



INDUSTRIAL BALL VALVES

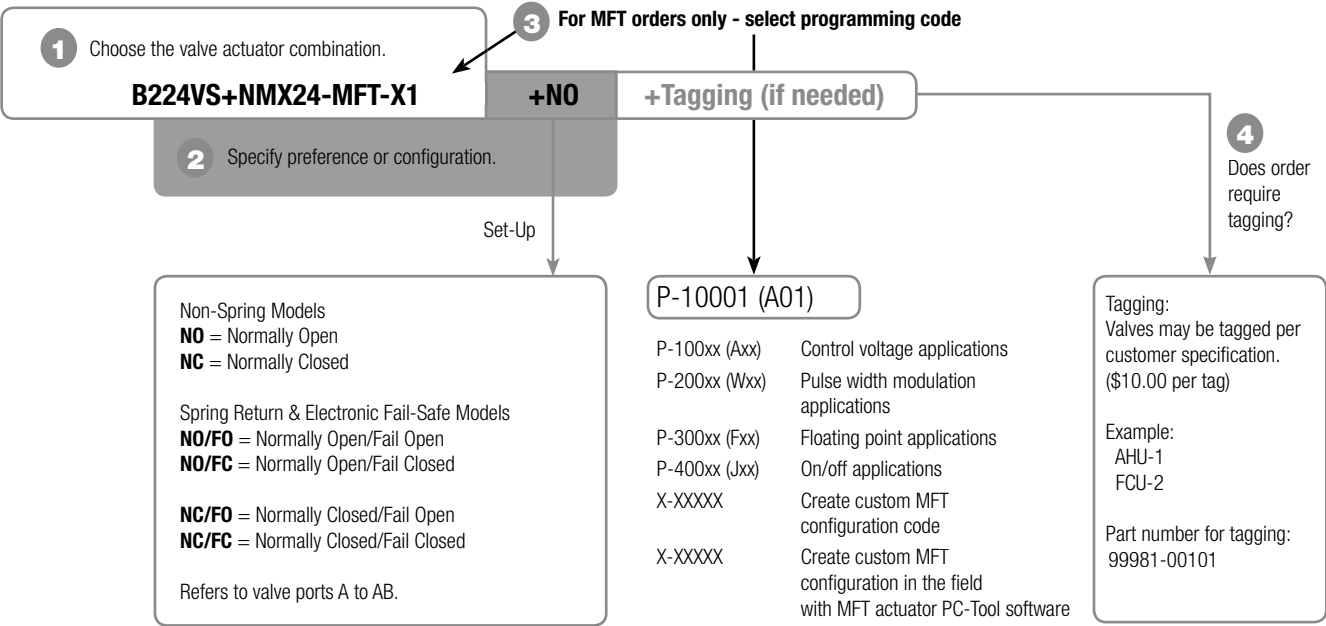
Achieve Control and Reliability

- Bronze, brass, and stainless steel ball valves with NPT connection for low and medium pressure steam applications.
- Range of media temperature ratings suited for chilled, hot water and steam service.
- Fitted with rotary actuators offers easy field assembly and installation.

Ball Valve Nomenclature

B2	24	VS	NMX	24	-MFT-X1	
Valve B2 = 2-way B3 = 3-way	Valve Size 15-50 = ½" to 2"	Industrial Construction/ Material VS = Bronze Body, Stainless Steel Ball and Stem VSS = Stainless Steel Body, Ball and Stem L = Nickel Plated Brass Body, Chrome Plated Brass Ball and Stem	Actuator Type Non-Spring Return LM/LR NM/NR AM/AR GM SY Spring Return LF/LR NF AF/AR Electronic Fail-Safe GK	Power Supply 24 = 24 VAC/DC 120 = 120 VAC 240 = 240 VAC UP = 24-240 VAC or 24-125 VDC	Control -3-X1 = On/Off, Floating Point -MFT-X1 =Multi-Function Technology -MFT95-X1 = 0-135 Ω	-S = Built-in Auxiliary Switch

Ordering Example



Tech Doc - 03/16 - Subject to change. © Belimo Aircontrols (USA), Inc.

