Plast-A-Vane 2-Way and 3-Way Butterfly Valves

Installation and Operating Instructions

Lug Style with "E" Series Electric Actuator

Lug Style with "L" Series Electric Actuator

Lug Style with "P" Series Piston-Style Pneumatic Actuator

3-Way Valve with "D" or "S" Series Rack & Pinion Pneumatic Actuator & Position Indicator

Complete butterfly valves with actuators for quick and easy selection. Corrosion and abrasion resistant butterfly valves are rated 150 PSIG (10.3 bar) and 225°F (107°C). Available in wafer or lug styles for pipe sizes 2″ through 16″. Features bubble tight sealing using extremely durable corrosion resistant Plast-A-Vane® disc (2″-10″). Plast-A-Vane® is manufactured from Noryl®, GE's glass filled thermoplastic resin. It is virtually unaffected by corrosive media such as acids and bases. Positive lever lock handles (locks every 10°), gear operated actuator, electric, pneumatic rack and pinion or piston style actuators make this valve ideally suited for precision throttling of corrosive chemicals at elevated temperatures.

For general purpose use plus HVAC applications, EPDM seat/O-ring and Noryl® Plast-A-Vane® discs are offered for temperatures to 225°F (107°C) and 150 PSI (10.3 bar).

For oil and hydrocarbon processing applications, BUNA-N seat/O-ring and Noryl® Plast-A-Vane® disc are offered for temperatures to 180°F (82°C) and 150 PSI (10.3 bar). For added corrosion resistance, Viton seat/O-ring and Noryl® Plast-A-Vane® discs are offered for temperatures to 225°F (107°C). For high temperature service, Viton seats/O-rings and stainless steel discs are offered from temperatures to 300°F (149°C).

Wafer type body is designed for use between 150 PSI (10.3 bar) ANSI B16.5 or 125 PSI ANSI B16.1 flanges, raised or flat face. All sizes meet industry face to face standards allowing simple retrofit. All valves made in America and bubble tested to 150 PSI (10.3 bar) before shipment.

PHYSICAL DATA

Sizes: 2″ to 16″ pipe; wafer or threaded lug bodies
Body: Cast iron or aluminum
Bearing: Three large luberized bronze (oilite)
Disc: 2″ to 10″: Plast-A-Vane® 30% glass filled Noryl® for 225°F (107°C) service. Stainless steel disc optional for 300°F (149°C) service.
Seat and O-ring: Two O-rings provide redundant shaft sealing between valve and actuator. Specify BUNA-N (nitnle) for 180°F (82°C) service. Specify EPDM or Viton for 225°F (107°C) service. [Viton optional for 300°F (149°C) service with stainless steel disc only.]

ACTUATORS

ELECTRIC:
Temperature: -20°F (-28.9°C) to 140°F (60°C)
Power Voltage: 120 VAC
Standard Features: Manual Override Handwheel, Heater, Position Indicator, NEMA-4 enclosure
Available Options: Auxiliary limit switches. 4-20 mA positioner 24 VAC, 24 VDC, 230 VAC power voltage, NEMA-7 enclosure

PNEUMATIC (PISTON-STYLE):
Temperature: -20°F (-28.9°C) to 180°F (82.2°C)
Connections: 3/16″ nipple for 1/4″ O.D. tubing
Spring Range: 8-13 PSI (.55-.90 bar)
Supply Pressure: 0 to 20 PSIG (0-1.4 bar) (normal operating) 30 PSIG (2.1 bar) maximum
Available Options: Positive Positioner

PNEUMATIC (RACK AND PINION):
Temperature: -10°F (-23.3°C) to 195°F (90.6°C)
Connection: 1/8″ Pipe
Supply Pressure: 80 PSIG (5.5 bar) (normal operating) 150 PSIG (10.3 bar) maximum
Available Options: Spring Return, mounted complete with solenoid, positioner, limit switches

OPTIONS: Consult factory for Barber-Colman, Automax. GH Bettis, RCS Actuators factory mounted on 2- and 3-way valves: solenoids, positioners, limit switches, hydraulic actuation, and marine applications.

INSTALLATION

Mounting can be accomplished with operating stem pointing in any style direction. When sedimentation of slurries are encountered, position the valve with the stem horizontal and the lower edge of disc opening downstream.

EXISTING SYSTEM: Spread flanges approximately 1/2″ wider than valve. Inspect flange face for foreign material. With the valve in closed position, insert carefully between the flanges, center the body, and insert flange bolts. While maintaining valve center position, slowly mate the flanges, and tighten flange bolts handtight (evenly). Slowly open and close valve to check valve disc clearance. With valve in full open position, cross tighten flange bolts to proper torque. Install handle or operator. Valve is ready for service.

NEW SYSTEM: Carefully center and assemble flanges to valve. Insert flange bolts and tighten flange bolts finger tight. Open and close valve. Open valve and tighten flange bolts to 1/2 final torque (evenly). Close valve. Position valve and flanges in pipe system with proper fit-up. Tack weld flanges to pipes. REMOVE VALVE with valve closed, loosening flange bolts. Spread flanges approximately 1/2 inch. DO NOT WELD FLANGE/PIPE JOINT WITH VALVE IN PLACE. Excessive heat could damage elastomer lining. Reassemble valve to flanges when ambient temperature is reaches, as detailed under EXISTING SYSTEM.

MAINTENANCE: Lubrication or routine maintenance is not required.

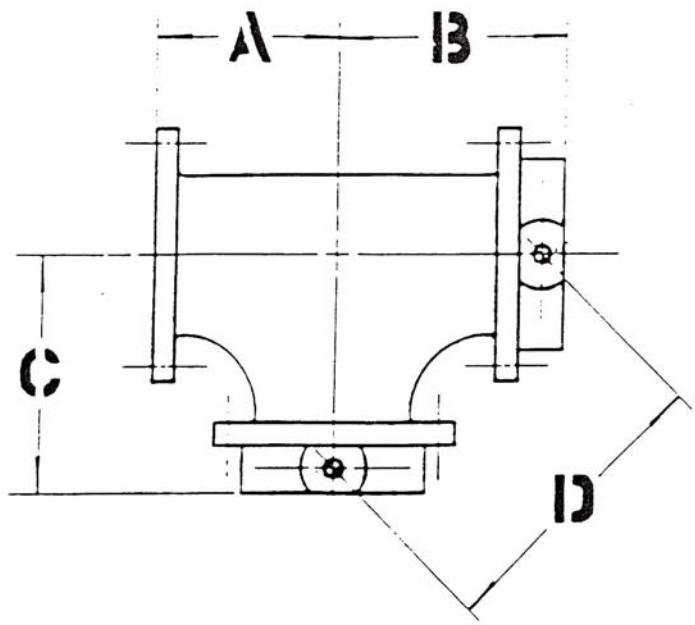
REPAIRS: Butterfly valve may be repaired in the field. If maintenance is indicated in service, secure system. Remove pressure and close valve. Loosen flange bolts and crack flange and valve faces. Spread flanges approximately 1/2 inch wider than valve. Remove sufficient bolts. Remove valve.

VALVE DISASSEMBLY: Loosen cap screws holding disc to shaft. Turn valve disc to open position. Remove cap screws. Remove top bearing (2 pcs.) and O-ring (2 pcs.). Carefully remove shaft by turning, pulling motion. Remove disc by sliding through rubber liner. Remove rubber liner, using a chisel-shaped wooden tool.

