FLOWSERVE

McCANNA/MARPAC Valves

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AN ISO 9001 REGISTERED COMPANY

Ball Valve
Actuator Selection

Automation of McCANNA Ball Valves

Increasing labor rates throughout the world are just one reason why valve automation is becoming more and more important. Other reasons include the need for reliability, speed, increased productivity and added safety. Automation continues to grow in importance at Flowserve for one major reason — it is important to our customers.

Flowserve is committed to offering its customers a variety of reliable automated valve packages, assembled by either factory personnel or trained local distributor personnel.

This brochure is designed to assist you in properly sizing actuators and accessories for use with your McCANNA ball valves. Should you have any question or need additional information, please call your Flowserve representative. Additional contact information can be found on the back cover.

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Explanation of Actuator Sizing Procedure

Five factors affect valve torque and hence, actuator sizing. These are:
1) Seat Materials 2) Service 3) Actuator Design 4) Type of Control 5) Failure Mode of Actuator

For sizing applications the following formula should be used.
Actuator sizing torque = Basic valve torque x service factor x control factor x design factor

EXAMPLE: 3" McCannaseal valve, metal seats, 600 psig, nitrogen gas, fail-closed actuator on-off service, 80 psig air supply

Basic Torque		Service Factor		Control Factor		Design Factor		Auxiliary Equipment		Sizing Torque
3480	x	1.30	x	1.00	x	.80	+	0	=	3619 in-lb

Actuator Torque Requirement is the minimum allowable actuator sizing torque, or the minimum torque that any actuator selected must produce. This number represents the break torque for pneumatic rack-and-pinion double-acting actuators, the end torque for pneumatic rack-and-pinion spring-return actuators, or the minimum torque output for all others, including electric.

Basic Valve Torque is the basic valve input torque requirement in inch-pounds (refer to pages 4 through 10). Tables list valve torques for maximum valve pressure ratings and at various points less than maximum valve pressure ratings. In determining actuator torque requirements please be certain that you read all footnotes and use torque multipliers where appropriate. Once the minimum actuator torque has been computed, refer to the actuator manufacturers' specifications for selection of the appropriate actuator.

For proper actuator selection, it is imperative to know the minimum and maximum air supply pressure for all pneumatic actuators, and the desired cycle time and voltage for electric actuators.

Flowserve Actuator Sizing

A very large percentage of automated ball valves go into on-off service involving clean lubricating media and using TFE, high-temperature or high-pressure sealing materials. For these applications, please refer to the torque charts on pages 4 through 10.

For those cases that involve modulating service, or media other than clean, lubricating fluids (i.e. superheated steam, dry gas or slurries) that have an increasing effect on torque, you must use the factor multipliers to arrive at the correct torque. Please refer to page 11.

Actuator Sizing Factors

Many factors affect the proper sizing of an actuator for a valve. These factors may be broken down into five categories: 1) valve seat materials such as TFE, RTFE, graphite, metal, etc., 2) media conditions such as slurry vs. dry gas, 3) actuator design such as electric, double-acting pneumatic, or spring-return pneumatic, 4) type of control, i.e. on-off vs. throttling, 5) failure mode of actuator. Each of the above factors will affect the torque relationship between valve and actuator and therefore warrant a brief discussion.

I. Valve Materials

The material factor that has a significant effect on the valve torque is the seat material. For instance, Reinforced TFE seats will increase the valve torque by 10% - 30% when compared to virgin TFE II.

II. Line Media

One of the greatest effects of media on the torque requirement is when the valve is in slurry service. Here, the abrasion commonly associated with slurries affects the ball-seat interface area, where pitting of the ball surface and "scoring" or scratching of the seat may combine to increase friction and, hence, torque. In addition, some slurries and media that deposit scale may cause a buildup of material on the ball surface and in the ball cavity, thus creating a high breakaway and running torque. In most slurry services, torques increase by as much as 100%.

Less obvious is the effect of dry gases or steam. Dry gases including superheated steam, can increase torque up to 25% over that required in liquid service.

III. Torque Reduction Factors for Rack-and-Pinion Spring-Return Actuators on Soft Seated Valves.

When sizing rack-and-pinion pneumatic spring return actuators, a multiplier may be applied to the published ball valve torque. The following explains why this factor is used, and how it works.

The theory behind the 0.67 (or 67%) valve torque factor when sizing is based on the fact that published Flowserve valve torques are breakaway torques from the closed position, and spring ending or air ending torques. A spring-return actuator selected on this basis would probably be over-sized, since the valve torque is at maximum, and actuator torque is at minimum.

