



# **Actuation Terminology & Definitions**



## **ENGINEERING GUIDE**

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The following valve actuation terminology is provided for better understanding and elimination of miscommunications. Terms and definitions are grouped by related topics and listed in alphabetical order.

## **GENERAL SYSTEM TERMS**

**Ambient Temperature** - The temperature of the air surrounding the actuator. Generally stated as a maximum and minimum for proper actuator operation. Note that ambient temperature range for an actuator may exceed that of a plastic valve and should not be considered to be the same as the service temperature.

**Maximum Line Pressure** - The media pressure against which the valve will have to close.

**Maximum Service Temperature** - Maximum temperature of the media. Service temperature should be considered in selection of the proper thermoplastic valve material for the application.

**Media** - The material flowing through a valve.

**Modulating** - Throttling or regulating the flow through a valve by varying the position between open and closed.

**On-Off Service** - Basic full open or full closed operation to start or stop flow.

**Operating Torque** - Force required to operate a valve, expressed in inch-pounds or foot-pounds

**Supply Pressure** - Facility air pressure supply required to operate pneumatic actuator.

## **ACTUATOR TERMS**

**Double Acting** - A Pneumatic actuator which uses air to both open and close the valve. Also referred to as "Air-to-Air" operation.

**Electric Actuator** - An electromechanical device used to actuate (open, close or modulate) a valve. An electric motor and gear train is used to actuate the valve. Numerous application considerations must be made in using an electric actuator. These include, duty cycle, cycle time, supply voltage, operating temperature and enclosure rating (NEMA) for use of electric devices under various environmental conditions.

**Fail-Closed** - Spring return in a pneumatic actuator which closes the valve upon loss of air pressure. Also referred to as "Air-to Spring Close" or "Spring-to-Close" operation.

**Fail-Open** - Spring return in a pneumatic actuator which opens the valve upon loss of air pressure. Also referred to as "Air-to-Spring Open" or "Spring-to-Open" operation.

**Pneumatic Actuator** - An air operated mechanical device used to actuate (open, close or modulate) a valve. The actuator converts air pressure into mechanical force most commonly using either a piston or diaphragm. The mechanical force output can be either rotational, as in actuation of a ball valve, or linear as commonly used in actuation of a diaphragm valve. Pneumatic actuators are not significantly limited by duty cycles and cycle time (virtually instantaneous) found with electric actuators. However, they may require additional accessories to further control speed of operation and a voltage supply for certain electric signal devices which may be desired.

**Spring Return** - An actuator using a spring to return the valve to either an open or closed position upon loss of power. Spring returns are most commonly used with pneumatic actuators, but can be used on electric actuators where it is necessary for the valve to open or close by design or by system failure (see also Fail-Close and Fail-Open terms).



## Actuated Valves Technical Actuator Accessory & Rating Terms

### ACTUATOR ACCESSORY & RATING TERMS

**Duty Cycle** - The capability of an Electric actuator motor to operate or "cycle" continuously - a 100% Duty Cycle. Ratings less than 100% mean that the actuator motor is capable of intermittent operation, as is the case with most actuation applications. For example, a 25% Duty Cycle means that for each 1-minute of operation, 3-minutes of non-operation is required. Duty cycles greater than 25% are generally needed only when additional work loads are encountered, such as valve modulation or in actuation of larger butterfly valves.

**Limit Switches** - Electrical switches which may be applied to either electric or Pneumatic actuators to supply a signal that the valve cycle has been completed. In Electric actuators, the primary limit switches are used to control the open and closed position of the valve. Auxiliary limit switches may be used to perform other functions such as starting or stopping a pump. Limit switches are most often mechanical and are activated by physical contact with either a lever or plunger. Proximity switches are electrically tripped without physical contact and may be used with certain computer or micro processor controls.

**NEMA Rating** - National Electric Manufacturers Association standard for rating electrical component enclosures. The most commonly used NEMA ratings for electric actuator and electrical accessory enclosures are NEMA 4 and NEMA 4X.

**NEMA 1:** - General Purposes - for indoor use without unusual service conditions, primarily to protect components from contact.

**NEMA 2:** - Drip proof - for indoor use with degree of protection against limited amounts of falling water or dirt.

**NEMA 3:** - Rain tight - for outdoor use with protection from windblown dust, rain and sleet, and undamaged by ice formation.

**NEMA 4:** - Watertight and Dust tight - for indoor/outdoor use with a protection from windblown dust, rain or hose directed wash down environments.

**NEMA 4X:** - Watertight and Dust tight - same as NEMA 4 with addition of corrosion resistance.

**NEMA 7:** - Explosion Proof (class I, division 1, groups A, B, C, D) - designed to contain an internal explosion without causing an external hazard when installed in a designated environment group. Group A= atmospheres containing acetylene; Group B = atmospheres containing hydrogen; Group C = atmospheres containing ethyl-ether vapors, ethylene, or cyclopropane; Group D = atmospheres containing gasoline, hexane, naphtha, benzene, butane, propane, alcohol, acetone, benzol, lacquer, solvent vapors or natural gas.

**NEMA 9:** - Explosion Proof (class II, division 1, groups E, F, G) - Dust-ignition-proof enclosures designed to prevent both entrance of dust and external heating capable of igniting dust on the enclosure or in the surrounding atmosphere. Group E = atmospheres containing metal dust including aluminum, magnesium, their commercial alloys, and other metals of similar hazardous characteristics; Group F = atmospheres containing carbon black, coal or coke dust; Group G = atmospheres containing flour, starch, or grain dust.

**Positioner** - Attachment for either electric or Pneumatic actuators which provides automatic modulating control of the valve position from open to closed. Electric positioners work by comparison of 2-currents, one derived from the input signal and one from the actuator. Pneumatic positioners increase, decrease and balance the air supply according to an input signal from an external control source. Input signals are generated by either a 3 to 15 psi pneumatic signal, or a 4 to 20 milliamp electro-pneumatic signal.

**Solenoid Valve** - An electro-magnetically operated valve which enables electrical control of air supply to a pneumatic actuator. Solenoids are wired to a manual switch or any electric controller. Double Acting actuators require a 4-way solenoid, Spring-Return actuators require a 3-way solenoid for proper air control. As electrical devices, solenoid valves are available in various NEMA ratings.

**Transducer** - A device that converts one signal type to another. In actuation controls, the most common use of a transducer is in conversion between electrical signals and pneumatic signals.