Control Valve Product Range

Ball Valve Product Range

	Valve Nominal Size		Type		Suitable Actuators		
C _v	Inches	DN [mm]	2-way NPT	3-way NPT	Non-Spring Return		Spring Return
1	½	15	B2050VS-01*		LM Series	SY Series	LF Series
2	½	15	B2050VS-02*				
4	½	15	B2050VS-04*				
15	½	15	B2050VS-15*				
30	¾	20	B219VS		NM Series		NF Series
51	¾	20	B220VS				
43	1	25	B224VS		AM Series		AF Series
68	1	25	B225VS				
48	1¼	32	B232VS		GM Series		
84	1½	40	B239VS				
177	1½	40	B240VS		NM Series		LF
108	2	50	B249VS				
15	½	15	B2050VSS-15*		AM		NF
30	¾	20	B219VSS				
43	1	25	B224VSS		GM		AF Series
108	2	50	B249VSS				
6.4	½	15		B315L**	LR Series	LFR Series	
12.8	¾	20		B320L**			
11	1	25		B325L**	NR		
34	1¼	32		B332L**		AR Series	AFR Series
57	1½	40		B340L**			
87	2	50		B350L**			

* For hot only or cold only applications. Not for temperature changeover applications.

** Not for steam applications.

NOTE: Industrial ball valves (B2..VS, B2..VSS) have serviceable components. Proper maintenance of these parts will ensure a longer in-service life for the valves. The seats of these valves will require replacement at an interval consistent with number of full cycles the valve has been operated, or as field condition dictates.



Mode of Operation

The control valve is operated by an electronic actuator that responds to a standard voltage for on/off control, by a modulating VDC/4...20 mA, or 3-point control system. The actuator will then move the ball of the valve to the position dictated by the voltage or the control signal thus changing the flow.

Product Features

Modified equal percentage of flow for B2. Modified linear flow for B3.

B3...L valves are for diverting and changeover applications and are not rated for steam.

Actuator Specifications

Control type	on/off, floating point, modulating, 2-10 VDC, multi-function technology (MFT)
Manual override	LM, NM, GM, AM, SY, AF, NF, GK, LR, NR, AR
Electrical connection	3 ft. [1 m] cable with ½" conduit fitting (excluding SY)

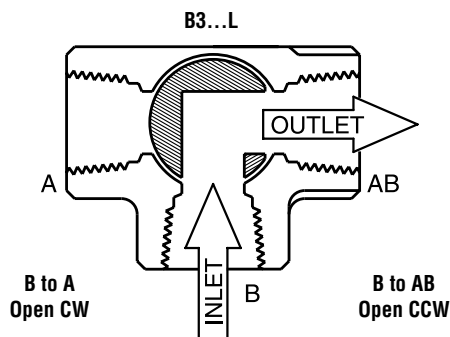
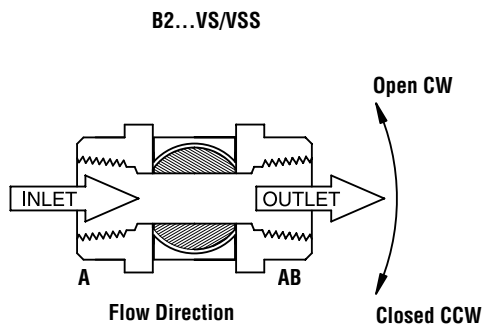
Valve Specifications

Service	chilled or hot water, (60% glycol), steam
Flow characteristic	modified equal percentage (B2), modified linear (B3...L)
Sizes	½", ¾", 1", 1¼", 1½", 2"
End fitting	NPT female ends
Materials	
Body	bronze (B2..VS) stainless steel (B2..VSS) nickel plated brass (B3..L)
Ball	stainless steel, bronze (B2050VSS-15) chrome plated brass (B3..L)
Stem	stainless steel nickel plated brass (B3..L)
Seats	
2-way	RPTFE
3-way	Teflon PTFE
Stem packing	
2-way NPT	MPTFE
O-rings	NPT EPDM (B3..L)
Media temp range	
B2..VS	-22°F to +280°F [-30°C to +138°C]
B2..VSS	-22°F to +298°F [-30°C to +148°C]
B3...L	0°F to 250°F [-18°C to +120°C]
Body pressure rating	
3-way	600 psi DN 15-25 (B3..L ½"-1") 400 psi DN 32-50 (B3..L 1¼" - 2")
Maximum inlet pressure	
Steam	35 psi B2..VS 50 psi B2..VSS
Leakage	ANSI Class IV (B2..VS, VSS) 0% (B3..L)