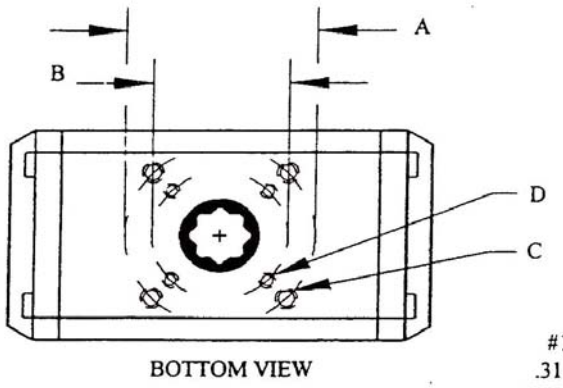
Pry under line at top point. Collapse liner into a round bottom double "U" configuration. Remove liner from valve body. Remove lower O-ring (1 pc) and lower bearing (1 pc). Inspect parts for wear, cuts, and nicked parts and replace.

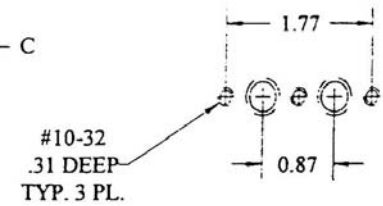
VALVE ASSEMBLY: Clean all parts. Use Silicon lubricant (Dow #111 or equiv.) to facilitate assembly.

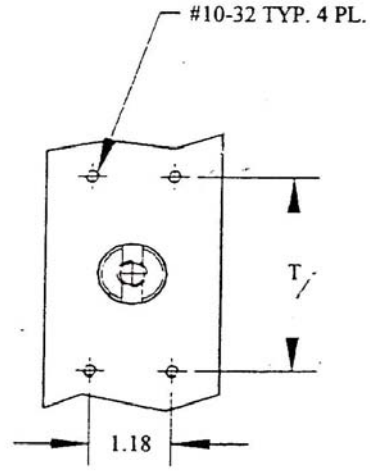
1. Insert lower bearing.
2. Insert lower O-ring. Inspect to assure proper positioning.
3. Collapse liner with shaft boss at bottom center to form double "U' configuration.
4. Insert liner into body and firmly seat lower shaft boss. Snap liner into place, seating upper shaft boss.
5. Carefully insert shaft and align the liner and lower O-ring seal by slowly twisting and rotating shaft as it is inserted and removed.
6. Slide disc into liner and align with shaft bore. Slowly insert shaft by twisting and rotating. Align keyway parallel to disc. Insert cap screws and tighten finger tight.
7. Insert O-ring.
8. Insert lower top bearing.
9. Insert O-ring.
10. Insert top bearing.
11. Attach handle or operator.
12. Slowly close valve. Torque cap screws.
13. Inspect for smooth opening and closing.
14. Valve is ready to install

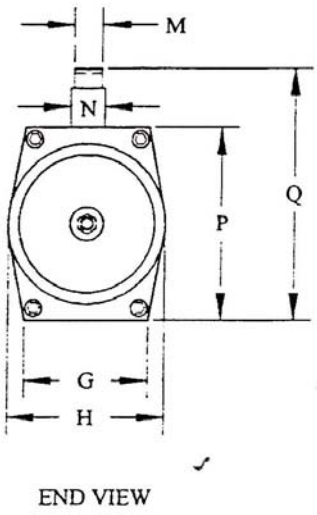


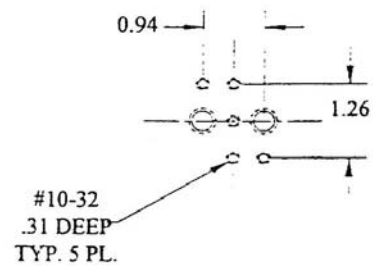
SIZE	A DIM.	B DIM.	C DIM.	D DIM.
2″	4 1/2	6 3/16	6 3/16	7 1/2
2 1/2	5	7	7	8 3/8
3″	5 1/2	7 1/2	7 1/2	9 3/16
4″	6 1/2	8 3/4	8 3/4	10 3/4
5″	7 1/2	9 3/4	9 3/4	12 1/4
6″	8	10 13/16	10 13/16	13 15/16
8″	9	11 15/16	11 15/16	14 14/16
10″	11	14 1/8	14 1/8	17 3/4
12″	12	15 3/8	15 3/8	19 3/8

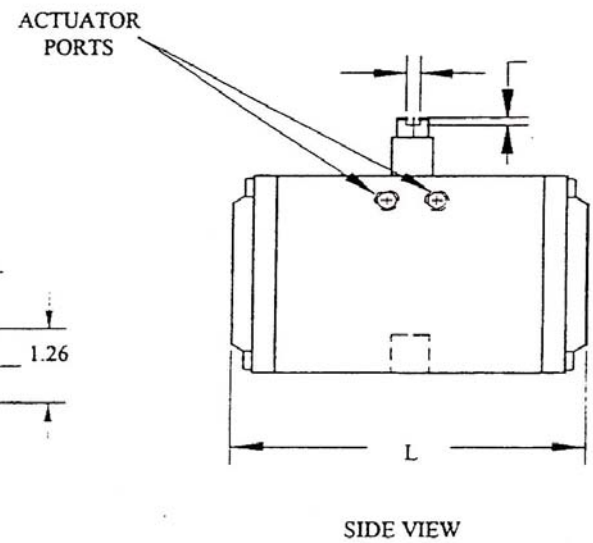






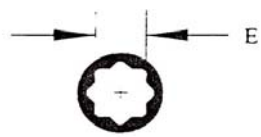




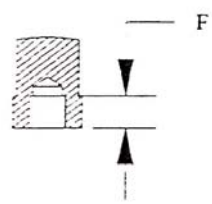


DIMENSIONAL TABLE

	D1/S1	D2/S2	D3/S3	D4/S4	D5/S5	D6/S6	D7/S7	D8/S8
A	1.97	2.76	2.76	2.76	4.02	4.02	4.92	5.51
B	1.42	1.97	1.97	1.97	2.76	4.02	4.02	
C	1/4-20	5/16-18	5/16-18	5/16-18	3/8-16	3/8-16	1/2-13	5/8-11
D	10/32	1/4-20	1/4-20	1/4-20	5/16-18	5/16-18	3/8-16	
E	0.551	0.551	0.669	0.669	0.866	0.866	1.063	1.417
F	0.55	0.71	0.75	0.75	0.96	0.96	1.14	1.57
G	1.97	2.36	2.56	2.76	3.54	4.06	4.33	5.31
H	2.32	2.76	3.27	3.94	4.72	5.39	6.77	8.82
I	0.39	0.39	0.39	0.55	0.55	0.79	1.1	1.26
L	5	5.24	6.1	7.99	8.5	11.42	14.49	17.72
M	0.472	0.472	0.551	0.768	0.768	1.102	1.417	1.85
N	0.472	0.472	0.707	0.984	0.984	1.575	1.575	2.362
P	2.91	3.46	3.94	4.61	5.51	6.3	7.8	10
Q	3.7	4.25	4.73	5.47	6.3	7.1	8.98	11.18
R	1/8	1/8	1/8	1/8	1/4	1/4	1/4	1/4
S	0.87	0.87	.87	0.87	0.94	0.94	0.94	0.94
T	3.15	3.15	3.15	3.15	3.15	3.15	5.12	5.12



OUTPUT SHAFT



OUTPUT SHAFT

A. JATOR SIZING

Prior to actual sizing it is important to obtain certain information. Key numbers to obtain are as follows:

- Valve torque for specific service pressure.
- Actuator air pressure.

