



### Valve Specifications

Service	chilled or hot water, 60% glycol max (open loop/steam not allowed)
Flow characteristic	equal percentage/linear
Size	2½", 3", 4", 5", 6"
Type of end fitting	pattern to mate with ANSI 125 flange
Materials	
Body	
Valve	cast iron - GG25
Sensor housing	ductile iron - GGG50
Ball	stainless steel
Seat	PTFE
Characterizing disc	stainless steel
Packing	2 EPDM O-rings, lubricated
Body pressure rating	according to ANSI 125, standard class B
Media temperature range	14°F to 250°F [-10°C to +120°C]
Maximum sound level	70 dBA
Conductivity of media	min. 20uS/cm
Leakage	0%
Close-off pressure	100 psi
Differential pressure range(ΔP)	1 to 50 psi*, 5 to 50 psi
Inlet length required to meet specified measurement accuracy	5x nominal pipe size (NPS)
Humidity	<95% RH non-condensing
Flow metering technology	electromagnetic
Flow control tolerance	±5%
Flow measurement tolerance	±2%
Flow measurement repeatability	±0.5%
Temperature sensors	32.8 ft. [10m] PT1000 insertion sensors Thermal well ½ NPT
Remote temperature sensor length	
Standard	32.8 ft. [10 m]
Optional	4.9 ft. [1.5m], 9.8 ft. [3m], 16.4 ft. [5m]
Temperature measurement tolerance	According to PT1000 DIN EN60751 Class B.
Resolution of temperature sensor	0.18°F (0.1°C)
Rated impulse voltage	actuator/sensor: 0.8 kV (in accordance with EN 60730-1)
Power supply for the flow sensor	actuator is powered by the flow sensor
Quality standard	ISO 9001
Agency listings	UL 60730-1/2-14, 2-18, CE according to 2004/108/EC and 2006/95/EC

All flow tolerances are @ 68°F (20°C) & water.

\* See flow reduction table on page 43.

Valve Nominal Size		Weights
Inches	DN [mm]	Pounds [kg]
2½"	65	52 [23.6]
3"	80	63 [28.7]
4"	100	89 [40.5]
5"	125	120 [54.7]
6"	150	154 [70.0]

### Application

Water-side control of heating and cooling systems for AHUs and water coils.  
Equal Percentage / Linear: heating / cooling applications.

### Mode of Operation

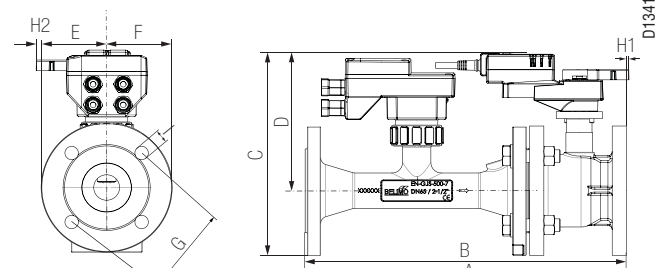
The Energy Valve is an energy metering pressure independent control valve that optimizes, documents and proves water coil performance.

### Product Features

The Energy Valve measures energy, controls power, and manages delta T.

- Measures Energy: using its built-in electronic flow sensor and supply and return temperature sensors.
- Controls Power: with its Power Control logic, providing linear heat transfer regardless of temperature and pressure variations.
- Manages Delta T: The Energy Valve solves Low Delta T Syndrome. In addition, it reduces pumping costs while increasing chiller/boiler efficiency by optimizing coil efficiency.

