

Automation & Valves for the Oil & Gas Industry



Automation - Thermoplastic Valves - Application Expertise




ASAHI/AMERICA[®]
www.asahi-america.com

Automation Solutions for Oil & Gas

Introduction



Asahi/America, Inc. ("Asahi"), is a diversified ISO9001 certified manufacturer of corrosion-resistant fluid flow and automation products. These include a wide variety of thermoplastic valves, actuators, tubing systems, and single and double containment piping systems. These products are used for the control, transmission, and containment of corrosive fluids and high-purity liquids, certain flammable gases, and compressed air.

Asahi has one of the industry's largest distributor networks with nearly 500 locations nationally and throughout Latin America. Customers include the world's leading manufacturers in the chemical and petrochemical, mining, pulp and paper, plating, pharmaceutical, food, oil and gas, and semiconductor industries. Additionally, Asahi has developed a strong presence in municipal and industrial water and wastewater treatment, aquariums, landfill recovery, and theme park and cruise ship construction.



We have developed and currently manufacture the industry's most extensive line of corrosion resistant actuators in our 100,000 square foot headquarters in Malden, MA. This product line consists of pneumatic actuators, electric actuators and a broad range of options and communication packages, which include solenoids for on/off applications, positioning devices for modulating applications, and auxiliary limit switches for position indication (also used for safety interlock), just to name a few.

All of Asahi's actuators employ ISO and NAMUR mounting, which is becoming an industry standard. By conforming to these standards, Asahi America is able to increase inventory levels of standard mounting kits for valves as well as for options (auxiliary limit switches, modulating devices, solenoids, etc.). These standards also allow for simple assembly and installation of the products in the field.

Commitment to Excellence

Our automation products were developed around the following objectives:

Variety: We offer six models of electric actuators available in three materials; and eleven models of pneumatic actuators, which are also available in three materials.

Flexibility: Our actuators have the ability to interface with a PLC/RTU/DCS system, flow controllers, BUS Systems, etc; allowing for customization to meet specific customer needs.

Reliability: Each actuator is 100% cycle tested prior to shipment (not random sample tested) to ensure that you are receiving a quality product that will perform to your satisfaction.

Corrosion Resistance: Asahi actuators are designed to withstand the toughest corrosive environments, with models available in Polyamide, Rilsan, 316SS, and thermally-bonded Powder Coating.

Response: Since we design, manufacture, and inventory our actuator products at our Malden, MA facility, we can respond quickly to our customer needs. These needs could be actuator parts, complete actuators, or a complete actuated valve package.

Engineering: Since the design, manufacturing, and testing is done at our MA facility, we can supply exceptional technical support for installation and troubleshooting along with assuming full responsibility for product quality and performance.

Inspection: All actuator components are fully inspected as our Assembly and Quality Control Department receives them. When actuators are ready to ship, they undergo cycle testing by our shop personnel, who then signs off on the product along with the Production Manager. The units are then sent to Quality Control Department where they again are tested and signed off by QC personnel.

**Another
Corrosion
Problem
Solved.™**

Automation Solutions for Oil & Gas

Oil & Gas Applications and Product Recommendation

DRILLING FLUIDS

- Manual Type 57 Butterfly Valves
- Series 79P Pneumatically Actuated Type 57 Butterfly Valves
- 3-Actuator Materials Used;
 1. Cataphoresis/Rilsan Coated Aluminum
 2. Engineered Resin (PAG)
 3. 316 SS
- Series 92 Electrically Actuated Type 57 Butterfly Valves

PIPELINE TRANSMISSION

- Manual Type 21 Ball Valves
- 316 SS Series 79P Pneumatically Actuated Type 21 Ball Valves
- Series 92 Electrically Actuated Type 21 Ball Valves (NEMA Type 7)
- Manual Type 57 Butterfly Valves
- 316 SS Series 79P Pneumatically Actuated Type 57 Butterfly Valves
- Series 92 Electrically Actuated Type 57 Butterfly Valves (NEMA Type 7)

WELL HEAD CONTROL

- Series 92 Electric Actuators

FRACTURE RIG

- Manual Type 21 Ball Valves
- 316 SS Series 79P Pneumatically Actuated Type 21 Ball Valves
- Type 57 Butterfly Valves
- 316 SS Series 79P Pneumatically Actuated Type 57 Butterfly Valves

FRACTURE BOATS

- Manual Type 21 Ball Valves
- 316 SS Series 79P Pneumatically Actuated Type 21 Ball Valves
- Type 57 Butterfly Valves
- 316 SS Series 79P Pneumatically Actuated Type 57 Butterfly Valves

MUD PLANTS

- Manual Type 57 Butterfly Valves
- Series 79P Pneumatically Actuated Type 57 Butterfly Valves
- 3-Actuator Materials Used;
 1. Cataphoresis/Rilsan Coated Aluminum
 2. Engineered Resin (PAG)
 3. 316 SS

FRACTURE BOATS

- Manual Type 21 Ball Valves
- 316 SS Series 79P Pneumatically Actuated Type 21 Ball Valves
- Manual Type 57 Butterfly Valves
- 316 SS Series 79P Pneumatically Actuated Type 57 Butterfly Valves

PUMPER RIG

- Manual Type 21 Ball Valves
- 316 SS Series 79P Pneumatically Actuated Type 21 Ball Valves
- Manual Type 57 Butterfly Valves
- 316 SS Series 79P Pneumatically Actuated Type 57 Butterfly Valves

CHEMICAL PLANTS

- Manual Type 21 Ball Valves
- 316 SS Series 79P Pneumatically Actuated Type 21 Ball Valves
- Series 92 Electrically Actuated Type 21 Ball Valves (NEMA Type 7)
- Manual Type 57 Butterfly Valves
- 316 SS Series 79P Pneumatically Actuated Type 57 Butterfly Valves
- Series 92 Electrically Actuated Type 57 Butterfly Valves (NEMA Type 7)
- Manual & Pneumatic or Electrically Actuated Type 14 Diaphragm Valves

Asahi/America Oil & Gas Installations

Companies from leading Oil & Gas concerns are currently specifying and installing Asahi/America Actuators and Valves.

Contact us at 781-321-5409
or via e-mail at
asahi@asahi-america.com
for a list of our current installs
in Oil & Gas applications.





Type 21 Ball Valve

Standard Features (Sizes 1/2" – 6")

- Pressure rated up to 230 psi (PVC, CPVC, PVDF)
- Double O-ring seals on stem for added protection.
- Full bore, sizes 1/2" – 2"
- Full vacuum rated, all sizes
- Blocks in two directions, upstream and downstream, leaving full pressure on the opposite end of the valve
- Integrally molded ISO mounting pad for both manual and actuated operations
- Integrally molded base pad to mount valves securely or panel mounting
- PTFE seats with elastomeric backing cushions ensure bubble-tight shut-off and a low fixed torque, while at the same time compensating for wear
- True Union design for easier installation or repairs without expanding the pipe system
- Built-in spanner wrench on the handle for valve disassembly and assembly
- Two sets of end connectors (socket and threaded) included with all PVC and CPVC valves in sizes 1/2" – 2"
- CPVC threaded end connectors on sizes 1/2" – 1" come with stainless steel reinforcing rings

Pressure vs. Temperature (PSI, WATER, NON-SHOCK)

NOMINAL SIZE		PVC				CPVC						PP				PVDF				
		30° F	71° F	106° F	121° F	30° F	71° F	106° F	121° F	141° F	176° F	-5° F	86° F	121° F	141° F	-5° F	71° F	106° F	141° F	176° F
INCHES	mm	70° F	105° F	120° F	140° F	70° F	105° F	120° F	140° F	175° F	195° F	85° F	120° F	140° F	175° F	70° F	105° F	140° F	175° F	210° F
1/2-2	15-50	230	170	150	30	230	170	150	120	75	55	150	110	90	55	230	185	150	115	85
2 1/2	65	230	170	150	NA	230	170	150	120	75	55	150	95	70	40	230	185	150	115	85
3	80	230	170	150	NA	230	170	150	85	55	40	150	95	70	40	230	185	150	100	70
4-6	100-150	150	150	150	NA	150	150	150	85	55	40	150	95	70	40	150	150	150	100	70

Specifications

Sizes: 1/2" – 6"

Models: PVC & CPVC: Socket, Threaded and Flanged (ANSI)
PP & PVDF: IPS and Metric (DIN)
Socket, Threaded, Butt and Flanged (ANSI)

Bodies: PVC, CPVC, PP and PVDF

Seats: PTFE backed with EPDM or FKM

Seals: EPDM or FKM or AFLAS®‡

Sizes 1/2" - 4" PVC/EPDM/FKM Models available with NSF-61 Certification

‡ Trademark of Asahi Glass Co., Ltd.