Obtaining the above information allows you to properly and effectively size a spring return actuator (Note: that double acting actuators have a constant torque throughout their stroke. When determining the air supply pressure it is important that you use the minimum air pressure that the actuator will experience and not the average air supply pressure. If an actuator is supplied by a lower air pressure than it is sized for, failure or improper performance can occur.

DOUBLE ACTING ACTUATORS:

1. Once valve torque has been determined, increase that number by 10%. (Note: Adding 10% is done to ensure an acceptable factor of safety. The data published in the sizing table indicates the actuators maximum capacity for that given pressure).

2. Look in the column that corresponds to the supply pressure you have selected. Move down the chart until you have found a torque which is larger than torque determined for your application. After you have found the correct value move across the table horizontally to determine the correct actuator.

SPRING RETURN ACTUATORS:

1. Multiply your valve torque by 20%. (Again this will provide an acceptable factor of safety). **NOTE: The Valve Torque for a normally open valve (fail open) corresponds to the actuator air pressure column. Valve torque for a normally closed valve (fail closed) corresponds to the spring end column.**

Example: Given information- Valve torque = 800 in-lbs. for a normally closed valve.

1. Increase be 20%: Valve Torque = 960in-lbs.
2. Refer to table below

	Column 1	Column 2
Model	Supply Pressure 80 PSI Air Stroke Torque	Spring Stroke Torque
S5	642	520
S6	1283	1033
S7	2688	2104

Note: This table is an excerpt from the sizing chart.

3. For a Normally Open Valve (fail open), use column 1 to determine which actuator model satisfies torque requirements. For a Normally Closed Valve (fail closed), use column 2 to determine which actuator model satisfies torque requirements. Since S6 meets our requirements, we select this actuator.

2. Move down the spring end column, for normally closed (fail closed) systems, and the actuator air pressure column for normally open (fail open) systems (remember to use the correct actuator air pressure column) until you find a torque valve in the same row that is larger than the valve torque value. Follow across that row to determine the actuator size.

UNITORQ MODEL	ACTUATOR WEIGHT
D1	1.98
D2	2.98
D3	4.3
D4	7.39
D5	10.58
D6	18.74
D7	34.4
D8	68.8
S1	2.2
S2	3.42
S3	5.07
S4	8.38
S5	12.79
S6	22.49
S7	42.78
S8	86.66

UNITORQ MODEL	AIR CONSUMPTION CUBIC INCHES PER STROKE
D1	15.3
D2	222.9
D3	36.6
D4	67.1
D5	112.9
D6	218.5
D7	416.2
D8	872.6
S1	7.3
S2	9.2
S3	15.3
S4	27.5
S5	41.5
S6	86.7
S7	174.5
S8	360

TORQUE VALUES

Torque values are in in.-lb. and represent air stroke for the Double Acting unit.

MODEL	40 PSIG	60 PSIG	80 PSIG	100 PSIG	120 PSIG
D1	102	153	203	225	305
D2	151	227	302	378	454
D3	263	394	526	657	788
D4	516	774	1032	1290	1548
D5	740	1109	1479	1849	2219
D6	1479	2218	2958	3697	4436
D7	2932	4399	5865	7331	8797
D8	6066	9099	12132	15165	18198

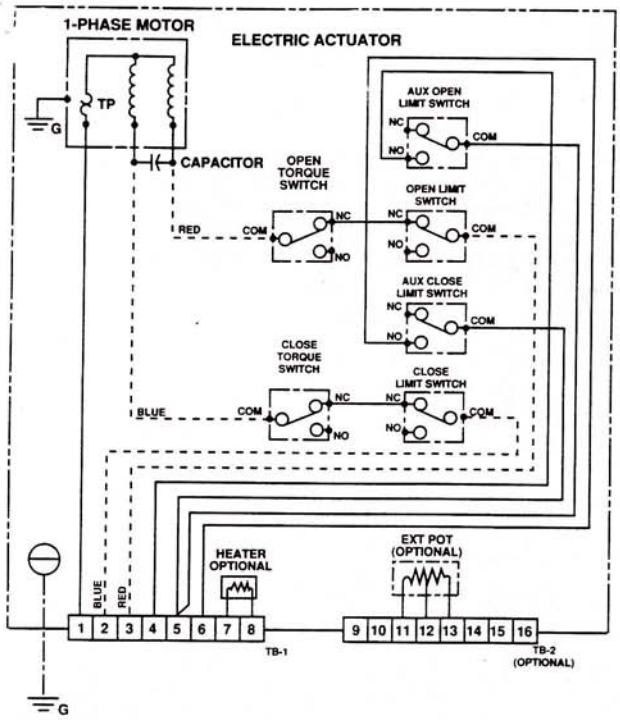
Torque values are in in.-lb. and represent air stroke for the Spring Return Unit.

PRESSURE	40 PSIG	60 PSIG	80 PSIG	100 PSIG	SPRING END
MODEL					
S1	-	36	86	137	76
S2	-	64	139	213	112
S3	-	79	209	338	208
S4	-	228	481	736	379
S5	-	278	642	1006	520
S6	-	555	1283	2010	1033
S7	-	1245	2688	4131	2104
S8	-	2954	5938	8923	4318

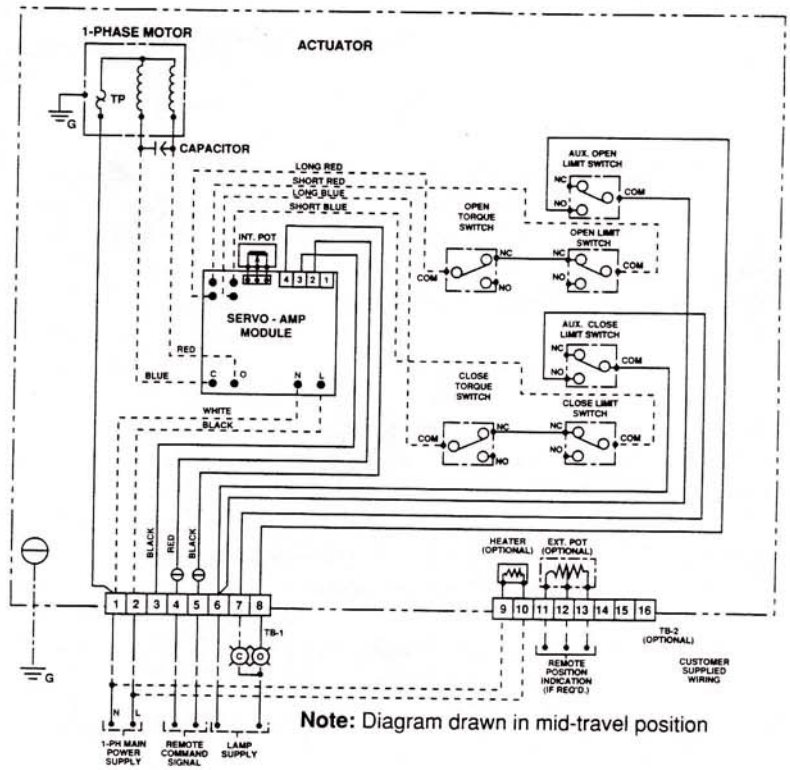
ACTUATOR CYCLE TIME

UNITORQ MODEL	CYCLE TIME (SEC.)	STROKE TIME (SEC.)
D1	0.158	0.079
D2	0.214	0.107
D3	1.333	0.167
D4	0.444	0.222
D5	0.461	0.231
D6	0.857	0.429
D7	1.62	0.811
D8	3.33	1.67