### Dimensions



Valve Nominal Size		Dimensions (Inches [mm])							
In.	DN [mm]	A	B	C	D	E	F	G	I
2½"	65	17.9" [454]	17.9" [454]	11.2" [284]	7.9" [201]	3.64" [92]	3.64" [92]	5.50" [140]	0.75" [19]
3"	80	19.7" [499]	19.7" [499]	11.8" [300]	7.9" [201]	3.94" [100]	3.94" [100]	6.07" [154]	0.75" [19]
4"	100	22.85" [581]	22.85" [581]	12.8" [325]	8.3" [211]	3.75" [95]	3.75" [95]	7.50" [190.5]	0.75" [19]
5"	125	25.18" [640]	25.18" [640]	14.4" [366]	9.4" [239]	5" [127]	5" [127]	8.50" [215.9]	0.88" [22]
6"	150	30.2" [767]	30.2" [767]	15.4" [391]	10.4" [264]	5.5" [140]	5.5" [140]	9.50" [241.3]	0.88" [22]

### Available Flow Rates

Design Flow Range GPM	Valve Nominal Size		Type	Actuator Type	Electronic Fail-Safe
	Inches	DN [mm]	2-way Flanged	Non-Spring Return	
38-127	2½"	65	EV250S-127	ARB, ARX	AKRB, AKRX
54-180	3"	80	EV300S-180	ARB, ARX	AKRB, AKRX
95-317	4"	100	EV400S-317	GRB, GRX	AKRB, AKRX
149-495	5"	125	EV500S-495	GRB, GRX	GKRB, GKRX
214-713	6"	150	EV600S-713	GRB, GRX	GKRB, GKRX

# EV... Series Energy Valve

## Stainless Steel Plug and Seat, ANSI 250 Flange



### Valve Specifications

Service	chilled or hot water, 60% glycol max (open loop/steam not allowed)
Flow characteristic	equal percentage/linear
Size	2½", 3", 4", 5", 6"
Type of end fitting	pattern to mate with ANSI 250 flange
Materials	
Body	cast iron
Stem	stainless steel
Sensor housing	ductile iron GGG50
Seat and Plug	stainless steel
Packing	NLP (no lip packing)
Body pressure rating	according to ANSI 250, standard class B
Media temperature range	14°F to 250°F [-10°C to +120°C]
Maximum sound level	70 dBA
Conductivity of media	min. 20uS/cm
Leakage	ANSI Class IV
Differential pressure range(ΔP)	7.5 to 50 psid or 1 to 50 psid with flow reductions
Maximum inlet pressure (water)	300 psi
Maximum differential pressure	50 psi
Inlet length required to meet specified measurement accuracy	5x nominal pipe size (NPS)
Humidity	<95% RH non-condensing
Flow metering technology	electromagnetic
Flow control tolerance	±5%
Flow measurement tolerance	±2%
Flow measurement repeatability	±0.5%
Temperature sensors	PT1000 insertion sensors with thermal well
Remote temperature sensor length	
Standard	32.8 ft. [10 m]
Optional	4.9 ft. [1.5m], 9.8 ft. [3m], 16.4 ft. [5m]
Temperature measurement tolerance	According to PT1000 DIN EN60751 Class B
Resolution of temperature sensor	0.18°F (0.1°C)
Rated impulse voltage	actuator/sensor: 0.8 kV (in accordance with EN 60730-1)
Power supply for the flow sensor	flow sensor is powered by the actuator
Quality standard	ISO 9001

All flow tolerances are @ 68°F (20°C) & water.

\* See flow reduction table on page 43.

### Close-off Pressures

Valve Nominal Size		Actuators		Weights
Inches	DN [mm]	EV	AVK	Pounds [kg]
2½	65	310 psi	310 psi	54 [24.5]
3	80	310 psi	310 psi	63 [28.7]
4	100	310 psi	290 psi	99 [44.9]
5	125	296 psi	202 psi	126 [57.2]
6	150	215 psi	135 psi	173 [78.5]

### Application

Water-side control of heating and cooling systems for AHUs and water coils. Equal Percentage / Linear: heating / cooling applications.

