

4.4.8.2 Bearings. All moving surfaces shall be supported by anti-friction bearings. A bearing of corrosion-resistant metal shall be provided on the shaft outboard of the valve shaft seal or in the actuator housing to protect the valve shaft seal from side thrust forces developed in the operating mechanism.

4.4.8.3 Lubrication. Housings shall contain seals to prevent the leakage of lubricant regardless of position. Lubricants shall be suitable for year-round service based on prevailing ambient temperature conditions.

4.4.8.4 Handwheel. Optional handwheels shall be so connected that operation by the actuator shall not cause the handwheel to rotate. Operation of the handwheel will assume loss or isolation of power to the actuator. The handwheel shall require a maximum actuator input force of 80 lb (356 N) on the rim at any point through valve travel. The handwheel shall have an arrow and the word “OPEN” integrally cast or permanently affixed indicating the direction to open the valve.

4.4.8.5 Position indication. Position indication shall be accomplished using an indicator dial or arrow.

4.4.8.6 Stop limiting devices. Valve actuators shall be equipped with adjustable, mechanical, stop limiting devices to prevent over-travel of the valve in the open and closed positions.

4.4.9 *Pneumatic quarter-turn vane-type actuators.* Pneumatic quarter-turn rotary actuators shall be of the vane-type design with a minimum operating pressure rating of 150 psig (1.03 MPa).

4.4.9.1 Actuator housing. Housing shall be of aluminum construction. The interior and exterior surfaces of the housing shall be fusion-bonded epoxy.

4.4.9.2 Vane construction. Vane shall be of carbon steel construction and shall be electroless nickel plated. Vane and output shafts shall be of one (1) piece design.

4.4.9.3 Actuator output shafts. Actuator output shafts shall include Teflon-impregnated bronze bushings backed by steel.

4.4.9.4. Vane seals. Vane seals shall be of a material suitable for air. Seal housing contact shall be accomplished by using seal expanders. Seal expanders shall be constructed of stainless steel to prevent corrosion on interior of actuator. Vane seals shall seal both sides of the vane to isolate output shaft. No compressed air or fluid shall be allowed at the output shaft.

4.4.9.5 Hardware. All stop screws and all case bolts and nuts shall be stainless steel.

4.4.10 *Hydraulic/pneumatic actuator application.*

4.4.10.1 Operating pressures. Operating pressures with either a hydraulic or pneumatic medium shall be maintained on the actuator driver mechanism at each end of its stroke unless other means are provided to prevent actuator drifting.

4.4.10.2 Adjustable flow-control device. When specified by the purchaser, actuators shall be equipped with adjustable flow-control devices at or near each port of the actuator controlling the operating medium exhausting from the actuator. Unless otherwise specified by the purchaser, the opening and closing speeds shall be nominally set for a range of 30 sec to 60 sec. However, the maximum operating time for pneumatic actuators without slave cylinders should be limited to not more than 5 sec per in. of stroke to avoid jerky operation. Final adjustments shall be made by the purchaser to minimize line surges during normal operation.

4.4.10.3 Actuator requirements. Pneumatic and water-hydraulic actuators shall not require more than 7-psi (48-kPa) pressure to cycle a complete stroke in each direction before being connected to a valve or slide gate operating mechanism. Oil-hydraulic actuators shall not require more than 15 psi (103 kPa) for the same type of cycling.

4.4.10.4 Rod-seal protection. Actuators shall be equipped with externally facing dirt wipers to protect the rod seals from dirt and other foreign materials. The externally facing wiper will not be required if the rod is fully protected by a sealed boot or a totally enclosed gasketed cover.

4.4.10.5 Working pressure. Actuator sizing shall be based on the minimum driver-medium working pressure specified by the purchaser.

Sec. 4.5 Painting and Coatings

4.5.1 *General.* Actuators shall be shop coated. Coatings for special service shall be as specified by the purchaser.

4.5.2 *Internal surfaces.* All ferrous internal surfaces, except finished working parts, such as shafts and gears, surfaces subject to constant coating by lubricants or working fluids, and corrosion-resistant metals, shall be shop cleaned and finish coated. A light color shall be used to enhance inspection and maintenance.

4.5.3 *External surfaces.* All external surfaces, except machined surfaces, shall be thoroughly cleaned and shop coated with a suitable primer or paint system to a