NOTE: STOKE TIME IS EQUAL FOR OPENING AND CLOSING STROKES
(For Spring Return, multiply valve by 2)

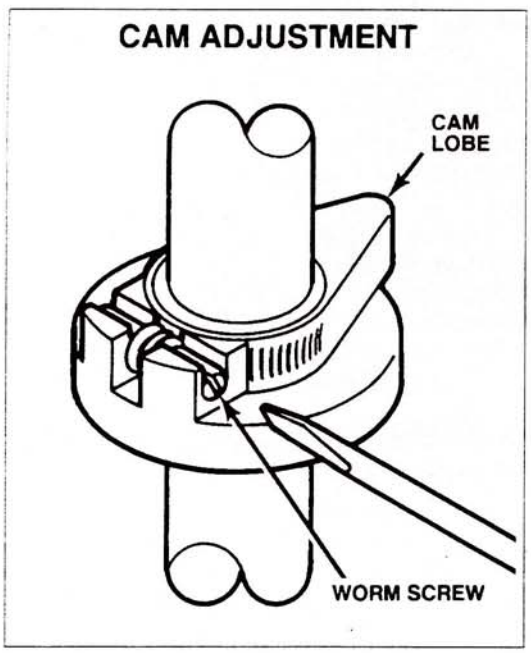


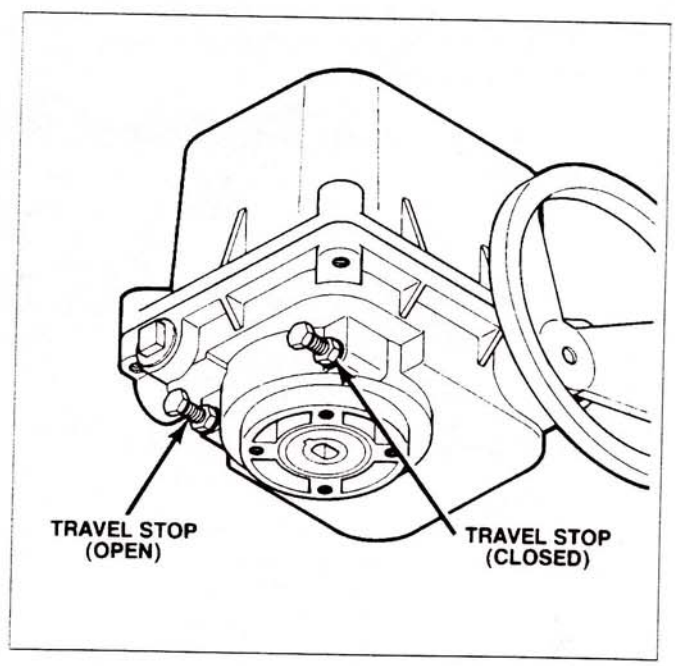
Wiring Diagram
ON/OFF



Note: Diagram drawn in mid-travel position

Wiring Diagram
4-20 mA Input Signal





PISTON-STYLE PNEUMATIC ACTUATORS

OPERATING: Specially designed for a wide range of applications, the pneumatic piston-style return actuators provide a low cost alternative for butterfly valve automation. These actuators combine linear stroke with a rugged crankarm to convert to rotary motion.

TORQUE CALCULATION: Table A illustrates the force in pounds for the piston-style pneumatic actuators in both the retracted and extended positions based on the conditions:

1. The actuator is fully retracted with 0PSI available to the actuator.

2. The actuator is fully extended with 20 PSI available to the actuator.

Retracted force is equal to the effective area in square inches times the pressure in PSI below the lower end of the spring range. Extended force is equal to the effective area in square inches times the pressure in PSI above the higher end of the spring range. The maximum return force is fixed for a given spring range; the maximum extended force may be increased by increasing the pressure available to the actuator up to a maximum 30 PSI.

To calculate torque in inch-pounds, multiply the force in pounds times the effective crankarm in inches (torque=force x effective crankarm).

Effective crankarm for 90° and 60° rotations are illustrated in Table B.

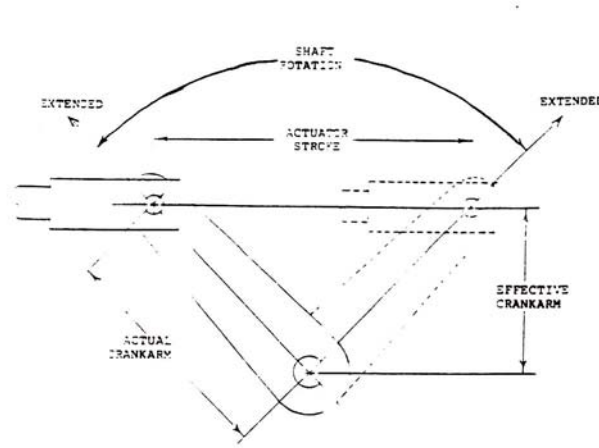
Model	Effective area (SQ. IN.)	Retracted Force (lbs.)	Extended Force (lbs.)
P1	11	88	77
P2 (P1 x 2)	11	176	154
P3	24.8	198.4	173.6
P4 (P3 x 2)	24.8	396.8	347.2

Note: Based on 8-13 PSI spring and 20PSI supply.

Table A

		Effective Crankarm For:	
Model	Stroke	90°	60°
P1, P2	4″	2″	3.46″
P3, P4	6″	3″	5.19″

Table B

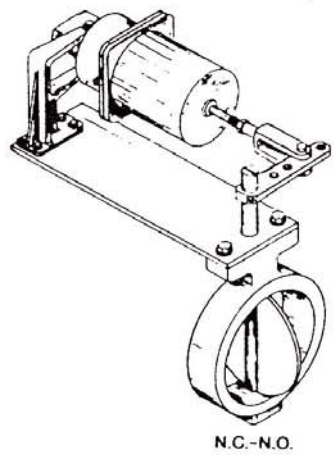


PHYSICAL DATA:
P1, P2*:
Effective Area: 11 IN^2 (17 CM^2)
Normal Stroke: 4″ (102 MM)
Weight: 4 LBS. (18 KG)
P3, P4**:
Effective Area: 24.8 IN^2 (148 CM^2)
Normal Stroke: 6″ (15.2 CM)
Weight: 9.8 LBS (4.4 KG)
Supply Pressure: 0-20 PSIG
(0-1.4 KG/CM^2)
Maximum Pressure: 30 PSIG
(2.1 KG/CM^2)
Temperature: -20°F (-28.9°C)
180°F (82.2°C)
Connections: 3/16″ nipple for
1/4″ O.D. Tubing
Spring Range: 8-13 PSI
(.55-.90 KG/CM^2)
Housing: Glass-filled nylon
Diaphragm: Neoprene
Optional Positioner: Start point adjustable;
span fixed @ 5 PSI
(.35 KG/CM^2)

