

25 34 13.13 - INTEGRATED AUTOMATION ACTUATORS AND OPERATORS

PART 1 - GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide complete Valve Actuators and Operators as shown on the drawings, control diagrams, herein, or in other Sections of the Specifications.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Valve Actuators and Operators shall comply with the requirements of NEC, NEMA, and shall be built to UL-508 standards, or equal as approved by the Municipality of Anchorage Building Department.

1.3 CONTRACTOR SUBMITTALS

- A. Furnish Shop Drawings in accordance with MASS Section 10.05 Article 5.6, and 26 05 00 – Electrical Work, General.
 - 1. Include schematics and layout drawings, and catalog cuts of all valve control equipment including enclosures, relays, pilot devices, terminations, and wire troughs.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The CONTRACTOR shall provide the Valve Actuators and Operators to satisfy the functional requirements in the relevant mechanical equipment and Instrumentation & Control specifications and the Electrical Schematics.
- B. All Valve Actuators and Operators shall be wired under this Section.
- C. Control conductors shall be provided in accordance with Section 26 05 00 – Electrical Work, General.
- D. The actuators shall be suitable for use on power supply as shown on the plans.

NOTE TO SPECIFIER – Preferred voltages are as follows:

3-phase 480V, 208V or single phase 230V only.

- E. Actuators shall incorporate motor, integral reversing starter, local control facilities and terminals for remote control and indication connections housed in an IP68(7 meters – 72 Hours), NEMA 4 and NEMA 6 rated enclosure.

- F. As a minimum the actuators should meet the requirements set out in EN15714-2 and ISA SP96.02.
- G. The actuator shall incorporate a single integrated circuit, hard-wired logic control and infra-red interface.
- H. In order to maintain the integrity of the enclosure, setting of the torque levels, position limits and configuration of the indication contacts etc. shall be carried out without the removal of any actuator covers and without mains power over an Infra-red or Bluetooth® wireless interface.
 - 1. Sufficient commissioning tools shall be provided with the actuators and must meet the enclosure protection and certification levels of the actuators.
 - 2. Commissioning tools shall not form an integral part of the actuator and must be removable for secure storage / authorized release. In addition, provision shall be made for the protection of configured actuator settings by a means independent of access to the commissioning tool.
 - 3. Integral battery backup provided to update and maintain local LCD and remote contact indication and status. Expected battery life shall be 5 years.
 - 4. Actuator configured settings shall be stored in non-volatile EEPROM to maintain setting independent of the battery.
 - 5. Provision shall be made to disable Bluetooth® communications or only allow a Bluetooth® connection initiated by an Infra-Red command for maximum security.
 - 6. The actuator shall include a device to ensure that the motor runs with the correct rotation for the required direction of valve travel irrespective of the connection sequence of the power supply.
- I. Manufacturer: **Rotork - IQT Pro** or equal.

2.2 Actuator Sizing

- A. The actuator shall be sized to guarantee valve closure at the specified differential pressure and temperature.
- B. Pulsed operation with independently adjustable “ON” and “OFF” time periods from 1-99 seconds selectable to operate over any portion of the closing or opening valve stroke.
- C. The safety margin of motor power available for seating and unseating the valve shall be sufficient to ensure torque switch trip at maximum valve torque with the supply voltage 10% below nominal.
- D. For linear operating valves, the operating speed shall be such as to give valve closing and opening at approximately 10-12 inches per minute unless otherwise stated in the data sheet.

For 90° valve types the operating time shall be _____.

2.3 Environmental

- A. Actuators shall be suitable for indoor and outdoor use.
- B. The actuator shall be capable of functioning in an ambient temperature ranging from -33°C (22°F) to 70°C (140°F), up to 100% relative humidity.
- C. Actuators for hazardous area applications shall meet the area classification, gas group and surface temperature requirements specified in data sheet.

2.4 Enclosure

- A. Actuators shall be o-ring sealed, watertight to IP66/IP68 7m for 72hrs, NEMA 4, 6.
- B. The motor and all other internal electrical elements of the actuator shall be protected from ingress of moisture and dust when the terminal cover is removed for site for cabling, the terminal compartment having the same ingress protection rating as the actuator with the terminal cover removed.
- C. Enclosure must allow for temporary site storage without the need for electrical supply connection.
- D. All external fasteners shall be plated stainless steel. The use of un-plated stainless steel or steel fasteners is not permitted.