SET-UP - Specify Upon Ordering

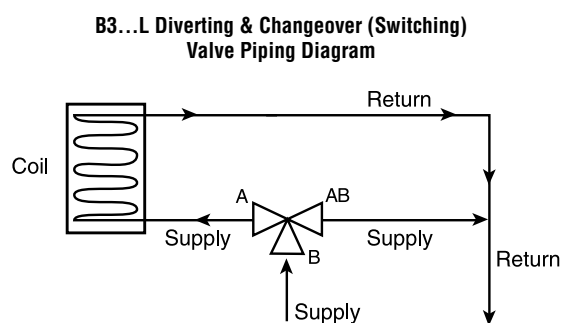
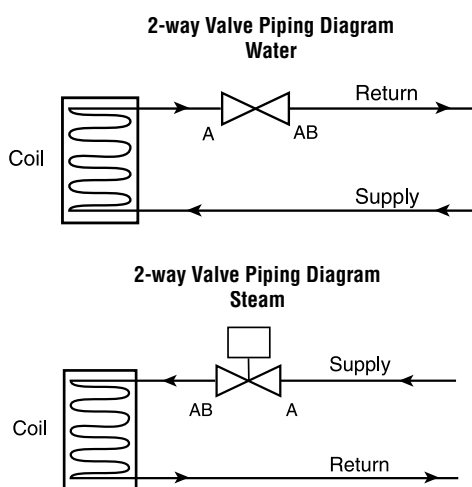
		2-WAY VALVE		3-WAY VALVE	
NON-SPRING RETURN Stays in Last Position	LMB24-3-X1, NMB24-3-X1, AMB24-3-X1, GMB24-3-X1, LRB24-3-X1, NRB24-3-X1, ARB24-3-X1, SY...	Power to pin 2 will drive valve CW. Power to pin 3 will drive valve CCW. The above will function when the directional switch is in the "1" position to reverse, select the "0" position.		Power to pin 2 will drive valve CW. Power to pin 3 will drive valve CCW. The above will function when the directional switch is in the "1" position to reverse, select the "0" position.	
	LMX24-MFT-X1, NMX24-MFT-X1, AMX24-MFT-X1, GMX24-MFT-X1, LRX24-MFT-X1, NRX24-MFT-X1, ARX24-MFT-X1, SY...MFT	NC: Normally closed A to AB, valve will open as voltage increases.	NO: Normally open A to AB, valve will close as voltage increases.	NC: Normally open B to A, valve will open as voltage increases.	NO: Normally open B to AB, valve will close as voltage increases.
SPRING RETURN Note Fail Position	LF24 US, LF120 US, NFB24-X1, AFB24-X1, AFBUP-X1, AFRBUP-X1	NO/FO: Normally open A to AB, valve will drive closed. Spring Action: Actuator will fail open A to AB upon power loss.	NC/FC: Normally closed A to AB, valve will drive open. Spring Action: Actuator will fail closed A to AB upon power loss.	NO/FO: Normally open B to AB, valve will drive closed. Spring Action: Actuator will fail open B to AB upon power loss.	NC/FC: Normally closed B to A, valve will drive open. Spring Action: Actuator will fail closed B to A upon power loss.
	LF24-MFT US, NFX24-MFT-X1, AFX24-MFT-X1, AFRX24-MFT-X1	NC/FO: Normally closed A to AB, valve will open as voltage increases. Actuator switch on CW. Spring Action: Will fail open upon power loss.	NC/FC: Normally closed A to AB, valve will open as voltage increases. Actuator switch on CW. Spring Action: Will fail closed upon power loss.	NO/FC: Normally open B to AB, valve will close as voltage increases. Actuator switch on CCW. Spring Action: Will fail closed upon power loss.	NO/FO: Normally open B to AB, valve will close as voltage increases. Actuator switch on CCW. Spring Action: Will fail open upon power loss.

FLOW PATTERN



NOTE: B3...L are piped differently than B3 CCV Valves.

PIPING DIAGRAMS

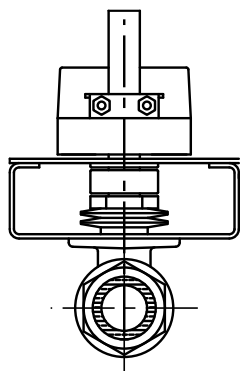


NOTE:

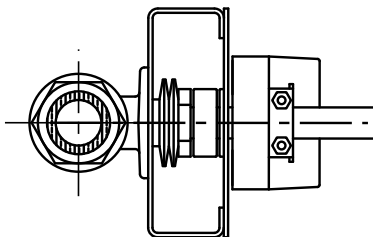
To avoid torque increase during off season shut down or other periods of inactivity longer than 1 month, the valve should be exercised (actuator or manually driven full open-closed cycle) at least once per month. This is necessary to avoid any application problems after an off season shut down. This is not required for B3...L valves.

