diamond schmitt

SUBMITTAL REVIEW FORM

384 Adelaide Street West, Suite 100
Toronto, ON M5V 1R7
t: 416 862 8800

1050 West Pender Street, Suite 2010
Vancouver, BC V6E 3S7
t: 604 674 0866

1776 Broadway, Suite 2200
New York, NY 10019
t: 212 710 4329

www.dsai.ca
info@dsai.ca

To:	Rafat General Contractor Inc. 8850 George Bolton Parkway Caledon, ON L7E 2Y4	Submittal No:	098
		Project No:	201014
		File No:	4-6-1-25
Attention:	Pino Antelope, Bashar Mikha	Date:	May-22-24

Project: Chris Gibson Recreation Centre

The Architect's review is for the sole purpose of ascertaining conformance with the general design concept and for general arrangement. This review shall not mean approval of the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for all dimensions to be confirmed and correlated at the job site, for information that pertains solely to the fabrication processes, quantities or to techniques of construction and installation and for co-ordination with related work.

Contractor Package #	Spec Section	Description	Reviewed by	Status
098	25 05 01	BAS, Valve and Damper Schedule	INT, DSA	**RN**

Status Legend: **R** – Reviewed **RN** – Reviewed As Noted **RR** – Revise and Resubmit **N** – Not Reviewed

Comments: Review Consultant comments in Submittal

Per: Patrick Johnson`

RAFAT

8850 GEORGE BOLTON PARKWAY, CALEDON, ONTARIO L7E 2Y4

Shop Drawings Transmittal No:	98

Project Name:	Renovation of Chris Gibson Recreation Centre Drive	**Project No.**	T2023-125
		DATE:	13-May-2024
		Submittal Required Return Date:	3 Jun 2024
Submittal No:	98		

Title:	BAS, Valve and Damper Schedule - 25-05-01 & 25-30-01

To:	Patrick Johnson Contract Administrator Halima Namugga Admin Project Coordinator 384 Adelaide Street West, Suite 100 Toronto, Ontario, Canada M5V 1R7 PJohnson@dsai.ca

Checked by:	**Ashish Singla (Rafat General Contractor Inc/Corebuild)**	**To Be Reviewed By the Following Consutlants**	1. Integral 2.DSA

Submitted for:	REVIEW

Consultants Response	

RAFAT | COR | IHSA.ca Work Safe for Life

SUBMITTAL REVIEW

For general compliance with the design concept and contract documents. Subcontractor is solely responsible for jobsite correlation and correctness of all ratings, sizings, type, style, dimensions, finish, quantities and satisfactory fitting to other work and equipment. This review does not change the intent of the contract document.

- ■ Reviewed
- ☐ Make Corrections
- ☐ Resubmit
- ☐ Rejected

Per:
Ashish Singla

Date:
13 May 2024

CFMS-WEST CONSULTING INC. Serving South Western Ontario

The receipt/review of this submission is for the sole purpose of reviewing general conformance with the construction and/or design concepts only. The review of this submission does not, in any way, relieve the contractor of the complete responsibility for errors or omissions, or for non-compliance with the contract documents. It also does not constitute authority to vary the requirements of the contract documents as they relate to this submission.

- ☑ REVIEWED
- ☐ REVIEWED AS NOTED
- ☐ REVISE & RESUBMIT

REVIEWED BY: Kevin Pellerin

DATE: May 21, 2024

CONSULT MECHANICAL 200 Tesma Way, Concord, ON, L4K 5C2 (905) 738-1400

Submittal Package 23-214 - 034

May 8, 2024

PROJECT NAME	PROJECT NUMBER	PROJECT ADDRESS	DUE DATE
CHRIS GIBSON REC CENTRE	23-214	125 McLaughlin Rd N, Brampton, ON, L6X 1N9	May 21, 2024

To

NAME	EMAIL
Ashish Singla	asingla@corebuildconstruction.com
COMPANY	**ADDRESS**
RAFAT GENERAL CONTRACTOR INC.	8850 GEORGE BOLTON PKWY, BOLTON, ON, L7E 2Y4

From

NAME	EMAIL
JOSHUA STEPHENSON	josh.s@consultmechanical.com
COMPANY	**ADDRESS**
Con-Sult Mechanical Inc	54 Audia Ct, Unit #2, Vaughan, ON, L4K 3N5

Subject

BAS, Valve and Damper Schedule

Notes

ERV-1, ERV-2 and DHU-1 preheat coil control valves will be sent after RFI has returned.