Options

- Pneumatic and electric actuators & accessories
- Stem extensions
- 2" square operating nut or "T" nut
- Locking and/or spring return handles
- Limit switches
- Vented Ball

Cv Values Weight (POUNDS)

NOMINAL SIZE		Cv	NOMINAL SIZE		SOCKET THREADED	FLANGED
INCHES	mm		INCHES	mm		
1/2	15	14	1/2	15	0.44	1.10
3/4	20	29	3/4	20	0.66	1.54
1	25	47	1	25	1.10	2.70
1 1/4	32	72	1 1/4	32	1.54	3.30
1 1/2	40	155	1 1/2	40	2.64	4.40
2	50	190	2	50	4.40	8.15
2 1/2	65	365	2 1/2	65	6.17	8.80
3	80	410	3	80	9.70	13.00
4	100	680	4	100	24.00	26.67

Caution

- Never remove valve from pipeline under pressure.
- Always wear protective gloves and goggles.
- Watch out for trapped fluid in valve. It is safe to close valve before removing it from the pipeline.



Series 92 Electric Actuators

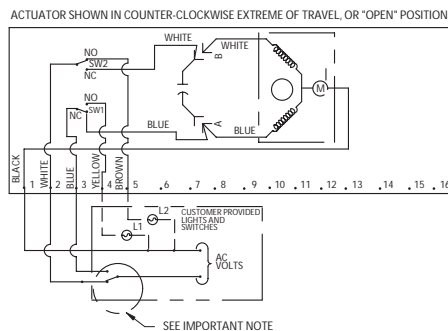
Standard Features (Sizes 1/2" – 4")

- Brushless, capacitor-run motors (AC models)
- Integral thermal overload protection without auto-reset (AC models)
- Permanently lubricated gear train
- Duty cycle 100% for high cycle applications
- Combination Type 4X, 7 and 9 enclosure with thermally bonded epoxy powder coating with stainless steel trim
- ISO bolt circle
- Two 1/2" NPT conduit ports prevent interference between control and power signals
- Declutchable manual override
- Standard travel-stop limit switches can simultaneously be used for indicator lights
- Highly visible position indicator

Options

- Failsafe Battery Pack
- Extra limit switches
- Feedback potentiometer
- Heater and thermostat (to -40° F)
- Positioner: 4–20mA or 0–10 VDC input
- 4–20 mA output position transmitter
- Voltages: 220 VAC, 24 VAC, 12 VAC, 24 VDC, 12 VDC

AC Wiring (For 115 VAC and 220 VAC only)



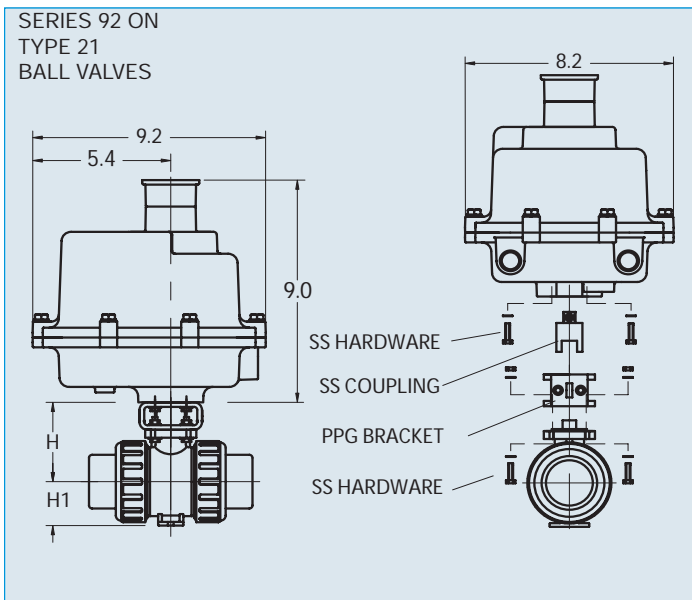
Specifications
Series 92: Motor Type – Reversing, 1/4 turn single phase



UL-508
Listed

Sizes – S92, A92 for sizes 1/2" – 4" ball valves
 Torque – 400 to 700 in-lbs
 Voltage – 120 VAC, 50/60 Hz
 Amp Draw – For S92: .50 Amps
 For A92: .80 Amps

Max Ambient Temp – 150° F
 Switches – Two single pole, double throw (15 Amp rating)



Engineering Data

Actuator Model	Torque (in-lbs.)	Duty Cycle	Cycle Time (sec.)	Weight (lbs.)	Amp Draw					
					115 Vac	220 Vac	24 Vac	12 Vac	24 Vdc	12 Vdc
S92	400	100	10	10.0	0.50	0.4	3.0	2.0	4.0	2.0
A92	700	75	10	10.0	0.80	0.6	3.0	2.0	4.0	2.0

Duty cycle shown above is for 115 VAC at ambient temperature.

NOTE TO WIRING DIAGRAM:

1. EACH ACTUATOR MUST BE POWERED THROUGH ITS OWN INDIVIDUAL SWITCH CONTACTS TO AVOID CROSS FEED.
2. WIRING AS SHOWN IS FOR S92 AND A92 MOTOR.
3. MOTOR HAS A THERMAL PROTECTOR AS SHOWN BY (M) IN DIAGRAM. (115 AND 220 VAC MODEL).
4. IF 115 & 220 VAC MODELS ARE PLC DRIVEN, OUTPUT CONTACTS OF PLC SHOULD BE RATED AT A MINIMUM OF 1.5 TIMES REQUIRED INPUT VOLTAGE OF ACTUATOR.

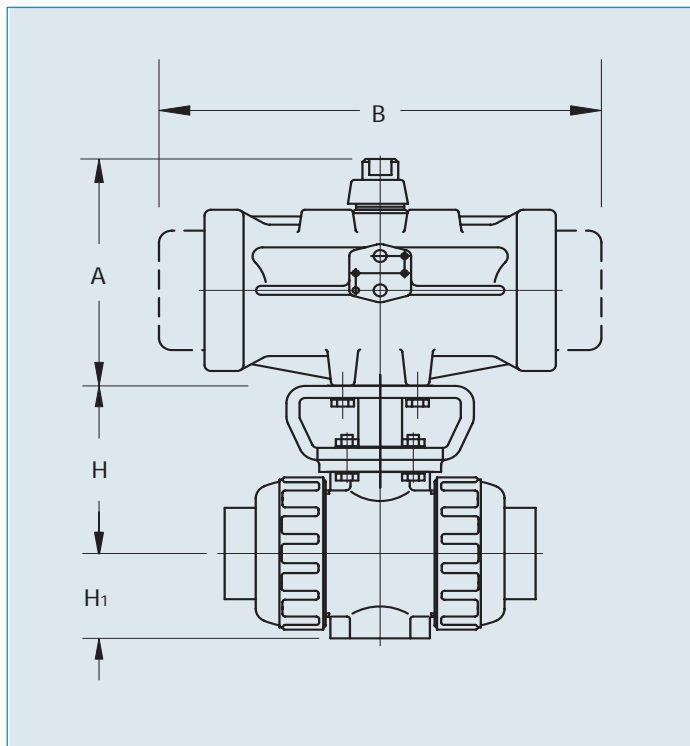
Dimensions

NOMINAL SIZE		H	H1
INCHES	mm		
1/2	15	2.76	1.14
3/4	20	3.01	1.38
1	25	3.29	1.54
1 1/4	32	3.64	1.85
1 1/2	40	3.98	2.17
2	50	4.43	2.60
2 1/2	65	5.12	2.83
3	80	5.47	3.35
4	100	6.97	4.33

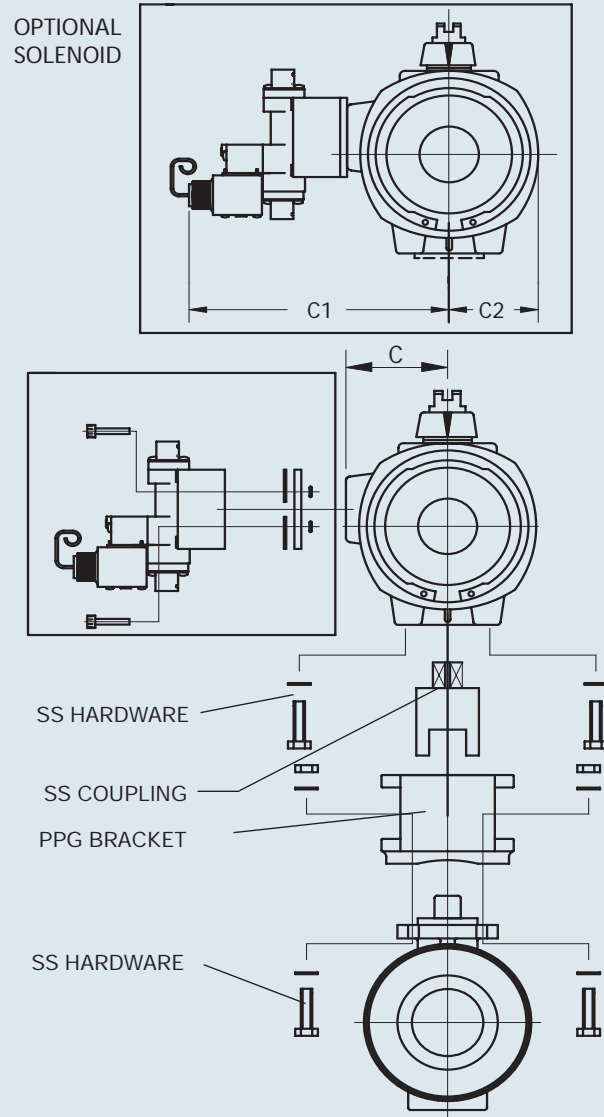
Pneumatically Actuated Ball Valves



Type 79P on Type 21 Ball Valve



OPTIONAL SOLENOID



Dimensions (Sizes 1/2" - 4")

