

**Specification for three phase non-intrusive electric actuators with conventional I/O (contact closure / discrete signals or analog signal)**

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**2.00 Electric Valve Actuators (Non-intrusive)**

**1. General**

**A. Equipment Requirements:**

The actuators shall be suitable for use on a 460 volt 3 phase 60 Hz power supply and must include motor, integral reversing starters, local controls and terminals for remote control and indication housed within a self contained, sealed enclosure. Set-up of the actuator shall be carried out without the removal of any covers. Actuator calibration shall be by integral pushbuttons and selector switch. No separate special commissioning tools shall be required. In addition, provision shall be made for the protection of configured actuator settings by means of a password.

**B. Actuator sizing:**

The actuator shall be sized to guarantee valve closure at the specified torque and/or thrust requirement as indicated by the valve manufacturer or supplier. The actuator must be adequately sized to provide the torque required to operate the valve at 90% of the nominal voltage. The operating speed shall provide valve closing and opening at approximately 12 inches per minute for gate valves, 4 inches per minute for globe valves and as indicated in the valve list for quarter turn valves. Quarterturn valves will be furnished with mechanical stops that restrict the valve/actuator travel.

**C. Environmental**

Actuators shall be suitable for indoor and outdoor use. The actuator shall be capable of functioning in an ambient temperature ranging from -20°F to +140°F, up to 100% relative humidity.

**D. Enclosure**

Actuators shall be O-ring sealed, watertight to NEMA 4X/6 (6 feet for 30 minutes). When required, actuators for hazardous locations shall be certified explosion proof for Class I, Division 1 & 2, Groups C & D. Enclosure must allow for temporary site storage without the need for electrical supply connection. All external fasteners shall be of stainless steel. Gear case shall be cast iron.

**E. Motor**

The electric motor shall be Class F insulated, with a duty rating of at least 15 minutes at 104°F (40°C). Motor shall be specifically designed and built by the actuator manufacturer for electric actuator service. Commercially available motors shall not be acceptable. Electrical disconnection of the motor shall be by means of a plug and socket and motor removal shall be possible without loss of lubricant. The actuator must include a device to ensure that the motor runs with the correct rotation for the required

direction of valve travel regardless of the connection sequence of the power supply.

#### **F. Motor protection**

The following criteria shall be provided for motor protection:

- 1) The motor shall be de-energized without damage in the event of a stall condition when attempting to move a jammed valve.
- 2) The motor shall be de-energized in the event of an overtorque condition
- 3) A minimum of three thermal devices imbedded in the motor windings shall be provided to de-energize the motor in case of overheating.
- 4) Lost phase protection

#### **G. Gearing**

The actuator gearing shall be totally enclosed in a grease-filled cast iron gearcase suitable for operation in any orientation. Actuator gearing shall be hardened steel with alloy bronze worm wheel. The design should permit the opening of the gearcase for inspection or disassembly without releasing the stem thrust or taking the valve out of service. Where required per application, electric actuators will be provided with worm gearboxes. The worm gearboxes shall be supplied with full 360° bronze worm wheels and end-of-travel mechanical stops on the worm shaft. Designs with segmented worm gears and end-of-travel stops in the gearbox housing will not be permitted.

#### **H. Manual operation**

Manual operation shall be by handwheel. Manual operation shall utilize the actuator worm shaft/worm wheel to maintain self-locking gearing and to facilitate changeover from motor to manual operation when the actuator is under load. Actuator designs that bypass electric actuator worm gears when declutched are unacceptable. The declutching from motor operation shall be at the motor shaft to minimize declutching effort. Designs that break the valve load at the worm and worm gear are unacceptable. Return from manual to electric mode of operation will be automatic upon motor operation. A seized or inoperable motor shall not prevent manual operation.

#### **I. Drive nut and thrust base assembly**

For multi turn rising stem applications, the drive nut shall be installed in a detachable thrust base. The design shall allow actuator removal from the thrust base, leaving the thrust base attached to the valve to retain valve position. Thrust bearings shall be lubricated by means of an easily accessible grease fitting.

#### **J. Valve position and torque calibration**

Position and torque shall be sensed by absolute encoder using hall effect sensors. Incremental encoders requiring batteries to retain settings upon

loss of power shall not be accepted. Position and torque settings will be stored in permanent non-volatile memory.

Torque and travel adjustment parameters are to be as follows:

- 1) Position setting range 1 to 500 or 10 to 5,000 turns, with resolution of 2.81 degrees and accuracy to 5.0 degrees of actuator output.
- 2) Torque setting: 40% to 100% of rated torque.

Torque switch bypass to be provided for the torque sensing system to inhibit torque switch trip during unseating or during starting in mid travel against high inertia loads.

## **2. Electric Actuator Control (contact closure / discrete signals or analog signal)**

### **A. Actuator status indication.**

Six contacts shall be provided. The contacts shall have a minimum rating of 5A, 250VAC.

- 1) one contact dedicated for collective fault (phase failure, motor protection tripped, torque fault) or one of eight other fault groups
- 2) five additional indication contacts selectable from a list of at least 45 parameters including, but not limited to: end position CLOSED, end position OPEN, selector switch in REMOTE mode, torque fault in CLOSED direction, and torque fault in OPEN direction.