PIPING/MOUNTING ORIENTATION

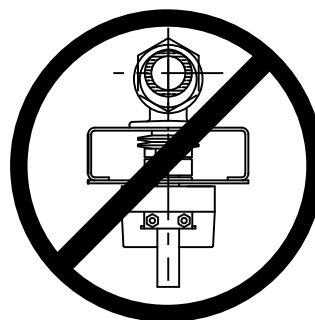
Assembly can be mounted horizontally or vertically for water applications. For steam applications the valve can be mounted vertically but if mounted horizontally the valve must be 90° off center of the pipe. Do not install with actuator below pipe.



(Water application only)



(Steam or water application)



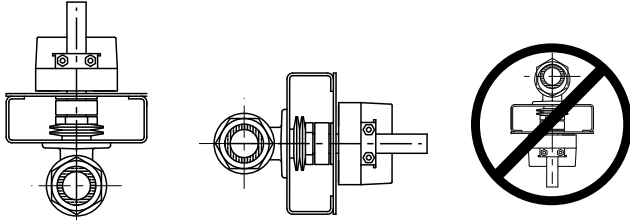
Mounting and Installation Instructions

Ball Valves



Mounting

The valves can be mounted in any position, except stem below horizontal.



The flange allows the actuator to be either parallel or perpendicular to the pipe; there are four orientations possible.

If field installing a spring return actuator, disconnect power and allow actuator to spring closed. Flip actuator over if necessary to achieve proper rotation direction. **DO NOT USE THE REVERSING SWITCH TO DO THIS.**

Two-way Valves Mounting

For NORMALLY CLOSED operation:

The ball of the valve must be rotated so that the ball is CLOSED to flow. The actuator should be mounted with the clamp fully rotated CW (R). Spring return actuators will show the CW (R) symbol near the clamp and position indicator. Depressing the gear release to move the clamp rotates non-spring return actuators.

For NORMALLY OPEN operation:

The ball of the valve must be rotated so that the ball is OPEN to flow. The actuator should be mounted with the clamp fully rotated CCW (L). Spring return actuators will show the CCW (L) symbol near the clamp and position indicator. Depressing the gear release to move the clamp rotates non-spring return actuators. There are marks on the top of the valve stem, which indicate the port directions.

Three-way Valves Mounting

For NORMALLY CLOSED Control Port operation:

The ball of the valve must be rotated CW (R) so that the "AB" port is CLOSED to flow. The actuator should be full CW (R) rotation of the clamp. Spring return actuators will show the CW (R) symbol near the clamp and position indicator. CCW (L) rotation of the actuator will open the control port and close the bypass port.

For NORMALLY OPEN operation:

The ball of the valve must be rotated CCW (L) so that the "AB" port is OPEN to flow. The actuator should be full CCW (L) rotation of the clamp. Spring return actuators will show the CCW (L) symbol near the clamp and position indicator. CW (R) rotation of the actuator will close the control port and open the bypass port. There are marks on the top of the valve stem which indicate the port directions.

Then the actuator-linkage can be set onto the valve. The square hole of the adapter fits easily onto the square stem extension. Rotate the ball as necessary using a wrench.

Do not force. Do not use the actuator to turn the pipe or the stem. Do not use any toothed tool such as pliers, which may damage the stem.

- Check that the actuator rotates so that the valve seats for close off and also rotates open to achieve full Cv. Use the gear release or the AF crank to verify. For LF or NF models apply power and control signal if necessary.
- Verify that CCW (L) rotation of the actuator will open the ball to flow.
- Install and tighten the hold down screw not more than 1/2 turn beyond the point where resistance is felt.