The .80 factor reflects the maximum valve torque expected at conditions, other than breakaway. This takes into consideration that the maximum output torque of the spring-return rack-and-pinion actuator is at the start of the spring (or air) stroke. The actuator air (or spring) break torque will exceed the valve breakaway torque by an amount greater than the valve torque when reduced using the .80 factor.

This factor would not necessarily apply to crank arm actuator, because the torque curve for these designs dips in the center, and may fall below the valve running torque if not sized based on full break torque for the valve.

Actuator manufacturers typically publish all of the air and spring starting and ending torques, requiring the user to select an actuator by determining which torque values apply. This is done because the actuators may be used on other than ball valves. This also means that they can't allow for torque curves of the equipment being actuated, without making the actuator selection process more cumbersome.

The .80 torque factor does not apply to our double-acting actuators because the output torque is constant over the full stroke. Thus, double-acting actuators are sized based on maximum valve torque, maximum actuator torque.

IV. Type of Control

Due to breakaway (static) friction, a valve's torque is highest as it starts to turn. Since a modulating application requires high torque starts and close control over the ball position, a 25% more powerful actuator performs better than an actuator sized for simple open-closed service.

It should be noted that improper actuator assembly, gland tightening or alignment may increase required torque.

Because of the nature of synthetic seal materials used in ball valves, the torque values are not constant. Conditions such as pressure, temperature, type of fluid, amount and kind of suspended material in the fluid, and frequency of operation all affect the torque values.

The accompanying tables recommend the minimum required output of the actuator to operate the valve from closed to open position. The values have been selected on the basis of breakaway torque of the valve. A safety factor, above tested breakaway torque, has been introduced in these tables to allow for the valve torque increase during the lifetime of the seats from deposits on seats and ball.

Actuator torque outputs are tabulated for electric and pneumatic actuators.

Note: McCANNA Automated Ball Valves are intended for remote on/off service, control system sequencing in on/off service or simple modulating flow control. Please consult Flowserve for recommendations on service other than the above.

Note: It is very important to note here that air breakaway applies to "fail-close" units, and spring breakaway applies to "fail-open" units.

McCannaseal Regular Port Valve Basic Sizing Torque

T Seats – Class 150 & 300 Valves (in-lb)

Valve Size	Line Pressure (psig)			
	Vacuum to 100	100 to 285	285 to 500	500 to 740
½", ¾", 1"	70	90	115	140
1½"	160	200	265	320
2"	270	360	470	570
3"	750	980	1,300	1,600
4"	1,500	1,950	2,600	3,200
6"	4,050	5,400	7,100	8,700
8"	8,300	10,500	14,000	17,000
10"	14,000	19,000	25,000	28,000
12"	20,000	27,000	36,000	43,000
14"	27,000	38,000	49,000	62,000

3, R, U & W Seats – Class 150, 300 & 600 Valves (in-lb)

Valve Size	Line Pressure (psig)					
	Vacuum to 100	100 to 285	285 to 500	500 to 740	740 to 1100	1100 to 1480
½", ¾", 1"	90	115	150	185	240	290
1½"	210	265	350	420	550	660
2"	360	480	620	750	980	1,200
3"	1,000	1,300	1,700	2,100	2,700	3,200
4"	2,000	2,600	3,400	4,200	5,400	6,500
6"	5,400	7,200	9,500	11,500	15,000	18,000
8"	11,000	14,000	18,500	23,000	30,000	36,000
10"	18,500	25,000	33,000	40,000	52,000	62,000
12"	27,000	36,000	48,000	58,000	71,000	87,000
14"	36,000	49,000	66,000	78,000	101,000	125,000

*G & J Seats – Class 150, 300 & 600 Valves (in-lb)

Valve Size	Line Pressure (psig)					
	Vacuum to 100	100 to 285	285 to 500	500 to 740	740 to 1100	1100 to 1480
½", ¾", 1"	120	165	215	265	360	450
1½"	270	370	480	590	800	1,000
2"	480	650	850	1,040	1,400	1,750
3"	1,300	1,800	2,400	2,900	4,000	4,900
4"	2,700	3,700	4,900	5,900	8,000	10,000
6"	7,400	10,200	13,500	16,500	22,500	28,000
8"	15,000	20,000	27,000	33,000	45,000	56,000
10"	25,000	35,000	47,000	58,000	78,000	96,000
12"	36,000	50,000	68,000	84,000	104,000	13,000
14"	49,000	70,000	92,000	115,000	149,000	186,000

