5			
2 Actuator Sizing		7	Preparation for Shipment,
2.1 Actuator Sizing Considerations..... 5			Handling, and Storage
2.2 Maximum Torque or Thrust for		7.1	Conditions Covered 20
Multiturn Applications 6		7.2	Packaging..... 20
		7.3	Storage 20
3 Electric-Motor Actuators —			
General Design		Tables	
3.1 General 6		1	Chemical and Physical
3.2 Gears 6			Requirements for Bronze 10
3.3 Lost-Motion Device..... 6		2	Prototype Actuator Test Cycles
3.4 Bearings 6			Required 18
3.5 Lubrication 6			
3.6 Handwheel 7			
3.7 Motor 7			
3.8 Limit Switches 7			
3.9 Torque Switches 7			

Foreword

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

I. History of Standard. The 1987 first edition of this AWWA standard 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. This is the first revision of this standard.

II. Discussion. This standard covers power-actuating devices that are externally mounted on gate, ball, plug, cone, globe, and butterfly valves, and on sluice gates suitable for use in water utilities. This standard does not cover pilot and control apparatus used to actuate the operating device.

At the time this standard was approved, two AWWA standards reference AWWA C540 rather than include separate power-actuator sections. The two standards are: AWWA C501, Standard for Cast-Iron Sluice Gates; and AWWA C507, Standard for Ball Valves 6 In. Through 48 In. (150 mm Through 1200 mm). A third standard, AWWA C504, Standard for Rubber-Seated Butterfly Valves, should include references to AWWA C540 in its next revision.

AWWA C540 covers 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 furnished 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 covered by this standard must be included in the purchaser's specifications.

III. Information Regarding Use of This Standard. 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. 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. *General Data.* Data to be furnished by the purchaser shall include the following:

1. Valve and sluice-gate characteristics.
 - a. Size and type of valve or sluice gate to be driven by the actuator.
 - b. Stem or shaft diameter at point of attachment.
 - c. Rising or nonrising stem.
 - d. Pitch, lead, hand of thread, or keyway dimensions.
 - e. Direction of rotation of actuator handwheel to open valve or sluice gate if other than counterclockwise (Sec. 3.6).
 - f. Number of starts/stops per hour for modulating service (Sec. 3.7).
 - g. Requirement for stem protector (Sec. 3.13).
 - h. Weight of gate and stem for sluice gate.

- i. Seating/unseating torque in foot-pounds (newton-metres), maximum dynamic torque in foot-pounds (newton-metres) and, when applicable, thrust in pounds (newtons).
- j. Maximum torque/thrust capability of the valve or sluice gate.
- 2. Operating requirements.
 - a. Type of service.
 - 1. Open-close. Give duty cycle.
 - 2. Throttling. Give operating conditions, including duty cycle.
 - 3. Modulating. Give input signal to actuator.
 - b. Operating-cycle requirements.
 - 1. Travel time or speed, in seconds or inches per minute (centimetres per minute), from fully open to fully closed positions, or the reverse under all operating conditions. State plus/minus limits (Sec. 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. 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.
 - 1. If submergence is expected, give depth and length of time of submergence.
- 3. Mounting and options.
 - a. Actuator orientation in relation to valve or sluice gate.
 - b. Type of actuator (Sec. 3 or Sec. 4).
 - c. Sec. 3.1.1, Sec. 3.1.2, and Sec. 3.14 describe equipment that is required to be provided with the electric-motor actuator. 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. 5).
 - f. If an agent of the purchaser is to visit the plant (Sec. 1.6).
 - g. Special shipping requirements (Sec. 7).

III.B. *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. 3.7 and Sec. 3.10). For special corrosion-resistant applications, contact the supplier before specifying enclosure type.
 - c. Number of heaters, their locations, and their supply voltages if required (Sec. 3.10).
 - d. Position-indication requirement (Sec. 3.12) and need for stem protector (Sec. 3.13).

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

- e. Electrical controls: Specify the following features desired and deviations from Sec. 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 starter 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. 3.14.2).
- g. Number of feedback and auxiliary potentiometers; if required, function, wattage, and resistance (Sec. 3.14.3).
- 2. Cylinder Actuators
 - a. The material references in Sec. 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. 4.6.8). 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.
 - c. Driver medium: air, water, or oil (Sec. 4.8).
 - d. Driver-medium properties if differing from those in Sec. 4.8.3, Sec. 4.8.4, or Sec. 4.8.5.
 - e. Minimum and maximum pressure of driver medium when the valve or sluice gate is to be operated (Sec. 2.1.2 and Sec. 4.7.5).
 - f. If required, adjustable flow-control devices and opening and closing speeds if other than specified (Sec. 4.7.2).
 - g. Need for special auxiliaries, such as tail, rod fail-safe, spring-return actuation, and so forth.
 - h. Controls and special devices, such as solenoid valves, additional speed-control valves, manually operated valves, interconnecting piping, limit switches, and positioners.
 - i. Material of construction (Sec. 4.3, Sec. 4.4, Sec. 4.5, and Sec. 4.6).
 - j. Pneumatic actuator prelubrication (Sec. 4.8.3.1.1 and Sec. 4.8.3.1.2).