Installation

1. Inspect shipping package, valve, linkage, and actuator for physical damage. If shipping damage has occurred notify appropriate carrier. Do not install.
2. Install valve with the proper ports as inlets and outlets. Check that inlet and outlet of 2-way valves are correct; check that the "A", "B", and "AB" ports of 3-way valves are piped correctly. Flow direction arrows must be correct.
3. Blow out all piping and thoroughly clean before valve installation.
4. Clean male pipe threads with wire brush and rag. If threads have been damaged or exposed to weather, running a tap or die over the threads may straighten them. Clean pipes, threads, and valve threads before installation; check for any foreign material that can become lodged in trim components. Strainers should be cleaned after initial startup.
5. Pipe sealing compound should be applied sparingly after cleaning and may not be applied to the two lead threads of a screwed pipe, which are innermost inside the valve. Sealing compound is to be placed on male threads only. The purpose is to lubricate the pipes when tightening.
6. Valve must be installed with the stem towards the vertical, not below horizontal.
7. Start the connection by turning the valve or pipe by hand as far as possible. Be certain the threads mate by the "feel" of the connection.
8. Use wrenches to tighten the valve to the pipe. Do not over tighten or strip the threads. Two wrenches are necessary to avoid damaging the valve.
9. Two-way valve Normally Open or Closed configurations must be verified by examining both the mechanical drawings and the valve and actuator.

Warning!

- Valve should not be used for combustible gas applications. Gas leaks and explosions may result. Do not install in systems, which exceed the ratings of the valve.
- Avoid installations where valve may be exposed to excessive moisture, corrosive fumes, vibration, high ambient temperatures, elements, or high traffic areas with potential for mechanical damage.
- Valve assembly location must be within ambient ratings of actuator. If temperature is below -22°F a heater is required.
- The valve assembly will require heat shielding, thermal isolation, or cooling if combined effect of medium and ambient temperatures – conduction, convection, and radiation – is above 122°F for prolonged time periods at the actuator.
- Following standard procedure, a strainer should be installed before the coil and valve or in another appropriate place in the system.
- Visual access must be provided. Assembly must be accessible for routine schedule service. Contractor should provide unions for removal from line and isolation valves.
- Avoid excessive stresses. Mechanical support must be provided where reducers have been used and the piping system may have less structural integrity than full pipe sizes.
- Sufficient upstream and downstream piping runs must be provided to ensure proper valve capacity and flow response. Five diameters in each direction are recommended.
- Life span of valve stems and O-rings is dependent on maintaining non-damaging conditions. Poor water treatment or filtration, corrosion, scale, other particulate can result in damage to trim components. A water treatment specialist should be consulted.
- Normal thread engagement between male pipe thread and valve body should be observed. Pipe run that is in too far will damage the valve.

VALVE SIZE	C _v	TYPE	MODEL #	LINE SIZE							
				¾" Fp Cv	1" Fp Cv	1¼" Fp Cv	1½" Fp Cv	2" Fp Cv	2½" Fp Cv	3" Fp Cv	4" Fp Cv
½"	1	2W NPT	B2050VS-01	1.0	1.0	-	-	-	-	-	-
½"	2	2W NPT	B2050VS-02	2.0	1.9	-	-	-	-	-	-
½"	4	2W NPT	B2050VS-04	3.8	3.6	-	-	-	-	-	-
½"	15	2W NPT	B2050VS-15 B2050VSS-15	8.9	7.2	-	-	-	-	-	-
¾"	30	2W NPT	B219VS/VSS	30.0	21.6	17.4	15.6	-	-	-	-
¾"	51	2W NPT	B220VS	51.0	26.5	19.9	17.3	-	-	-	-
1"	43	2W NPT	B224VS/VSS	-	43.0	36.1	30.5	25.8	-	-	-
1"	68	2W NPT	B225VS	-	68.0	48.3	36.7	29.2	-	-	-
1½"	177	2W NPT	B240VS	-	-	-	177.0	102.7	77.9	67.3	-
2"	108	2W NPT	B249VS/VSS	-	-	-	-	108.0	100.4	91.8	83.2
½"	6.4	3W NPT	B315L	5.5	5.0	4.8	-	-	-	-	-
¾"	12.8	3W NPT	B320L	12.8	11.8	11.0	10.5	-	-	-	-
1"	11	3W NPT	B325L	-	11.0	10.9	10.7	10.4	-	-	-
1¼"	34	3W NPT	B332L	-	-	34.0	32.8	29.9	28.2	-	-
1½"	57	3W NPT	B340L	-	-	-	57.0	51.9	47.4	44.9	-
2"	87	3W NPT	B350L	-	-	-	-	87.0	82.8	77.9	72.3

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)

Typically actuators require a 24 VAC Class 2 transformer and draw a maximum of 10 VA per actuator. The actuator enclosure cannot be opened in the field; there are no parts or components to be replaced or repaired.