*P2 actuator utilized two P1 actuators
**P4 actuator utilizes two P3 actuators

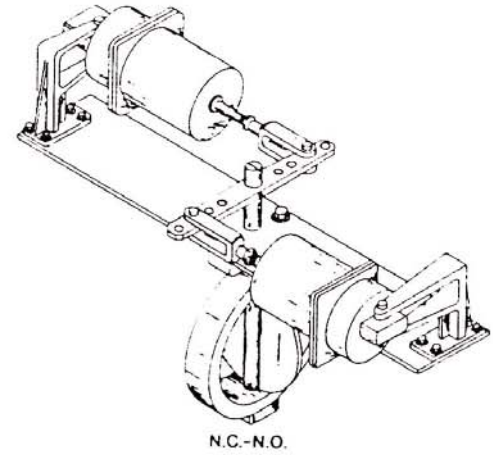
TYPICAL ARRANGEMENT

2-WAY



WITH (1) ACTUATOR

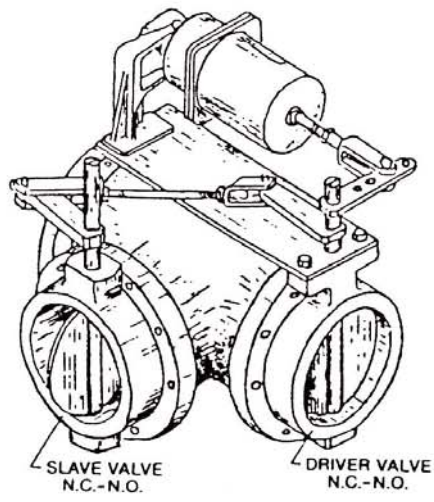
P1,P3



WITH (2) ACTUATORS

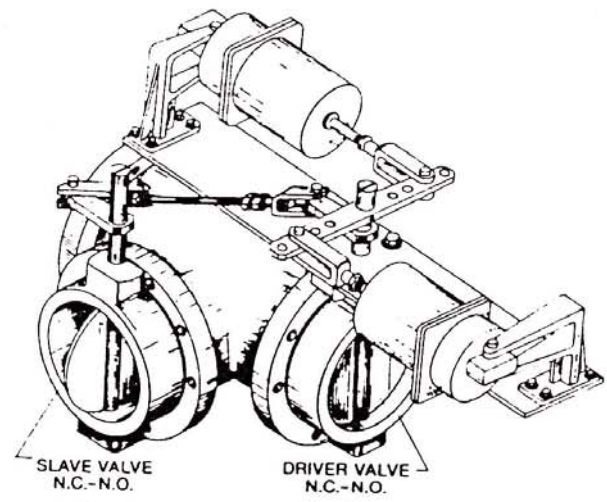
P2,P4

3-WAY



WITH (1) ACTUATOR

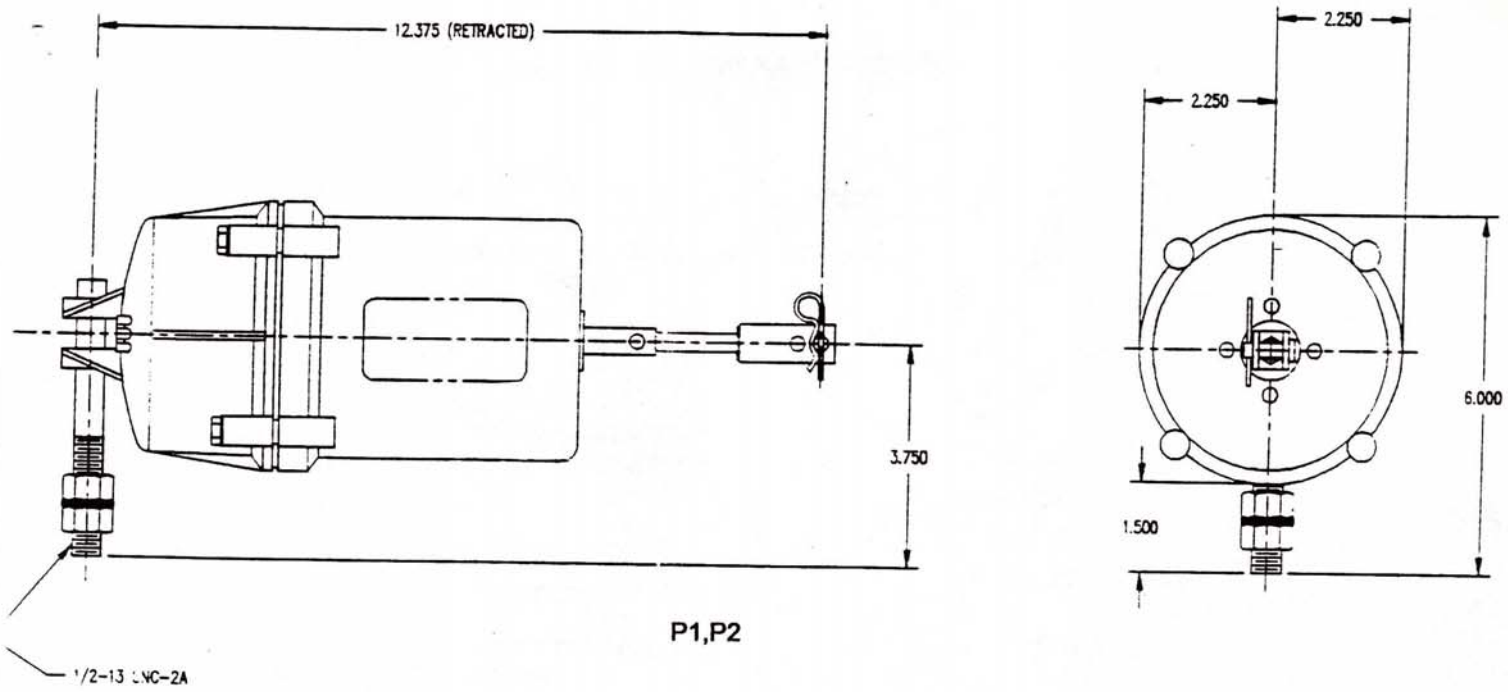
P1,P3



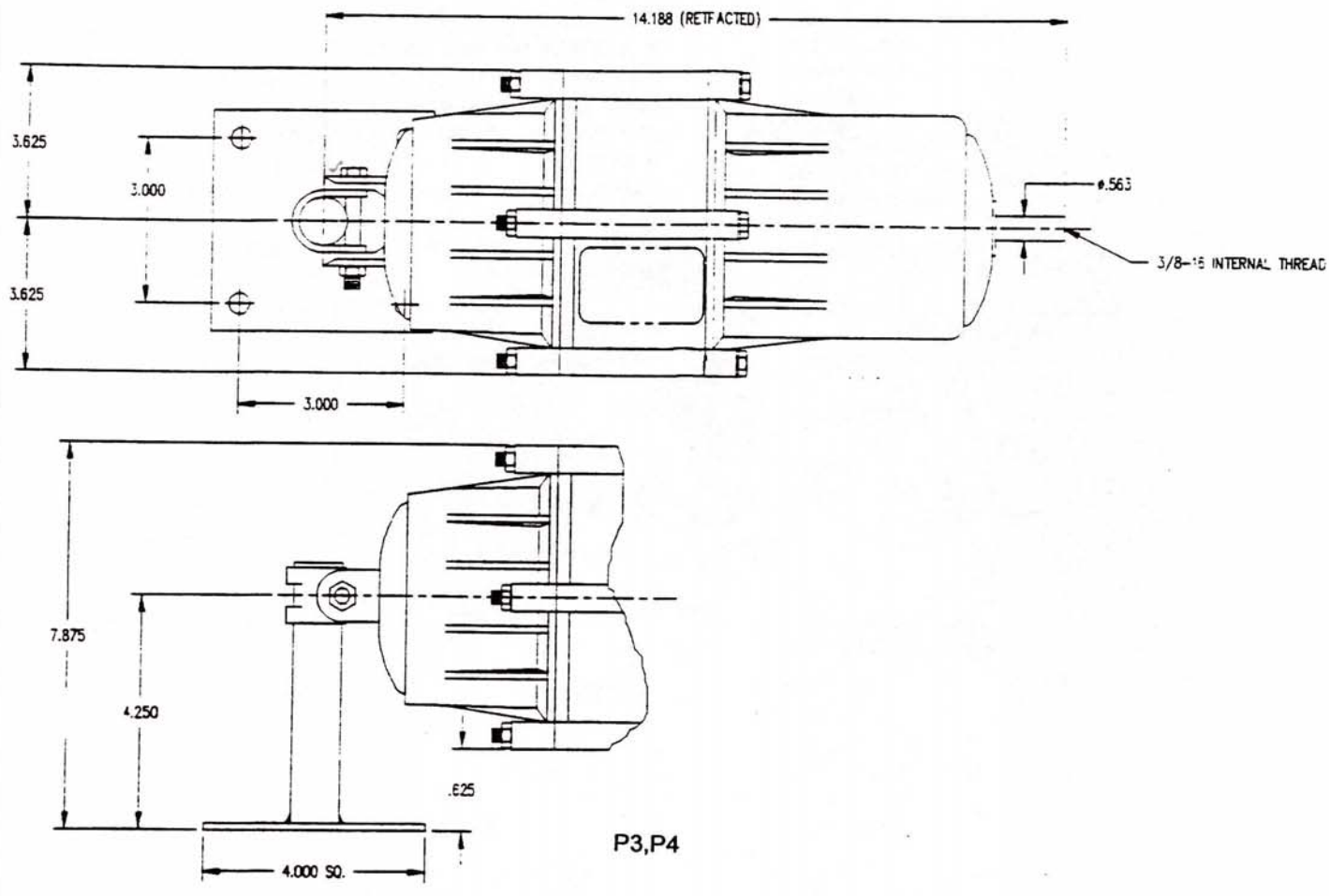
WITH (2) ACTUATORS

P2,P4

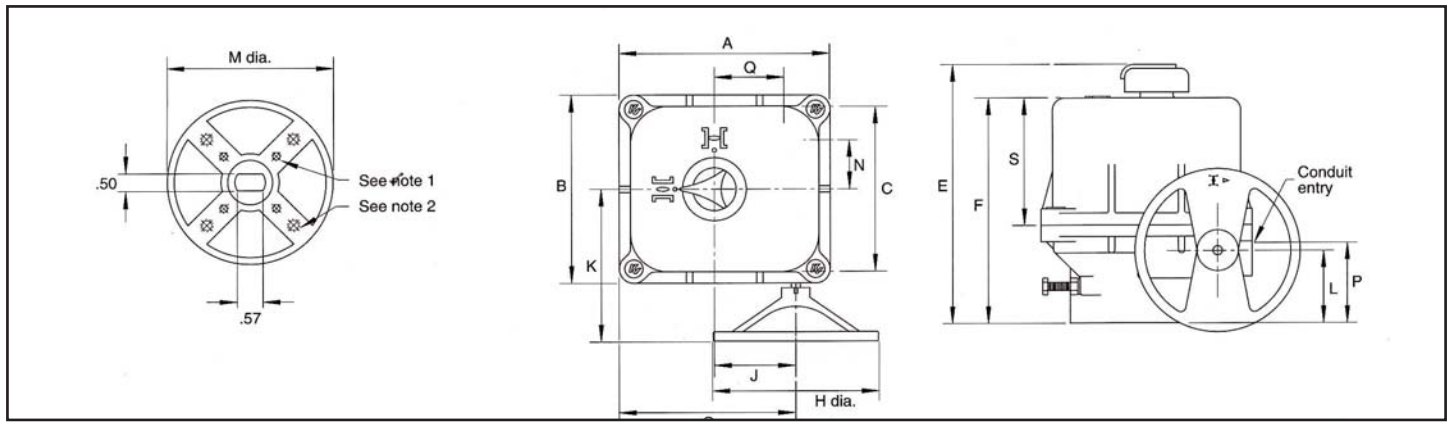
DIMENSIONAL DRAWINGS



P1,P2

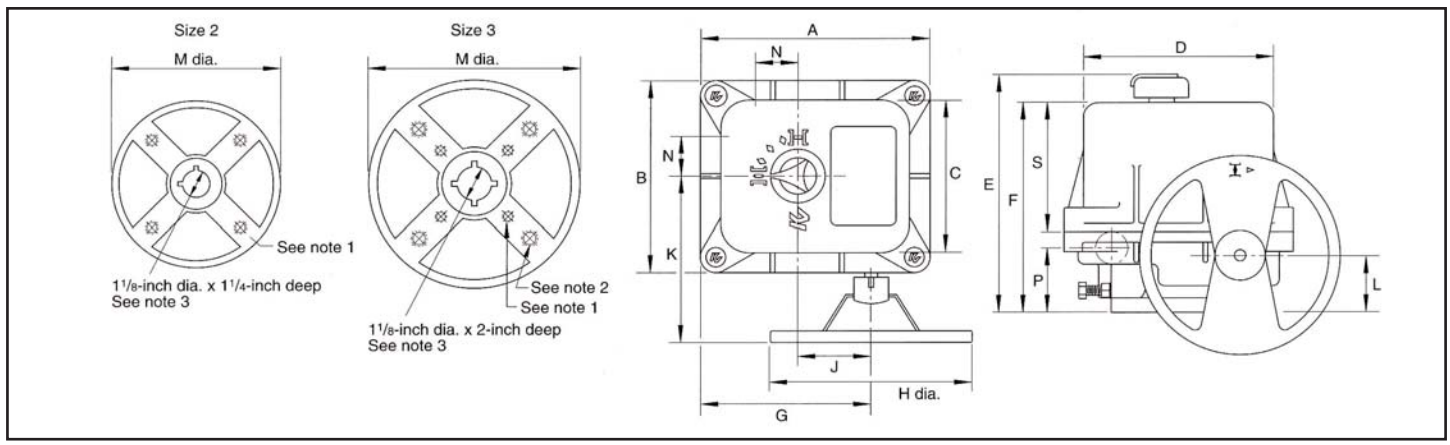


P3,P4



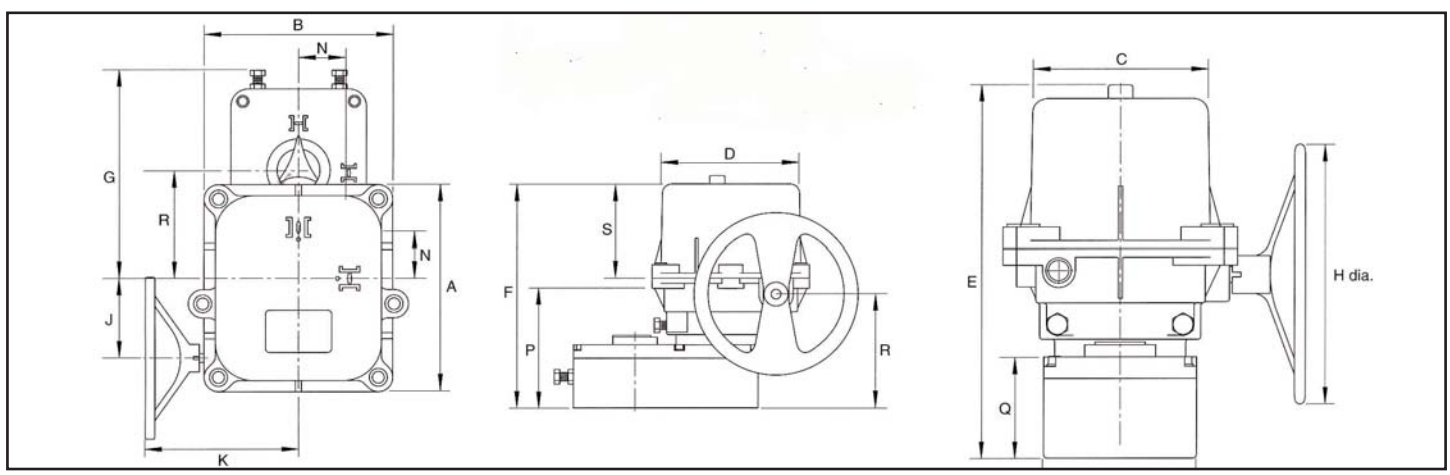
SIZE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q
1	E1	6.38″	5.75″	4.75″	5.38″	7.72″	6.69″	5.32″	5.00″	2.44″	4.54″	2.09″	4.00″	1.37″	2.12″	2.00″
		(162.0)	(146.0)	(120.6)	(136.6)	(196.0)	(170.0)	(135.1)	(127.0)	(61.9)	(115.3)	(53.1)	(101.6)	(34.8)	(53.8)	(50.8)

Notes: 1. Four tapped holes in actuator are 1/4-20UNC on a 1 3/4″ bolt circle. 2. Four tapped holes in actuator are 3/8-16UNC in a 3/14″ bolt circle.
3. Conduit entries have installed as standard, 1 plastic conduit cap and 1 metal conduit plug. 4. “R” dimension is the clearance needed to remove a cover.



SIZE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q
2	E2	8.94″	7.56″	6.75″	8.11″	9.60″	8.57″	6.90″	8.00″	3.13″	6.50″	2.32″	4.00″	2.06″	2.44″	6.38″
		(277.1)	(192.0)	(171.5)	(206.0)	(243.8)	(217.7)	(175.3)	(203.2)	(79.5)	(165.1)	(58.9)	(101.6)	(52.3)	(62.0)	(162.1)
3	E3	11.50″	9.50″	8.25″	10.25″	13.00″	11.95″	9.06″	12.00″	4.31″	8.25″	3.81″	6.00″	2.81″	4.00″	7.88″
		(292.1)	(241.3)	(209.6)	(260.4)	(330.2)	(303.5)	(230.1)	(304.8)	(109.5)	(209.6)	(96.8)	(152.4)	(71.4)	(101.6)	(200.2)

Notes: 1. Four tapped holes in actuator are 3/8-16UNC on a 3 1/4″ bolt circle. 2. Four tapped holes in actuator are 1/2-13UNC on a 5″ circle.
3. Keyways are to accept 1/4″ square key. 4. Conduit entries have installed as standard, 1 plastic conduit cap and 1 metal conduit plug.
