



Belimo Resilient Seat Butterfly Valves HD & L Series Technical Documentation

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Butterfly Valve Nomenclature

F6	200	L	+PRB	UP	-3	-T	-200
Valve F6 = 2-way F7 = 3-way	Valve Size 50 = 2" 65 = 2½" 80 = 3" 100 = 4" 125 = 5" 150 = 6" 200 = 8" 250 = 10" 300 = 12" 350 = 14" 400 = 16" 450 = 18" 500 = 20" 600 = 24"	Trim Material HD = Stainless Disc, Ductile Iron Body, EPDM Liner, 0% Leakage to 200 psi (2" to 6"), 150 psi (14"+) L = Stainless Disc, Ductile Iron Body, EPDM Liner, 0% Leakage to 200 psi (8" to 12") HDU/LU = Stainless Disc, Ductile Iron Body, EPDM Liner, 0% Leakage to 50 psi (3" to 10") VIC = Ductile Iron Grooved End Body, Nickel Coated Ductile Iron Disc, 0% Leakage up to 200 psi -150SHP = ANSI Class 150, Stainless Disc, Steel Body, RPTFE Seat, 0% Leakage up to 285 psi -300SHP = ANSI Class 300, Stainless Disc, Steel Body, RPTFE Seat, 0% Leakage up to 600 psi	Actuator Type Non Fail-Safe ARB, ARX AMB, AMX GMB, GMX GRB, GRX GR/GM... N4 DRB, DRX DR... N4 PRB, PRX SY Fail-Safe Electronic GKB, GKX DKRB, DKRX DKR...N4 PKRX Spring Return AFB, AFX AFRB, AFRX	Power Supply -24 = 24 VAC/DC -110 = 110/120 VAC -120 = 120 VAC -230 = 230 VAC UP = 24-240 VAC or 24-125 VDC	Control -3-X1 = On/Off, Floating Point -SR = Modulating Input = 2-10 VDC -MFT or -MFT-X1 = Multi-Function Technology	-S = Built-in Auxiliary Switch N4 = NEMA 4/4X -T = Terminal Block	-200 = 8" -250 = 10"

"X" models are customizable. Refer to page 15 for programming options.

Ordering Example

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1 Choose the valve actuator combination.

F6200L+PRBUP-3-T-200

2 Specify preference or configuration.

3 For MFT orders only - select programming code (consult factory)

Programming codes, refer to page 15.

2-way Configuration

Non Fail-Safe	2 Pos.	Set Up Required Field Logic Determines Normal Position
	Modulating	<p>NC (Normally Closed) 0.5 VDC/2 VDC/4mA = Closed</p> <p>NO (Normally Open) 0.5 VDC/2 VDC/4mA = Open</p>
Fail-Safe	2 Pos.	NO/FO (Normally Open/Fail Open) Field Logic Determines Normal Position Valve Fails OPEN
		NC/FC (Normally Closed/Fail Closed) Field Logic Determines Normal Position Valve Fails CLOSED
	Modulating	NO/FC (Normally Open/Fail Closed) 0.5 VDC/2 VDC/4mA = Open Valve Fails CLOSED
		NC/FO (Normally Closed/Fail Open) 0.5 VDC/2 VDC/4mA = Closed Valve Fails OPEN
		NO/FO (Normally Closed/Fail Open) 0.5 VDC/2 VDC/4mA = Master Valve Open Master (Actuated) Valve Fails OPEN
		NC/FC (Normally Closed/Fail Closed) 0.5 VDC/2 VDC/4mA = Master Valve Closed Master (Actuated) Valve Fails CLOSED

3-way Configuration

Non Fail-Safe	2 Pos.	No Set Up Required Field Logic Determines Normal Position
	Modulating	<p>NC Master (Actuated) Valve (Normally Closed) 0.5 VDC/2 VDC/4mA = Closed</p> <p>NO Master (Actuated) Valve (Normally Open) 0.5 VDC/2 VDC/4mA = Open</p>
Fail-Safe	2 Pos.	NO/FO (Normally Open/Fail Open) Field Logic Determines Normal Position Master (Actuated) Valve Fails OPEN
		NC/FC (Normally Closed/Fail Closed) Field Logic Determines Normal Position Master (Actuated) Valve Fails CLOSED
	Modulating	NO/FO (Normally Open/Fail Closed) 0.5 VDC/2 VDC/4mA = Master Valve Open Master (Actuated) Valve Fails OPEN
		NO/FC (Normally Closed/Fail Open) 0.5 VDC/2 VDC/4mA = Maser Valve Open Master (Actuated) Valve Fails CLOSED
		NC/FO (Normally Closed/Fail Open) 0.5 VDC/2 VDC/4mA = Master Valve Closed Master (Actuated) Valve Fails OPEN
		NC/FC (Normally Closed/Fail Closed) 0.5 VDC/2 VDC/4mA = Master Valve Closed Master (Actuated) Valve Fails CLOSED

4 Does order require tagging?

Tagging: Valves may be tagged per customer specification. (\$12.00 per tag)

Example: Chiller 1
3rd Floor East

Part number for tagging: 99981-00101

5 Complete Ordering Example: **F6200L+PRBUP-3-T-200**

Configuration: **NO**

Programming: **X10**

Resilient Seat Butterfly Valve Product Range

		2-way			Suitable Actuators						
		Valve Nominal Size		Type	Non Fail-Safe				Fail-Safe		
C_v 90°	C_v 60°	IN	DN [mm]	2-way	HDU LU	L	HD		Spring Return	Electronic	
									HD	L	HD
115	44	2	50	F650				AR			
196	75	2½	65	F665				GR Series	AF Series		
302	116	3	80	F680	AR GR						GKR
600	230	4	100	F6100			DR				DKR
1022	392	5	125	F6125	GR				PR Series		PKR Series
1579	605	6	150	F6150	DR						
3136	1202	8	200	F6200L	PR						
5340	2047	10	250	F6250L		PR				PKR	
8250	3162	12	300	F6300L							
11917	4568	14	350	F6350							
16388	6282	16	400	F6400							
21705	8320	18	450	F6450							
27908	10698	20	500	F6500							
43116	16528	24	600	F6600							
					SY Series (2 Year Warranty)						

		3-way			Suitable Actuators						
		Valve Nominal Size		Type	Non Fail-Safe				Fail-Safe		
C_v 90°	C_v 60°	IN	DN [mm]	3-way	HDU	L	HD		Spring Return	Electronic	
									HD	L	HD
115	44	2	50	F750				AM			
196	75	2½	65	F765					GM Series	AF	
302	116	3	80	F780	GM						GK
600	230	4	100	F7100							
1022	392	5	125	F7125	2*GM Series				PR Series		PKR Series
1579	605	6	150	F7150							
3136	1202	8	200	F7200L							
5340	2047	10	250	F7250L		PR					
8250	3162	12	300	F7300L							
11917	4568	14	350	F7350							
16388	6282	16	400	F7400							
21705	8320	18	450	F7450							
					SY Series (2 Year Warranty)						



Mode of Operation

Butterfly valves are capable of handling higher flow rates with relatively low pressure loss. These valves may be used for isolation (shut-off) service or throttling service within a range of 0-60 degrees for two-way valves. Butterfly valves are controlled with a maintenance-free electronic actuator or manually with an ergonomic handle or gear operator.

Product Features

The unique disc and seat design ensures positive valve seating while maintaining low seating torque.

Actuator Specifications

Control type	on/off, floating point, modulating, 2-10 VDC, multi-function technology (MFT)
Manual override	all models
Electrical connection	3 ft. [1 m] cable terminal block (-T models)
Communication (PR)	BACnet MS/TP, NFC, listed by BTL, Modbus

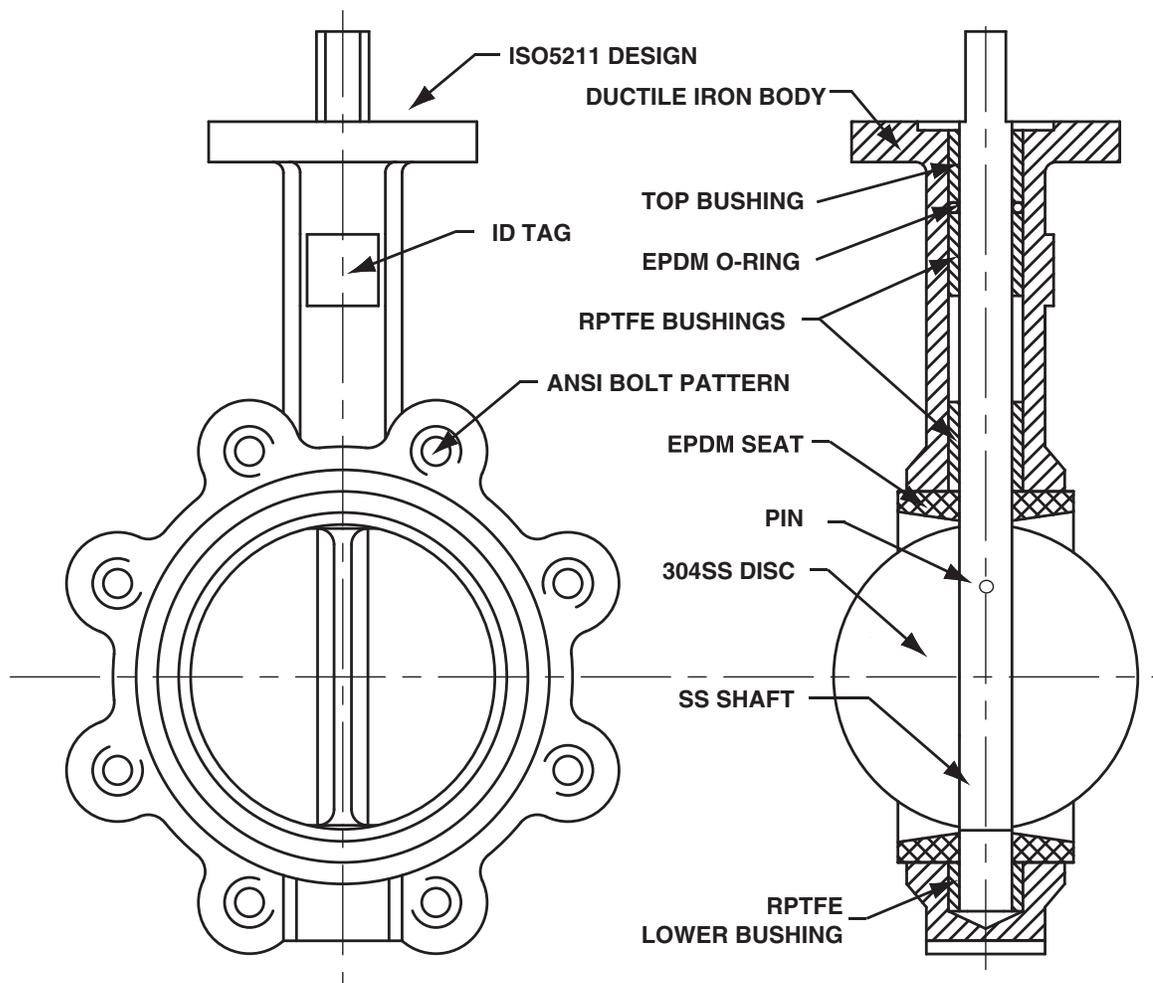
Valve Specifications

Service	chilled, hot water, 60% glycol
Flow characteristic	F6 modified equal percentage F7 modified linear
Sizes	2" to 24"
End fitting	for ASME/ANSI Class 125/150 flanges
Materials	<ul style="list-style-type: none"> Body: ductile iron ASTM A536 Body finish: polyester powder coat Disc: 304 stainless steel Shaft: HD Series: 416 stainless steel L Series: 420 stainless steel Seat: EPDM O-rings: EPDM Bushings: HD Series: RPTFE L Series: bronze, steel, PTFE
Media (water) temp. range	-22°F to +250°F [-30°C to +120°C]
Body pressure rating	232 psi cold working pressure (CWP)
Close-off pressure	HDU, LU: 50 psi, 3" to 10" HD: 200 psi, 2" to 6" HD: 150 psi, 14" to 24" L Series: 200 psi 8" to 12"
Rangeability	10:1
Maximum velocity	12 FPS
Leakage	0%

Belimo resilient seat HD and L Series Butterfly Valves are designed for use in ANSI Class 150 piping systems and are supplied in standard lug style body designs.

VALVE DESIGN FEATURES

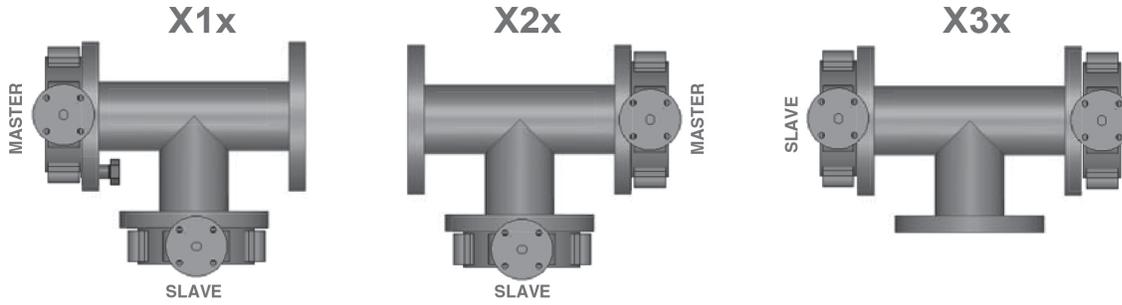
- Unique seat and disc design ensures positive valve sealing while maintaining low seating torque
- Butterfly valve discs are precision machined to half ball profile, providing a precise disc-to-seat relationship
- Cartridge style seat incorporates an elastomer bonded to a phenolic stabilizing ring, eliminating elastomer movement and reducing seat tearing or fatiguing due to bunching
- Cartridge seat has a much smaller mass of elastomer than traditional boot seat designs, limiting seat swell and the accompanying variations in seating torque
- The five bushing design completely isolates the valve shaft from the body, resulting in increased control of the valve disc, lower valve seating torque, and longer valve life
- Ductile Iron Full Lug Bodies
- EPDM liner
- Stainless Steel Disc
- Three Models to suit the application:
 - HDU/LU Series provides undercut disc to 50 psi
 - HD Series provides full-rated close-off to 200 psi (2" to 6") or 150 psi (12" to 24")
 - L Series provides full-rated close-off to 200 psi (8" to 12")
- 2-way and 3-way applications



Butterfly Valve Selection

HD, L Series Valves, 3-way Configuration

D163_12



CONFIG CODE	ON/OFF OR MOD@2 VDC MASTER VALVE IS	MASTER VALVE @ FAIL
X10	OPEN	FAIL IN PLACE
X11	OPEN	OPEN
X12	OPEN	CLOSED
X13	CLOSED	FAIL IN PLACE
X14	CLOSED	OPEN
X15	CLOSED	CLOSED

CONFIG CODE	ON/OFF OR MOD@2 VDC MASTER VALVE IS	MASTER VALVE @ FAIL
X20	OPEN	FAIL IN PLACE
X21	OPEN	OPEN
X22	OPEN	CLOSED
X23	CLOSED	FAIL IN PLACE
X24	CLOSED	OPEN
X25	CLOSED	CLOSED

CONFIG CODE	ON/OFF OR MOD@2 VDC MASTER VALVE IS	MASTER VALVE @ FAIL
X30	OPEN	FAIL IN PLACE
X31	OPEN	OPEN
X32	OPEN	CLOSED
X33	CLOSED	FAIL IN PLACE
X34	CLOSED	OPEN
X35	CLOSED	CLOSED

X Specifies Bi-Directional Flow Capability

Notes:

1. Slave Valve operates inversely of the Master Valve.
2. The Master Valve is always located on the run.
3. The Slave Valve may also have an actuator if required (Direct Coupled).
4. On/Off actuator normal position is a function of field logic.
5. Modulating actuator normal position (i.e., fully CW or fully CCW) is set by the direction control switch or field programming via NFC app.
6. All 3-way assemblies are designed for 90 degree actuator rotation.
7. **Actuators installed default over Master Valve.**

Flow in Schedule 40 Pipe (Fluid Velocity in GPM). Use with HD/L Series Butterfly Valves.							
VALVE	SIZE	2 FPS	4 FPS	6 FPS	8 FPS	10 FPS	12 FPS
HD	2"	19	39	59	78	98	117
HD	2½"	30	61	92	122	153	184
HD	3"	44	88	132	176	220	264
HD	4"	78	157	235	313	392	470
HD	5"	122	245	367	490	612	734
HD	6"	176	352	529	705	881	1058
L	8"	313	627	940	1253	1567	1880
L	10"	490	979	1469	1958	2448	2738
L	12"	705	1410	2115	2820	3525	4230
HD	14"	959	1919	2879	3838	4798	5758
HD	16"	1253	2507	3760	5013	6267	7520
HD	18"	1586	3173	4759	6345	7931	9518
HD	20"	1958	3917	5875	7834	9792	11750
HD	24"	2820	5640	8460	11280	14100	16921

It is not recommended to exceed 12 feet per second through resilient seat butterfly valves.