NOMINAL SIZE		Model No. Air-Air	Model No. Air-Spring	H	H ₁	A		B		C		C ₁		C ₂	
INCHES	mm					A-A	A-S	A-A	A-S	A-A	A-S	A-A	A-S	A-A	A-S
1/2	15	AP79PN	AP79PSN	2.76	1.14	3.34	3.34	4.22	5.55	1.47	1.47	5.41	5.41	1.21	1.21
3/4	20	AP79PN	AP79PSN	3.01	1.38	3.34	3.34	4.22	5.55	1.47	1.47	5.41	5.41	1.21	1.21
1	25	AP79PN	AP79PSN	3.29	1.54	3.34	3.34	4.22	5.55	1.47	1.47	5.41	5.41	1.21	1.21
1 1/4	32	AP79PN	BP79PSN	3.64	1.85	3.34	4.40	4.22	5.86	1.47	1.73	5.41	5.41	1.21	1.41
1 1/2	40	AP79PN	BP79PSN	3.98	2.17	3.34	4.40	4.22	5.86	1.47	1.73	5.41	5.41	1.21	1.41
2	50	AP79PN	CP79PSN	4.43	2.60	3.34	5.00	4.22	7.64	1.47	1.97	5.41	5.41	1.21	1.85
2 1/2	65	CP79PN	CP79PSN	5.12	2.83	5.00	5.00	7.00	8.74	1.97	1.97	5.89	5.89	1.85	1.85
3	80	CP79PN	DP79PSN	5.47	3.35	5.00	6.49	7.00	11.49	1.97	2.56	5.89	5.89	1.85	2.36
4	100	DP79PN	DP79PSN	6.97	4.33	6.49	6.49	9.21	11.49	2.56	2.56	6.48	6.48	2.36	2.36



Type 57 Butterfly Valve

Specifications

Sizes: Lever: 1-1/2" – 8"
Gear: 8" – 14"

Models: Wafer Style

Operators: Lever and Gear

Bodies: PVC, PP and PVDF

Discs: PVC, PP and PVDF

Seats: EPDM, FKM, and Nitrile

Seals: Same as seating material

Stems: 403 and 316 stainless steel, Titanium, Hastelloy C[®] ‡

‡ Trademark of Cabot Corporation

Standard Features (Sizes 1-1/2" – 14")

- Standard model (1-1/2" – 14") has PVC Body and PP Disc for superior chemical resistance and elevated temperature capabilities
- 316/403 stainless steel shaft has full engagement over the entire length of the disc and is a non-wetted part.
- Only solid and abrasion-resistant plastic disc and elastomeric liner are wetted parts.
- ISO bolt circle on top flange—no body or stem modifications required for accessories.
- Stem retainer—PP retainer to prevent stem removal.
- Seat over tightening protection—Molded body stops and seat stress relief area.
- Spherical disc design offers increased Cv, ultimate sealing and high cycle life.

Options

- Pneumatically and electrically actuated with accessories
- Alternate discs:
 - (I) PVC : 1-1/2" – 14"
 - (II) PVDF : 1-1/2" – 14"
- Plasgear[™] gear operators for 1-1/2" – 6"
- Lug style (stainless steel 304 or 316) for blocking and end-of-line applications
- Stems in 316 stainless steel, titanium, Hastelloy C[®]
- 2" square nut on stem (1-1/2" - 8" only)
- 2" square nut on gear operator (All sizes)
- Stem extensions (Single stem and two-piece stem)
- Locking devices (Gear Type – Standard on Lever)
- Chain operators
- Manual limit switch - Asahi P-Series
- Tandem arrangements (Patented by A/A, Inc.)

Pressure vs. Temperature (PSI, WATER, NON-SHOCK)*

BODY		PVC			PP			PVDF			
DISC		PP			PP			PVDF			
NOMINAL SIZE		30° F	121° F	141° F	-5° F	141° F	-5° F	141° F	176° F	211° F	
INCHES	mm	120° F	140° F	175° F	140° F	175° F	140° F	175° F	210° F	250° F	
1 1/2	40	150	70	30	150	100	150	100	85	75	
2	50	150	70	30	150	100	150	100	85	75	
2 1/2	65	150	70	30	150	100	150	100	85	75	
3	80	150	70	30	150	100	150	100	85	75	
4	100	150	45	30	150	100	150	100	85	75	
5	125	150	45	30	150	100	150	100	85	75	
6	150	150	45	30	150	100	150	100	85	75	
8	200	150	40	20	150	85	150	85	75	60	
10	250	150	40	20	150	85	150	85	75	60	
12	300	100	30	15	100	60	100	60	45	30	
14	350	100	30	7	100	45	100	45	30	15	

Cv Values Wt. (LBS)

NOMINAL SIZE		Cv	NOMINAL SIZE	PVC	PP	PVDF	
INCHES	mm	90					
1 1/2	40	71	INCHES				
2	50	120	mm				
2 1/2	65	250	1 1/2	40	3	3	3
3	80	300	2	50	4	3	4
4	100	470	2 1/2	65	4	3	4
5	125	830	3	80	5	4	5
6	150	1100	4	100	6	5	7
8	200	2500	5	125	11	9	13
10	250	3860	6	150	13	10	15
12	300	5700	8	200	21	16	25
14	350	6440	10	250	33	27	41
			12	300	62	53	76
			14	350	67	58	81



Series 92 Actuator on Type 57 Butterfly Valve

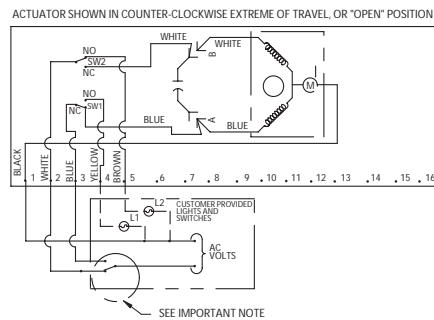
Standard Features (Sizes 1-1/2" – 8")

- Brushless, capacitor-run motors (AC models)
- Integral thermal overload protection with auto-reset (AC models)
- Permanently lubricated gear train
- Duty cycle 100% for high cycle applications
- Combination Type 4X, 7 and 9 enclosure with thermally bonded powder coating/304 SS trim
- ISO bolt circle
- Two 1/2" NPT conduit ports prevent interference between control and power signals
- Declutchable manual override
- Standard travel-stop limit switches can simultaneously be used for indicator lights
- Highly visible position indicator

Options

- Failsafe battery pack
- Extra limit switches
- Feedback potentiometer
- Heater and thermostat (to -40° F)
- Positioner: 4-20mA or 0-10VDC input
- 4-20mA output position transmitter
- Voltages: 220 VAC, 24 VAC, 12 VAC, 24 VDC, 12 VDC
- Mechanical brake eliminates seating oscillation

AC Wiring (For 115 VAC and 220 VAC only)



Specifications

Series 92: Motor Type – Reversing, 1/4 turn single phase

Models – S92, A92, B92, C92 for sizes 1-1/2" – 8"


Contact factory for sizes 10" – 24"

Torque – 400 – 2000 in.-lbs.

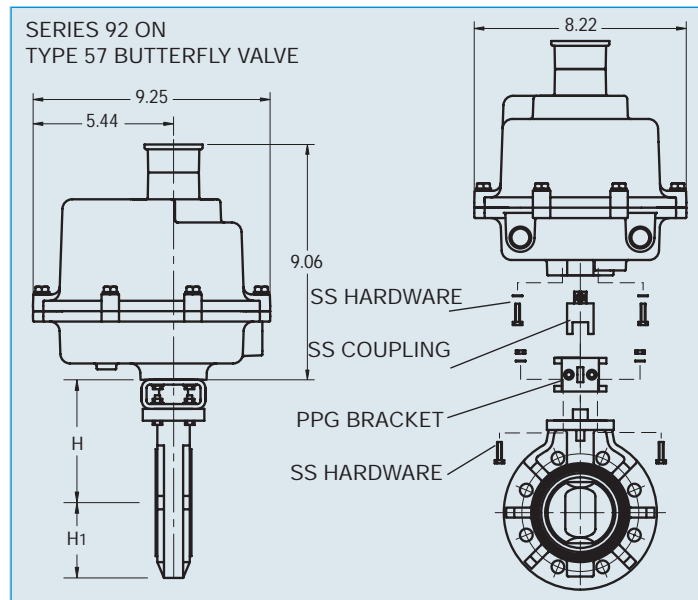
Voltage – 120 VAC, 50/60 Hz

Max Ambient Temp – 150° F

Switches – Two single pole, double throw (15 Amp rating)



UL - 508 Listed



Engineering Data

Duty cycle shown above is for 115 Vac at ambient temperature.