III.C. *Data by Supplier.* On request by the purchaser, the supplier shall make available the following:

- 1. Certification of nonmetallic-cylinder-material confirmation tests (Sec. 4.6.9).
- 2. Certification of proof-of-design test (Sec. 6.2).

3. Certification of performance test (Sec. 6.3).
4. Affidavit of compliance (Sec. 1.7).
5. Drawings and manuals (Sec. 1.5).

IV. Modification to Standard. Any modification of the provisions, definitions, or terminology in this standard must be provided in the purchaser's specifications.

V. 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.

VI. Major Revisions.

1. A general provision for quarter-turn cylinder and electric actuators is now included.
2. Section 3.15 on stop limiting devices has been added for quarter-turn actuators.
3. A proof-of-design test for quarter-turn cylinder actuators is included (Sec. 6.2.4).
4. The definitions for purchaser, supplier, and corrosion-resistant metals have either been modified or added.



AWWA STANDARD FOR POWER-ACTUATING DEVICES FOR VALVES AND SLUICE GATES

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard covers power-actuating devices for valves 3 in. (75 mm) in diameter and larger and sluice gates in ordinary water service. This standard covers actuators purchased by parties defined as the purchaser in Sec. 1.3.

1.1.1 *Actuator types.* Actuators covered by this standard are divided into the following types:

1.1.1.1 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. 3.1.2.

1.1.1.2 Cylinder type producing a linear motion.

1.1.1.3 Quarter-turn cylinder type producing a rotary motion.

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

Sec. 1.2 Items Not Covered by This Standard

1.2.1 *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.

(2) Electric-motor actuators with direct current (DC) motors and multispeed motors.

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

(1) Electric/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 sluice gate.

Sec. 1.3 Definitions

In this standard, the following definitions of terms shall apply:

1.3.1 *Actuator manufacturer*: The party that manufactures power-actuating devices.

1.3.2 *Corrosion-resistant metal*: Corrosion-resistant metals shall be stainless steel, nickel-copper alloy, or grades A, D, or E bronze, all conforming to the requirements of Sec. 4.2.1.

1.3.3 *Cylinder actuator*: A power-actuating device that uses hydraulic or pneumatic pressure in a cylinder to produce linear output motion.

1.3.4 *Duty cycle*: The cycle of operation that the actuator is required to perform during a defined period or periods.

1.3.5 *Electric-motor actuator*: A power-actuating device that uses electrical energy acting through a motor with a gear train to produce a rotary or linear output motion.

1.3.6 *Modulate*: To move a valve or sluice gate to intermediate positions in response to a variable control signal.

1.3.7 *Open-close*: To move a valve or sluice gate to the fully open or fully closed position.

1.3.8 *Power-actuating device*: A device that uses electrical energy or hydraulic or pneumatic pressure to open, close, or position a valve or sluice gate.

1.3.9 *Purchaser*: The person, company, or organization that purchases any materials or work to be performed. The purchaser may be the valve or sluice-gate manufacturer, the supplier, or the party that will own and operate the actuator after installation.

1.3.10 *Supplier*: The party who supplies materials or services. A supplier may or may not be the valve or sluice-gate manufacturer or actuator manufacturer.

1.3.11 *Tail-rod*: An auxiliary rod connected to the piston of a cylinder actuator that permits an external pull on a valve or sluice gate in an emergency situation.

1.3.12 *Throttle*: To move and maintain a valve or sluice gate in an intermediate position between fully open and fully closed in response to a manually initiated control.

1.3.13 *Thrust*: A linear force on the stem of a valve or sluice gate, generally expressed in units of pounds (newtons).

1.3.14 *Torque*: A rotary twist or turning moment on the valve stem or shaft expressed in units of foot-pounds (newton-metres).

1.3.15 *Valve or sluice-gate manufacturer*: The party that manufactures valves or sluice gates and also may assemble and test related power-actuating devices and auxiliaries.

Sec. 1.4 References

The latest editions of the following standards are incorporated by reference and form a part of this standard to the extent specified herein. In any case of conflict, the requirements of this standard shall prevail.