2.5 Motor

- A. The motor shall be an integral part of the actuator, designed specifically for valve actuator applications.
 - 1. It shall be a low inertia high torque design, class F insulated with a class B temperature rise giving a time rating of 15 minutes at 40°C (104°F) at an average load of at least 33% of maximum valve torque.
 - 2. Temperature shall be limited by 2 thermostats embedded in the motor end windings and integrated into its control.
- B. Electrical and mechanical disconnection of the motor should be possible without draining the lubricant from the actuator gear case.
- C. Protection shall be provided for the motor as follows:
 - 1. Stall - the motor shall be de-energized within 8 seconds in the event of a stall when attempting to unseat a jammed valve.
 - 2. Over temperature - thermostat will cause tripping of the motor. Auto-reset on cooling
 - 3. Single phasing - lost phase protection.
 - 4. Direction – phase rotation correction.

2.6 Gearing

- A. The actuator gearing shall be totally enclosed in a oil-filled gear case suitable for operation at any angle.
- B. Grease lubrication is not permissible.
- C. All drive gearing and components must be of metal construction and incorporate a lost-motion hammer blow feature.
- D. For rising spindle valves the output shaft shall be hollow to accept a rising stem, and incorporate thrust bearings of the ball or roller type at the base of the actuator. The design should be such as to permit the opening of the gear case for inspection or disassembled without releasing the stem thrust or taking the valve out of service.
- E. For 90° operating type of valves drive gearing shall be self-locking to prevent the valve back-driving the actuator.

2.7 Hand Operation

- A. A handwheel shall be provided for emergency operation, engaged when the motor is de-clutched by a lever or similar means, the drive being restored to electrical operation automatically by starting the motor.
- B. The handwheel or selection lever shall not move on restoration of motor drive.
- C. Provision shall be made for the Hand / Auto selection lever to be locked in both Hand and Auto positions.
- D. It should be possible to select hand operation while the actuator is running or start the actuator motor while the hand/auto selection lever is locked in hand without damage to the drive train.
- E. Clockwise operation of the handwheel shall give closing movement of the valve unless otherwise stated in the data sheet.
- F. For linear valve types the actuator handwheel drive must be mechanically independent of the motor drive and should be such as to permit valve operation in a reasonable time with a manual force not exceeding 400N through stroke and 800N for seating / unseating of the valve.

2.8 Drive Interface

- A. The actuator shall be furnished with a drive bushing easily detachable for machining to suit the valve stem or gearbox input shaft. The drive bush shall be positioned in a detachable base of the actuator.

- B. Thrust bearings shall be sealed for life and the base shall be capable of withstanding five times the rated thrust of the actuator.

2.9 Local Controls

- A. The actuator shall incorporate local controls for Open, Close and Stop and a Local/Stop/Remote mode selector switch lockable in any one of the following three positions: Local Control Only, Stop (no electrical operation), Remote Control plus Local Stop Only.
- B. Local control selectors shall be non-intrusive.
- C. It shall be possible to select maintained or non-maintained local control.
- D. The local controls shall be arranged so that the direction of valve travel can be reversed without the necessity of stopping the actuator.
- E. The local controls and display shall be rotatable through increments of 90 degrees to suit valve and actuator orientation.

2.10 Torque and Limits

- A. Torque and turns limitation to be adjustable as follows:
 - 1. Position setting range – multi-turn: 2.5 to 8,000 turns, with resolution to 7.5 deg. of actuator output.
 - 2. Position setting range – direct drive part turn actuators: 90° +/-10°, with resolution to 0.1 deg. of actuator output.
 - 3. Torque setting: 40% to 100% rated torque.
- B. Position measurement
 - 1. Absolute position measurement should be incorporated within the actuator.
 - 2. The technology must be capable of reliably measuring position even in the case of a single fault. The design must be simple with the minimum amount of moving parts (no more than 5). Technologies such as LEDs or potentiometers for position measurement are considered unreliable and therefore not preferred.
- C. Measurement of torque shall be from direct measurement of force at the output of the actuator. Methods of determining torque-using data derived from the motor such as motor speed, current, flux etc are not acceptable
- D. A means for automatic “torque switch bypass” to inhibit torque off during valve unseating and “latching” to prevent torque switch hammer under maintained or repeated control signals shall be provided.
- E. The electrical circuit diagram of the actuator should not vary with valve type remaining identical regardless of whether the valve is to open or close on torque or position limit.