5. “Q” dimension is the clearance needed to remove cover.



SIZE		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S
4	E4	11.50″	9.50″	8.00″	10.00″	17.33″	16.70″	13.06″	12.00″	4.31″	8.25″	8.56″	7.00″	2.81″	8.75″	4.75″	6.00″	7.88”
		(292.1)	(241.3)	(203.2)	(254)	(440.2)	(424.2)	(331.72)	(304.8)	(109.5)	(209.6)	(217.4)	(177.8)	(71.4)	(222.3)	(120.7)	(152.4)	(200.2)

Notes: 1. Four tapped holes in actuator are 1/2-13UNC on a 5 bolt circle. 2. Four tapped holes i actuator are 3/4-10UNC on a 6 1/2″ bolt circle.
3. Keyways are to accept 3/8″ x 4″ key for1-7/8″ dia. and 2-1/4″ dia. 4. Conduit entries have installed as standard, 1 plastic conduit cap and 1 metal conduit plug. 5. “S” dimension is the clearance needed to remove cover.

SPECIFICATION AND PERFORMANCE DATA

General Specifications:

The valve actuator shall consist of a permanent split capacitor, reversible type electric motor which drives a compound epicylic gear. The electric actuator shall have visual mechanical position indication, readable from a distance of 25 feet, showing output shaft and valve position. Unit shall be capable of mounting directly to Keystone butterfly valves without brackets and adaptors, or readily adapted to suit all other types of quarter-turn valve.

The actuator shall have an integral terminal strip, either UL 10A/300V or 20A/600V, which through conduit entries, will ensure simple wiring to power supplies. Cable entry shall be by means of two (2) 1˝ NPT threaded connections (except for 3/4˝ on E1). Cable entries shall have UL recommended gland stops within the NPT hole to prevent glands from being screwed in too far and damaging cable.

The actuator shall be constructed to withstand high shock and vibrations without operations failure. The actuator cover shall have captive bolts to elimiate loss of bolts when removing the cover from the base (except for E1). One copy of the wiring diagram shall be provided with the actuator.