Actuator Model	Torque (in.-lbs.)	Duty Cycle	Cycle Time (sec.)	Weight (lbs.)	Amp Draw					
					115 Vac	220 Vac	24 Vac	12 Vac	24 Vdc	12 Vdc
S92	400	100	10	10.0	0.50	0.4	3.0	2.0	4.0	2.0
A92	700	75	10	10.0	0.80	0.6	3.0	2.0	4.0	2.0
B92	1100	100	25	11.0	0.50	0.4	3.0	2.0	4.0	2.0
C92	2000	50	25	21.0	1.00	0.6	3.0	2.0	4.0	2.0

(Contact factory for sizes above 8")

Dimensions/ Actuator Model

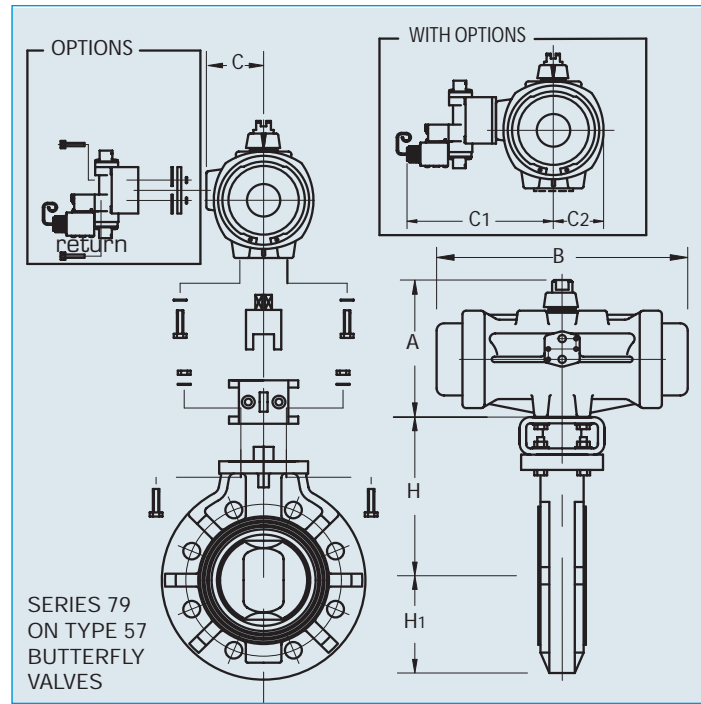
- NOTE TO WIRING DIAGRAM:**
1. EACH ACTUATOR MUST BE POWERED THROUGH ITS OWN INDIVIDUAL SWITCH CONTACTS TO AVOID CROSS FEED.
 2. MOTOR LEADS "A" AND "B" ARE REVERSED FOR B92 & C92
 3. MOTOR HAS A THERMAL PROTECTOR AS SHOWN BY (M) IN DIAGRAM. (115 AND 220 VAC MODEL).
 4. IF 115 & 220 VAC MODELS ARE PLC DRIVEN, OUTPUT CONTACTS OF PLC SHOULD BE RATED AT A MINIMUM OF 1.5 TIMES REQUIRED INPUT VOLTAGE OF ACTUATOR.

NOMINAL SIZE		MODEL	H	H1
INCHES	mm			
1 1/2	40	S92	5.51	2.95
2	50	S92	5.75	3.27
2 1/2	65	S92	6.18	3.66
3	80	S92	6.46	3.94
4	100	S92	7.16	4.53
5	125	A92	8.46	5.00
6	150	B92	8.97	5.63
8	200	C92	11.25	6.70

Pneumatically Actuated Butterfly Valves

Standard Features (Sizes 1-1/2" – 24")

- Recommended air supply pressure:
80 psi (filtered air)
maximum air supply pressure 120 psi
- Double piston, double rack and pinion design (Polyamid-Nylon 66)
- Air-to-Air (double acting) or Air-to-Spring (spring failsafe) models
- Position indication through highly visible indicator knob
- Manual override easily employed by inserting wrench onto flats of stem. A declutchable gear operator is required on Air-to-Air sizes 8" and above and on all Air-to-Spring sizes
- Actuator shaft 303 stainless steel or Cataphoresis encapsulated steel
- ISO and NAMUR mounting dimensions allow for valve accessory mounting
- All models are corrosion resistant to handle the most aggressive applications



Options

- Solenoids in various Type enclosure ratings and voltages are supplied with muffler speed control & push button override
- Double limit switches in Type 4 and 7 enclosures
- Positioner for modulating service: 4–20 mA or 3–15 psi control signal (requiring no solenoid)
- 316 stainless steel actuator body
- Bus systems
- Cataphoresis encapsulated alluminum

Dimensions (Sizes 1-1/2" – 24")

NOMINAL SIZE		MODEL NO. AIR-AIR	MODEL NO. AIR-SPRING	H	H1	A		B		C		C1		C2	
INCHES	mm					A-A	A-S	A-A	A-S	A-A	A-S	A-A	A-S	A-A	A-S
1 1/2	40	BP79PN	CP79PSN	5.51	2.95	4.40	5.00	4.92	8.74	1.73	2.17	5.66	5.89	1.41	1.85
2	50	BP79PN	CP79PSN	5.75	3.25	4.40	5.00	4.92	8.74	1.73	2.17	5.66	5.89	1.41	1.85
2 1/2	65	BP79PN	CP79PSN	6.18	3.66	4.40	5.00	4.92	8.74	1.73	2.17	5.66	5.89	1.41	1.85
3	80	CP79PN	DP79PSN	6.46	3.94	5.00	6.49	7.00	11.50	2.17	2.64	5.89	6.48	1.85	2.36
4	100	CP79PN	DP79PSN	7.16	4.53	5.00	6.49	7.00	11.50	2.17	2.64	5.89	6.48	1.85	2.36
5	125	CP79PN	E79PSN	8.46	5.00	5.00	8.31	7.00	18.86	2.17	3.70	5.89	7.55	1.85	3.27
6	150	DP79PN	E79PSN	8.97	5.63	6.49	8.31	9.21	18.86	2.64	3.70	6.48	7.55	2.36	3.27
8	200	E79PN	E79PSN	11.27	6.69	8.31	8.31	13.74	18.86	3.70	3.70	7.55	7.55	3.27	3.27
10	250	E79PN	F79PSN	12.46	7.99	8.31	10.71	13.74	23.54	3.10	4.72	7.55	8.57	4.18	4.18
12	300	F79PN	G79PSN	14.69	9.53	10.71	12.32	17.48	27.32	4.72	5.20	8.57	9.17	4.82	4.82
14	350	G79PN	M79PSN	14.81	10.24	12.32	16.85	20.63	29.23	5.32	8.50	9.17	12.35	4.82	7.35
16	400	G79PN	M79PSN	16.78	11.81	12.32	16.85	20.63	29.23	5.32	8.50	9.17	12.35	4.82	7.35
18	450	G79PN	M79PSN	17.57	12.40	12.32	16.85	20.63	29.23	5.32	8.50	9.17	12.35	4.82	7.35
20	500	G79PN	M79PSN	18.75	13.78	12.32	16.85	20.63	29.23	5.32	8.50	9.17	12.35	4.82	7.35
24	600	G79PN	M79PSN	21.31	16.02	12.32	16.85	20.63	29.23	5.32	8.50	9.17	12.35	4.82	7.35



Specifications

Sizes: 1/2" - 4"

Body Materials: PVC, CPVC, PP and PVDF

Bonnet Materials: PVC, PP, PPG and PVDF

Diaphragms: EPDM and 3-Layer EPDM/PVDF/PTFE
Also available in Nitrile and FKM

End Connection: Flanged or True Union

Operator: Handwheel

Standard Features

- Flanged (ANSI) face-to-face dimensions are equivalent to most commonly used metallic valves
- Rugged body and bonnet are of solid thermo-plastic for maximum corrosion resistance
- Uniquely designed body and bonnet together with diaphragms of new sealing designs by computer dynamic analysis for superior sealing
- Weir design for excellent throttling
- Bubble-tight sealing, even in applications such as slurries or suspended particles
- Bonnet seals to protect internals from corrosive environments
- Built-in travel stop to prevent over-tightening or compressive strain on diaphragm
- Integrally molded bottom stand for simple yet firm panel mounting
- Indicator at the top for indication of valve position and prevention of over-tightening
- PVDF Gas Barrier, which protects EPDM backing from gas permeation, is standard for all valves with PTFE Diaphragm
- Low profile
- Bayonet structure to connect compressor and diaphragm - easy diaphragm replacement

Options

- 2" square nut
- Stem extensions (single and two-piece design)
- Locking device for tamper-proofing
- Pneumatic (all sizes) or electric (to 4") actuation

Caution

- After replacing diaphragm, do not tighten bolts for bonnet and body with diaphragm in the closed position. Excessive force could damage bonnet or body.
- Vacuum Rating
(1) Rubber Diaphragms (2) PTFE Diaphragm

3"	- 25.59"	- 9.84"
4"	- 19.69"	- 3.94"
- Never remove valve from pipeline under pressure.
- Always wear protective gloves and goggles.