### Mode of Operation

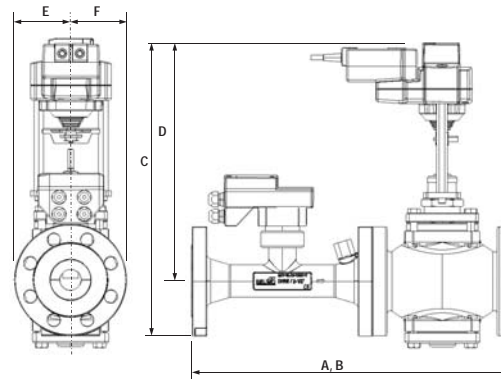
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The Energy Valve measures energy, controls power, and manages delta T.

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- Controls Power: with its Power Control logic, providing linear heat transfer regardless of temperature and pressure variations.
- Manages Delta T: The Energy Valve solves Low Delta T Syndrome. In addition, it reduces pumping costs while increasing chiller/boiler efficiency by optimizing coil efficiency.

### Dimensions



Valve Nominal Size		Dimensions (Inches [mm])					
Inches	DN [mm]	A	B	C	D	E	F
2½"	65	22.2" [564]	22.2" [564]	20.4" [516]	18.25" [464]	4.5" [114]	4.5" [114]
3"	80	23.81" [605]	23.81" [605]	20.99" [533]	19.18" [487]	4.5" [114]	4.5" [114]
4"	100	28.27" [718.1]	28.27" [718.1]	22.73" [577.3]	20.37" [517]	4.5" [114]	4.5" [114]
5"	125	31.5" [800]	31.5" [800]	20.99" [533]	20.87" [530]	4.5" [114]	4.5" [114]
6"	150	36.37" [924]	36.37" [924]	25.12" [638]	21.25" [540]	4.5" [114]	4.5" [114]

### Available Flow Rates

Design Flow Range GPM	Valve Nominal Size		Type	Actuator Type	
	Inches	DN [mm]	2-way Flanged	Non-Spring Return	Electronic Fail-Safe
38-127	2½	65	EV250S-127-250	EVX	AVKX
54-180	3	80	EV300S-180-250	EVX	AVKX
95-317	4	100	EV400S-317-250	EVX	AVKX
149-495	5	125	EV500S-495-250	EVX	AVKX
214-713	6	150	EV600S-713-250	EVX	AVKX

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## Operation

The actuator is electronically protected against overload.

The actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuators rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in a holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

## Non-Spring Return LR, NR, GR, AR and Electronic Fail-Safe Actuators AKR and GKR

Actuator Specifications	
Power supply	24 VAC ± 20% 24 VDC ± 10%
Electric frequency	50/60 Hz
Power consumption	
LR Series	4W
NR Series	5W
GR Series	8W
AR Series	5W (½" to 2"), 7W (2½" to 6")
AKR Series	14W (½" to 2"), 16W (2½" to 6")
GKR Series	17W
Transformer sizing	
LR Series	7 VA (class 2 power source)
NR Series	8 VA (class 2 power source)
GR Series	12 VA (class 2 power source)
AR Series	8 VA (½" to 2"), 11 VA (2½" to 6")(class 2 power source)
AKR Series	23 VA (½" to 2"), 26 VA (2½" to 6") (class 2 power source)
GKR Series	29 VA (class 2 power source)
Electrical connection	18 GA, plenum rated cable ½" conduit connector protected NEMA 2 (IP54) 3 ft. [1 m] cable
Overload protection	electronic throughout 0° to 90° rotation
Operation range Y	2 to 10 VDC (default) VDC variable
Control	modulating
Input impedance	100 kΩ (0.1 mA), 500Ω
Flow Feedback	2 to 10 VDC (default), VDC variable
Communication	BACnet IP, BACnet MS/TP, Listed by BTL, web server, Belimo MP-Bus
Direction of rotation	motor: electronically variable fail-safe: reversible with built-in switch
Manual override	external push button
Running time normal operation	90 seconds
Running time fail-safe	35 seconds
Humidity	5 to 95% RH, non-condensing
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP54, UL enclosure type 2
Noise level	<45dB(A) at 90 seconds
Servicing	maintenance free
Quality standard	ISO 9001
Agency listings	UL 60730-1/2-14, 2-18, CE according to 2004/108/EC and 2006/95/EC