Velocities greater than 12 fps may damage the valve liner and disc. Torque may increase, potentially exceeding the actuator's capacity.

SERIES	MODEL #	Run Time(s) 90° @60Hz	Power Supply	Duty Cycle	CONTROL TYPE			Feedback
					Modulating	3 Point	On/Off	
PR	PRBUP-3-T*	35 seconds (default)	24-240 VAC/ 24-125 VDC, 50/60 Hz	100%		•	•	none
	PRXUP-3-T*	35, 30 - 120 seconds	24-240 VAC/ 24-125 VDC, 50/60 Hz	100%		•	•	none
	PRBUP-MFT-T*	35 seconds (default)	24-240 VAC/ 24-125 VDC, 50/60 Hz	100%	•	•	•	2-10 VDC
	PRXUP-MFT-T*	35, 30 - 120 seconds	24-240 VAC/ 24-125 VDC, 50/60 Hz	100%	•	•	•	2-10 VDC
PKR	PKRXUP-MFT-T*	35, 30 - 120 seconds	24-240 VAC/ 24-125 VDC, 50/60 Hz	100%	•	•	•	2-10 VDC
SY4	SY4-110	19 seconds	120 VAC ±10%, 50/60 Hz	30%		•	•	none, opt 1k Ω
	SY4-24	20 seconds	24 VAC/DC ±10%, 50/60 Hz	30%		•	•	none, opt 1k Ω
	SY4-220	20 seconds	230 VAC ±10%, 50/60 Hz	30%		•	•	none, opt 1k Ω
	SY4-24MFT	20 seconds	24 VAC/DC ±10%, 50/60 Hz	75%	•			2-10 VDC
	SY4-120MFT	24 seconds	120 VAC ±10%, 50/60 Hz	75%	•			2-10 VDC
	SY4-230MFT	22 seconds	230 VAC ±10%, 50/60 Hz	75%	•			2-10 VDC
SY5	SY5-110	26 seconds	120 VAC ±10%, 50/60 Hz	30%		•	•	none, opt 1k Ω
	SY5-24	26 seconds	24 VAC/DC ±10%, 50/60 Hz	30%		•	•	none, opt 1k Ω
	SY5-220	26 seconds	230 VAC ±10%, 50/60 Hz	30%		•	•	none, opt 1k Ω
	SY5-24MFT	26 seconds	24 VAC/DC ±10%, 50/60 Hz	75%	•			2-10 VDC
	SY5-120MFT	28 seconds	120 VAC ±10%, 50/60 Hz	75%	•			2-10 VDC
	SY5-230MFT	28 seconds	230 VAC ±10%, 50/60 Hz	75%	•			2-10 VDC
SY6	SY6-110	34 seconds	120 VAC ±10%, 50/60 Hz	30%		•	•	none, opt 1k Ω
	SY6-220	34 seconds	230 VAC ±10%, 50/60 Hz	30%		•	•	none, opt 1k Ω
	SY6-120MFT	38 seconds	120 VAC ±10%, 50/60 Hz	75%	•			2-10 VDC
	SY6-230MFT	35 seconds	230 VAC ±10%, 50/60 Hz	75%	•			2-10 VDC
SY7	SY7-110	50 seconds	120 VAC ±10%, 50/60 Hz	30%		•	•	none, opt 1k Ω
	SY7-120MFT	59 seconds	120 VAC ±10%, 50/60 Hz	75%	•			2-10 VDC
	SY7-230MFT	59 seconds	230 VAC ±10%, 50/60 Hz	75%	•			2-10 VDC
SY8	SY8-110	51 seconds	120 VAC ±10%, 50/60 Hz	30%		•	•	none, opt 1k Ω
	SY8-120MFT	79 seconds	120 VAC ±10%, 50/60 Hz	75%	•			2-10 VDC
	SY8-230MFT	79 seconds	230 VAC ±10%, 50/60 Hz	75%	•			2-10 VDC
SY9	SY9-110	62 seconds	120 VAC ±10%, 50/60 Hz	30%		•	•	none, opt 1k Ω
	SY9-120MFT	65 seconds	120 VAC ±10%, 50/60 Hz	50%	•			2-10 VDC
	SY9-230MFT	72 seconds	230 VAC ±10%, 50/60 Hz	50%	•			2-10 VDC
SY10	SY10-110	62 seconds	120 VAC ±10%, 50/60 Hz	30%		•	•	none, opt 1k Ω
	SY10-120MFT	76 seconds	120 VAC ±10%, 50/60 Hz	50%	•			2-10 VDC
	SY10-230MFT	85 seconds	230 VAC ±10%, 50/60 Hz	50%	•			2-10 VDC
SY11	SY11-110	62 seconds	120 VAC ±10%, 50/60 Hz	30%		•	•	none, opt 1k Ω
	SY11-120MFT	71 seconds	120 VAC ±10%, 50/60 Hz	50%	•			2-10 VDC
	SY11-230MFT	61 seconds	230 VAC ±10%, 50/60 Hz	50%	•			2-10 VDC
SY12	SY12-110	62 seconds	120 VAC ±10%, 50/60 Hz	30%		•	•	none, opt 1k Ω
	SY12-120MFT	76 seconds	120 VAC ±10%, 50/60 Hz	50%	•			2-10 VDC
	SY12-230MFT	65 seconds	230 VAC ±10%, 50/60 Hz	50%	•			2-10 VDC

Modulating actuators will accept 0-10 VDC or 2-10 VDC control signals as standard.

All SY actuators are non fail-safe, but can be used with back up systems for fail-safe applications. Fail-safe options available with PKR.

SY products carry a two year warranty when sold as part of an assembly or with a UFLK retrofit kit.

*-200 and -250 versions have the same ratings.

Power Supply 24 VAC/VDC Single Phase

Model #	Torque	Speed 50 Hz/60 Hz	Current Draw (60 Hz)	VA (60 Hz)	Override	Weight
PRBUP-3-T*	1400 in-lbs/ 160 Nm	35 seconds	0.8 A	20	Manual override crank	5.8 kg/12.8 lbs.
PRXUP-3-T*	1400 in-lbs/ 160 Nm	35, 30-120 seconds	0.8 A	20	Manual override crank	5.8 kg/12.8 lbs.
SY4-24	3540 in-lbs/ 400 Nm	16 seconds	9.5 A	228	Hand wheel	22 kg/48.5 lbs.
SY5-24	4430 in-lbs/ 500 Nm	35 seconds	9.4 A	227	Hand wheel	22 kg/48.5 lbs.

Power Supply 120 VAC Single Phase

Model #	Torque	Speed 60 Hz	Current Draw (60 Hz)	VA (60 Hz)	Override	Weight
PRBUP-3-T*	1400 in-lbs/ 160 Nm	35 seconds	0.2 A	23	Manual override crank	5.8 kg/12.8 lbs.
PRXUP-3-T*	1400 in-lbs/ 160 Nm	35, 30-120 seconds	0.2 A	23	Manual override crank	5.8 kg/12.8 lbs.
SY4-110	3540 in-lbs/ 400 Nm	18 seconds	1.8 A	216	Hand wheel	22 kg/48.5 lbs.
SY5-110	4430 in-lbs/ 500 Nm	25 seconds	1.8 A	216	Hand wheel	22 kg/48.5 lbs.
SY6-110	5750 in-lbs/ 650 Nm	32 seconds	1.8 A	216	Hand wheel	22 kg/48.5 lbs.
SY7-110	8850 in-lbs/ 1000 Nm	49 seconds	3.5 A	420	Hand wheel	36 kg/79.5 lbs.
SY8-110	13280 in-lbs/ 1500 Nm	50 seconds	4.8 A	576	Hand wheel	36 kg/79.5 lbs.
SY9-110	17700 in-lbs/ 2000 Nm	57 seconds	2.8 A	336	Hand wheel	72 kg/176.4 lbs.
SY10-110	22130 in-lbs/ 2500 Nm	62 seconds	2.9 A	348	Hand wheel	72 kg/176.4 lbs.
SY11-110	26550 in-lbs/ 3000 Nm	69 seconds	3.6 A	432	Hand wheel	72 kg/176.4 lbs.
SY12-110	30980 in-lbs/ 3500 Nm	60 seconds	3.8 A	456	Hand wheel	72 kg/176.4 lbs.

Power Supply 230 VAC Single Phase

Model #	Torque	Speed 60 Hz	Current Draw (60 Hz)	VA (60 Hz)	Override	Weight
PRBUP-3-T*	1400 in-lbs/ 160 Nm	35 sec.	0.2 A	52	Manual override crank	5.8 kg/12.8 lbs.
PRXUP-3-T*	1400 in-lbs/ 160 Nm	35, 30-120 sec.	0.2 A	52	Manual override crank	5.8 kg/12.8 lbs.
SY4-220	3540 in-lbs/ 400 Nm	18 seconds	0.9 A	207	Hand wheel	22 kg/48.5 lbs.
SY5-220	4430 in-lbs/ 500 Nm	25 seconds	0.9 A	207	Hand wheel	22 kg/48.5 lbs.
SY6-220	5750 in-lbs/ 650 Nm	31 seconds	0.9 A	207	Hand wheel	22 kg/48.5 lbs.

*-200 and -250 versions have the same ratings.

Power Supply 24 VAC/VDC Single Phase

Model #	Torque	Speed 50 Hz/60 Hz	Current Draw (60 Hz)	VA (60 Hz)	Override	Weight
PRBUP-MFT-T*	1400 in-lbs/160 Nm	30-120 sec.	0.9 A	20	Manual override crank	5.8 kg/12.8 lbs.
PRXUP-MFT-T*	1400 in-lbs/160 Nm	30-120 sec.	0.9 A	20	Manual override crank	5.8 kg/12.8 lbs.
PKRXUP-MFT-T*	1400 in-lbs/160 Nm	30-120 sec.	2.2 A	55	Manual override crank	6.4 kg/14.1 lbs.
SY4-24MFT	3540 in-lbs/ 400 Nm	16 seconds	11.0 A	264	Hand wheel	22 kg/48.5 lbs.
SY5-24MFT	4430 in-lbs/ 500 Nm	30 seconds	10.2 A	245	Hand wheel	22 kg/48.5 lbs.

Power Supply 120 VAC Single Phase

Model #	Torque	Speed 60 Hz	Current Draw (60 Hz)	VA (60 Hz)	Override	Weight
PRBUP-MFT-T*	1400 in-lbs/160 Nm	30-120 sec.	0.2 A	23	Manual override crank	5.8 kg/12.8 lbs.
PRXUP-MFT-T*	1400 in-lbs/160 Nm	30-120 sec.	0.2 A	23	Manual override crank	5.8 kg/12.8 lbs.
PKRXUP-MFT-T*	1400 in-lbs/160 Nm	30-120 sec.	0.3 A	43	Manual override crank	6.4 kg/14.1 lbs.
SY4-120MFT	3540 in-lbs/ 400 Nm	17 seconds	2.4 A	288	Hand wheel	22 kg/48.5 lbs.
SY5-120MFT	4430 in-lbs/ 500 Nm	21 seconds	2.3 A	276	Hand wheel	22 kg/48.5 lbs.
SY6-120MFT	5750 in-lbs/ 650 Nm	29 seconds	2.2 A	264	Hand wheel	22 kg/48.5 lbs.
SY7-120MFT	8850 in-lbs/ 1000 Nm	44 seconds	1.7 A	204	Hand wheel	36 kg/79.5 lbs.
SY8-120MFT	13280 in-lbs/ 1500 Nm	48 seconds	2.6 A	312	Hand wheel	36 kg/79.5 lbs.
SY9-120MFT	17700 in-lbs/ 2000 Nm	47 seconds	3.4 A	408	Hand wheel	72 kg/176.4 lbs.
SY10-120MFT	22130 in-lbs/ 2500 Nm	51 seconds	4.0 A	480	Hand wheel	72 kg/176.4 lbs.
SY11-120MFT	26550 in-lbs/ 3000 Nm	56 seconds	3.0 A	360	Hand wheel	72 kg/176.4 lbs.
SY12-120MFT	30980 in-lbs/ 3500 Nm	62 seconds	3.4 A	408	Hand wheel	72 kg/176.4 lbs.