L Seats – Class 150 & 300 Valves; **M Seats – Class 150, 300, 600, 900 1500 Valves (in-lb)

Valve Size	Line Pressure (psig)							
	Vacuum to 100	100 to 285	285 to 500	500 to 740	740 to 1100	1100 to 1480	1480 to 1850	1850 to 2220
½", ¾", 1"	120	165	260	320	430	540	610	700
1½"	270	370	580	710	960	1,200	1,400	1,600
2"	480	650	1,020	1,730	1,680	2,100	2,400	2,800
3"	1,300	1,800	2,880	3,480	4,800	5,880	6,800	7,740
4"	2,700	3,700	5,880	7,080	9,600	12,000	14,000	16,000
6"	7,400	10,200	16,200	19,800	27,000	33,600	40,000	44,000
8"	15,000	20,000	32,400	39,600	54,000	67,200	81,000	93,000
10"	25,000	35,000	56,400	69,600	93,600	115,200	127,000	148,000
12"	40,000	55,000	85,000	100,000	131,000	163,000	196,000	228,000
14"	50,000	75,000	15,000	135,000	188,000	235,000	282,000	328,000

Note: Torques are for clean fluids only. Other services such as dry gases, or slurry/abrasive result in higher torques.High lubricity clean fluids reduce torque requirements. Consult Flowserve for information.*There are three grades of "G" seats. Please refer to MMAPS0002.**There are two different "M" seats (Stellite & Waukesha 88). Refer to MMAPS0005.

McCannaseal Full-Port Valve Sizing Torque

T Seats – Class 150 & 300 Valves (in-lb)

Valve Size	Line Pressure (psig)			
	Vacuum to 100	100 to 285	285 to 500	500 to 740
1"	160	200	265	320
1½"	270	360	470	570
2"	750	980	1,300	1,600
3"	1,500	1,950	2,600	3,200
4"	4,050	5,400	7,100	8,700
6"	8,300	10,500	14,000	17,000
8"	14,000	19,000	25,000	28,000
10"	20,000	27,000	36,000	43,000
12"	27,000	38,000	49,000	62,000

3, R, U & W Seats – Class 150, 300 & 600 Valves (in-lb)

Valve Size	Line Pressure (psig)					
	Vacuum to 100	100 to 285	285 to 500	500 to 740	740 to 1100	1100 to 1480
1"	210	265	350	420	550	660
1½"	360	480	620	750	980	1,200
2"	1,000	1,300	1,700	2,100	2,700	3,200
3"	2,000	2,600	3,400	4,200	5,400	6,500
4"	5,400	7,200	9,500	11,500	15,000	18,000
6"	11,000	14,000	18,500	23,000	30,000	36,000
8"	18,500	25,000	33,000	40,000	52,000	62,000
10"	27,000	36,000	48,000	58,000	71,000	87,000
12"	36,000	49,000	66,000	78,000	101,000	125,000

*G & J Seats – Class 150, 300 & 600 Valves (in-lb)

Valve Size	Line Pressure (psig)					
	Vacuum to 100	100 to 285	285 to 500	500 to 740	740 to 1100	1100 to 1480
1"	270	370	480	590	800	1,000
1½"	480	650	850	1,040	1,400	1,750
2"	1,300	1,800	2,400	2,900	4,000	4,900
3"	2,700	3,700	4,900	5,900	8,000	10,000
4"	7,400	10,200	13,500	16,500	22,500	28,000
6"	15,000	20,000	27,000	33,000	45,000	56,000
8"	25,000	35,000	47,000	58,000	78,000	96,000
10"	36,000	50,000	68,000	84,000	104,000	130,000
12"	49,000	70,000	92,000	115,000	149,000	186,000

L Seats – Class 150 & 300 Valves; **M Seats – Class 150, 300, 600, 900 1500 Valves (in-lb)