The Energy Valve is based on Belimo patent and patent pending technology:

- US-Patent: 6,039,304: Ball valve with modified characteristics.
- US-Patent Pending: 2011/0153089: HVAC actuator comprising a network interface, data store and a processor.
- US-Patent Pending: 2009/0009115: Control of sensor less and brushless DC-Motor.

The Energy Valve incorporates additional technology – Powered by Optimum Energy™.

## Wiring Diagrams

### ✂ INSTALLATION NOTES

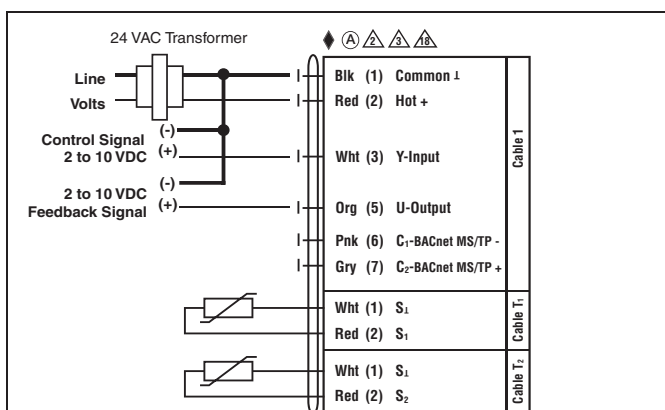
- Ⓐ Actuators with appliance cables are numbered.
- 2 **CAUTION Equipment damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- 3 Actuators may also be powered by 24 VDC.
- 18 Actuators with plenum rated cable do not have numbers on wires; use color codes instead.

### 📄 APPLICATION NOTES

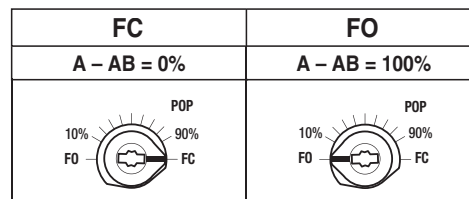
- ◆ Meets cULus requirements without the need of an electrical ground connection

### ⚠ WARNING Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.



## 2-10 VDC



## Fail-Safe Power-Off Position, AKRB, AKRX, GKR, GKRX

## System Ground

In cases where the valve body is electrically isolated from the water pipe, an earth ground should be installed in order for the sensor to work properly.

# EV...Series Energy Valve

## Non-Spring Return and Electronic Fail-Safe Actuator Series



### Operation

The actuator is electronically protected against overload.

The actuators use a brushless DC motor, which is controlled by an Application Specific Integrated Circuit (ASIC). The ASIC monitors and controls the actuators rotation and provides a digital rotation sensing (DRS) function to prevent damage to the actuator in a stall condition. Power consumption is reduced in a holding mode.

Add-on auxiliary switches or feedback potentiometers are easily fastened directly onto the actuator body for signaling and switching functions.