- EMC directive: 89/336/EEC
- Software class A: Mode of operation type 1
- Low voltage directive: 73/23/EEC

Typical Transformer Sizing

Actuator Series	Voltage	Max. VA Per Actuator
AF/AFR	24	10
LF	24	6
AM/AR	24	6
NM/NR	24	4
LM/LR	24	3
GM	24	7

CAUTION It is good practice to power electronic or digital controllers from a separate power transformer. 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 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. 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. 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.

		NON-SPRING RETURN					SPRING RETURN				ELECTRONIC FAIL-SAFE	
WEATHER SHIELDS		LM	NM	AM	GM	2*GM	LF	NF	AF	2*AF	GK	2*GK
	ZS-SPBV-10 NM/AM/GM/NF/AF/GK series on VS/VSS/VB		•	•	•			•	•		•	
	ZS-SPBV-20 Dual GM/AF/GK series on VS/VSS/VB					•				•		•
	ZS-BVVS-0002 LM on VS/VSS	•										
	ZS-BVVS-0003 LF series on VS/VSS						•					
AUXILIARY SWITCHES & POTENTIOMETERS												
	S1A Auxiliary switch - 1x SPDT, 3A (0.5A Inductive) @ 250 VAC	•	•	•	•						•	
	S2A Auxiliary switch - 1x SPDT, 3A (0.5A Inductive) @ 250 VAC	•	•	•	•						•	
	P140A GR Feedback potentiometer 140 Ω	•	•	•	•						•	
	P500A GR Feedback potentiometer 500 Ω	•	•	•	•						•	
	P1000A GR Feedback potentiometer 1000 Ω	•	•	•	•						•	
	P2800A GR Feedback potentiometer 2800 Ω	•	•	•	•						•	
	P5000A GR Feedback potentiometer 5000 Ω	•	•	•	•						•	
	P10000A GR Feedback potentiometer 10000 Ω	•	•	•	•						•	
BATTERY BACKUP												
	NSV24 US Battery backup module	•	•	•	•							
	NSV-BAT 12VDC 1.2 AH battery (2 required)	•	•	•	•							

Note: Each NSV-24 US requires 2 NSV-BAT.

		NON-SPRING RETURN			SPRING RETURN
ELECTRIC DISCONNECT		AM, NM, LM	GM	SY	AF, NF, LF
	HOA-120V Local electric disconnect SY2-SY12 110/230V - 2 position			•	
	HOA-120VMFT Local electric disconnect SY2-SY12 110/230V - modulating			•	
	HOA-24V Local electric disconnect SY2-SY12 24V - 2 position			•	
	HOA-24VMFT Local electric disconnect SY2-SY12 24V - modulating			•	
AUXILIARY SWITCHES & POTENTIOMETERS					
	SY-1000-FB01 1000 Ω feedback potentiometer 2 position, factory installed option only			•	
	SY-1000-FB02 1000 Ω feedback potentiometer modulating, factory installed option only (modulating models SYx...-P, SR or MFT)			•	
PROGRAMMING TOOLS					
	MFT-P Belimo MFT configuration software (V3.X) Includes: PC-Tool software (interface cables [ZTH US] not included)	•	•	•	•
INTERFACES, CABLES					
	ZTH US Handheld interface module that allows field programming.	•	•	•	•
	ZK1-GEN Cable for use with ZTH US to connect to new generation non-spring return actuator via diagnostic/programming socket	•	•		
	ZK2-GEN Cable for use with ZTH US to connect with spring and non-spring return actuators not equipped with diagnostic/programming socket	•	•	•	•
	ZK6-GEN Cable for use with ZTH US to connect to SY actuator via RJ11 port			•	
BATTERY BACKUP					
	EXT-NSV-B01-120 Battery backup system, SY1 - SY3 120 VAC, on/off actuators			•	
	EXT-NSV-B02-120 Battery backup system, SY1 - SY3 120 VAC, MFT actuators			•	
	EXT-NSV-B11-24 Battery backup system, SY1 24 VAC, on/off actuators			•	
	EXT-NSV-B12-24 Battery backup system, SY1 24 VAC, MFT actuators			•	
	EXT-NSV-B21-230 Battery backup system, SY1 - SY3 230 VAC, on/off actuators			•	
	EXT-NSV-B22-230 Battery backup system, SY1 - SY3 230 VAC, MFT actuators			•	