Power Supply 230 VAC Single Phase

Model #	Torque	Speed 60 Hz	Current Draw (60 Hz)	VA (60 Hz)	Override	Weight
PRBUP-MFT-T*	1400 in-lbs/160 Nm	30-120 sec.	0.1 A	52	Manual override crank	5.8 kg/12.8 lbs.
PRXUP-MFT-T*	1400 in-lbs/160 Nm	30-120 sec.	0.1 A	52	Manual override crank	5.8 kg/12.8 lbs.
PKRXUP-MFT-T*	1400 in-lbs/160 Nm	30-120 sec.	0.2 A	68	Manual override crank	6.4 kg/14.1 lbs.
SY4-230MFT	3540 in-lbs/ 400 Nm	17 seconds	1.1 A	253	Hand wheel	22 kg/48.5 lbs.
SY5-230MFT	4430 in-lbs/ 500 Nm	22 seconds	1.0 A	230	Hand wheel	22 kg/48.5 lbs.
SY6-230MFT	5750 in-lbs/ 650 Nm	32 seconds	1.1 A	253	Hand wheel	22 kg/48.5 lbs.
SY7-230MFT	8850 in-lbs/ 1000 Nm	44 seconds	0.8 A	184	Hand wheel	36 kg/79.5 lbs.
SY8-230MFT	13280 in-lbs/ 1500 Nm	57 seconds	1.4 A	322	Hand wheel	36 kg/79.5 lbs.
SY9-230MFT	17700 in-lbs/ 2000 Nm	61 seconds	1.1 A	253	Hand wheel	72 kg/176.4 lbs.
SY10-230MFT	22130 in-lbs/ 2500 Nm	70 seconds	1.4 A	322	Hand wheel	72 kg/176.4 lbs.
SY11-230MFT	26550 in-lbs/ 3000 Nm	48 seconds	1.9 A	437	Hand wheel	72 kg/176.4 lbs.
SY12-230MFT	30980 in-lbs/ 3500 Nm	51 seconds	2.0 A	460	Hand wheel	72 kg/176.4 lbs.

*-200 and -250 versions have the same ratings.

General Wiring Instructions

WARNING: The wiring technician must be trained and experienced with electronic circuits. Disconnect power supply before attempting any wiring connections or changes. Make all connections in accordance with wiring diagrams and follow all applicable local and national codes. Provide disconnect and overload protection as required. Use copper, twisted pair, conductors only. If using electrical conduit, the attachment to the actuator must be made with flexible conduit.

Always read the controller manufacturer's installation literature carefully before making any connections. Follow all instructions in this literature. If you have any questions, contact the controller manufacturer and/or Belimo.

Transformer(s)

Belimo actuators require a 24 VAC Class 2 transformer. The actuator enclosure cannot be opened in the field, there are no parts or components to be replaced or repaired.

- EMC Directive: 2004/108/EC
- Software Class A: Mode of Operation Type 1
- Low Voltage Directive: 2006/95/EC

Example: 3 AF Actuators Supplied, 16 Ga. wire (refer to table on page 3)
350 ft. (allowable wire length) ÷ 3 actuators = 117 ft. maximum wire run

Typical Transformer Sizing

Actuator Series	Voltage	Required VA Per Actuator
EFB, EFX	24	16
AFB, AFX	24	10
AF	24	10
NFB, NFX	24	9
LF	24	7
TF	24	5
GMB	24	7
AMB / ARB	24	6
NMB	24	6
LMB / LRB	24	3
CMB	24	1.5
AHB	24	4.5
LHB	24	3
LUB	24	3
AMQB	24	26
NMQB	24	23
LMQB	24	23
AHQB	24	23
LHQB	24	23
GK / GKR	24	21
NK	24	22
AHK	24	20

CAUTION: It is good practice to power electronic or digital controllers from a separate power transformer than that used for actuators or other end devices. The power supply design in our actuators and other end devices use half wave rectification. Some controllers use full wave rectification. When these two different types of power supplies are connected to the same power transformer and the DC commons are connected together, a short circuit is created across one of the diodes in the full wave power supply, damaging the controller. Only use a single power transformer to power the controller and actuator if you know the controller power supply uses half wave rectification.

Multiple actuators, one transformer

Multiple actuators may be powered from one transformer provided the following rules are followed:

1. The TOTAL current draw of the actuators (VA rating) is less than or equal to the rating of the transformer.
2. Polarity on the secondary of the transformer is strictly followed. This means that all No. 1 wires from all actuators are connected to the common leg on the transformer and all No. 2 wires from all actuators are connected to the hotleg. Mixing wire No. 1 & 2 on one leg of the transformer will result in erratic operation or failure of the actuator and/or controls.

Multiple actuators, multiple transformers

Multiple actuators positioned by the same control signal may be powered from multiple transformers provided the following rules are followed:

1. The transformers are properly sized.
2. All No. 1 wires from all actuators are tied together and tied to the negative leg of the control signal. See wiring diagram.

Wire type and wire installation tips

For most installations, 18 or 16 Ga. cable works well with Belimo actuators. Review job requirements and determine whether a plenum or appliance rated cable is appropriate. Use code-approved wire nuts, terminal strips or solderless connectors where wires are joined. It is good practice to run control wires unspliced from the actuator to the controller. If splices are unavoidable, make sure the splice can be reached for possible maintenance. Tape and/or wire-tie the splice to reduce the possibility of the splice being inadvertently pulled apart.

Wire length for actuator installation

Keep power wire runs below the lengths listed in the following tables. If more than one actuator is powered from the same wire run, divide the allowable wire length by the number of actuators to determine the maximum run to any single actuator.

Wire Size vs. Length of Run for SY Series Actuators On/Off



24 VAC					
	SY1	SY2	SY3	SY4	SY5
	[A]	[A]	[A]	[A]	[A]
current	1.6	3.4	3.1	9.4	8.9
wire gauge	MAX distance between actuator and supply [feet]				
18	97	45	50		
16	153	72	79	26	28
14	244	115	126	42	44
12	387	182	200	66	70
10	616	290	318	105	111
8	980	461	506	167	176

120 VAC												
	SY1	SY2	SY3	SY4	SY5	SY6	SY7	SY8	SY9	SY10	SY11	SY12
	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]
current	0.7	1.2	1.2	2.1	2	2.4	4.2	4.2	3	3.2	3.6	3.8
wire gauge	MAX distance between actuator and supply [feet]											
18	1,103	644	644	368	386	322	184	184	257	241	215	203
16	1,750	1,021	1,021	583	613	510	292	292	408	383	340	322
14	2,788	1,626	1,626	929	976	813	465	465	651	610	542	514
12	4,428	2,583	2,583	1,476	1,550	1,292	738	738	1,033	969	861	816
10	7,044	4,109	4,109	2,348	2,465	2,054	1,174	1,174	1,644	1,541	1,370	1,298
8	11,204	6,536	6,536	3,735	3,922	3,268	1,867	1,867	2,614	2,451	2,179	2,064

230 VAC												
	SY1	SY2	SY3	SY4	SY5	SY6	SY7	SY8	SY9	SY10	SY11	SY12
	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]
current	0.4	0.6	0.6	1.1	1	1.1	2	2	2.5	2.6	2.7	2.5
wire gauge	MAX distance between actuator and supply [feet]											
18	3,701	2,467	2,467	1,346	1,480	1,346	740	740	592	569	548	592
16	5,871	3,914	3,914	2,135	2,348	2,135	1,174	1,174	939	903	870	939
14	9,352	6,234	6,234	3,401	3,741	3,401	1,870	1,870	1,496	1,439	1,385	1,496
12	14,854	9,903	9,903	5,401	5,942	5,401	2,971	2,971	2,377	2,285	2,201	2,377
10	23,626	15,751	15,751	8,591	9,450	8,591	4,725	4,725	3,780	3,635	3,500	3,780
8	37,581	25,054	25,054	13,666	15,033	13,666	7,516	7,516	6,013	5,782	5,568	6,013

The NEC mandates that 24 VAC over 100 VA power requires CLASS 1 wiring conduit. Local codes may vary. Do NOT mix CLASS 1 & CLASS 2 circuits in the same conduit. Generally, 24 VAC actuators over 100 VA should be changed to 120 VAC models.

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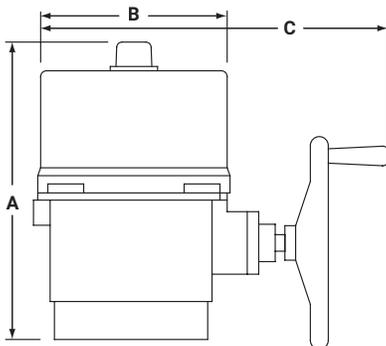
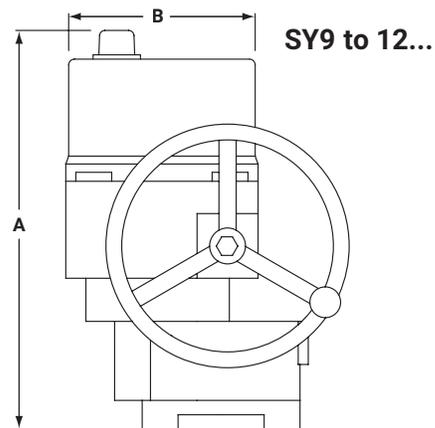
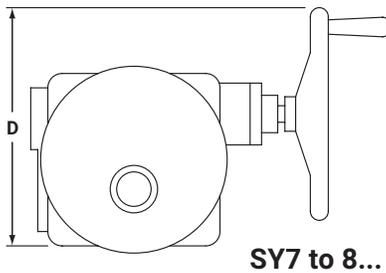
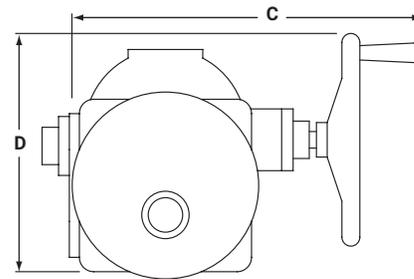
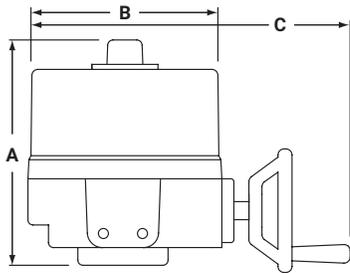
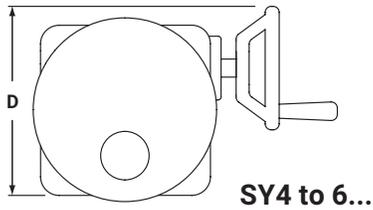
24 VAC						
	SY1	SY2	SY3	SY4	SY5	SY6
current	[A]	[A]	[A]	[A]	[A]	[A]
wire gauge	2.8	3.4	3.1	3.1	3.1	3.1
MAX distance between actuator and supply [feet]						
18	55	45	50	50	50	50
16	88	72	79	79	79	79
14	139	115	126	126	126	126
12	221	182	200	200	200	200
10	352	290	318	318	318	318
8	560	461	506	506	506	506

120 VAC												
	SY1	SY2	SY3	SY4	SY5	SY6	SY7	SY8	SY9	SY10	SY11	SY12
current	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]
wire gauge	0.6	0.8	0.7	2.1	1.9	2	2	2.8	2.7	3	4.3	4.5
MAX distance between actuator and supply [feet]												
18	1,287	966	1,103	368	407	386	386	276	286	257	180	172
16	2,042	1,531	1,750	583	645	613	613	438	454	408	285	272
14	3,253	2,440	2,788	929	1,027	976	976	697	723	651	454	434
12	5,167	3,875	4,428	1,476	1,632	1,550	1,550	1,107	1,148	1,033	721	689
10	8,218	6,163	7,044	2,348	2,595	2,465	2,465	1,761	1,826	1,644	1,147	1,096
8	13,072	9,804	11,204	3,735	4,128	3,922	3,922	2,801	2,905	2,614	1,824	1,743

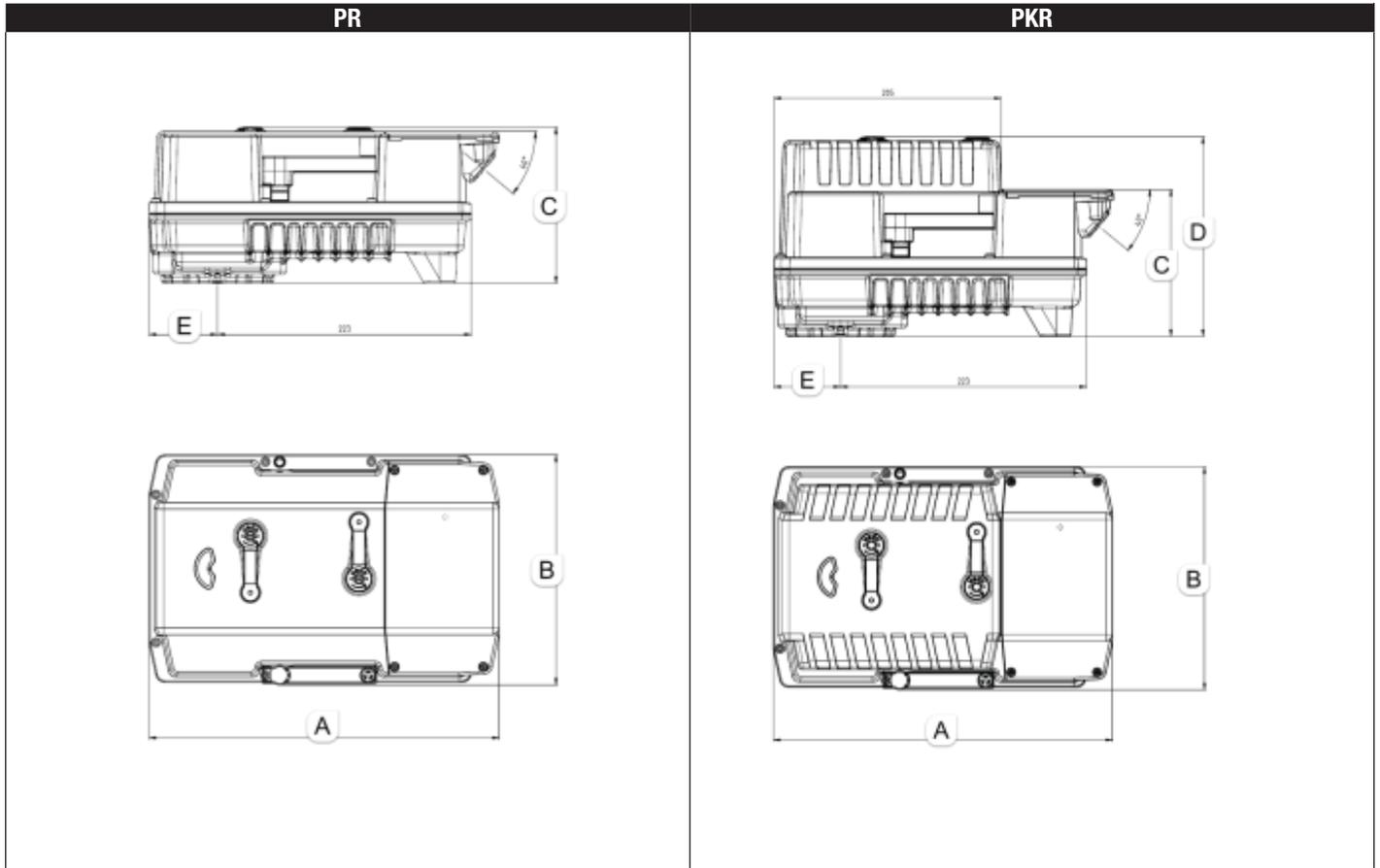
230 VAC												
	SY1	SY2	SY3	SY4	SY5	SY6	SY7	SY8	SY9	SY10	SY11	SY12
current	[A]	[A]	[A]	[A]	[A]	[A]						
wire gauge	0.4	0.4	0.4	1.1	1	1	1.2	1.6	1.1	1.4	2.2	2.5
MAX distance between actuator and supply [feet]												
18	3,701	3,701	3,701	1,346	1,480	1,480	1,234	925	1,346	1,057	673	592
16	5,871	5,871	5,871	2,135	2,348	2,348	1,957	1,468	2,135	1,677	1,067	939
14	9,352	9,352	9,352	3,401	3,741	3,741	3,117	2,338	3,401	2,672	1,700	1,496
12	14,854	14,854	14,854	5,401	5,942	5,942	4,951	3,713	5,401	4,244	2,701	2,377
10	23,626	23,626	23,626	8,591	9,450	9,450	7,875	5,906	8,591	6,750	4,296	3,780
8	37,581	37,581	37,581	13,666	15,033	15,033	12,527	9,395	13,666	10,738	6,833	6,013

The NEC mandates that 24 VAC over 100 VA power requires CLASS 1 wiring conduit. Local codes may vary. Do NOT mix CLASS 1 & CLASS 2 circuits in the same conduit. Generally, 24 VAC actuators over 100 VA should be changed to 120 VAC models.