Valve Size	Line Pressure (psig)							
	Vacuum to 100	100 to 285	285 to 500	500 to 740	740 to 1100	1100 to 1480	1480 to 1850	1850 to 2220
1"	270	370	580	710	960	1,200	1,400	1,600
1½"	480	650	1,020	1,730	1,680	2,100	2,400	2,800
2"	1,300	1,800	2,880	3,480	4,800	5,880	6,800	7,740
3"	2,700	3,700	5,880	7,080	9,600	12,000	14,000	16,000
4"	7,400	10,200	16,200	19,800	27,000	33,600	40,000	44,000
6"	15,000	20,000	32,400	39,600	54,000	67,200	81,000	93,000
8"	25,000	35,000	56,400	69,600	93,600	115,200	127,000	148,000
10"	40,000	55,000	85,000	100,000	131,000	163,000	196,000	228,000
12"	50,000	75,000	15,000	135,000	188,000	235,000	282,000	328,000

Note: Torques are for clean fluids only. Other services such as dry gases, or slurry/abrasive result in higher torques.High lubricity clean fluids reduce torque requirements. Consult Flowserve for information.*There are three grades of "G" seats. Please refer to MMAPS0002.**There are two different "M" seats (Stellite & Waukesha 88). Refer to MMAPS0005.

Petro E790, E325, E525 Basic Sizing Torques

Petro E790 Valve Basic Sizing Torques (in-lb)

Valve Size	Seat/Seal Code	Line Pressure (psig)					Maximum Rated Pressure		
		to 100	100 to 500	500 to 1000	1000 to 1500	1500 to 2500	Size	JT JL	KT KL
¼", ½", ⅜"	TT TE TF TL	40	45	55	65	85	¼", ½", ⅜"	180	180
	RT RE RF RL PC	110	110	110	125	125			
¾"	TT TE TF TL	125	125	125	150	150	¾"	250	370
	RT RE RF RL PC	175	175	175	200	200			
1"	TT TE TF TL	190	190	190	210	250	1"	450	450
	RT RE RF RL PC	250	250	250	252	345			
1/1¼"	TT TE TF TL	220	240	340	400	450	1¼"	650	930
	RT RE RF RL PC	410	410	410	410	520			
1½"	TT TE TF TL	240	270	340	399	520	1½"	700	950
	RT RE RF RL PC	375	375	415	495	585			
2"	TT TE TF TL	375	375	410	470	575	2"	850	–
	TR RE RF RL PC	440	440	535	580	705			

E325 Valve Basic Sizing Torques (in-lb)

Valve Size	Seat/Seal Code	Line Pressure (psig)					Maximum Rated Pressure	
		to 100	100 to 500	500 to 1000	1000 to 1500	1500 to 2500	Size	JL
¼", ⅜", ½"	TT TF	30	35	40	45	50	¼", ⅜",½"	120
	RT RF PC	40	50	50	60	65		
¾"	RT RE	45	50	50	60	60	¾"	180
	RT RF PC	60	70	70	75	80		
1"	TT TF	90	100	115	125	135	1"	240
	TF TL	120	130	150	175	175		
1¼"	TT TF	155	155	170	185	200	1¼"	625
	RT RF PC	200	200	210	240	250		
1½"	TT TF	155	155	170	185	200	1½"	625
	RT RF PC	200	200	210	240	250		
2"	TT TF	175	175	210	250	280	2"	800
	RT RF PC	230	230	280	320	360		

E525 Valve Basic Sizing Torques (in-lb)

Valve Size	Seat/Seal Code	Line Pressure (psig)					Maximum Rated Pressure	
		to 100	100 to 500	500 to 1000	1000 to 1500	1500 to 2500	Size	JL
½"	TT TF	45	50	50	60	60	½"	120
	RT RF PC	60	70	70	75	80		
¾"	RT RE	90	100	115	125	135	¾"	180
	RT RF PC	120	130	150	175	175		
1"	TT TF	155	155	170	185	200	1"	240
	TF TL	200	200	210	240	250		
1½"	TT TF	175	175	210	250	280	1½"	625
	RT RF PC	230	230	280	320	360		
2"	TT TF	245	250	280	320	360	–	–
	RT RF PC	300	310	370	410	450		

E-Series Flanged Class 150 & 300 Valve Basic Sizing Torques

Regular Port – T Seats – Models ERP1 & ERP3 (in-lb)

Valve Size	Line Pressure (psig)					
	50	100	200	285	450	740
½"	25	25	25	25	25	25
¾"	35	35	35	35	35	35
1"	45	45	50	53	55	60
1½"	150	150	150	150	150	150
2"	190	190	200	230	240	250
3"	285	285	300	420	460	550
4"	530	530	570	600	835	1250
6"	900	900	1,150	1350	2900	4300
8"	2500	2500	3,500	4400	4500	6700
10"	8640	8640	8,640	8640	10800	13000