Package Items

Spec	Subsection	Description
Mechanical	HVAC	BAS valve and damper schedule

SUBMITTAL REVIEW

INTROBA
380 Wellington Street West
Toronto, ON
M5V 1E3

Introba

- ☐ REVIEWED
- ☑ REVIEWED AS NOTED
- ☐ REJECTED - REVISE AND RESUBMIT
- ☐ NOT REVIEWED

CHECKED BY: ILITTLEY
DISCIPLINE: Mechanical
DATE: 5/22/2024

REVIEWED FOR GENERAL DESIGN AND COMPLIANCE WITH CONTRACT DOCUMENTS. DIMENSIONS AND SUITABILITY FOR SITE CONDITIONS ARE THE RESPONSIBILITY OF THE CONTRACTOR. THIS REVIEW OF THE DRAWING SHALL NOT RELIEVE THE CONTRACTOR FROM COMPLYING WITH THE CONDITIONS OF THE CONTRACT DOCUMENTS.

IRB Comments:
- All final quantities, sizes, and locations are the responsibility of the contractor to meet all requirements in the contract documents.

200 Tesma Way,
Concord, ON, L4K 5C2
(905) 738-1400

Submittal Item Information

May 8, 2024

Spec Section

Mechanical

Sub Section

HVAC

Description

BAS valve and damper schedule

100 – 5525 Eglinton Avenue W
Toronto ON Canada M9C5K5
Telephone +1 647.789.2600
Facsimile +1 647.789.2557

BAS Valve and Damper Schedule Rev1.0

P444D57 - City of Brampton-Chris Gibson Rec Centre - Addition

125 McLaughlin Road North
Brampton, Ontario
L6X 1Y7

INFORMATION SHEET

Project Location:	**Chris Gibson Recreation Centre** 125 McLaughlin Road North, Brampton, Ontario L6X 1Y7
Mechanical Engineer:	**Integral** 380 Wellington Street West, Toronto, ON, M5V 1E3 Tel:- 416-488-4425
Mechanical Contractor:	**Consult Mechanical** 200 Tesma Way, Unit 9 Concord, Ontario L4K 0J9 Tel:- 416-919-1527, Email: josh.s@consultmechanical.com
Control Details:	Extended the existing Delta Control BAS System. Supply BAS controls for Boiler (EB-1), AHU(A-2, A-3, A-4, A-8), DHU1(BACnet integration), ERV-1/2(BACnet integration), WSHP1, 2A, 2B, Pumps, VAV's, Exhaust fans as per the system sequence of operations in Section 25 90 01. Supply and install VAV controllers with space Temp/CO2 sensors, VAV box supply and installed by others. Supply and connect DDC heating/cooling control valves to Delta Control BAS, control valves installed by others. Supply loose BAS control dampers not supplied as part of OEM equipment, installed by othere. Supply and install BAS control damper actuators, connect to Delta BAS. Supply and install BAS immersion temperature & Diff pressure sensors to Delta BAS, thermowell provided by Ainswoth but installed by others.
Delta Hardware Information:	
Software Information:	Use Existing
Warranty	1 years from the hand over date.
Prepared by:	**Ainsworth Inc.** **5525 Eglinton Ave. West, Suite 100,** **Toronto, Ontario, M9C 5K5** **Toll Free Tel: 1-800-510-6285 Local Tel: 647-789-2600 Fax: 647-789-2557** **Website: www.ainsworth.com**

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LEGEND

- BAS INPUT
- BAS OUTPUT
- DUCT TEMP. SENSOR
- DUCT AVE. TEMP. SENSOR
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- DUCT HUMIDITY SENSOR
- DUCT LOW LIMIT SENSOR
- DUCT HIGH LIMIT SENSOR
- DUCT STATIC PRESS. SENSOR
- DIFF. STATIC PRESS. SENSOR
- SPACE DIFF. PRESS. SENSOR
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- 2-WAY VALVE
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- DRY CONTACT
- FAN
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- BELIMO DAMPER ACTUATOR
- SIEMENS DAMPER ACTUATOR
- GAS HEATING
- HOT WATER HEATING COIL
- ELECTRIC DUCT HEATER
- DX COOLING COIL
- CHILLED WATER COOLING COIL
- FILTER WITH DIFF. PRESS. SENSOR