The actuator shall have a self-locking gear train which is permanently lubricated at the factory. The gearing shall be run on ball and needle bearings. Actuators with 600 in/lbs or more output torque shall have two adjustable factory calibrated mechanical torque limit switches of the single-pole, double-throw type. The motor shall be fitted with thermal overload protection. Motor rotor shall fun in ball bearings at each end of motor.

The actuator housing shall be hard anodized aluminum for full environment protection. Ductile iron housings shall be available as an option. For E2 and larger sizes, the actuator housing shall be manufactured to NEMA IV Standards and UL recognized.

The environmental temperature range of the actuator shall be -30°C to +60°C (-20°F to+140°F).

For more frequent cycling and modulating service, an actuator shall be rated for continuous duty. The actuator rated for continuous duty shall be capable of operating 100% of the time at an ambient temperature of 40°C.

The actuator shall have an integral self-locking gear train. Motor brakes shall not be required to maintain desired valve position. Levers or latches shall not be required to engage or disengage the manual override. Mechanical travel stops, adjustable to 15° in each direction of 90° rotation, shall be standard, as well as two adjustable travel limit switches with electrically isolated contacts. Additional adjustable switches shall be available as option.

1-Phase Motor Specifications

The motor shall have Class B insulation capable of withstanding locked-rotor for 25 seconds without overheating. Wiring shall also be Class B insulation. An auto-reset thermal cut-out-protector shall be embedded in the motor windings to limit heat se to 80°C in a 40° C ambient. The motor in the E2, E3, E4 sizes shall be UL recognized and CSA approved. All motors shall be capable of being replaced by simply disconnecting the wires and then removing mounting bolts. Disassembly of gears shall not be required to remove the motor.