SY... Series Non-Spring Return Actuator Dimensions



MODEL	DIM A (MAX)	Add to Dim A for cover removal	DIM B	DIM C (MAX)	DIM D
	Inches [mm]	Inches [mm]	Inches [mm]	Inches [mm]	Inches [mm]
SY4-6	12.40 [315]	8.86 [225]	9.21 [234]	14.96 [380]	11.81 [300]
SY7-8	16.54 [420]	8.86 [225]	9.21 [234]	17.72 [450]	13.39 [340]
SY9-12	23.23 [590]	8.86 [225]	10.24 [260]	18.50 [470]	13.78 [350]



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MODEL	DIM A	DIM B	DIM C	DIM D	DIM E	Weight (Actuator Only)
	Inches [mm]	Lbs [kg]				
PR	12.09 [307]	7.96 [202]	5.40 [137]	-	2.37 [60]	12.8 [5.8]
PKR	12.09 [307]	7.96 [202]	5.28 [134]	7.13 [181]	2.37 [60]	14.2 [6.4]

Standard Actuation (Average Assembly Weights)

					ACTUATOR									
					NON-SPRING RETURN				SPRING RETURN		ELECTRONIC FAIL-SAFE			
					AMB(X)	GMB(X)	2*GMB(X)	PR	AF...	2*AF...	GK...	2*GK...	PKR...	
FULL RATED MODELS	2-WAY	Size	Valve	Max GPM	COP									
		2"	F650HD	118	200	13 lbs.				14 lbs.				
		2.5"	F665HD	184	200	13 lbs.					24 lbs.	161 lbs.	32 lbs.	
		3"	F680HD	264	200		15 lbs.				25 lbs.			
		4"	F6100HD	470	200			30 lbs.	35 lbs.					37 lbs.
		5"	F6125HD	734	200				39 lbs.					41 lbs.
		6"	F6150HD	1,058	200				43 lbs.					45 lbs.
		8"	F6200L	1,880	200				55 lbs.					57 lbs.
	10"	F6250L	2,738	200				75 lbs.					77 lbs.	
	12"	F6300L	4,230	200				110 lbs.					111 lbs.	
	3-WAY	2"	F750HD	118	200	44 lbs.				46 lbs.				
		2.5"	F765HD	184	200		55 lbs.				65 lbs.	56 lbs.		
		3"	F780HD	264	200			72 lbs.					74 lbs.	
		4"	F7100HD	470	200			122 lbs.	126 lbs.				124 lbs.	128 lbs.
5"		F7125HD	734	200				157 lbs.					159 lbs.	
6"		F7150HD	1,058	200				191 lbs.					193 lbs.	
8"		F7200L	1,880	200				266 lbs.					268 lbs.	
10"		F7250L	2,738	200				421 lbs.					423 lbs.	
12"	F7300L	4,230	200				586 lbs.					588 lbs.		

Max GPM = Maximum US gallons of water (gpm) per minute, at room temperature, that will flow through the fully open valve without exceeding design velocity limits.

COP = Close-Off Pressure stated in psi. This is the maximum differential pressure the valve will close-off against while maintaining a bubble tight seal.

All SY series actuators are NEMA 4X rated and include 2 auxiliary switches and a heater.

HD Series Industrial Actuation (Average Assembly Weights)

					ACTUATOR							
					NON-SPRING RETURN							
					PR...	SY4...	SY6...	SY7...	SY8...	SY10...	SY12...	
FULL RATED MODELS	2-WAY	Size	Valve	Max GPM	COP							
		2"	F650HD	118	200	16 lbs.						
		2.5"	F665HD	184	200	16 lbs.						
		3"	F680HD	264	200	16 lbs.						
		4"	F6100HD	470	200	26 lbs.						
		5"	F6125HD	734	200	30 lbs.						
		6"	F6150HD	1058	200	34 lbs.						
		12"	F6300HD	4230	200		122 lbs.					
		14"	F6350HD	5758	150		131 lbs.					
		16"	F6400HD	7520	150			197 lbs.				
	18"	F6450HD	9518	150				272 lbs.				
	20"	F6500HD	11750	150					241 lbs.			
	24"	F6600HD	16921	150						332 lbs.		
	3-WAY	2"	F750HD	118	200	45 lbs.						
		2.5"	F765HD	184	200	57 lbs.						
		3"	F780HD	264	200	64 lbs.						
		4"	F7100HD	470	200	114 lbs.						
		5"	F7125HD	734	200	143 lbs.						
		6"	F7150HD	1058	200	177 lbs.						
		12"	F7300HD	4230	200		603 lbs.					
14"		F7350HD	5758	150			785 lbs.					
16"		F7400HD	7520	150				1140 lbs.				
18"		F7450HD	9518	150					1408 lbs.			
20"	F7500HD	11750	150					1599 lbs.				
24"	F7600HD	16921	150						2419 lbs.			

Max GPM = Maximum US gallons of water (gpm) per minute, at room temperature, that will flow through the fully open valve without exceeding design velocity limits.

COP = Close-Off Pressure stated in psi. This is the maximum differential pressure the valve will close-off against while maintaining a bubble tight seal.

All SY series actuators are NEMA 4X rated and include 2 auxiliary switches and a heater.

ACTUATOR TYPE	CONFIGURATION DESCRIPTION	CODE	CONTROL		RUNNING TIME**	
			CONTROL INPUT	FEEDBACK POSITION		
Standard Actuator Series: AR, AM, GR, GM, GKR, AFR, AF, DKR	-MFT	P-10001*	A01*	2-10 VDC	2-10 VDC	150 seconds
		P-10002	A02	0.5-10 VDC	0-10 VDC	150 seconds
		P-10003	A03	2-10 VDC	0-5.10 VDC	150 seconds
		P-10019	A19	2-10 VDC	2-10 VDC	100 seconds
		P-10028	A28	0.5-10 VDC	0.5-10 VDC	100 seconds
		P-10063	A63	0.5-4.5 VDC	0.5- 4.5 VDC	150 seconds
		P-10064	A64	5.5-10 VDC	5.5-10.0 VDC	150 seconds
		P-20002	W02	0.02 to 5.00 seconds PWM	2-10 VDC	150 seconds
		P-20003	W03	0.10 to 25.50 seconds PWM	2-10 VDC	150 seconds
		P-30001	F01	Floating Point	2-10 VDC	150 seconds
	P-40002	J02	On/Off	2-10 VDC	150 seconds	
PR Series	-3, -T	N/A	L01*	On/Off	N/A	35 seconds
		N/A	L02	On/Off	N/A	60 seconds
	-MFT	NC	L05*	2-10 VDC	2-10 VDC	35 seconds
		NC	L06	2-10 VDC	2-10 VDC	60 seconds
		NC	L09	0.5-10 VDC	0.5-10 VDC	35 seconds
		NC	L0A	0.5-10 VDC	0.5-10 VDC	60 seconds
		NC	L0D	4-20 mA	2-10 VDC	35 seconds
		NC	L0E	4-20 mA	2-10 VDC	60 seconds
		NO	L0H	2-10 VDC	2-10 VDC	35 seconds
		NO	L0J	2-10 VDC	2-10 VDC	60 seconds
NO	L0M	0.5-10 VDC	0.5-10 VDC	35 seconds		
NO	L0R	4-20 mA	2-10 VDC	35 seconds		
PKR Series		NC-FC	L21	On/Off, Floating Point	2-10 VDC	35 seconds
		NC-FO	L25	On/Off, Floating Point	2-10 VDC	35 seconds
		NO-FC	L29	On/Off, Floating Point	2-10 VDC	35 seconds
		NO-FO	L2D	On/Off, Floating Point	2-10 VDC	35 seconds
		NC-FC	L31*	2-10 VDC	2-10 VDC	35 seconds
		NC-FO	L35	2-10 VDC	2-10 VDC	35 seconds
		NO-FC	L39	2-10 VDC	2-10 VDC	35 seconds
		NO-FO	L3D	2-10 VDC	2-10 VDC	35 seconds
		NC-FC	L41	0.5-10 VDC	0.5-10 VDC	35 seconds
		NC-FO	L45	0.5-10 VDC	0.5-10 VDC	35 seconds
		NO-FC	L49	0.5-10 VDC	0.5-10 VDC	35 seconds
		NO-FO	L4D	0.5-10 VDC	0.5-10 VDC	35 seconds
		NC-FC	L51	4-20 mA	2-10 VDC	35 seconds
		NC-FO	L55	4-20 mA	2-10 VDC	35 seconds
		NO-FC	L59	4-20 mA	2-10 VDC	35 seconds
	NO-FO	L5D	4-20 mA	2-10 VDC	35 seconds	
	NO-FO	L5E	4-20 mA	2-10 VDC	60 seconds	
SY Series	-MFT	Loss of Signal Stop	ACE*	2-10 VDC	2-10 VDC	Varies (15-20 seconds)
		Loss of Signal Stop	ACF	0.5-10 VDC	0.5-10 VDC	Varies (15-20 seconds)
		Loss of Signal Stop	ACG	4-20 mA	4-20 mA	Varies (15-20 seconds)
		Loss of Signal Open	ACJ	2-10 VDC	2-10 VDC	Varies (15-20 seconds)
		Loss of Signal Open	ACK	0.5-10 VDC	0.5-10 VDC	Varies (15-20 seconds)
		Loss of Signal Open	ACL	4-20 mA	4-20 mA	Varies (15-20 seconds)
		Loss of Signal Close	ACN	2-10 VDC	2-10 VDC	Varies (15-20 seconds)
		Loss of Signal Close	ACP	0.5-10 VDC	0.5-10 VDC	Varies (15-20 seconds)
	Loss of Signal Close	ACR	4-20 mA	4-20 mA	Varies (15-20 seconds)	

*Default configuration

**More running times available upon request

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Storage of Butterfly Valve Assemblies

- Assemblies must be stored indoors, protected from the elements.
- Materials received on job sites that have long installation lead times should receive extra protection from construction damage.
- Resilient seats must be protected from abrasion, cutting and nicking, as this will damage the liner and may cause flange area leaks.
- Electric actuators cannot be stored in wet, damp or caustic areas.
- Do not store construction material on top of valve assemblies.

Installation Practices

- HD series butterfly valves are designed to be installed between ANSI 125/150 flat-faced, raised face, slip-on or weld neck flanges.
- Valve should be installed a minimum of 6 pipe diameters from upstream or downstream elbows, strainers, pumps, etc.
- For chilled water, condenser water or hot water applications, the valve should be installed with the stem in a vertical orientation, with the actuator mounted above the valve.
- For applications in which there is a possibility of sediment in the flow, the valve should be installed with the stem in a horizontal position and the bottom of the disc should close FROM the downstream side, rather than from the upstream side.
- Make sure the flange faces are clean and free of rust, scale and debris to prevent damage to the liner face.
- Do NOT use flange gaskets on HD series BFV valves. (Fig. 1a)
- Follow the recommended flange bolting sequence. (Fig. 8, pg. 16)

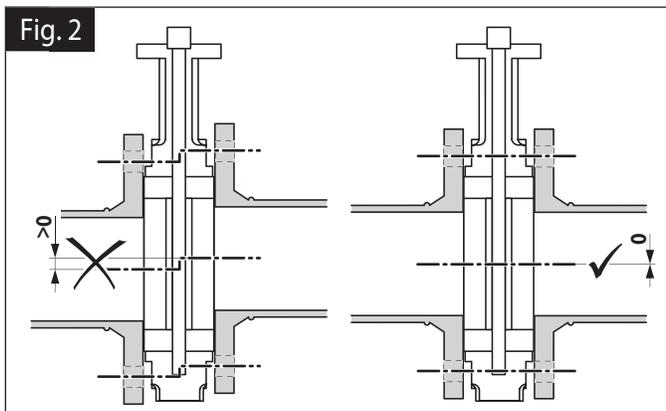
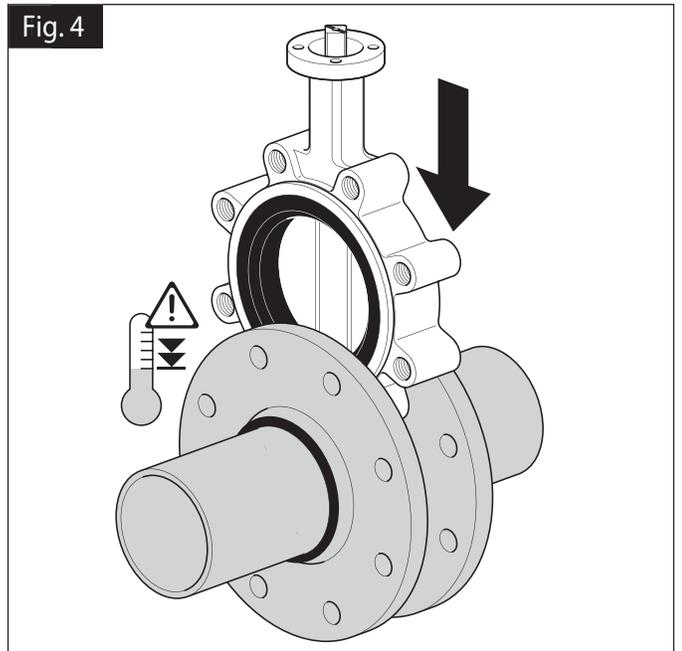
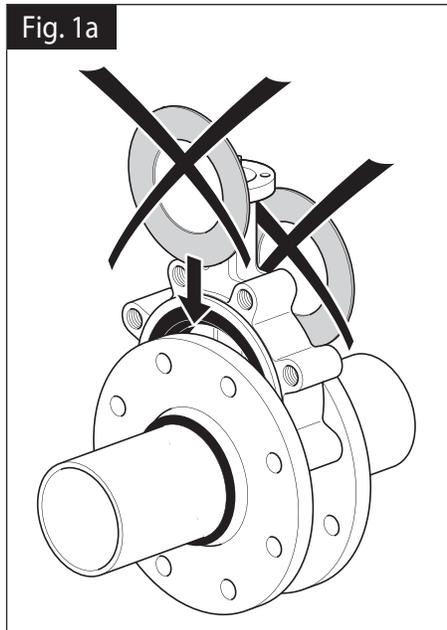
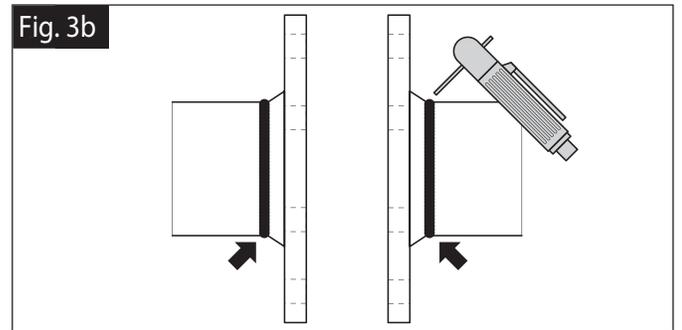
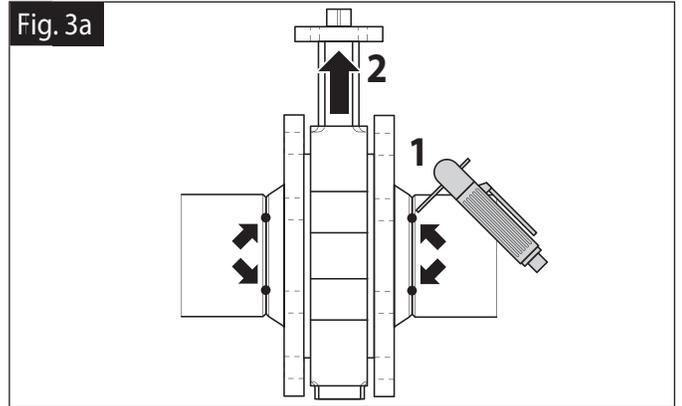
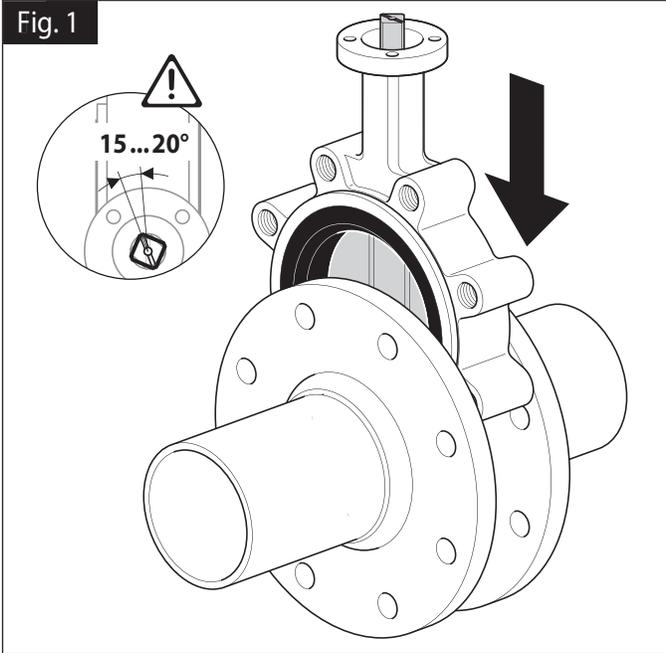
Installation using Welded Flanges