PROJECT

City of Brampton-Chris Gibson Rec Centre - Addition

AINSWORTH

5525 Eglinton Ave. West, Suite 100, Toronto, Ontario, M9C 5K5

DRAWING TITLE:

INFORMATION SHEET

PROJECT MANAGER Noel Santana	PROJECT DESIGNER Jingli An
PROJECT NO. P444D57	DATE May. 6, 2024
VERSION 1.0	DRAWING NO. DWG-1

Valve Schedule

#	Valve Tag	QTY	Service	Line Size [in]	Type	Connection	2/3 Way	FLOW [l/s]	FLOW [GPM]	Design PD	Actual PD	Req. Cv	Valve CV	Close Off Press	Valve Size [in]	Manuf.	Valve Model #	Actuator Model #	Voltage	Control Signal	SR	Normal Position	Fail Position	*Assembly Part#*
Heating/Cooling Water system																								
1	V-1	1	Boiler 1 Isolation Valve	2-1/2"	GLOBE	Screwed/NPT	2W	3.79	**60.00**	**3.0**	**2.3**	**34.6**	**40.0**	**250 psi**	2"	Belimo	G250B-N	NFB24-SR-X1	24 VAC/VDC	2-10 VDC	✓	Open	Open	G250B-N+NFB24-SR-X1
2	V-2	1	WSHP-01 CWS Control Valve	2"	CCV	Screwed/NPT	2W	3.15	**50.00**	**3.0**	**3.0**	**28.9**	**29.0**	**200 psi**	1-1/2"	Belimo	B239	AFRB24-SR	24 VAC/VDC	2-10 VDC	✓	Open	Open	B239+AFRB24-SR
3	V-3	1	WSHP-02A CWS Control Valve	4"	GLOBE	Flanged	2W	17.95	**284.50**	**3.0**	**2.8**	**164.3**	**170.0**	**140 psi**	4"	Belimo	G6100C	2*AFX24-MFT-X1	24 VAC/VDC	MFT (Configurable) 2-10 VDC	✓	Open	Open	G6100C+2*AFX24-MFT-X1
4	V-4	1	WSHP-02A HWR Control Valve	4"	GLOBE	Flanged	2W	10.88	**172.40**	**3.0**	**1.0**	**99.5**	**170.0**	**140 psi**	4"	Belimo	G6100C	2*AFX24-MFT-X1	24 VAC/VDC	MFT (Configurable) 2-10 VDC	✓	Open	Open	G6100C+2*AFX24-MFT-X1
5	V-5	1	WSHP-02A CHWR Control Valve	4"	GLOBE	Flanged	2W	12.26	**194.40**	**3.0**	**1.3**	**112.2**	**170.0**	**140 psi**	4"	Belimo	G6100C	2*AFX24-MFT-X1	24 VAC/VDC	MFT (Configurable) 2-10 VDC	✓	Close	Close	G6100C+2*AFX24-MFT-X1
6	V-6	1	CHWS Control Valve	6"	GLOBE	Flanged	2W	24.92	**395.00**	**3.0**	**2.3**	**228.1**	**263.0**	**140 psi**	5"	Belimo	G6125C	2*AFX24-MFT-X1	24 VAC/VDC	MFT (Configurable) 2-10 VDC	✓	Close	Close	G6125C+2*AFX24-MFT-X1
7	V-7	1	CHWR Control Valve	6"	GLOBE	Flanged	2W	24.92	**395.00**	**3.0**	**2.3**	**228.1**	**263.0**	**140 psi**	5"	Belimo	G6125C	2*AFX24-MFT-X1	24 VAC/VDC	MFT (Configurable) 2-10 VDC	✓	Close	Close	G6125C+2*AFX24-MFT-X1
8	V-8	1	WSHP-02B CWS Control Valve	3"	GLOBE	Flanged	2W	9.21	**146.00**	**3.0**	**2.6**	**84.3**	**90.0**	**140 psi**	3"	Belimo	G680C	AFX24-MFT-X1	24 VAC/VDC	MFT (Configurable) 2-10 VDC	✓	Close	Close	G680C+AFX24-MFT-X1
9	V-9	1	WSHP-02B Return Water Control Valve	3"	GLOBE	Flanged	2W	6.37	**101.00**	**3.0**	**2.4**	**58.3**	**65.0**	**140 psi**	2-1/2"	Belimo	G665C	AFX24-MFT-X1	24 VAC/VDC	MFT (Configurable) 2-10 VDC	✓	Close	Close	G665C+AFX24-MFT-X1