Materials of Construction

The electric actuator shall have a pressure diecast, hard anodized aluminum base and cover. The compound gear shall be made of die-cast, hard adonized aluminum or steel. An alloy steel worm gear shall be provided for manual override and torque limiting. Bearings for gears shall be of the ball and needle type; bronze bearings shall be used on the shafting parts.

Performance Data

Actuator Size	Gear ratios		Handwheel rim pull		Torque output		Full load current ratings (amperes)				Time for 90° travel (seconds)*		Weight	
	Electrical	Manual	Lb	Kg	Lb	N-M	110V 1 Ph	240V 1Ph	240V 3 Ph	440V 3 Ph	Normal	Speed Control Range	Lb	Kg
E1	3500: 1	70:1	15	7	300	34	0.8	0.3	NA	NA	17	18-100	8.8	4
E2	2105:1	61:1	30	14	1300	147	1.1	0.4	0.09	0.07	21	22-180	20	9
E3	2205:1	65:1	75	34	5100	576	2.1	1.5	0.35	0.3	22	23-180	53	24
E4	6615:1	195:1	90	40	15000	1695	2.5	1.8	0.5	0.45	60	61-300	110	49.5

*Note: These cycle times are approximate under no load conditions. Actual time may vary slightly with load conditions near maximum rating of the actuator and setting of the limit switch cams.

STEP 1-MOUNTING:

- Install proper adapter, if required, onto valve stem to accommodate actuator bore.
- Install furnished mounting studs into actuator base mounting holes (short threading length into actuator).
- Position actuator bore over valve stem with mounting studs aligned with valve bonnet or mounting bracket holes.

  NOTE: Standard mounting orientation is with the manual override shaft perpendicular to the run of the valve. A second keyway is provided for mounting 90° to standard.
- Lower actuator onto valve stem and secure in place with hex nuts and lock washers furnished.

STEP 2-CLOSE LIMIT SWITCH AND TRAVEL STOP ADJUSTMENTS:

Manually operate the actuator handwheel clockwise, until the valve is fully closed.

- Check that, at this closed position, the lower two limit switches (wired with blue wires) are actuated by the cam lobes. For adjustment, rotate the cam's brass worm screw until the cam lobe just trips the switch from a clockwise direction. Each cam is individually adjustable.
- With the close limit switches adjusted, loosen the closed travel stop locknut.
- Rotate closed travel stop 1/2 turn counterclockwise and lock in position with locknut.

  NOTE: Travel stops are located on the base of the E1 thru E3 and on the gear case housing of the E4.

STEP 3-OPEN LIMIT SWITCH AND TRAVEL STOP ADJUSTMENT:

- Manually operate the actuator handwheel counterclockwise, until the valve is fully open.
- Check that, at this open position, the upper two limit switches (wired with red wire) are actuated by the cam lobes.
- For adjustment, rotate the cam's brass worm screw until the cam lobe just trips the switch from a counterclockwise direction. Each cam is individually adjustable.
- With the open limit switches adjusted, loosen the open travel stop locknut.
- Rotate open travel stop clockwise until it just touches the internal stop lug of the output drive.
- Rotate open travel stop 1/2 turn counterclockwise and lock in position with locknut.

STEP 4-MOUNTING:

- A wiring diagram is enclosed with each actuator and external wiring should be terminated at the terminal strip in accordance with this diagram.
- Each actuator is provided with two conduit entries threaded for 1″ NPT. Due to variable cable gland requirements, glands are not supplied with the actuator.
- Proper sealing of the conduit connections must be done by the user to maintain the weatherproof integrity of the actuator enclosure.

TROUBLESHOOTING CHECKLIST:

If the actuator does not function properly, examine the items on the following checklist.

1. All customer wiring should be securely in place and in accordance with the proper diagram.
2. The power supply input should be in accordance with that specified on the actuator nameplate.
3. The internal wiring should be securely in place.
4. The travel limit switches should be properly adjusted and should operate before the mechanical travel stops are reached.
5. The gear train should move freely when the handwheel is rotated.
6. All gears should be properly meshed, secured and free from excessive wear.
7. The motor shaft should turn by hand with only a small amount of resistance.
8. Tripping the torque of travel limit switches should stop the motor. Switches connected with red wire prevent the actuator from further counterclockwise rotation. Switches connected with blue wire prevent the actuator from further clockwise rotation.
9. The valve on which the actuator is mounted should not be jammed or require more that the rated torque of the actuator.
10. The capacitor and its associated wiring should be securely connected. A loose or defective capacitor will cause the motor to hum, but not rotate.
11. The torque switches should be factory calibrated and the torque shaft drive pin should fit in the annular groove on the worm gear. Rotation of the handwheel, after contact has been made with the travel stop, should simulate an overtorque situation and cause a rotary motion of the torque shaft to operate the torque switch associated with that direction of travel.

12. The application should not require the actuator to be operated in excess of it duty rating.

13. The ambient temperature should be between -20°F and +140°F.

14. The thermal overload protector should only operate and disconnect motor circuit on fault conditions. If the thermal overload protector does operate, it will not automatically reset until the motor temperature cools down to a safe level.

15. The control circuitry feeding the actuator must not allow power to be supplied to both "open" and "close" motor windings at the same time. For example, when power is applied to the "open" terminal, the "close" terminal must be isolated from the power supply and vice versa. Failure to do so will result in motor overheating.

16. If two or more actuators are to be controlled in parallel with one 3-position switch, that switch must have isolated contacts for each actuator being controlled.

PREVENTATIVE MAINTENANCE:

WARNING:

Ensure that electrical supply is shut off prior to performing maintenance.

- Remove cover as per instructions for figure 2.
- Check visually that:

  a. All fixed screws are secure.

  b. All wiring terminal block screws are secure and terminat ed wiring is in place.

  c. All wiring quick discount terminations on capacitor, torque switches and travel limit switches are secure.

  d. Torques and travel limit switch operating cams are secure. Check that cam fixing screws are tight.

  e. Electrical compartment shows no signs within it of excessive dampness, overheating, dirt or foreign bodies.

  f. Cover o-ring is in place and not damaged or distorted.

  g. Indicator shaft o-ring is in place and not worn or dam aged.

  h. Ground terminal is intact and secure.

DISASSEMBLY/ASSEMBLY PROCEDURES:

Handwheel Removal:

- Unit is shown with handwheel removed. This would be done by loosening the set screw located in the handwheel hub and pulling off the handwheel.

Cover Removal

- Remove the yellow position indicator by prying off with a screwdriver.
- Remove the socket head capscrew and black indicator cap.
- Remove the yellow dust covers, exposing the cover/base socket head capscrews.
- Disengage the captive capscrews from the base. Screws will remain captive in the cover.

  E1 has 4 x 5/16″-18 UNC screws (not retained).

  E2 has 4 x 1/2″-13 UNC retained screws.

  E3 and E4 have 6 x 12″-13″ UNC retained screws.

- Remove cover by pulling up in a vertical action.

CUSTOMER WIRING REMOVAL:

WARNING:

Check that supply voltage is shut off before attempting to remove any wiring.

- Customer wiring should be tagged for later reinstallation. All units are shipped wit wiring diagram enclosed inside the housing.
- Remove customer incoming wiring at terminal block.

Consult factory before performing any further disassembly.