Pressure vs. Temperature PSI, WATER, NON-SHOCK

NOMINAL SIZE		PVC		CPVC				PP				PVDF			
		ALL DIAPHRAGMS		ALL DIAPHRAGMS				ALL DIAPHRAGMS				PTFE DIAPHRAGM			
		30° F 105° F	106° F 140° F	30° F 105° F	106° F 140° F	141° F 175° F	176° F 195° F	-5° F 105° F	106° F 140° F	141° F 175° F	176° F 195° F	-40° F 140° F	141° F 175° F	176° F 210° F	211° F 250° F
INCHES	mm														
1/2	15	150	100	150	115	85	40	150	115	85	70	150	120	95	70
3/4	20	150	100	150	115	85	40	150	115	85	70	150	120	95	70
1	25	150	100	150	115	85	40	150	115	85	70	150	120	95	70
1 1/4	32	150	100	150	115	85	40	150	115	85	70	150	120	95	70
1 1/2	40	150	100	150	115	85	40	150	115	85	70	150	120	95	70
2	50	150	100	150	115	85	40	150	115	85	70	150	120	95	70
2 1/2	65	150	115	150	120	95	85	150	120	95	85	150	115	85	70
3	80	150	115	150	120	95	85	150	120	95	85	150	115	85	70
4	100	150	115	150	120	95	85	150	120	95	85	150	115	85	70

Cv Values/Wt.

NOMINAL SIZE		Cv	WT. FLG. (lbs)
INCHES	mm		
1/2	15	4.8	1.50
3/4	20	5.3	1.80
1	25	8.5	2.40
1 1/4	32	11	3.10
1 1/2	40	26	6.20
2	50	43	8.00
2 1/2	65	85	14.33
3	80	115	17.64
4	100	185	25.80

Actuator Options

Diaphragm Valves



Series 92 Electric Actuators

Standard Features (Sizes 1/2" - 4")

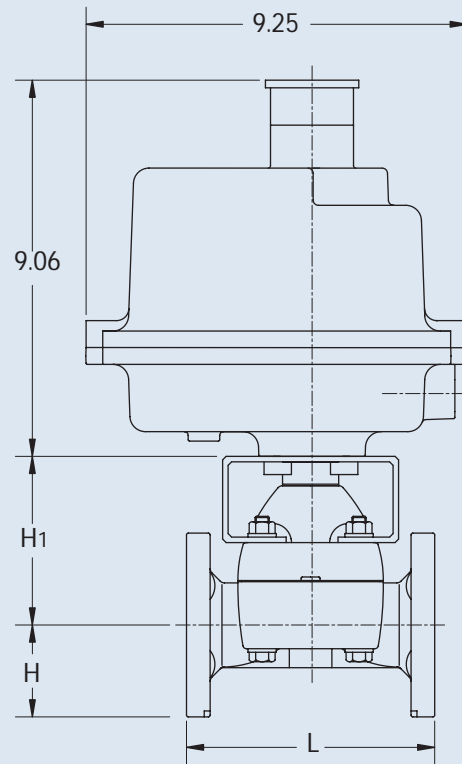
- Brushless, capacitor-run motors (115V/60 Hz)
- Integral thermal overload protection with auto-reset
- Permanently lubricated gear train
- Combination Type 4X, 7 and 9 enclosure with thermally bonded powder coating/304 SS trim
- ISO bolt circle
- Two 1/2" NPT conduit ports prevent interference between control and power signals
- Declutchable manual override
- Highly visible position indicator
- 3-layer rotary switch for dry contact indication
- Extra Limit switches supplied as a standard

Options

- Heater and thermostat (to -40° F)
- Positioner: 4-20mA or 0-10 VDC input signal
- 4-20mA output position transmitter
- Feedback potentiometer

Electrically Actuated Diaphragm

ACTUATOR DEPTH: 9.25"



NOTE: CONSULT FACTORY FOR SIZES GREATER THAN 4" FOR TRUE UNION "L" DIMENSIONS SEE PAGE 67 OF AA VALVE & ACTUATION CATALOG. (Rev E 09-08)

AC Wiring (For 115 VAC only)

NOTE TO WIRING DIAGRAM:

1. EACH ACTUATOR MUST BE POWERED THROUGH ITS OWN INDIVIDUAL SWITCH CONTACTS TO AVOID CROSS FEED.

2. MOTOR HAS A THERMAL PROTECTOR AS SHOWN BY (M) IN DIAGRAM.

4. IF 115 VAC MODELS ARE PLC DRIVEN, OUTPUT CONTACTS OF PLC SHOULD BE RATED AT A MINIMUM OF 1.5 TIMES REQUIRED INPUT VOLTAGE OF ACTUATOR.

Cycle Times

NOMINAL SIZE		TIME (SEC.)
INCHES	mm	
1/2	15	170
3/4	20	210
1	25	210
1 1/2	40	210
2	50	210
2 1/2	65	210
3	80	250
4	100	250

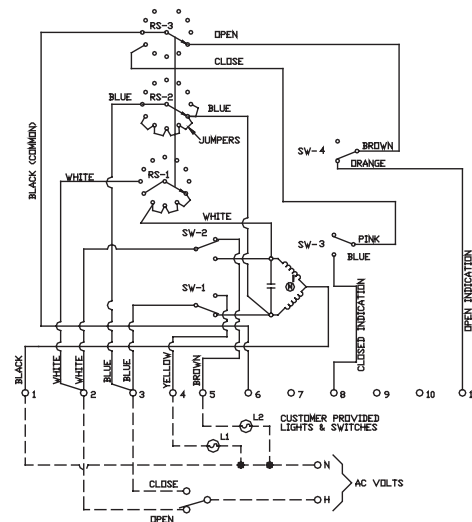
*Duty Cycle: 25%

Weight

NOMINAL SIZE		WT. (LBS.)
INCHES	mm	
1/2	15	16.80
3/4	20	17.10
1	25	17.70
1 1/2	40	21.50
2	50	23.30
2 1/2	65	29.60
3	80	32.94
4	100	41.10

Dimensions

NOMINAL SIZE				
INCHES	mm	H	H1	L
1/2	15	1.75	3.55	4.25
3/4	20	1.94	3.61	5.88
1	25	2.13	3.77	5.88
1 1/2	40	2.50	6.50	6.94
2	50	3.00	7.02	7.94
2 1/2	65	3.50	9.52	9.84
3	80	3.75	10.25	10.38
4	100	4.50	11.00	12.94





Type 14 Pneumatic Diaphragm

Features

- Rugged solid thermoplastic construction for maximum corrosion resistance
- Uniquely designed body and bonnet together with diaphragms of new sealing designs by the-state-of-the-art computer aided analysis for superior sealing
- Weir design for excellent throttling
- NAMUR pad mount for easy installation of solenoid valves
- Full vacuum rated
- Bubble-tight sealing, even in applications such as slurries or those with suspended particles
- Bonnet seals to protect internals from corrosive environments
- Adjustable travel stop to prevent diaphragm from being over-tightened
- Bayonet structure to connect compressor and diaphragm for quick maintenance
- Integrally molded bottom stand for simple yet firm panel mounting
- Indicator at the top for valve position
- PVDF gas barrier, which protects EPDM backing cushion from gas permeation, is a standard for all valves with PTFE diaphragm
- Low profile

Options

- Solenoid valves in all Electrical Type ratings and voltages
- Limit switches for interface with computers and other equipment
- Positioners: 3 - 15mA and 4 - 20mA inputs for throttling applications 4 - 20mA output for interface with computers and other equipment
- Manual over-ride for Air-to-Spring

Specifications

Sizes: 1/2" - 2"

Body Materials: PVC, CPVC, PP and PVDF

Bonnet Materials: PPG

Diaphragms: EPDM and 3-Layer EPDM/PVDF/PTFE
Also available in Nitrile and FKM

Actuator Housing: PPG

Type: Air-to-Air; Air-to-Spring

Air Supply: 60 psi (Recommended)
90 psi (Maximum)