10	V-10	1	WSHP-02A_B CHWS Cahnge Over Control Valve	6"	GLOBE	Flanged	2W	24.92	**395.00**	**3.0**	**2.3**	**228.1**	**263.0**	**140 psi**	5"	Belimo	G6125C	2*AFX24-MFT-X1	24 VAC/VDC	MFT (Configurable) 2-10 VDC	✓	Close	Close	G6125C+2*AFX24-MFT-X1
11	V-11	1	WSHP-02A_B CHWR Cahnge Over Control Valve	6"	GLOBE	Flanged	2W	24.92	**395.00**	**3.0**	**2.3**	**228.1**	**263.0**	**140 psi**	5"	Belimo	G6125C	2*AFX24-MFT-X1	24 VAC/VDC	MFT (Configurable) 2-10 VDC	✓	Close	Close	G6125C+2*AFX24-MFT-X1
12	V-12	1	WSHP-02A_B HWS Cahnge Over Control Valve	6"	GLOBE	Flanged	2W	24.92	**395.00**	**3.0**	**2.3**	**228.1**	**263.0**	**140 psi**	5"	Belimo	G6125C	2*AFX24-MFT-X1	24 VAC/VDC	MFT (Configurable) 2-10 VDC	✓	Close	Close	G6125C+2*AFX24-MFT-X1
13	V-13	1	WSHP-02A_B HWR Cahnge Over Control Valve	6"	GLOBE	Flanged	2W	24.92	**395.00**	**3.0**	**2.3**	**228.1**	**263.0**	**140 psi**	5"	Belimo	G6125C	2*AFX24-MFT-X1	24 VAC/VDC	MFT (Configurable) 2-10 VDC	✓	Close	Close	G6125C+2*AFX24-MFT-X1
14	V-14	1	CWS Control Valve to WSHP-02A_B	6"	GLOBE	Flanged	2W	26.86	**425.70**	**3.0**	**2.6**	**245.8**	**263.0**	**140 psi**	5"	Belimo	G6125C	2*AFX24-MFT-X1	24 VAC/VDC	MFT (Configurable) 2-10 VDC	✓	Open	Open	G6125C+2*AFX24-MFT-X1
15	V-15	1	CWS Control Valve to CHW System	6"	GLOBE	Flanged	2W	24.92	**395.00**	**3.0**	**2.3**	**228.1**	**263.0**	**140 psi**	5"	Belimo	G6125C	2*AFX24-MFT-X1	24 VAC/VDC	MFT (Configurable) 2-10 VDC	✓	Close	Close	G6125C+2*AFX24-MFT-X1
16	V-16	1	CWR Control Valve From WSHP-02A_B	6"	GLOBE	Flanged	2W	26.86	**425.70**	**3.0**	**2.6**	**245.8**	**263.0**	**140 psi**	5"	Belimo	G6125C	2*AFX24-MFT-X1	24 VAC/VDC	MFT (Configurable) 2-10 VDC	✓	Open	Open	G6125C+2*AFX24-MFT-X1
17	V-17	1	CWR Control Valve From CHW System	6"	GLOBE	Flanged	2W	24.92	**395.00**	**3.0**	**2.3**	**228.1**	**263.0**	**140 psi**	5"	Belimo	G6125C	2*AFX24-MFT-X1	24 VAC/VDC	MFT (Configurable) 2-10 VDC	✓	Close	Close	G6125C+2*AFX24-MFT-X1
18	V-18	1	CHW Bypass Control Valve	3"	GLOBE	Flanged	2W	8.31	**131.67**	**3.0**	**2.1**	**76.0**	**90.0**	**140 psi**	3"	Belimo	G680C	AFX24-MFT-X1	24 VAC/VDC	MFT (Configurable) 2-10 VDC	✓	Close	Close	G680C+AFX24-MFT-X1
19	V-19	1	HW Bypass Control Valve	3"	GLOBE	Flanged	2W	8.31	**131.67**	**3.0**	**2.1**	**76.0**	**90.0**	**140 psi**	3"	Belimo	G680C	AFX24-MFT-X1	24 VAC/VDC	MFT (Configurable) 2-10 VDC	✓	Close	Close	G680C+AFX24-MFT-X1
20	V-20	1	CWS Control Valve To Chiller System	6"	GLOBE	Flanged	2W	11.99	**190.00**	**3.0**	**1.2**	**109.7**	**170.0**	**140 psi**	4"	Belimo	G6100C	2*AFX24-MFT-X1	24 VAC/VDC	2-10 VDC	✓	Open	Open	G6100C+2*AFX24-MFT-X1