- Mount flanges on both sides of valve body and install bolts to properly align valve body and both flanges.
- Install the valve with the disc in the “Almost Closed” position (Fig. 1)
- Do not use any flange gaskets (Fig. 1a)
- Make sure the valve liner and flange internal diameters are in alignment. (Fig. 2)
- Take valve body / flange pair assembly and align with piping ends.
- TACK weld the flanges to the piping in several places. (Fig. 3a)
Do NOT seam weld at this time!
- Remove the lug bolts and carefully remove the valve body from the flanges.
- Seam weld the entire flange / piping connection for both flanges. (Fig 3b)
- Let the piping components cool completely before re-inserting the valve body. (Fig. 4)

WARNING! Seam welding with the valve body installed between the flanges can damage the liner due to heat migration through the flange to the valve body.

Max Torque for Bolts		
Valve Size	Bolt Size	Max Torque [ft-lbs]
2" - 4"	5/8"	70
5" - 8"	3/4"	120
10" - 12"	7/8"	200
14" - 16"	1"	240
18" - 20"	1 1/8"	380
24" - 30"	1 1/4"	520
32" - 48"	1 1/2"	800
54" - 60"	1 3/4"	1800

HD Series Butterfly Valves

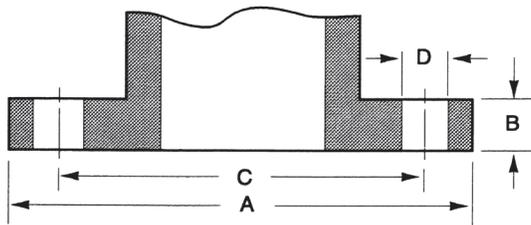


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FLANGE BOLTING RECOMMENDATIONS

Flange Detail for ANSI B16.5 Pipe Flanges

Nominal Pipe Size	FLANGES		DRILLING		BOLTING	
	A Flange Diameter	B Flange Thickness	C Diameter of Bolt Circle	D Diameter of Bolt Holes	Number of Bolts	Diameter of Bolts
2"	6"	3/4"	4 3/4"	3/4"	4	5/8"
2 1/2"	7"	7/8"	5 1/2"	3/4"	4	5/8"
3"	7 1/2"	15/16"	6"	3/4"	4	5/8"
4"	9"	15/16"	7 1/2"	3/4"	8	5/8"
5"	10"	15/16"	8 1/2"	7/8"	8	3/4"
6"	11"	1"	9 1/2"	7/8"	8	3/4"
8"	13 1/2"	1 1/8"	11 3/4"	7/8"	8	3/4"
10"	16"	1 3/16"	14 3/4"	1"	12	7/8"
12"	19"	1 1/4"	17"	1"	12	7/8"
14"	21"	1 3/8"	18 3/4"	1 1/8"	12	1"
16"	23 1/2"	1 7/16"	21 1/4"	1 1/8"	16	1"
18"	25"	1 5/8"	22 3/4"	1 1/4"	16	1 1/8"
20"	27 1/2"	1 11/16"	25"	1 1/4"	20	1 1/8"
24"	32"	1 7/8"	29 1/2"	1 3/8"	20	1 1/4"



PRE-INSTALLATION PROCEDURE

1. Remove any protective flange covers from the valve.
2. Inspect the valve to be certain the waterway is free from dirt and foreign matter. Be certain the adjoining pipeline is free from any foreign material such as rust and pipe scale or welding slag that could damage the seat and disc sealing surfaces.
3. Any actuator should be mounted on the valve prior to installation to facilitate proper alignment of the disc in the valve seat.
4. Check the valve identification tag for materials, and operating pressure to be sure they are correct for the application.

WARNING! Personal injury or property damage may result if the valve is installed where service conditions could exceed the valve ratings.

5. Check the flange bolts or studs for proper size, threading, and length.
6. These valves are designed to be installed between ASME/ANSI Class 125/150 flanges.
7. Carefully follow installation using welded flanges on page 82 of this document.
8. Follow ASME flange alignment standards:
SECTION 335.1.1 ALIGNMENT
 - a. PIPING DISTORTIONS: Any distortion of piping to bring into alignment for joint assembly which introduces a detrimental strain in equipment or piping components is prohibited.
 - b. FLANGE JOINTS: Before bolting up, flange faces shall be aligned to the design plane within 1/16"/ft measured across any diameter; flange bolt holes shall be aligned within 1/8" maximum offset.
9. When observed during assembly, the flange faces shall be parallel within 1 degree, and the force required to align pipe axes shall not exceed 10 lb/ft per inch of NF bolts and nuts shall be fully engaged.

FLANGE BOLTING RECOMMENDATIONS

Lug Valves, 2"-30", ANSI 125/150 Bolt Pattern

Valve Size	Thread Size	Number Required	Bolt Length Semi-Lug Butterfly (inches)
2"	5/8 - 11	4	1 1/4
2 1/2"	5/8 - 11	4	1 1/2
3"	5/8 - 11	4	1 1/2
4"	5/8 - 11	8	1 3/4
5"	3/4 - 10	8	1 3/4
6"	3/4 - 10	8	2
8"	3/4 - 10	8	2 1/4
10"	7/8 - 9	12	2 1/4
12"	7/8 - 9	12	2 1/2
14"	1 - 8	12	2 3/4
16"	1 - 8	16	2 3/4
18"	1 1/8 - 7	16	3 1/2
20"	1 1/8 - 7	20	4 1/4
24"	1 1/4 - 7	20	4 3/4
30"	1 1/4 - 7	24	4 1/2

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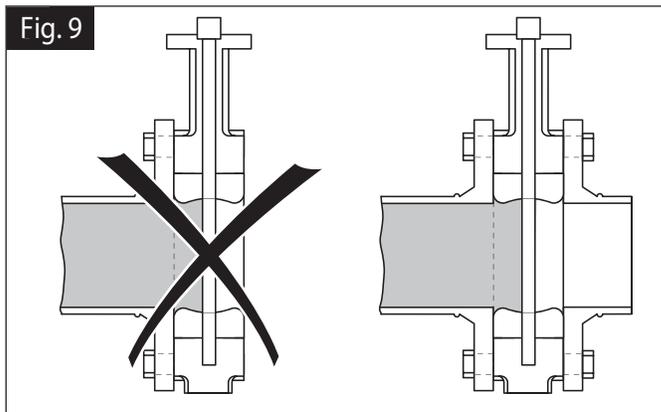
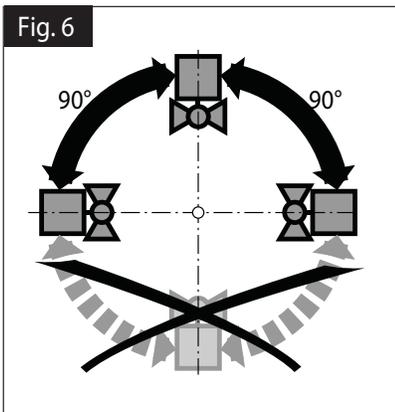
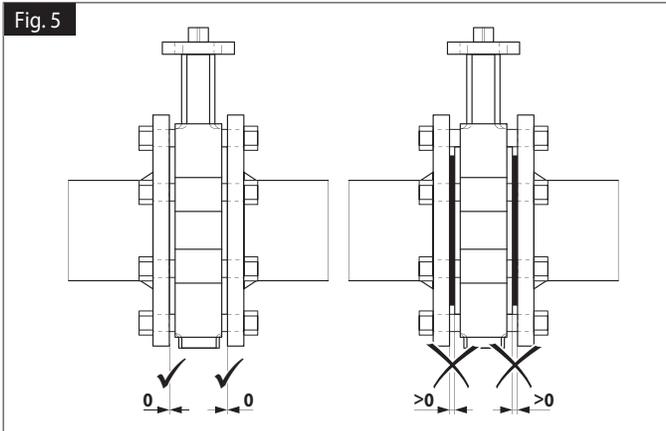
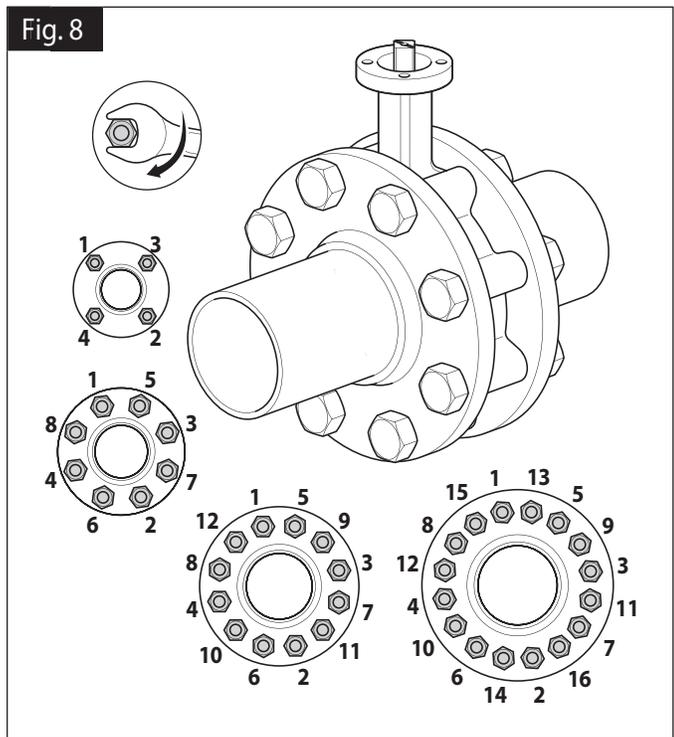
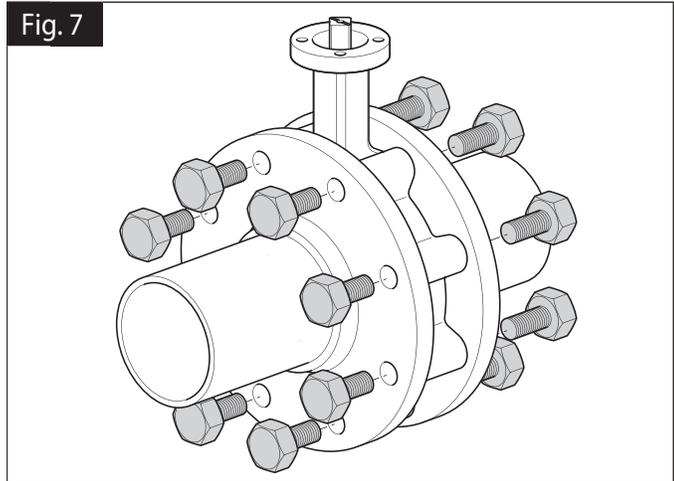
Valve Installation Procedure

Position the connecting pipe flanges in the line to insure proper alignment prior to valve installation. Spread the pipe flanges apart enough to allow the valve body to be located between the flanges without actually contacting the flange surfaces. Exercise particular care in handling the valve so as to prevent possible damage to the disc or seat faces.

Note: Actuator must be mounted at or above pipe center line for all actuator types. (Fig. 6)

1. When installing in Victaulic piping systems, use Victaulic 41 series flange nipples. 741 flanges not recommended without the use of adapter rings.
2. HD-Series Butterfly valves are designed to be installed between ANSI 125/150 flat-faced, raised face, slip-on or weld neck flanges.
3. Do NOT use flange gaskets on HD-Series Butterfly valves.
4. For Lug style valves:
 - a. Place the valve between the flanges.
 - b. Install all bolts between the valve and the mating flanges. Hand tighten bolts as necessary. (Fig. 7)
5. Before completing the tightening of any bolts, the valve should be centered between the flanges and then carefully opened and closed to insure free, unobstructed disc movement.
6. Using the sequence, (Fig. 8) tighten the flange bolts evenly to assure uniform compression. In assembling flange joints, the resilient seating surface shall be uniformly compressed. (Fig. 5) A small gap may be present if max torque is reached. Do not over tighten bolts or stripping may occur. (Fig. 5)
7. If an actuator is to be operated, electricity should be connected to the unit in accordance with the local electrical codes.
8. Cycle the valve to the fully open position, then back to the fully closed position, checking the actuator travel stop settings for proper disc alignment. The valve should be operated to assure that no binding is taking place. If no power is available, use the manual handwheel.
9. The valve is now ready for operation.