Regular Port – P&R Seats – Models ERP1 & ERP3 (in-lb)

Valve Size	Line Pressure (psig)					
	50	100	200	285	450	740
½"	25	25	25	25	25	25
¾"	35	35	35	35	35	35
1"	45	45	50	53	55	60
1½"	150	150	150	150	150	150
2"	200	200	210	260	270	275
3"	370	370	385	400	500	650
4"	725	725	780	825	1,050	1450
6"	1000	1000	1200	1400	3200	4800
8"	4000	4000	4400	4700	5100	9000
10"	10800	10800	10800	10800	13500	16250

Full Port – T Seats – Models EFP1 & EFP3 (in-lb)

Valve Size	Line Pressure (psig)					
	50	100	200	285	450	740
½"	50	50	50	50	75	100
¾"	110	110	120	135	150	175
1"	150	150	160	180	200	220
1½"	190	190	200	230	240	250
2"	240	240	245	250	330	450
3"	530	530	570	600	835	1250
4"	900	900	1150	1,350	2,900	4300
6"	2500	2500	3500	4400	4500	6700
8"	8640	8640	8640	8640	10800	13000
10"	17280	17280	17280	17280	21,650	26,000

Full Port – P&R Seats – Models EFP1 & EFP3 (in-lb)

Valve Size	Line Pressure (psig)					
	50	100	200	285	450	740
½"	125	120	120	125	150	175
¾"	150	150	160	180	200	220
1"	190	190	200	230	240	250
1½"	200	200	210	260	270	275
2"	370	370	385	400	500	650
3"	725	725	780	825	1050	1450
4"	1000	1000	1200	1400	3200	4800
6"	4000	4000	4400	4700	5100	9000
8"	10800	10800	10800	10800	13500	16250
10"	21600	21600	21600	21600	27000	32500

J-Series Class 150 & 300 Valve Basic Sizing Torques

Regular Port – T Seats – Models JRP1 & JRP3 (in-lb)

Valve Size	Line Pressure (psig)					
	50	100	200	285	450	740
½"	25	25	25	25	25	25
¾"	28	29	30	30	30	30
1"	60	62	65	65	70	75
1½"	150	150	155	155	160	170
2"	220	220	225	230	235	240
3"	325	350	400	425	500	600
4"	500	550	575	625	675	850
6"	825	900	1000	1100	1200	1400
8"	1400	1500	1750	2050	2300	3000
10"	5500	6000	7000	8000	9500	14,000

Regular Port – R Seats – Models JRP1 & JRP3 (in-lb)

Valve Size	Line Pressure (psig)					
	50	100	200	285	450	740
½"	28	28	29	30	30	30
¾"	35	35	35	35	35	35
1"	70	70	70	70	70	70
1½"	200	200	210	210	220	230
2"	325	325	325	325	350	375
3"	325	325	375	400	475	575
4"	550	650	700	750	950	1100
6"	1300	1500	1650	1800	2200	2800
8"	2300	2600	3000	3500	4800	6000
10"	3200	3800	4200	5000	7000	9000

Full Port – T Seats – Models JFP1 & JFP3 (in-lb)

Valve Size	Line Pressure (psig)					
	50	100	200	285	450	740
½"	28	29	30	30	30	30
¾"	60	62	65	65	70	75
1"	150	150	155	155	160	170
1½"	220	220	225	230	235	240
2"	325	350	400	425	500	600
3"	500	550	575	625	675	850
4"	825	900	1000	1100	1200	1400
6"	1400	1500	1750	2050	2300	3000
8"	5500	6000	7000	8000	9500	14,000

J-Series Class 150 & 300 Valve Basic Sizing Torques

Full Port – R Seats – Models JFP1 & JFP3 (in-lb)

Size	Line Pressure (psig)					
	50	100	200	285	450	740
½"	35	35	35	35	35	35
¾"	70	70	70	70	70	70
1"	200	200	210	210	220	230
1½"	325	325	325	325	350	375
2"	325	325	375	400	475	575
3"	550	650	700	750	950	1100
4"	1300	1500	1650	1800	2200	2800
6"	2300	2600	3000	3500	4800	6000
8"	6,000	7,000	8,000	9,000	12,000	14,000
10"	8,500	9,500	12,000	14,000	16,000	19,500

Note: Torques are for clean fluids only. Other services such as dry gases, or slurry/abrasive result in higher torques. High lubricity clean fluids reduce torque requirements. Consult Flowserve for information.