### Non-Spring Return EV and Electronic Fail-Safe Actuators AVK

Actuator Specifications	
Power supply	24 VAC ± 20% 24 VDC ± 10%
Electric frequency	50/60 Hz
Power consumption	EV Series 6 W running, 3.5 W holding AVK Series 12 W running, 3 W holding
Transformer sizing	EV Series 7 VA (class 2 power source) AVK Series 21 VA (class 2 power source)
Electrical connection	18 GA, plenum rated cable ½" conduit connector protected NEMA 2 (IP54) 3 ft. [1 m] cable
Overload protection	electronic throughout full stroke
Electrical Protection	actuators are double insulated
Operation range Y	2 to 10 VDC (default), variable VDC
Control	proportional
Input impedance	100 kΩ (0.1 mA) for 2-10 VDC, 500Ω for 4 to 20 mA
Feedback output U	2 to 10 VDC
Stroke	EV Series 2" [50 mm] AVK Series 1.25" [32 mm]
Linear force	EV Series 562 lbf [2500 N] AVK Series 450 lbf [2000 N]
Direction of rotation	motor reversible with built-in switch fail-safe reversible with switch
Position indication	stroke indicator on bracket
Manual override	5 mm hex crank (3/16" Allen), supplied
Running time	motor 90 seconds (default), variable (90 to 150 sec) fail-safe 35 seconds
Humidity	5 to 95% RH, non-condensing
Ambient temperature	-22°F to 122°F [-30°C to 50°C]
Storage temperature	-40°F to 176°F [-40°C to 80°C]
Housing	NEMA 2, IP42, UL enclosure type 2
Housing material	aluminum die cast and plastic casing
Noise level	<60 dB(A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	EV Series 9 lbs AVK Series 15.9 lbs
Agency listings	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2004/108/EC and 2006/95/EC
Bridging time (AVK Series)	2 second delay before fail-safe activates
Pre-charging time (AVK Series)	5 to 20 seconds

The Energy Valve is based on Belimo patent and patent pending technology, US-Patent 6,039,304: Ball valve with modified characteristics. US-Patent Pending: 2011/0153089: HVAC actuator comprising a network interface, data store and a processor. US-Patent Pending: 2009/009115: Control of sensor less and brushless DC-Motor. The Energy Valve incorporates additional technology - Powered by Optimum Energy™.

### Wiring Diagrams

#### INSTALLATION NOTES

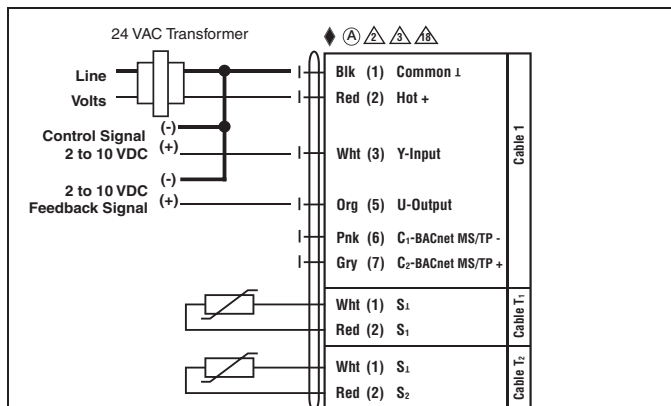
- Ⓐ Actuators with appliance cables are numbered.
- ⚠ **CAUTION Equipment damage!**  
Actuators may be connected in parallel.  
Power consumption and input impedance must be observed.
- ⚠ Actuators may also be powered by 24 VDC.
- ⚠ Actuators with plenum rated cable do not have numbers on wires; use color codes instead.

#### APPLICATION NOTES

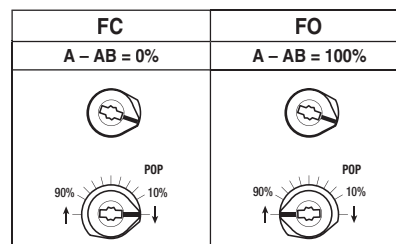
- ◆ Meets cULus requirements without the need of an electrical ground connection

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#### 2-10 VDC



#### Fail-Safe Power-Off Position, AVKX

#### System Ground

In cases where the valve body is electrically isolated from the water pipe, an earth ground should be installed in order for the sensor to work properly.

Use flexible metal conduit. Push the Listed conduit fitting device over the actuator's cable to butt against the enclosure. Screw in conduit connector. Jacket the actuators input wiring with Listed flexible conduit. Properly terminate the conduit in a suitable junction box. Rated impulse Voltage 800V. Type of action 1. Control Pollution Degree 3.