O-Ring End Connectors: EPDM

2" PVDF TYPE 14 AIR-TO-AIR FLANGED DIAPHRAGM VALVE



1" PP TYPE 14 AIR-TO-AIR TRUE UNION DIAPHRAGM VALVE



2" PVC TYPE 14 AIR-TO-SPRING FLANGED DIAPHRAGM VALVE WITH NEMA IV DOUBLE LIMIT SWITCH AND NEMA IV SOLENOID VALVE



Series 92

Electric Actuator

Standard Features

- **Motor:** Reversing, brushless, capacitor run 115 VAC 50/60 Hz, single phase
- **Overload protection:** Integral thermal overload protection for motor windings with automatic reset
- **Gear train:** Permanently lubricated, solid gear that is Rockwell hardened
- **Corrosion Resistant housing:** Thermally bonded powder coating with stainless steel trim
- **ISO** mounting configuration
- **Conduit:** Two 1/2" FNPT conduit entries to eliminate cross feed between control, feedback, and power signals
- **Position indication:** Highly visible Beacon position indicator for positive position of valve, even at a distance
- **Decutchable manual override:** Pull up on indicator knob, insert 5/8" wrench on to flats and rotate in the appropriate direction (CCW for open, CW for close). Models with handwheel override do not require a wrench. Simply push down on handwheel until engaged with cam and rotate
- **Limit switches:** Standard end of travel limit switches can be used for light indication (not to be use with PLC for position confirmation)
- **Enclosure:** Combination Type 4X, 7 & 9 enclosure for use in various environments
- **CE compliant motor:** All 115 VAC and 230 VAC motors are CE compliant stamped as such
- **Extended duty cycles:** Our extended duty cycles are ideal for modulating and high cycling applications
- **Output torque:** Series 92 Electric Actuators have an output torque range from 400 in/lbs to 2000 in/lbs

Options

- Auxiliary (additional) limit switches
- Feedback potentiometer
- Heater and thermostat
- 4-20 mA Positioner
- Mechanical brake
- 4-20 output source (transmitter)
- Two-wire control

Engineering Data

ENGINEERING DATA															
Model	Torque (in/lbs)	115 Vac		230 Vac		12 Vdc		24 Vdc		12 Vac		24 Vac		Cycle Time per 90 Degrees (seconds)	Weight (lbs)
		Amp Draw	Duty Cycle	Amp Draw	Duty Cycle	Amp Draw	Duty Cycle	Amp Draw	Duty Cycle	Amp Draw	Duty Cycle	Amp Draw	Duty Cycle		
S92	400	0.5	100%	0.4	100%	2.0	75%	4.0	75%	2.0	75%	3.0	75%	10	15.3
A92	700	0.8	75%	0.6	75%	2.0	75%	4.0	75%	2.0	75%	3.0	75%	10	15.3
B92	1100	0.5	100%	0.4	100%	2.0	75%	4.0	75%	2.0	75%	3.0	75%	25	15.3
C92	2000	1.0	50%	0.6	50%	2.0	75%	4.0	75%	2.0	75%	3.0	75%	25	18.3

Note: Amp rating is considered locked rotor. Duty cycles are for ambient temperature (73°F)



Series 94 Electric Actuators

Engineering Specifications

Size: S92, A92, B92, C92

Torque: 400-2000 in/lbs

Voltage: 120 VAC 1Ph 50/60 Hz

Amp Draw: S92, B92 .5A, A92 .8A, C92 1.0A

Conduit Entry: Two (2) 1/2" FNPT

Max Ambient Temperature: 150° F

Switches: Two (2) single pole, double throw (2-SPDT) 15 amp rated

Cycle Time per 90°: S92, A92: 10 seconds
B92, C92: 25 seconds

Sample Specification

All Series 92 electric actuators shall have a thermally protected, bi-directional (reversing type), capacitor run motor with a permanently lubricated gear train. 115vac & 230vac motors shall conform to CE and be indicated on motor housing. Actuator shall have solid, heat-treated alloy steel gearing encompassed in a thermally bonded powder coated die cast aluminum housing with stainless steel trim, which meets Type 4X, 7 & 9. Each actuator to have a decutchable manual override, visual position indication, and an ISO mounting configuration as manufactured by Asahi/America

Options (continued)

- Relay control package
- Custom wiring configurations
- Time delay
- Voltages (12 or 24vdc; 12, 24, or 230vac)
- Hand wheel manual override
- No manual override
- TYPE 7 Breather

Series 08

Electric Actuator



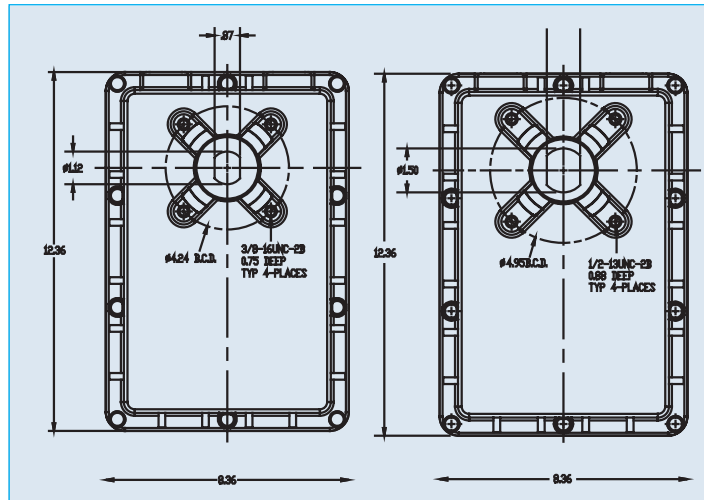
Series 08 Electric Actuators

Standard Features

- **Motor:** Reversing, brushless, capacitor run 115 VAC 50/60 Hz, single phase
- **Overload protection:** Integral thermal overload protection for motor windings with automatic reset
- **Gear train:** Permanently lubricated, solid, heat treated alloy steel gearing
- **Corrosion Resistant housing:** Thermally bonded powder coating with stainless steel trim
- **Conduit:** Two 3/4" FNPT conduit entries to eliminate cross feed between control and power signals
- **Position indication:** Position indicator for positive position of valve
- **Manual override:** Push down on handwheel until engaged with cam and rotate
- **Limit switches:** Standard end of travel limit switches can be used for light indication (not to be use with PLC for position confirmation)
- **Auxiliary (Additional) limit switches:** Each electric actuator is provided as a standard with 2-SPDT auxiliary limit switches (115vac units only)
- **Enclosure:** Combination Type 4X, 6 & 7 enclosure for use in various environments
- **Output torque:** Series 08 Electric Actuators have an output torque range from 5000 in/lbs to 10,000 in/lbs
- **PTC Space Heater:** A PTC (Positive Temperature Coefficient) space heater is provided as standard equipment (115vac units only)

Options

- Feedback potentiometer
- 4-20 mA Positioner (Modulating PCB)
- 4-20 output source (transmitter)
- Relay control packages
- Two-wire control
- Center-off



Engineering Specifications

Size: E08, F08
 Torque: 5000-10,000 in/lbs
 Voltage: 120 VAC 1Ph 50/60 Hz
 Amp Draw: E08 1.7, F08 2.2
 Conduit Entry: Two (2) 3/4" FNPT
 Max Ambient Temperature: 150° F
 Switches: Four (4) single pole, double throw (4-SPDT) 15 amp rated (115vac units only)
 Cycle Time per 90°: E08, F08: 30 seconds

Sample Specification

All Series 08 electric actuators shall have a thermally protected, bi-directional (reversing type), capacitor run motor with a permanently lubricated gear train. Actuator shall have solid, alloy steel planetary gearing encompassed in a thermally bonded, die-cast aluminum housing with stainless steel trim, conforming to Type 4X, 6, & 7. Each actuator shall have a manual override and visual position indication, as supplied by Asahi/America (115vac units include two (2) auxiliary limit switches, a PTC heater and a mechanical brake).