### **B. Local indication**

The actuator shall include a digital position indicator with a display from fully open to fully closed in 1% increments.

Five programmable local indicating lights shall be available to indicate functions including, but not limited to: end position CLOSED, end position OPEN, fault, selector switch in REMOTE and actuator moving.

### **C. Remote position and torque feedback**

Actuator shall provide a 4 to 20 mA analog position feedback signal.

Actuator shall provide a 4 to 20 mA analog torque feedback signal corresponding to required valve torque for diagnostics and preventive maintenance.

### **D. Integral starter and transformer**

The starter shall be suitable for up to 60 starts per hour for open/close service and 1200 starts per hour for motors of  $\frac{3}{4}$  HP or less used in modulating service.

A removable plug and socket controls housing containing reversing starters or thyristors, power supply/control transformer and local controls capable of:

- 1) mounted integrally with the actuator and capable of being re-oriented at 90° increments
- 2) wall mounted remotely where required by application conditions

#### **E. Integral local controls and control mode selector.**

The actuator shall include local Open/Stop/Close/Reset pushbuttons and a Local/Off/Remote selector switch lockable in any of the three positions. The Reset pushbutton shall be provided to facilitate actuator commissioning. It shall be possible to select maintained or non-maintained control independently for either the local or remote modes. It shall be possible to re-orient local pushbutton controls in 90° increments.

#### **F. Control capabilities – for control by contact closure / discrete signals**

The following control capabilities must be available:

- 1) Input remote control signals for:
  - a. open/stop/close (maintained contacts) or emergency
  - b. open/close 'push to run' (momentary)
  - c. programmable emergency input for fail to any intermediate or end of travel positions when required
- 2) Programmable electronic torque switch bypass initialized in end and intermediate positions. Settable from 0-5 seconds.
- 3) Separate open and close direction pulse timer (stepping mode) circuits capable of initializing at any position (open, close or intermediate).
- 4) It shall be possible to reverse valve travel without the necessity of stopping the actuator. The starter contactors shall be protected from excessive current surges during travel reversal by an automatic time delay on energization of the contactor coils.
- 5) The internal circuits associated with the remote control and monitoring functions are to be designed to withstand simulated lightning impulses of up to 1.1 kV.

#### **G. Control capabilities – for analog signal input**

The following control capabilities must be available:

- 1) 4-20 mA positioner to incorporate the following features: automatic end position settings, adaptive behavior (automatic setting of deadband), programmable deadband time, programmable tolerance for open/close end positions, programmable behavior on loss of signal, split range operation.
- 2) Programmable electronic torque switch bypass initialized in end and intermediate positions. Settable from 0-5 seconds.
- 3) Programmable emergency input for fail to any intermediate or end of travel positions when required.
- 4) The internal circuits associated with the remote control and monitoring functions are to be designed to withstand simulated lightning impulses of up to 1.1 kV.

#### **H. Monitoring facilities**

Facilities shall be provided for monitoring actuator operation and availability as follows:

- 1) Liquid Crystal Display (LCD) – minimum four lines back-lit for setting menu showing status indication and diagnostic information.

- 2) Monitoring capability via Bluetooth® connection shall be an available option.
- 3) Retrievable (lifetime and re-settable) data logs including:
  - a. motor run time
  - b. total number of cycles
  - c. number of torque trips in each direction of travel
  - d. number of limit switch trips at each end of travel
  - e. total torque trip faults
  - f. motor thermal overloads.
- 4) Diagnostic capability, which will store and enable download of historical actuator operation and torque data to permit analysis of actuator and valve in-service performance. Data download shall be carried out without removing any covers and all shall be available locally at the actuator or accessible via laptop computer.

#### **I. Wiring and terminals**

Internal wiring shall be tropical grade insulated stranded cable of appropriate size for the control and 3-phase power.

All external wiring shall terminate in a removable plug and socket head, which allows easy disconnection of all power and control voltages. Actuators furnished without plug and socket terminal connections must have power and control disconnect switches for ease of maintenance and safety.

### **3. Electric Actuator Commissioning and Test Reports**

#### **A. Commissioning Kit**

Each actuator will be provided with a commissioning kit consisting of a wiring diagram and installation and operation manual. No special commissioning tools or parts will be required for start-up.

#### **B. Performance Test Documentation**

Each actuator shall be performance tested. Test documentation must be provided if requested indicating the following:

- 1) torque sensing tripping points in both the open and closed directions of travel
- 2) current at the maximum torque tripping point
- 3) actuator output speed
- 4) high voltage test

#### **C. Non-intrusive capability**

In order to maintain the integrity of the enclosure, setting of all actuator parameters including the torque levels, position limits, configuration of the indication contacts and positioner functionality shall be accomplished without removing covers from the actuator control assemblies or housing. Settings shall be made by entering the set up mode and following menu prompts appearing in the LCD window. The LCD window shall have four

lines of data clearly indicating the set up options. Set up shall be accomplished by using the actuator integral selector switch and pushbuttons - without the need for a hand-held setting device. Actuator parameters may also be set by means of laptop computer via a two-way information infrared interface or laptop or PDA via Bluetooth® interface. No special setting tools or devices are acceptable

#### **4. Electric Actuator Manufacturers**

- A. All actuators shall be manufactured by AUMA Actuators, Inc. of Canonsburg, PA.
- B. No substitution is permitted