21	V-21	1	CWR Control Valve From Chiller System	6"	GLOBE	Flanged	2W	11.99	**190.00**	**3.0**	**1.2**	**109.7**	**170.0**	**140 psi**	4"	Belimo	G6100C	2*AFX24-MFT-X1	24 VAC/VDC	2-10 VDC	✓	Open	Open	G6100C+2*AFX24-MFT-X1
22	V-22	1	CW Bypass Control Valve Chiller System	6"	GLOBE	Screwed/NPT	2W	4.00	**63.33**	**3.0**	**2.5**	**36.6**	**40.0**	**250 psi**	2"	Belimo	G250S-N	NFB24-SR-X1	24 VAC/VDC	2-10 VDC	✓	Close	Close	G250S-N+NFB24-SR-X1
23	V-23	1	In floor Heating 3-way HWS Mixing Control Valve	2"	CCV	Screwed/NPT	3W M/D	1.75	**27.80**	**3.0**	**2.1**	**16.1**	**19.0**	**200 psi**	1-1/4"	Belimo	B330	AFRB24-SR	24 VAC/VDC	2-10 VDC	✓	Open B to AB	Open B to AB	B330+AFRB24-SR
24	V-24	1	In floor Heating 3-way HWR Mixing Control Valve	2"	CCV	Screwed/NPT	3W M/D	1.75	**27.80**	**3.0**	**2.1**	**16.1**	**19.0**	**200 psi**	1-1/4"	Belimo	B330	AFRB24-SR	24 VAC/VDC	2-10 VDC	✓	Open B to AB	Open B to AB	B330+AFRB24-SR
AHU, ERV & DHU Heating/Cooling Coils																								
25	V-25	1	AHU-A-2 Heating Coil Control Valve	1-1/2"	CCV	Screwed/NPT	2W	0.95	**15.10**	**3.0**	**2.3**	**8.7**	**10.0**	**200 psi**	1"	Belimo	B223	LF24-SR US	24 VAC/VDC	2-10 VDC	✓	Open	Open	B223+LF24-SR US
26	V-26	1	AHU-A-2 Cooling Coil Control Valve	2"	CCV	Screwed/NPT	2W	1.51	**24.00**	**3.0**	**1.6**	**13.9**	**19.0**	**200 psi**	1-1/2"	Belimo	B238	AFRB24-SR	24 VAC/VDC	2-10 VDC	✓	Close	Close	B238+AFRB24-SR
27	V-27	1	AHU-A-3 Heating Coil Control Valve	1-1/2"	CCV	Screwed/NPT	2W	2.78	**44.00**	**3.0**	**2.3**	**25.4**	**29.0**	**200 psi**	1-1/2"	Belimo	B239	AFRB24-SR	24 VAC/VDC	2-10 VDC	✓	Open	Open	B239+AFRB24-SR
28	V-28	1	AHU-A-3 Cooling Coil Control Valve	2-1/2"	CCV	Screwed/NPT	2W	3.95	**62.60**	**3.0**	**1.9**	**36.1**	**46.0**	**200 psi**	2"	Belimo	B249	AFRB24-SR	24 VAC/VDC	2-10 VDC	✓	Close	Close	B249+AFRB24-SR
29	V-29	1	AHU-A-4 Heating Coil Control Valve	1-1/2"	CCV	Screwed/NPT	2W	1.03	**16.30**	**3.0**	**2.7**	**9.4**	**10.0**	**200 psi**	1"	Belimo	B223	LF24-SR US	24 VAC/VDC	2-10 VDC	✓	Open	Open	B223+LF24-SR US
30	V-30	1	AHU-A-4 Cooling Coil Control Valve	2"	CCV	Screwed/NPT	2W	1.80	**28.50**	**3.0**	**2.3**	**16.5**	**19.0**	**200 psi**	1-1/2"	Belimo	B238	AFRB24-SR	24 VAC/VDC	2-10 VDC	✓	Close	Close	B238+AFRB24-SR
31	V-31	1	AHU-A-8 Preheat Coil Control Valve	1-1/2"	CCV	Screwed/NPT	2W	0.63	**10.00**	**3.0**	**1.8**	**5.8**	**7.4**	**200 psi**	3/4"	Belimo	B218	LF24-SR US	24 VAC/VDC	2-10 VDC	✓	Open	Open	B218+LF24-SR US
32	V-32	1	AHU-A-8 Heating Coil Control Valve	2"	CCV	Screwed/NPT	2W	2.06	**32.60**	**3.0**	**2.9**	**18.8**	**19.0**	**200 psi**	1-1/2"	Belimo	B238	AFRB24-SR	24 VAC/VDC	2-10 VDC	✓	Open	Open	B238+AFRB24-SR