Engineering Data

ENGINEERING DATA							
Model	115 Vac			230 Vac		Cycle Time per 90 Degrees (seconds)	Weight (lbs)
	Torque (in/lbs)	Amp Draw	Duty Cycle	Amp Draw	Duty Cycle		
E08	5,000	1.7	50%	1.0	50%	30	34
F08	10,000	2.2	50%	1.2	50%	30	34

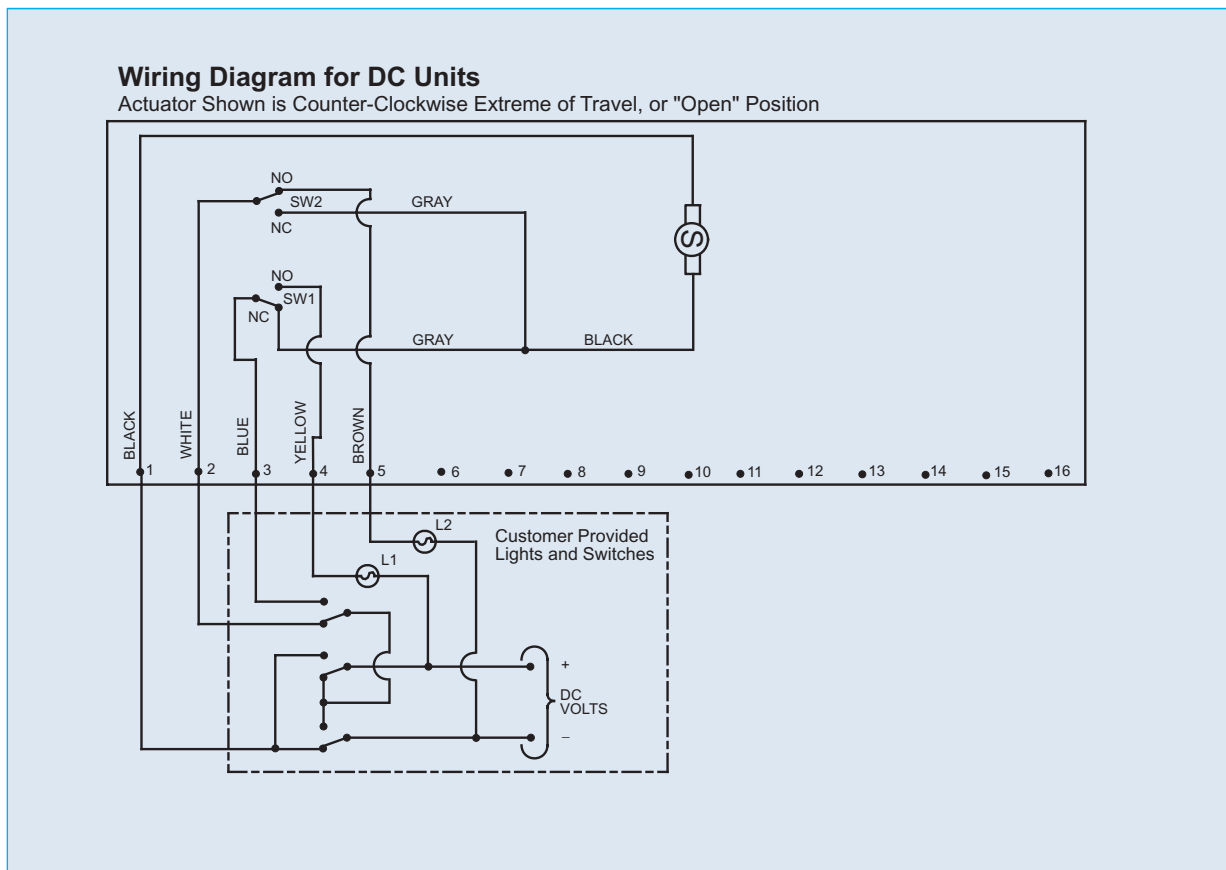
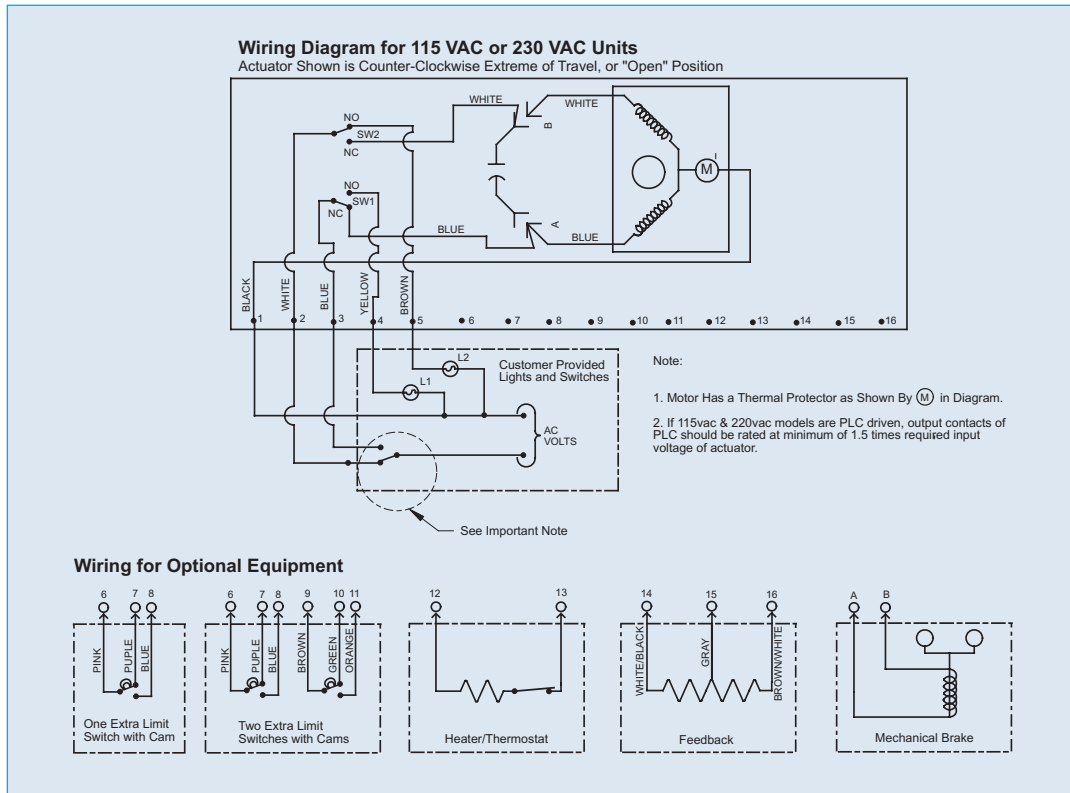
Options (continued)

- Voltages (12 or 24vdc; 12, 24, or 230vac)
- Custom wiring configurations
- Time delay
- No manual override
- Mechanical Brake
- Auxiliary (additional) Limit Switches

Wiring Diagrams

Series 92 & 08

Wiring Diagrams



Please note: These are general wiring diagrams please contact Factory for specific diagrams



Series 79P (Aluminum)



**Series 79P (Glass-filled Polyamide)
with solenoid valve**

Pneumatic Actuators

Specifications

Series 79 P: Type – Double Piston, Double Rack and Pinion

Bodies – Aluminum, Glass-filled Polyamide, and 316 ss

Torque – 58 to 44,611 in-lbs

Models– Air-to-Air

Spring Return (Fail Open)

Spring Return (Fail Closed)

Air Supply – 60 psi – 120 psi

Air Connections – 1/4" NPT

Mounting Dim. – ISO and NAMUR



Series 79P (316 Stainless Steel)

Standard Features

- Standard actuator bodies glass-filled polyamide (highly corrosion resistant)
- Double piston, double rack and pinion design (polyamide)
- ISO mounting pattern with female star outdrive (for ease of valve mounting)
- NAMUR mounting pattern (for accessory mounting solenoids, limit switches, positioners, etc.)
- Recommended air supply 80 psi (normal) to 120 psi (maximum) filtered air
- Captive spring sets (spring return models only)
- Available in air-to-air (double acting) and air-to-spring (spring return failsafe) models
- Position Indication through visible indicator knob and actuator shaft flats
- Actuator shaft is glass filled polyamide with SS insert, 303 SS or cataphoresis encapsulated steel

Standard Features

- Manual override
- For A-A – Insert wrench onto flats of stem and rotate
- For A-S – Declutchable gear-operator is required

Options

- 316 SS bodies (Models BS79P thru ES79P)
- Aluminum bodies encapsulated with Rilsan and cataphoresis (Models A79PA thru M79P)
- Flush mount NAMUR style solenoids in various Type ratings and voltages with mufflers, speed controls, and push button override standard.
- NAMUR double limit switches in a variety of Type ratings (Type 4 and 7 standard) and sensor options (2-mechanical SPDT switches standard)
- Positioners in either 3-15 psi or 4-20mA for modulating service requiring no solenoid (optional limit switch packages and 4-20mA output signal available)