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INSTALLATION NOTES

1. Follow previously described pre-installation and installation procedures.
2. To achieve the full close-off pressure of the HD series, a flange is required on the open or down stream side of the valve (Fig. 9)

Maintenance Instructions

Safety Precautions

Before removing the valve from the line or loosening any bolts, it is important to verify the following conditions:

1. Be sure the line is depressurized and drained.
2. Be sure of the pipeline media. Proper care should be taken for protection against toxic and/or flammable fluids.
3. Never remove the valve without an Operator (Manual or Automatic) already attached to the valve shaft.
4. Never remove the Operator from the valve while the valve is in the pipeline under pressure.
5. Always be sure that the disc is cracked approximately 5° off of the closed position before removing the valve.

General Maintenance

The following periodic preventative maintenance practices are recommended for all Butterfly Valves.

1. Operate the valve from full open to full closed to assure operability.
2. Check flange bolting, actuator mounts and hangers for evidence of loosening and correct as needed.
3. Inspect the valve and surrounding area for previous or existing leakage at flange faces or shaft connections.
4. Check piping and/or wiring to actuators and related equipment for looseness and correct as needed.
5. If not in use, exercise the butterfly valve (full open and close) at least once a month.

L Series Ductile Butterfly Valves

Technical Data	
Service	chilled, hot water, 60% glycol
Flow characteristic	F6 modified equal percentage
	F7 linear
Controllable flow range	90°
Sizes	8" to 12"
Type of end fitting	for use with ANSI Class 125/150 flanges
Materials	
Body	ductile iron ASTM A536
Body finish	epoxy powder coated
Disc	304 stainless steel
Seat	EPDM
Shaft	416 stainless steel
O-ring	EPDM
Bushings	Steel, PTFE, Bronze
Media temperature range	-4°F to 250°F [-20°C to 120°C]
Body pressure rating	232 psi
Close-off pressure	200 psi
Rangeability	10:1 (for 30° to 70° range)
Maximum velocity	12 FPS
Leakage	0%
Warranty	5 Years

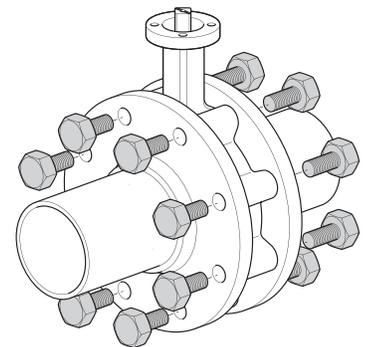
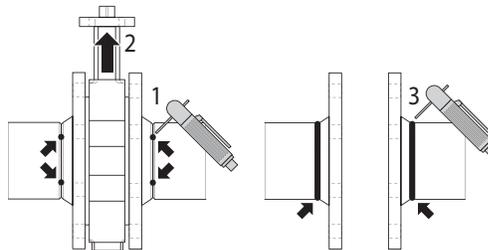
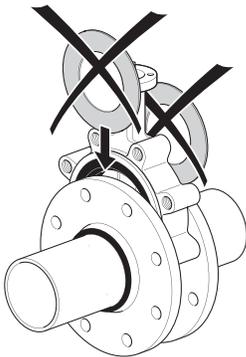
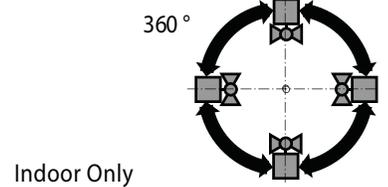
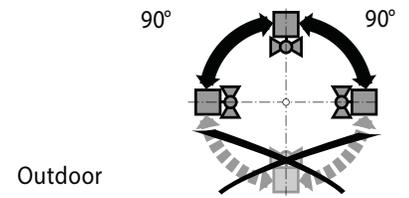
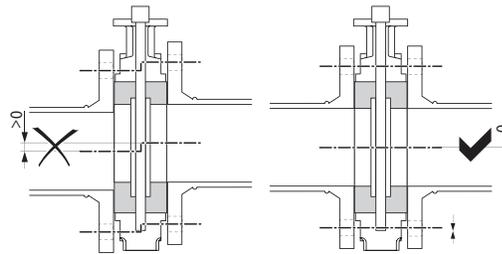
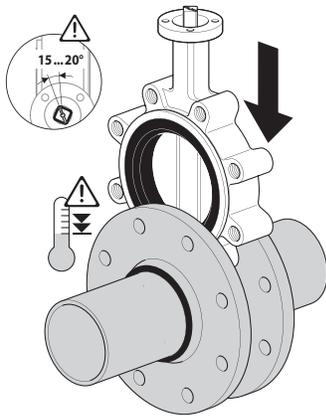
Smart Heating

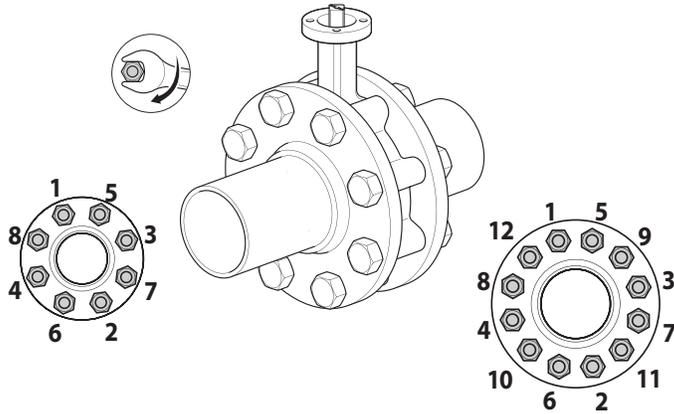
When the actuator is idle; the onboard temperature and humidity sensors and logic within the actuator activate heating elements when needed to prevent condensation within the housing. The heater switches on when the ambient temperature drops below 50°F (10°C) or the relative humidity is higher than 65% and the temperature is below 86°F (30°C).

Self-adjusting End Stops

The intelligent self-adjusting end stops close the valve based on torque or travel over the entire lifespan of the valve.

Installation Recommendations





Max Torque for Bolts

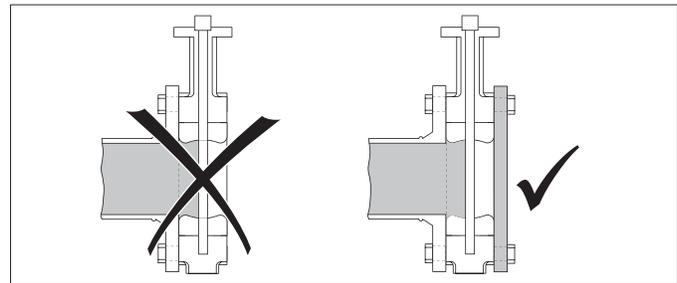
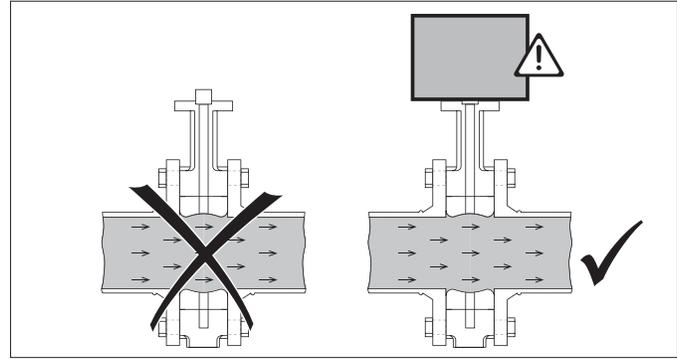
Valve Size	Bolt Size	Max Torque [ft-lbs]
8"	3/4-10"	120
10"-12"	7/8-9"	200

Valve Installation Procedure

Position the connecting pipe flanges in the line to insure proper alignment prior to valve installation. Spread the pipe flanges apart enough to allow the valve body to be located between the flanges without actually contacting the flange surfaces. Exercise particular care in handling the valve so as to prevent possible damage to the disc or seat faces.

Note: Actuator must be mounted at or above pipe center line for all actuator types.

- When installing in Victaulic piping systems, use Victaulic 41 series flange nipples. 741 flanges not recommended without the use of adapter rings.
- L-Series Butterfly valves are designed to be installed between ANSI 125/150 flat-faced, raised face, slip-on or weld neck flanges.
- Do NOT use flange gaskets on L-Series Butterfly valves. Valve should be installed a minimum of 6 pipe diameters from upstream or downstream elbows, strainers, pumps, etc.
- For Lug style valves:
 - Place the valve between the flanges.
 - Install all bolts between the valve and the mating flanges. Hand tighten bolts as necessary.
- Before completing the tightening of any bolts, the valve should be centered between the flanges and then carefully opened and closed to insure free, unobstructed disc movement.
- Using the sequence, tighten the flange bolts evenly to assure uniform compression. In assembling flange joints, the resilient seating surface shall be uniformly compressed. A small gap may be present if max torque is reached. Do not over tighten bolts or stripping may occur. (Fig. 5)
- If an actuator is to be operated, electricity should be connected to the unit in accordance with the local electrical codes.
- Cycle the valve to the fully open position, then back to the fully closed position, checking the actuator travel stop settings for proper disc alignment. The valve should be operated to assure that no binding is taking place. If no power is available, use the manual handwheel.
- The valve is now ready for operation.



General Maintenance

The following periodic preventative maintenance practices are recommended for all Butterfly Valves.

- Operate the valve from full open to full closed to assure operability.
- Check flange bolting, actuator mounts and hangers for evidence of loosening and correct as needed.
- Inspect the valve and surrounding area for previous or existing leakage at flange faces or shaft connections.
- Check piping and/or wiring to actuators and related equipment for looseness and correct as needed.
- If not in use, exercise the butterfly valve (full open and close) at least once a month.

Safety Precautions

Before removing the valve from the line or loosening any bolts, it is important to verify the following conditions:

- Be sure the line is depressurized and drained.
- Be sure of the pipeline media. Proper care should be taken for protection against toxic and/or flammable fluids.
- Never remove the valve without an Operator (Manual or Automatic) already attached to the valve shaft.
- Never remove the Operator from the valve while the valve is in the pipeline under pressure.
- Always be sure that the disc is cracked approximately 5° off of the closed position before removing the valve.

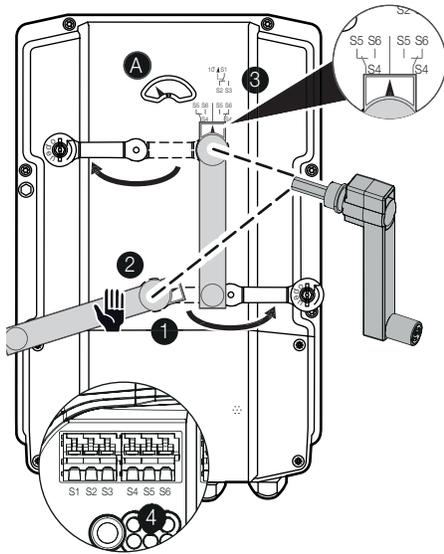
Storage of Butterfly Valve Assemblies

- Assemblies must be stored indoors, protected from the elements.
- Materials received on job sites that have long installation lead times should receive extra protection from construction damage.
- Valve faces must be protected from abrasion, cutting and nicking, as this will damage the face and may cause flange area leaks.
- Electric actuators cannot be stored in wet, damp or caustic areas.
- Do not store construction material on top of valve assemblies.

Auxiliary Switch Setup for PR and PKR Actuators

The setting of the auxiliary switches work like the S2A module.

The first auxiliary switch is fixed at 10°, the second auxiliary switch can be set between 0° and 90°. A YouTube® video is available to further help explain the auxiliary switch settings.

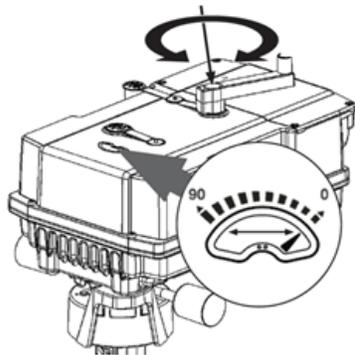


- 1 **Remove power**
- 2 **Gear disengagement**
Opening the manual override cover and adjust the hand crank.
- 3 **Manual override control**
Turn the hand crank until the desired switched position **A** is indicated and then remove the crank.
- 4 **Auxiliary switch**
Opening the auxiliary switch adjustment cover and adjust the hand crank. Turn the crank until the arrow points to the vertical line.
- 5 **Terminals**
Connect continuity tester to S4 + S5 or S4 + S6.
If the auxiliary switch should switch in the opposite direction, rotate the hand crank 180°.

Manual Override Function for PR and PKR Actuator

The PR actuator offers a hand crank connection. When the hand crank is placed correctly then the actuator is disengaged.

Manual operation



When handcrank is connected to actuator, the motor & signal control will be disabled

After removing the handcrank, the actuator drives to its control signal

Sensor Monitoring with MFT Models of PR and PKR Actuators

The PR actuator with BACnet interface and the PKR electronic fail-safe actuator offer 2 passive sensor inputs.

PT1000 (linear 3.890hm/°C)	NI1000 (linear 5.70hm/°C)	NTC10k Typ2 B3970
Without sensor failure	Without sensor failure	Without sensor failure
Ohm [Ω] failure = 3%	Ohm [Ω] failure = 3%	Ohm [Ω] failure = 7%
$\pm 10^\circ$ accuracy	$\pm 10^\circ$ accuracy	$\pm 3^\circ$ accuracy

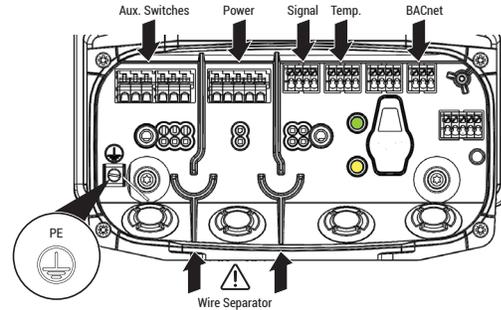
Sequence of the LED lights:

Green LED status indicator light sequence:

On: operation ok, no faults

Blinking: fail-safe mechanism is active

Off: fault is detected or not in operation/capacitors charging

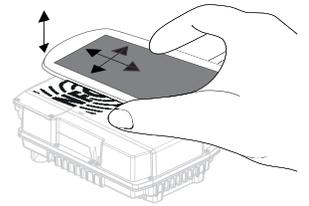


Charge and bridge time of the PKR:

The initial charge time is 20 seconds with a settable delay or bridge time of 0-10 seconds for brown out interruptions.

WARNING: The wiring technician must be trained and experienced with electronic circuits. Disconnect power supply before attempting any wiring connections or changes. Make all connections in accordance with wiring diagrams and follow all applicable local and national codes. Provide disconnect and overload protection as required. Use copper, twisted pair, conductors only. If using electrical conduit, the attachment to the actuator must be made with flexible conduit.

The PR actuator with Near Field Communication (NFC) allows for easy commissioning, programming and troubleshooting directly from your smartphone, even when the actuator is not powered. Settings can also be changed with the ZTH-US handheld tool.