In cases where the valve body is electrically isolated from the water pipe, an earth ground should be installed in order for the sensor to work properly. Earth ground can be connected directly on the sensor body. A connection point is provided on the flange of the sensor body.

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## Flow Reduction Chart

MAXIMUM FLOW BASED ON MINIMUM DIFFERENTIAL PRESSURE FOR ANSI 125 NPT MODELS

Size		8 psi	5 psi*	4 psi	3 psi	2 psi	1 psi
Inches	DN [mm]						
½	15	5.5 GPM	5.5 GPM	5.5 GPM	5.5 GPM	4.8 GPM	3.4 GPM
¾	20	10.3 GPM	10.3 GPM	10.3 GPM	9.9 GPM	8.1 GPM	5.7 GPM
1	25	18.2 GPM	18.2 GPM	18.2 GPM	17.2 GPM	14.1 GPM	9.9 GPM
1¼	32	28.5 GPM	28.5 GPM	28.5 GPM	28.5 GPM	23.3 GPM	16.5 GPM
1½	40	39.6 GPM	39.6 GPM	39.6 GPM	39.6 GPM	34.9 GPM	24.7 GPM
2	50	100 GPM**	76.1 GPM	74 GPM	64.1 GPM	52.3 GPM	37 GPM
2½	65	127 GPM	127 GPM	93 GPM	81 GPM	66 GPM	47 GPM
3	80	180 GPM	180 GPM	138 GPM	120 GPM	97 GPM	69 GPM
4	100	317 GPM	317 GPM	235 GPM	203 GPM	166 GPM	117 GPM
5	125	495 GPM	495 GPM	367 GPM	318 GPM	260 GPM	183 GPM
6	150	713 GPM	713 GPM	550 GPM	476 GPM	389 GPM	275 GPM

\* Select valve based on a minimum of 5 PSI differential.

\*\* Applies to 2" EPIV models P2200S-800 through P2200S-1000 only.

MAXIMUM FLOW BASED ON MINIMUM DIFFERENTIAL PRESSURE FOR ANSI 250 FLANGED MODELS

Size		7.5 psi***	5 psi	4 psi	3 psi	2 psi	1 psi
Inches	DN [mm]						
½	15	127 GPM	109 GPM	98 GPM	85 GPM	69 GPM	49 GPM
¾	20	180 GPM	153 GPM	137 GPM	118 GPM	97 GPM	68 GPM
1	25	317 GPM	280 GPM	251 GPM	217 GPM	177 GPM	125 GPM
1¼	32	495 GPM	436 GPM	390 GPM	337 GPM	275 GPM	195 GPM
1½	40	713 GPM	593 GPM	531 GPM	460 GPM	375 GPM	265 GPM

\*\*\* Select valve based on a minimum of 7.5 PSI differential.

## Input Signal Scaling

FLOW CONTROL: EQUAL PERCENTAGE FLOW RESPONSE TO INPUT SIGNAL (Y)

0.5-10 VDC Signal	2-10 VDC Signal	Water Flow in % of V' max
0.5	2	0%
3.16	4.24	10%
5.25	6	20%
6.49	7.04	30%
7.29	7.72	40%
7.95	8.28	50%
8.48	8.72	60%
8.96	9.12	70%
9.34	9.44	80%
9.66	9.73	90%
10	10	100%

POWER CONTROL: LINEAR POWER RESPONSE OR FLOW CONTROL: LINEAR FLOW RESPONSE TO INPUT SIGNAL (Y)

0.5-10 VDC Signal	2-10 VDC Signal	Power in % of P' max or Water Flow in % of V' max
0.5	2	0%
1.45	2.8	10%
2.40	3.60	20%
3.35	4.40	30%
4.30	5.20	40%
5.25	6	50%
6.20	6.80	60%
7.15	7.60	70%
8.10	8.40	80%
9.05	9.20	90%
10	10	100%