Technical Data and Standards

Physical Properties of Thermoplastics Used In Asahi Valves*

Properties	Unit	PVC	HI-PVC	CPVC	PP	PVDF	Test Method
Specific Gravity	-	1.43	1.40	1.54	0.92	1.76	ASTM D792
Tensile Strength	psi	7690 - 8700	7110 - 7540	8410 - 9280	4210 - 4930	7980 - 8700	ASTM D638
Elongation	%	60 - 120	60 - 180	30 - 80	200 - 400	30 - 60	ASTM D638
Tensile Modulus	10 ³ psi	421 - 479	392 - 421	479 - 508	116 - 174	174 - 203	ASTM D638
Flexural Strength	psi	11310 - 15660	11310 - 12760	14210 - 15660	7830 - 9280	13490 - 14940	ASTM D790
Flexural Modulus	10 ³ psi	377 - 406	290 - 334	421 - 450	203 - 232	218 - 261	ASTM D790
Compressive Strength	psi	12760 - 14210	8410 - 11310	14210 - 15660	8410 - 10010	12760 - 14210	ASTM D695
Compressive Modulus	10 ³ psi	232 - 261	189 - 218	247 - 290	131 - 160	145 - 203	ASTM D695
Poisson's Ratio	-	0.37	NA	0.35	0.44	0.28	ASTM D638/D790
Hardness (Rockwell R)	degrees	114 - 116	112 - 116	117	95	110	ASTM D785
Impact Strength (Izod) with V-Notch	kJ/m ²	3 - 5	10 - 15	4 - 6	4 - 7	8 - 10	ASTM D256
Heat resistance	°F	32 ~ 140	23 ~ 140	32 ~ 194	- 4 ~ 194	- 40 ~ 248	-
Deflection Temperature (at 66 psi)	°F	163 - 167	162 - 165	250	230 - 244	302	ASTM D648
Thermal Expansion	10 ⁻⁵ mm/mm/°C	6 - 8	7 - 8	6 - 8	11 - 12	11 - 12	ASTM D696
Thermal Conductivity	Kcal/mh°F	0.15	0.11	0.14	0.09	0.11	ASTM C177
Dielectric Strength	kV/inch	0.90	NA	0.90	1.02	1.18	ASTM D149
Volume Resistivity	ohm-inch	2.17 x 10 ¹⁵	NA	2.28 x 10 ¹⁶	1.93 x 10 ¹⁶	1.97 x 10 ¹⁵	ASTM D257
Dielectric Constant							
10 Hz	-	2.8 - 3.0	NA	NA	NA	NA	ASTM D150
60 Hz	-	3.15	NA	2.93	2.42	9.8	
10 ³ Hz	-	3.14	NA	2.92	2.41	9.5	
10 ⁶ Hz	-	2.85	NA	2.69	2.41	7.5	
Dissipation Factor							
60 Hz	10 ⁻²	1.18	NA	1.09	NA	0.05	ASTM D150
10 ³ Hz	10 ⁻²	1.91	NA	1.10	0.044	0.048	
10 ⁶ Hz	10 ⁻²	1.72	NA	0.92	0.063	0.160	
Water absorption 24 hr. 1/8 inch thickness	%	0.07	NA	0.15	0.01	0.03	ASTM D570

* This data for reference only.

Standards

ANSI B1.20.1 (Was B2.1) (American National Standards Institute)

This specification details the dimensions and tolerance for tapered pipe threads. This standard is referenced in the ASTM standard for threaded fittings mentioned above.

ASTM STANDARD D-1784 A (American Society for Testing and Materials)

This standard covers PVC and CPVC compounds used in the manufacture of plastic pipe, valves, and fittings. It provides a means for selecting and identifying compounds on the basis of a number of physical and chemical criteria. Conformance to a particular material classification in this standard requires meeting a number of minimum physical and chemical properties.

ANSI B16.5

This specification sets forth standards for bolt holes, bolt circles, and overall dimensions for steel 150 lbs flanges.

ASTM STANDARD D-3222

This standard covers the polymerization method and physical properties of PVDF (polyvinylidene fluoride) fluoroplastic materials for molding and extrusion. Organizations other than ASTM issue standards that are commonly encountered in industrial thermoplastic piping design. The most important of these are described here.

ASTM STANDARD D-4101 (FORMERLY D-2146)

This standard covers the polymeric content and physical characteristics of PP (polypropylene) plastic materials for injection molding and extrusion.

Additional Asahi/America Products

Single-Wall Piping Systems

Asahi/America offers piping systems in Proline® polypropylene, Purad® PVDF, PolyPure® natural polypropylene, and UltraPro® Halar® with pipe diameters ranging from 1/2" to 24" and above. Each system offers a wide assortment of fittings and joining techniques. Air-Pro® HDPE compressed air systems and Pro-Vent® PP ventilation and exhaust systems are examples of the effective application of thermoplastics.

High Purity Piping Systems

Asahi/America and its partner, Agru, have been providing quality, high purity thermoplastic systems for decades. From state-of-the-art Purad® Ultra High Purity PVDF to cost-effective PolyPure® and PP-Pure™ Polypropylene we have the experience and expertise to provide you with the right product for the right application.

EM-Technik Tube Systems

Asahi/America has partnered with EM-Technik of Germany to provide high quality compression fittings, valves and control products for tube systems. Components are available with a variety of connection methods, including common flared ends, and are offered in PFA, PVDF, or polypropylene. EM-Technik Tube Systems are designed to provide you with the right fit.

Double-Contained Piping Systems

Asahi/America has pioneered engineered, thermoplastic double-contained piping systems since 1987. Since then, our comprehensive systems and technical support have provided unsurpassed quality and reliability. Today, Asahi/America offers three systems to match your application requirements, no matter how demanding:

Duo-Pro® is fabricated from separate pipes in sizes 20" and above. It is available in polypropylene, PVDF, and E-CTFE with carrier and containment pipes being of the same or different materials.

Poly-Flo® is of unitary construction, extruded by a patented process, in sizes from 1" to 4" (carrier), in polypropylene, HDPE and PVDF.

Fluid-Lok® is a fabricated system made exclusively from single wall HPDE pipe. It is available in a wide assortment of sizes and pressure ratings designed for your specific needs.

Dymatrix Specialty Valves

The Dymatrix™ specialty valve product line is engineered to offer unique solutions to critical wet process requirements. These valves are ideally suited for Chemical Process, CMP Slurry and UPW Water applications. Asahi/America's large stocking commitments allow us to quickly deliver critical products and leverage larger manufacturing volume. **Pinch Valves (PV3, PVM)** provides superior durability and eliminates particle generation in CMP slurry applications. **Diaphragm Valves (SDV, HDV)** are engineered for high cycle life and a compact design. **Needle Valves (NVM)** utilizes a dual stem for true linear flow control and integrated diaphragm for superior purity. **Pressure Regulators (HPRL, HPRS)** designed to provide precisely accurate and highly stable control.

Warranty: Limitation on Liability

Asahi/America, Inc., ("Seller") warrants, to the original Buyer only, that all products delivered hereunder shall be free from defects in design and manufacture for a period of one year from the date of delivery, provided that such products are installed, used, operated, adjusted and serviced only in a proper and appropriate manner and in strict accordance with any instructions relating thereto furnished to Buyer by Seller. In no event shall the foregoing warranty extend to any products in any way caused or allowed to be, or installed, operated or used in such a manner as to be, subject or exposed to conditions of misuse, abuse or accident.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESS OR IMPLIED. NO WARRANTY OF MERCHANTABILITY, NO IMPLIED WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE, AND NO IMPLIED WARRANTY ARISING BY USAGE OF TRADE, COURSE OF DEALING OR COURSE OF PERFORMANCE IS GIVEN BY SELLER OR SHALL ARISE BY OR IN CONNECTION WITH THIS SALE AND/OR THE SELLER'S AND/OR BUYER'S CONDUCT IN RELATION THERETO OR TO EACH OTHER, AND IN NO EVENT SHALL SELLER BE LIABLE ON ANY SUCH WARRANTY WITH RESPECT TO ANY PRODUCT.

Liability of the Seller under or in connection with this sale and/or the foregoing warranty shall be limited, at the sole option of the Seller, to one repair of, replacement of, or a refund of the purchase price of any products or part thereof (a), with respect to which Seller receives, promptly after Buyer's discovery of any alleged defect and prior to the expiration of the one-year warranty period as provided above, notice from Buyer or Buyer's claim defect and (b) which shall be returned to Seller by Buyer, as provided herein, promptly after Buyer's discovery of such alleged defect and which shall be determined by the Seller to have proven defective within the one-year warranty period provided above; failure by Buyer to notify

Seller and return such products to Seller after Buyer's discovery of such alleged defect shall constitute a waiver by Buyer of any and all claims of any kind with respect thereto. Any products returned by Buyer to Seller under the foregoing terms shall be returned to Seller's place of business freight prepaid, accompanied or preceded by Buyer's particularized statement of the claimed defect. The risk of loss and freight charges to and from Seller in connection with any returned products shall be borne by Buyer; but Seller shall bear such additional freight charges arising in connection with any such returned products ultimately determined by Seller to be defective under the terms of the foregoing warranty, the cost of repair or replacement (if any) of such products, and the risk of loss or damage which such products are in Seller's possession at its place of business. The foregoing remedy shall constitute the sole and exclusive remedy of the Buyer under or in connection with this sale and/or warranty of the Seller. Except as specifically provided herein, Seller shall not be responsible or liable for any costs, expenses or damages of Buyer in connection with any removal, repair or replacement (including any attempts or actions relating thereto) of any allegedly defective products, and no charge of setoff of any kind of Buyer relating thereto shall be made against the Seller without prior and specific written approval of Seller.

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