The following table shows the factory settings and settings that can be changed with NFC and ZTH-US.

Values & Settings	Factory Setting	Manual	Power On 	Power Off 	Power On 
Running time setting [30-120 s]	35 s	-	RW	RW	RW
Max angle of rotation	100%	-	RW	RW	RW
Actuator Position [0-100%]	-	Position Indicator	R	-	R
Setting for auxiliary switch s2 [0-90°]	85%	Hand crank	-	-	-
Display of input signal voltage (Power supply)	-	-	R	-	-
Valve Setting [Regular, 8", 10", 12"]	Type specific	-	RW	RW	-
Override Control (Force Position)	-	Hand crank	RW	-	RW
Location String	-	-	RW	RW	-
Control [Floating Point, On/Off, 0.5 - 10V, 2 - 10V, 4 - 20 mA]	2..10V	-	RW	RW	RW
Feedback Mode [2 - 10V, 0.5 - 10V, inverted]	2..10V	-	RW	RW	RW
Feedback Mode [DC variable]	-	-	-	-	RW
Control Signal [DC variable]	-	-	-	-	RW
Control Signal Fail Position [None, On/Off]	None	-	RW	RW	-
Hybrid Mode - Setpoint [MP-Bus, Analog]	Bus	-	RW	RW	-
Bus Setting [MP-Bus, BACnet]	MP, PP	-	RW	RW	-
Power Off Position [0 - 100%]	0%	-	RW	RW	RW
Power Fail Delay [0 - 10 s]	2 s	-	RW	RW	RW

[R=reading; W=writing]

General information	Date:	3. April 2017
	Vendor Name:	BELIMO Automation AG
	Vendor ID:	423
	Product Name:	Rotary actuator for butterfly valves
	Product Model Number:	BACMFT for xy, e.g. PRBUP-MFT-T, PKRBUP-MFT-T
	Applications Software Version:	02.04.0000
	Firmware Revision:	07.03.0002
	BACnet Protocol Revision:	1.12
	Product Description:	Actuator for butterfly valves providing two sensor inputs
	BACnet Standard Device Profile:	BACnet Application Specific Controller (B-ASC)
	BACnet Interoperability Building Blocks supported:	Data Sharing - ReadProperty-B (DS-RP-B) Data Sharing - ReadPropertyMultiple-B (DS-RPM-B) Data Sharing - WriteProperty-B (DS-WP-B) Data Sharing - Write Property Multiple-B (DS-WPM-B) Data Sharing - COV-B (DS-COV-B) Device Management - DynamicDeviceBinding-B (DM-DDB-B) Device Management - DynamicObjectBinding-B (DM-DOB-B) Device Management - DeviceCommunicationControl-B (DM-DCC-B)
	Segmentation Capability:	No
	Data Link Layer Options:	MS/TP master, baud rates: 9'600, 19'200, 38'400, 76'800, 115'200
	Device Address Binding:	No static device binding supported
	Networking Options:	None
	Character Sets Supported:	ISO 10646 (UTF-8)
	Gateway Options:	None
	Network Security Options:	Non-secure Device

PICS

(continued)

Standard objects

The device provides datapoints for common operation as well as datapoints for parameterization.

Datapoint	BACnet Object
Relative Setpoint in %	AO [1]
Override Control	MO [1]
Relative Position in %	AI [1]
Absolute Position in °	AI [2]
Analog Setpoint in %	AI [6]
Sensor 1 Type	MV [220]
Sensor 1 as analog value	AI [20]
Sensor 2 Type	MV [221]
Sensor 2 as analog value	AI [21]
Summary Status	BI [101]
Command: Initiate Function	MV [120]
Max Setpoint in %	AV [98]
Bus Watchdog in s	AV [130]

Object processing

Object type	Optional properties	Writeable properties
Analog Input	Description COV_Increment	COV_Increment
Analog Output	Description COV_Increment	COV_Increment Present_Value Relinquish_Default
Analog Value	Description	Present_Value
Binary Input	Description Active_Text Inactive_Text	
Device	Description Location Active_COV_Subscription	Object_Identifier Object_Name (max. 32 char) Location (max. 64 char) Description (max. 64 char) APDU_Timeout Number_Of_APDU_Retries Max_Master Max_Info_Frames
Multi-state Output	Description State_Text	Present_Value Relinquish_Default
Multi-state Value	Description State_Text	Present_Value

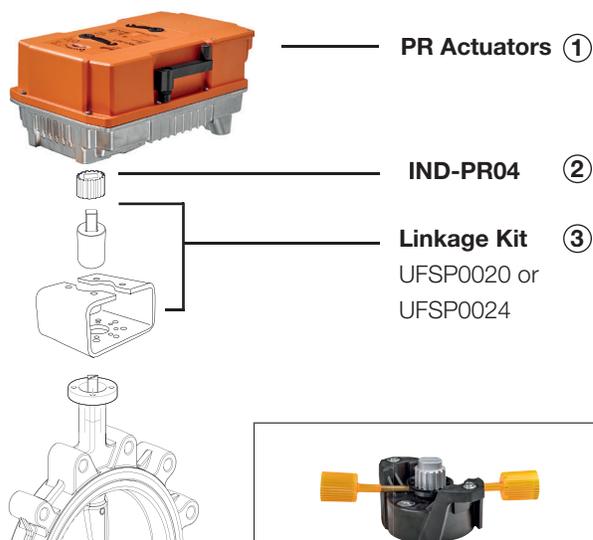
- The device does not support the CreateObject and DeleteObject service.
- The specified maximum length of writable strings is based on single-byte characters.
- No support of COV subscription on Analog Value objects.

Service processing

- The device supports DeviceCommunicationControl service. No password is required.
- Max. 6 active COV subscriptions with lifetime up to 8 h supported

Object Name	Object Type / Instance	Description	Values	Default
<i>Device_Name</i>	Device [x]			
SpRel	Analog Output [1]	Relative Setpoint in % If analog control is enabled, the Present_Value is not evaluated and Out_of_Service is TRUE and.	0 - 100	0
Override	Multi-state Output[1]	Override Control Override control is possible in analog or digital control. Min/Mid are not supported by the device and interpreted as 0%	None Open Close Min Mid Max	None
RelPos	Analog Input [1]	Relative Position in % If the gear is disengaged, it is signaled in the Status_Flags:OVERRIDDEN=TRUE.	0 - 100	-
AbsPos	Analog Input [2]	Absolute Position in ° If the gear is disengaged, it is signaled in the Status_Flags:OVERRIDDEN=TRUE.	0 - 90	-
SpAnalog	Analog Input [6]	Analog Setpoint in % The Present_Value represents the relative value calculated from the analog signal (3-point, 0-10 V, 4-20 mA). If analog control is disabled, the Present_Value is not updated and Out_of_Service is TRUE and.	-10, 0 - 100, 110%	-
Sens1Type	Multi-state Value [220]	Sensor 1 Type The sensor input T1 supports passive temperature sensors only. The measured signal is provided by Sens1Analog either as resistance value (Passive 1K, Passive 20K) or as converted temperature (PT1000, NI1000, NTC10K) in °C or °F.	None - Passive_1K Passive_20K - PT1000_C NI1000_C NTC10K_C PT1000_F NI1000_F NTC10K_F	None
Sens1Analog	Analog Input [20]	Sensor 1 as analog value in Ω or °C/°F	200 - 50 kΩ -50 - 200°C -60 - 400°F	-
Sens2Type	Multi-state Value [221]	Sensor 2 Type, according Sens1Type	...	None
Sens2Analog	Analog Input [21]	Sens1Analog, according Sens1Analog	...	-
SummaryStatus	Binary Input [101]	Summary Status	None Fault	-
Command	Multi-state Value [120]	Initiate Function	None - Test Reset	-
MaxSp	Analog Value [98]	Max setpoint in %	20 - 100	-
BusWatchdog	Analog Value [130]	Timeout for Bus Watchdog in s 0s = watchdog deactivated If neither the Present_Value for AO[1] nor MV[1] is updated within the period, the Priority_Array of both objects is cleared and the Relinquish_Default becomes valid.	0 - 3600	0

PR actuators can be used for retrofitting competitor butterfly valves that require under 1400 in-lbs. Until released, contact Technical Support for a custom linkage. 1, 2, and 3 are required to retrofit. Refer below for required parts for custom retrofit.



Valve Size	Valve Series	2-way Valve Linkage with Position Indicator	2-way Valve Linkage without Position Indicator	3-way Valve Linkage without Position Indicator
4" - 6"	HD	IND-PR01	IND-PR02	UFLK6924
8"	HD	Not Available - Use SY Series*	Not Available - Use SY Series*	Not Available - Use SY Series*
8", 10", 12"	L	IND-PR03	IND-PR04	UFLK6925
10", 12"	HD	Not Available - Use SY Series*	Not Available - Use SY Series*	Not Available - Use SY Series*

* Contact Technical Support for details.

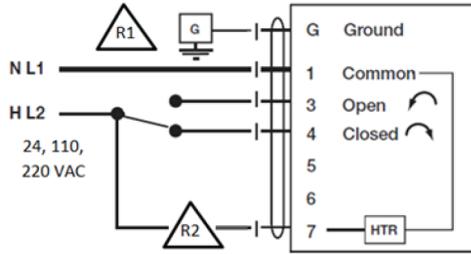
PR, PKR Replacement of SY On/Off Actuator

In case an SY3 on/off is replaced with a PR actuator, the following changes are needed.

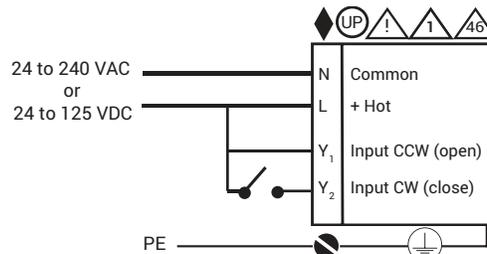
The SY is a 3-wire device and the PR actuator is a 4-wire device and additional wiring changes to the auxiliary switches are required. See below.

Ground power and control signal wiring revisions.

Replace an SY series on/off control actuator with a PR, PKR series actuator with noted R1, R2 revisions. See table 1 for terminal cross reference



SY On/Off Wiring (original)
(see submittal document for details)



PR, PKR On/Off Wiring (replacement)
(see submittal document for details)



Revision 1: Abandon SY ground wire. PR and PKR actuators are UL Class II devices and do not require grounding.



Revision 2: Relocate SY hot wire #7 (heater) to PR and PKR actuator terminal L. Terminal L must be always hot. Smart heater is integrated for PR, PKR models and requires no additional wiring connections.

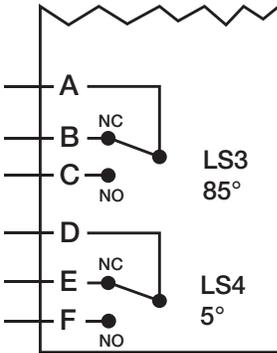
Series	SY	PR/PKR
Terminal	G	none
	1	N
	3	Y1
	4	Y2
	5	-
	6	-
	7	L

Table 1

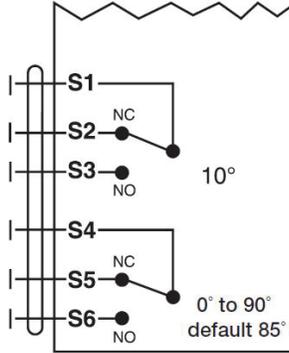
WARNING: The wiring technician must be trained and experienced with electronic circuits. Disconnect power supply before attempting any wiring connections or changes. Make all connections in accordance with wiring diagrams and follow all applicable local and national codes. Provide disconnect and overload protection as required. Use copper, twisted pair, conductors only. If using electrical conduit, the attachment to the actuator must be made with flexible conduit.

Refer to table 2 for terminal cross reference.

When travel setpoint is achieved the SPDT normally open (NO) contact becomes closed. For example; when the original SY actuator travel is 85° the A-C contact is closed. When PR, PKR actuator travel is 85° (default) the S4-S6 contact is closed.



SY Series (original)
See submittal document for details



PR, PKR Series (replacement)
See submittal document for details

Auxiliary Switch Wiring Cross Reference		
Series	SY	PR/PKR
SPDT (Normal)	Terminal	
Com	A	S4
NC	B	S5
NO	C	S6
Com	D	S1
NC	E	S2
NO	F	S3

Table 2

WARNING: The wiring technician must be trained and experienced with electronic circuits. Disconnect power supply before attempting any wiring connections or changes. Make all connections in accordance with wiring diagrams and follow all applicable local and national codes. Provide disconnect and overload protection as required. Use copper, twisted pair, conductors only. If using electrical conduit, the attachment to the actuator must be made with flexible conduit.

Does the PR actuator make an adaptation during the first commissioning?

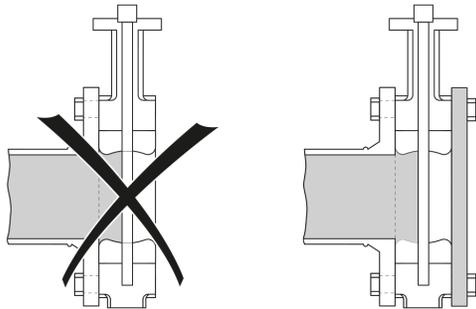
The PR actuator comes with an integrated potentiometer, therefore an adaptation is not necessary. The actuator always knows its position.

Is it allowed to mount the PR actuator upside down?

Yes, for indoor applications only.

Can the new 8" and 12" butterfly valves also be used for dead-end service?

The new butterfly valves can only be used with a closed counter-flange for dead-end service.



Can the new butterfly valves also be used for district heating and cooling applications or for ANSI 250/300 applications?

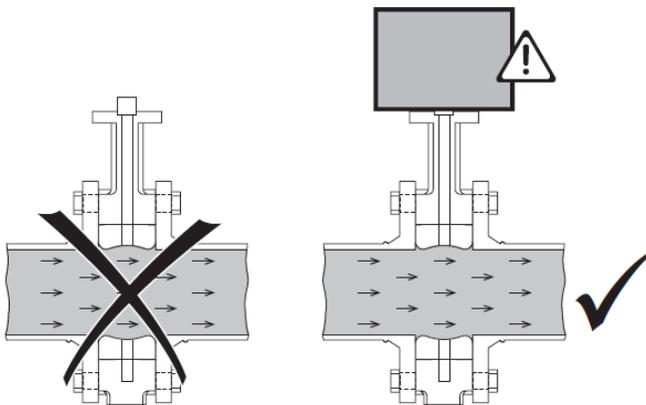
The new butterfly valves are not suitable for these applications, due to longer pipes and the high pressure drops associated with them. These valves are ANSI 125/150 type flanges.

Can we motorize an existing F6200HD butterfly valve with a PR actuator?

The PR actuator is NOT available for the F6200HD butterfly valve. The reason is that the SY3 actuator has a nominal torque of 150 Nm but can shortly develop a higher torque. The PR actuator has a constant 160 Nm torque. If a replacement for a SY3 is needed, the SY3 is still available until end of 2018 and afterwards a SY4 can be delivered as a replacement.