Regular Port – P Seats – Models JRP1 & JRP3 (in-lb)

Valve Size	Line Pressure (psig)					
	50	100	200	285	450	740
½"	30	30	30	30	30	30
¾"	38	38	38	40	40	40
1"	60	60	60	63	65	70
1½"	130	130	135	140	140	150
2"	240	240	245	250	260	270
3"	400	450	500	525	650	700
4"	700	780	820	900	1100	1200
6"	2,000	2,500	2,800	3,000	3,800	4,000
8"	2,600	3,000	3,500	4,000	5,800	7,000
10"	4,000	5,000	5,800	6,500	8,800	11,000

Full Port – P Seats – Models JRP1 & JRP3 (in-lb)

Valve Size	Line Pressure (psig)					
	50	100	200	285	450	740
½"	38	38	38	40	40	40
¾"	60	60	60	63	65	70
1"	130	130	135	140	140	150
1½"	240	240	245	250	260	270
2"	400	450	500	525	650	700
3"	700	780	820	900	1100	1200
4"	2,000	2,500	2,800	3,000	3,800	4,000
6"	2,600	3,000	3,500	4,000	5,800	7,000
8"	4,000	5,000	5,800	6,500	8,800	11,000

McCannaflo F602 Threaded Valve Basic Sizing Torques

T Seats – Operating Line Pressures (in-lb)

Valve Size	Line Pressure (psig)				
	Vacuum to 100	100 to 285	285 to 500	500 to 740	740 to 1100
¼"	15	20	30	35	35
⅜"	15	20	30	35	35
½"	20	25	40	45	50
¾"	30	35	60	70	75
1"	55	70	120	135	145
1¼"	90	115	200	225	NR
1½"	130	160	270	305	NR
2"	225	280	480	540	NR

R Seats – Operating Line Pressures (in-lb)

Valve Size	Line Pressure (psig)						
	Vacuum to 100	100 to 285	285 to 720	720 to 900	900 to 1000	1000 to 1100	1100 to 1200
¼"	20	25	40	40	45	50	50
⅜"	20	25	40	40	45	50	50
½"	25	30	50	60	60	65	65
¾"	35	45	75	90	90	95	100
1"	70	90	150	170	180	190	200
1¼"	115	145	250	280	290	310	NR
1½"	160	200	340	380	400	430	NR
2"	280	350	600	670	720	760	NR

Note: Torques are for clean fluids only. Other services such as dry gases, or slurry/abrasive result in higher torques. High lubricity clean fluids reduce torque requirements. Consult Flowserve for information.

Service Factors

McCannaseal Ball Valves

Service	T Seats	R,U,W Seats	A,G,J Seats	L,M Seats
High Lubricity Fluids	0.8	0.75	0.7	0.7
Dry Gases	1.1	1.15	1.15	1.15
Solids/Abrasives	Not Rec.	1.4	1.3	1.3

E-Series Flanged Ball Valves

Service	T Seats	R Seats	2 Seats
Dry Gases	1.25	1.25	1.25
Slurries	2	2	2

Actuator Design Factor

Actuator	Factor
Spring-Return	0.8
Double-Acting	1
Electric	1

McCannaflo F602 Valves

Service	T Seats	R Seats
High-Lubricity Fluids	0.8	0.8
Dry Gases	1.1	1.1
Solids/Abrasives	NR	1.4

Control Factor

Control Type	Factor
On/Off	1
Modulating	1.25

Additional Torque Requirements for Auxiliary Equipment

Equipment Type	Torque (in-lb)
Proximity Switches	0
Limit Switches	4
Special Heavy-Duty Switches	Consult Flowserve
Positioners	15
Overrides	50

Actuator Selection

Electric or Double-Acting Pneumatic

Determine appropriate valve torque requirements from pages 4 through 10. For double-acting actuators, select the actuator whose torque output at available air supply exceeds breakaway torque requirements of the valve.

Spring-Return Pneumatic

For fail-closed, spring-return actuators, select the appropriate size actuator whose torque output at end of spring stroke (at available air supply) meets or exceeds the sizing torque.

For fail-open, spring-return actuators, select appropriate actuator whose torque output at the end of the air stroke. For fail-open actuators, it is also necessary to determine that the torque output at the start of the spring stroke exceeds breakaway* requirements of the valve.

*Divide the sizing torque by .80 to determine this valve.

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