2.11 Remote Valve Position and Status Indication

- A. Four contacts shall be provided which can be selected to indicate any position of the valve;
 - 1. Provision shall be made for the selection of a normally closed or open contact form.
 - 2. Contacts shall maintain and update position indication during handwheel operation when all external power to the actuator is isolated.
- B. The contacts shall be rated for 5mA to 5A, 120V AC, 30V DC.
- C. As an alternative to providing valve position indication any of the four above contacts shall be selectable to signal one of the following:
 - 1. Valve opening, closing or moving
 - 2. Thermostat tripped, lost phase
 - 3. Motor tripped on torque in mid travel, motor stalled
 - 4. Remote selected
 - 5. Actuator being operated by handwheel
 - 6. Actuator fault
- D. Provision shall be made in the design for an additional eight contacts having the same functionality.
- E. A configurable monitor relay shall be provided as standard, which can be used to indicate either Availability or Fault. The relay should be a spring return type with a Normally Open / Normally Closed contact pre-wired to the terminal bung.
- F. The Monitor (availability or fault) relay, being energized from the control transformer will de-energize under any one or more the following conditions:
 - 1. Available Mode
 - a. Loss of main or customer 24V DC power supply
 - b. Actuator control selected to local or stop
 - c. Motor thermostat tripped
 - d. Actuator internal fault
 - 2. Fault Mode
 - a. Loss of main or customer 24V DC power supply
 - b. Motor thermostat tripped
 - c. Actuator internal fault
- G. Provision shall be made in the design for the addition of a contactless transmitter to give a 4-20mA analogue signal corresponding to valve travel and / or torque for remote indication when required. The transmitter will auto range to the set limits

2.12 Local Position Indication

- A. The actuator display shall include a dedicated numeric/symbol digital position indicator displaying valve position from fully open to fully close in 0.1% increments.

Valve closed and open positions shall be indicated by symbols showing valve position in relation to the pipework to ensure that valve status is clearly interpreted. With mains power connected, the display shall be backlit to enhance contrast at all ambient light levels and shall be legible from a distance of at least 5m (16ft).

- B. Red, green, and yellow LEDs corresponding to open, closed and intermediate valve positions shall be included on the actuator display when power is switched on. The yellow LED should also be fully programmable for on/off, blinker and fault indication. The digital display shall be maintained and updated during handwheel operation when mains power to the actuator is isolated.
- C. The actuator display shall include a fully configurable dot-matrix display element with a minimum pixel resolution of 168 x 132 to display operational, alarm, configuration and graphical datalogger information. The text display shall be selectable between English and other languages such as: Spanish, German, French, and Italian. Provision shall be made to upload a different language without removal of any covers or using specialized tools not provided as standard with the actuator.
- D. Datalogger graphical displays should as a minimum be able to display log and trend graphs on the local LCD for the following:
 - 1. Torque versus Position
 - 2. Number of Starts versus Position
 - 3. Number of starts per hour
 - 4. Dwell Time
 - 5. Average temperature
- E. The main display shall be capable of indicating 4 different home-screens of the following configuration:
 - 1. Position and status
 - 2. Position and torque (analogue)
 - 3. Position and torque (digital)
 - 4. Position and demand (positioning)
- F. Provision shall be made for the addition of an optional environmental cover to protect the display from high levels of UV radiation or abrasive materials.
- G. The local controls and display shall be rotatable through increments of 90 degrees to suit valve and actuator orientation.

2.13 Integral Starter and Transformer

- A. The reversing starter, control transformer and local controls shall be integral with the valve actuator, suitably housed to prevent breathing and condensation.
- B. The starter shall be suitable for 60 starts per hour and of rating appropriate to motor size.

- C. The controls supply transformer shall be fed from two of the incoming three phases and incorporate overload protection. It shall have the necessary tapping and be adequately rated to provide power for the following functions:
 - 1. Energizing of the contactor coils.
 - 2. 24V DC or 110V AC output for remote controls (maximum 5W / VA)
 - 3. Supply for all the internal electrical circuits.

2.14 Remote Control Facilities

- A. The necessary control, wiring and terminals shall be provided integral to the actuator enclosure.
- B. Open and close external interlocks shall be made available to inhibit local and remote valve opening / closing control.
- C. It shall be possible to configure the interlocks to be active in remote control only.
- D. Remote control signals fed from an internal 24V DC (or 110VAC) supply and/or from an external supply between 20V and 60 VDC or 40V and 120VAC, to be suitable for any one or more of the following methods of control:
 - 1. Open, Close and Stop control.
 - 2. Open and Close maintained or “push to run” (inching) control.
 - 3. Overriding Emergency Shut-down to close (or open) valve from a normally closed or open contact.
 - 4. Two-wire control, energize to close (or open), de-energize to open (or close).
- E. Additionally provision shall be made for a separate ‘drive enable’ input to prevent any unwanted electrical operation.
- F. It shall be possible to reverse valve travel without the necessity of stopping the actuator. The motor starter shall be protected from excessive current surges during rapid travel reversal. The internal circuits associated with the remote control and monitoring functions are to be designed to withstand simulated lightning impulses of up to 2kV.
- G. Provision shall be made for operation by distributed control system utilizing DeviceNet.