Is it possible for a butterfly valve to be installed in the line without an actuator?

Yes, but not for long periods of time. The butterfly valve may not be operated without an actuator or gear operator if there is flow in the line. In the absence of an actuator or gear operator, the butterfly valve might close and cause damage (water hammer).



Why is there no possibility to use the PC-Tool for parameterization?

The future tool for parameterization is the Belimo Assistant App. In a long term perspective the PC-Tool will not be supported.

I. General

1.1. The following Terms and Conditions of Sale and Warranty ("Terms") apply to the sale of products described in this Product Guide and products sold by Seller as an original equipment manufacturer ("OEM") which may not be included in this Product Guide ("Product" or "Products"). As used herein, "Seller" or "Belimo" refers to Belimo Aircontrols (USA), Inc., or Belimo Aircontrols (CAN), Inc., or Belimo Automation AG, or Belimo Brasil – Comércio de Automação Ltda. as applicable, and "Client" refers to the individual or business entity that purchases the Products directly from Seller. These Terms shall apply unless the Seller and Client mutually agree to different terms and memorialize such agreement in writing signed by both Client and Seller or (ii) unless Seller changes these Terms and publishes the Terms on its Website to be found at: www.belimo.us, in which case the most recent Terms published on the Website will prevail. In case Seller's delivery includes software and/or application software and accompanying documentation, the terms of the license agreement for such software and/or application software are applicable in addition to these Terms. However, in case of conflicts between the terms and conditions of the license agreement and the Terms, the terms and conditions of the license agreement shall prevail.

II. Price

2.1. The Seller's price for Products (the "Price") is net, F.O.B. Point of Origin, and is calculated in US currency for sales made by Belimo Aircontrols (USA), Inc., and calculated in Canadian currency for sales made by Belimo Aircontrols (CAN) Inc., and Brazilian currency for sales made by Belimo Automation AG or Belimo Brasil – Comércio de Automação Ltda. to Clients in Brazil.

2.2. The Price, unless otherwise agreed upon, does not include freight and packaging (wooden crates, pallets, etc.), the costs of which will be charged to Client at cost for each shipment and shall be payable with payment of the Price.

2.3. Orders for Products where the total order has a net value of less than US \$300 (CAN \$300) will be subject to a US \$20 (CAN \$20) handling fee (the "Handling Fee"). The Handling Fee will not be charged for orders of Products with a net value equal to or greater than US \$300 (CAN \$300) or for Products ordered through Seller's e-commerce ordering system at: www.belimo.com.

2.4. Seller reserves the right to make partial deliveries of orders of Products, each of which deliveries may be invoiced separately by Seller.

2.5. The Price does not include charges for wiring diagrams, installation, and commissioning, which will be charged to Client separately and will be payable on demand.

III. Payment

3.1. Invoices are payable in US currency for sales made by Belimo Aircontrols (USA), Inc., and in Canadian currency for sales made by Belimo Aircontrols (CAN); Inc., and in Brazilian currency for sales made by Belimo Automation AG on behalf of Brazil or Belimo Brasil – Comércio de Automação Ltda. Payments on invoices are due no later than 30 days from the date of invoice, without any deductions.

3.2. If Client maintains an outstanding balance for 45 days or more after the date of invoice, Client may be subject to restricted shipments of Products. A Client may also be required to pay for all future deliveries of Products on a cash-on-delivery or approved credit card only basis.

IV. Title and Risk

4.1. Title to Products will pass to Client from the Seller based upon the agreed Incoterms as stated on the Order Confirmation. The Seller retains the right to a return of the Product when payment is not received.

V. Damage or Loss in Transit

5.1. Seller assumes no liability for damage or loss of shipment of Products, which risk shall at all times remain with the carrier. All shipments must be unpacked and examined by Client immediately upon receipt. Any external evidence of loss or damage must be noted on the freight bill accompanying the shipment of Products or carrier's receipt and signed by the carrier's agent at the time of delivery. Failure to do so will result in the carrier's refusal to honor any claim relating to damage of Products. Client must also notify Seller within 5 days of such damage by providing Seller with a copy of the freight bill or damage report so that Seller can file a claim for loss or damage in transit with the carrier. If the damage does not become apparent until the shipment is unpacked, Client must make a request for inspection by the carrier's agent and file with the carrier within 15 days after receipt of product

and notify Seller of the same.

VI. Delivery

6.1. Seller undertakes to make every attempt to adhere to its stated delivery parameters and to make a timely delivery of the Products but does not guarantee any delivery specifications. Each contract entered into for the purchase of Products is not cancelable nor is Seller liable for any direct or indirect losses that may arise, for any reason whatsoever, due to Seller's failure to meet any stated or assumed delivery schedules.

VII. Inventory Overstock

7.1. If Client has an overstock of Product inventory, such Products received by Client cannot be returned unless and until: (i) Client alerts Seller that it intends to return some overstock of Products, (ii) Seller agrees to accept such return, (iii) Client obtains a Return Material Authorization ("RMA") number from Seller for such return of such Products, and (iv) Client follows all return instructions provided by the Seller. The RMA number must be clearly written on the outside of all packaging for any returned overstock of Products.

7.2. Only such Products returned in original packaging and shipped to Seller at Client's cost may be accepted for return under this Section. Client is also responsible for payment of a restocking charge for all returned overstocked Products in an amount no less than 20% of the invoice value of the Products ("Restocking Charges"). Any piping package or custom order returns carry a minimum restocking charge of 75% of the invoice value. Returns that result from Seller errors and not overstocking will be credited in full and will not be subject to Restocking Charges.

7.3. Any Product received damaged or showing evidence of having been installed will be refused or assessed a higher restocking charge. Custom kits designed to a Client's unique specifications are not returnable.

7.4. If Client requests product to be returned to Client, the Client will be responsible for return shipping charges. See specific product literature for exclusions or exceptions.

7.5. Any Products that are retrofit are not returnable.

VIII. Handling, Installation and Use of Products

8.1. Products are only intended for installation and commissioning by trained technicians.

8.2. The installation and exchange of Products may only be carried out by trained technicians. Products may only be handled by trained technicians and only in accordance with the most current valid data and installation sheet.

IX. Limited Warranty

A. 5-year Limited Warranty

9.1. Products that are designated by Seller as carrying a 5-year warranty to a location in the United States, Canada, or Latin America shall carry a 5-year warranty. The 5-year warranty is unconditional for the first two years from the date of sale of the Products to Client, subject to the Limitation On Warranty in Section 9C. After the first two years from the date of sale, the warranty coverage shall not apply to damage to Products not resulting from normal wear and tear (e.g. negligence, misuse, or failure to maintain). Product specific terms of warranty with regard to warranty period or conditions of warranty may apply to certain specified Products as stated in the documentation for those Products.

B. 2-year Conditional Warranty

9.2. Products that are designated by Seller as carrying a 2-year warranty to a location in the United States, Canada, or Latin America shall carry a 2-year warranty. The 2-year warranty is conditional from the date of sale of the Products to Client, and the warranty coverage shall not apply to damage to Products not resulting from normal wear and tear (e.g. negligence, misuse, or failure to maintain). Product specific terms of warranty with regard to warranty period or conditions of warranty may apply to certain specified Products as stated in the documentation for those Products.

C. Limitation On Warranty; Warranty Disclaimer

9.3. Seller's warranties hereunder shall be null and void in the event of any: (a) modification or unauthorized repairs of Products by Client; (b) unauthorized incorporation or integration of Products into or with Client's equipment; (c) use of Products in an unauthorized manner; or (d) damage to Products not caused by Seller.

9.4. These Terms constitute the entire understanding and agreement between Seller and Client regarding the warranties that cover Products and supersedes

all previous understandings, agreements, communications and representations. All Seller warranties are extended only to Client and are non-transferable. All Seller warranties shall extend only to HVAC use of the Products. If Products are used in non-HVAC applications (e.g., aircraft, industrial processes, etc.), Seller's warranties will not cover such Products. Client will be solely responsible for any damage to or malfunction of Products or for any damage resulting from such use of Products.

9.5. Both the conditional and unconditional warranties hereunder cover the Products only, and do NOT cover labor associated with the troubleshooting, removal or replacement of such Products.

9.6. EXCEPT FOR THE EXPRESS WARRANTIES SPECIFIED IN SECTION IX, SELLER MAKES NO OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, AND DISCLAIMS ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE AND IMPLIED WARRANTY OF MERCHANTABILITY.

D. Remedies

9.7. If a defect arises in the Product and an RMA is issued as provided in Section 9.8, Seller will, at its option and to the extent permitted by law, either (1) repair the Product at no charge, using new or refurbished replacement parts or (2) replace the Product with a new Product. In the event of such a defect, to the extent permitted by law, these are Client's sole and exclusive remedies.

9.8. Client cannot return Products to Seller unless: (i) Client notifies Seller that it intends to return such Products, (ii) Seller agrees to accept the return of such Products, (iii) Client obtains a RMA number from Seller for the return of such Products, and (iv) Client follows all return instructions provided by the Seller. Client shall promptly notify Seller of Products' alleged defect and provide Seller with other evidence and documentation reasonably requested by Seller. The RMA number must be clearly written on the outside of all packaging for any returned Products. Only Products returned to the proper location as instructed by Seller and identified with an RMA number will be considered for credit.

9.9. Seller will only accept for return Products returned in original packaging. All returned Products must be shipped to Seller at Client's cost. Such returned Products must be received within one year from original sale date to Client, in as-new condition, adequate for resale as new Products to qualify for credit. Client will be responsible for payment of a restocking charge for all returned Products in an amount no less than 20% of the invoice value of the Products ("Restocking Charges"). Product received damaged or showing evidence of having been installed will be refused or assessed a higher restocking charge. Custom kits designed to a Client's unique specifications are not returnable. If Client requests repaired Product to be returned to them, Client will be responsible for return shipping charges. See specific Product literature for exclusions or exceptions.

9.10. Returns that result from Seller's breach of these Terms will be credited in full and will not be subject to Restocking Charges.

9.11. Seller-authorized support technicians are available for troubleshooting before any shipments to Seller. The contact information for Belimo customer service is listed on the back page of Belimo's Product Guide and Price List ("PGPL") or may be found at www.belimo.com.

9.12. If Seller determines that a problem cannot be resolved without Product replacement, an RMA number will be issued by Seller for return of the Products. Prior to returning any Products under a warranty, Client must obtain an RMA number from Seller, along with shipping instructions for the return. The RMA number must be clearly written on the outside of the box containing the returned Products. Only Products returned to the proper location and identified with an RMA number will be accepted by the Seller.

9.13. All returned Products should be packaged appropriately to prevent further damage. Seller reserves the right to refuse any returned Product if improperly packaged or labeled (e.g. without an RMA number on the outside of packaging). Products returned without proper RMA documentation will void Seller's warranty. Seller is not responsible for charges that Client may incur as a result of the removal or replacement of Products.

9.14. Repaired or replacement Products are shipped from Seller via ground shipment. Other shipping methods are available at the sole expense of the Client.

9.15. Repaired, replaced or exchanged Products will carry a warranty for a period of time equal to the greater of: (i) the remainder of the original 5-year warranty or 2-year warranty that was applicable to the repaired, replaced or exchanged Products, or (ii) six months, effective from the date the repaired,

exchanged or replaced Products are shipped by Seller (the "Replacement Warranty Period").

9.16. If Seller determines that Product under warranty is to be replaced, Seller may elect to send a replacement in advance of receiving the returned item. For valve products 2-1/2" in diameter or greater, a purchase order is required. An invoice will be issued and shall be due and payable if the returned Products are not received by Seller within 60 days from the date that the replacement Products are shipped. Additional charges may apply if the nature of the problem has been misrepresented by Client.

9.17. New Products ordered in an attempt to circumvent the warranty process may NOT be reimbursed if, upon receipt of returned Products, it is determined that the defect in the returned Products is actually field related, or the Products have been returned for cosmetic reasons only.

X. Liability Disclaimer

10.1. IN NO EVENT SHALL SELLER HAVE ANY LIABILITY TO CLIENT OR ANY THIRD PARTY FOR ANY (a) LOST PROFITS OR COSTS OF PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, OR FOR ANY INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES, OR (b) ANY DAMAGES WHATSOEVER RESULTING FROM THE PERFORMANCE OR A TEMPORARY OR PERMANENT LOSS OF USE OF PRODUCTS, HOWEVER CAUSED UNDER ANY THEORY OF LIABILITY AND WHETHER BASED IN CONTRACT, TORT (INCLUDING NEGLIGENCE), STATUTE OR OTHERWISE. THE FOREGOING LIMITATIONS SHALL APPLY EVEN IF SELLER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES AND NOTWITHSTANDING THE FAILURE OF ESSENTIAL PURPOSE OF ANY LIMITED REMEDY STATED HEREIN. SELLER'S MAXIMUM AGGREGATE LIABILITY UNDER, ARISING FROM OR IN CONNECTION WITH THE SALE OF ITS PRODUCTS TO CLIENT, SHALL BE LIMITED TO THE AMOUNT PAID BY CLIENT FOR THE PRODUCT DEEMED RESPONSIBLE FOR THE LOSS OR DAMAGE.

10.2. Client releases Seller in full from any possible third party claims resulting in connection with the circumstances listed above. This also applies to claims in connection with products liability.

10.3. If Client becomes aware that any third party has made or appears likely to make any claim regarding Products (including, without limitation, regarding Product defects or rights infringed by Products), then Client shall immediately inform Seller and afford to Seller all assistance that Seller may require to enforce its rights and defend such claim.

XI. Proper Law and Jurisdiction

11.1. All sales of Products under these Terms described herein shall be governed by the laws of the State of Connecticut, without regard to its conflicts of law principles, and Seller and Client agree to submit to the exclusive jurisdiction of the federal and state courts located in the State of Connecticut with respect to any dispute arising from the subject matter hereof. The Seller and Client hereby waive all rights to a jury trial in connection with any claims relating to the subject matter hereof. All causes of action arising out of or connected to the sales of Products under these Terms shall be resolved individually, with no right by Seller or Client to participate in a representative capacity, or as a member of any class action.

XII. Privacy and Data

12.1 Seller places great value on the implementation of lawful data processing to protect Client's personal data. Seller is obliged to process Client's personal data in accordance with applicable law. Seller is dependent on the services of a third party for the provision of its services. Seller has obligated the third party to process Client's data only in connection with the services agreed with Seller, to ensure the same level of data protection as Seller, and to not pass on Client's data to other third parties without Client's consent. When processing Client's data and transferring Client's data to third parties, Seller will use reasonable commercial efforts to provide an appropriate level of data protection and that appropriate organizational and technical measures are implemented to protect Client's personal data. More detailed information on Seller's data protection guidelines is available from the following Internet address: www.belimo.com/privacy.

XIII. California Proposition 65



13.1 WARNING: For Belimo Products sold in California, these Products do or may contain chemicals which are known to the State of California to cause cancer and or birth defects or other reproductive harms. For more information see www.p65warnings.ca.gov.

Belimo Americas

USA, Latin America, and the Caribbean: www.belimo.us

Canada: www.belimo.ca

Brazil: www.belimo.com.br

Belimo Worldwide: www.belimo.com