2.15 Monitoring Facilities

- A. Facilities shall be provided for monitoring actuator operation and availability as follows:
- B. Actuator text display indication of the following status/alarms:
 - 1. Closed Limit, Open Limit, Moving Open, Moving Closed, Stopped
 - 2. Torque Trip Closing, Torque Trip Opening, Stalled
 - 3. ESD Active, Interlock Active

4. Thermostat Trip, Phase Lost, 24V Supply Lost, Local Control Failure
 5. Configuration Error, Position Sensor Failure, Torque Sensor Failure
 6. Battery Low, Power Loss Inhibit
- C. Integral datalogger to record and store the following operational data:
1. Opening last /average torque against position
 2. Closing last /average torque against position
 3. Opening motor starts against position
 4. Closing motor starts against position
 5. Total open/closed operations
 6. Maximum recorded opening and closing torque values
 7. Event recorder logging operational conditions (valve, control and actuator)
- D. The datalogger shall record relevant time and date information for stored data.
- E. Datalogger data shall be accessed via non-intrusive Bluetooth® communication and data displayed on the local LCD.
- F. Sufficient standard intrinsically safe tools shall be provided for downloading datalogger and actuator configuration files from the actuators and subsequent uploading to a PC.
- G. The actuator manufacturer shall supply PC software to enable datalogger files to be viewed and analyzed.

2.16 Wiring and Termination

- A. Internal wiring shall be tropical grade PVC insulated stranded cable of appropriate size for the control and 3-phase power. Each wire shall be clearly identified at each end. The terminals shall be embedded in a terminal block of high tracking resistance compound.
- B. The terminal compartment shall be separated from the inner electrical components of the actuator by means of a watertight seal and shall be provided with a minimum of 3 threaded cable entries with provision for an additional 5 extra conduit entries.
- C. All wiring supplied as part of the actuator to be contained within the main enclosure for physical and environmental protection. External conduit connections between components are not acceptable. A durable terminal identification card showing a plan of terminals shall be provided attached to the inside of the terminal box cover indicating:
1. Serial number
 2. External voltage values
 3. Wiring diagram number
 4. Terminal layout

- D. The code card shall be suitable for the contractor to inscribe cable core identification alongside terminal numbers.

2.17 Commissioning Kit

- A. Each actuator shall be supplied with a start-up kit comprising installation instruction manual, electrical wiring diagram and cover seals to make good any site losses during the commissioning period. In addition, sufficient actuator commissioning tools shall be supplied to enable actuator set up and adjustment during valve/actuator testing and site installation commissioning.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Actuators shall be installed in accordance with in Section 26 05 00 – Electrical Work, General, and in accordance with the manufacturer's recommendations.
- B. Actuators shall be protected at the Site from loss, damage, and the effects of weather. Actuators shall be stored in an indoor, dry location. Heating shall be provided in areas subject to corrosion and humidity.
- C. Conduit, conductors, and terminations shall be installed in accordance with Section 26 05 00 – Electrical Work, General.

3.2 FACTORY PERFORMANCE AND TEST CERTIFICATE

- A. Each actuator must be performance tested and individual test certificates shall be supplied free of charge. The test equipment should simulate a typical valve load, and the following parameters should be recorded.
 - 1. Current at maximum torque setting
 - 2. Torque at max. torque setting
 - 3. Flash test voltage
 - 4. Actuator output speed or operating time.
- B. In addition, the test certificate should record details of specification such as gear ratios for both manual and automatic and second stage gearing if provided, drive closing direction, wiring diagram number.

3.3 FIELD TESTING

- A. Testing, checkout, and startup services shall be performed by or under the technical direction of a local authorized factory technician.
- B. Each device shall be tested for functional operation after the connection of external conductors and prior to equipment startup.

- C. Deficient actuators and operators shall be corrected, to the ENGINEER'S satisfaction, at the CONTRACTOR'S expense.

END OF SECTION 25 14 05