33	V-33	1	AHU-A-8 Cooling Coil Control Valve	2-1/2"	CCV	Screwed/NPT	2W	3.35	**53.10**	**3.0**	**1.3**	**30.7**	**46.0**	**200 psi**	2"	Belimo	B249	AFRB24-SR	24 VAC/VDC	2-10 VDC	✓	Close	Close	B249+AFRB24-SR
35	V-35	1	ERV-01 Heating Coil Control Valve	1"	CCV	Screwed/NPT	2W	0.13	**2.00**	**3.0**	**2.8**	**1.2**	**1.2**	**200 psi**	1/2"	Belimo	B210	TFRB24-SR	24 VAC/VDC	2-10 VDC	✓	Open	Open	B210+TFRB24-SR
36	V-36	1	ERV-01 Cooling Coil Control Valve	1-1/4"	CCV	Screwed/NPT	2W	0.49	**7.83**	**3.0**	**2.8**	**4.5**	**4.7**	**200 psi**	3/4"	Belimo	B217	TFRB24-SR	24 VAC/VDC	2-10 VDC	✓	Close	Close	B217+TFRB24-SR
38	V-38	1	ERV-02 Heating Coil Control Valve	1-1/4"	CCV	Screwed/NPT	2W	0.30	**4.76**	**3.0**	**1.0**	**2.7**	**4.7**	**200 psi**	3/4"	Belimo	B217	TFRB24-SR	24 VAC/VDC	2-10 VDC	✓	Open	Open	B217+TFRB24-SR
39	V-39	1	ERV-02 Cooling Coil Control Valve	1-1/4"	CCV	Screwed/NPT	2W	0.85	**13.48**	**3.0**	**1.8**	**7.8**	**10.0**	**200 psi**	3/4"	Belimo	B219	TFRB24-SR	24 VAC/VDC	2-10 VDC	✓	Close	Close	B219+TFRB24-SR
40	V-40	1	ERV-03 Heating Coil Control Valve	2"	CCV	Screwed/NPT	2W	1.49	**23.60**	**3.0**	**1.5**	**13.6**	**19.0**	**200 psi**	1-1/2"	Belimo	B238	AFRB24-SR	24 VAC/VDC	2-10 VDC	✓	Open	Open	B238+AFRB24-SR
41	V-41	1	DHU-01 Post Heating Coil Control Valve	3"	CCV	Screwed/NPT	2W	2.04	**32.30**	**3.0**	**1.2**	**18.6**	**29.0**	**200 psi**	1-1/2"	Belimo	B238	AFRB24-SR	24 VAC/VDC	2-10 VDC	✓	Open	Open	B238+AFRB24-SR
42	V-42	1	DHU-01 Cooling Coil Control Valve	3"	CCV	Screwed/NPT	2W	4.64	**73.60**	**3.0**	**2.6**	**42.5**	**46.0**	**200 psi**	2"	Belimo	B249	AFRB24-SR	24 VAC/VDC	2-10 VDC	✓	Close	Close	B249+AFRB24-SR

Notes

1. Valve selection need to be approved/reviewed by Mechanical/ Consultant before placing an order.
2. ERV01 & ERV02 preheat coils control valves are not in the original BAS scope of work, valve schedule will update accordingly once get RFI001 return back.
3. DHU01 react heat coil control valve is not in the original BAS scope of work, valve schedule will update accordingly once get RFI004 return back.

PROJECT

City of Brampton-Chris Gibson Rec Centre - Addition

AINSWORTH

5525 Eglinton Ave. West, Suite 100, Toronto, Ontario, M9C 5K5

DRAWING TITLE:

VALVE SCHEDULE

PROJECT MANAGER	PROJECT DESIGNER
Noel Santana	Jingli An
PROJECT NO.	DATE
P444D57	May. 6, 2024
VERSION	DRAWING NO.
1.0	**DWG-2**

Motorized Damper Schedule

#	Name	Damper Location	Area Served	Damper									Actuator						
				Application	Connection Type	Blade Type	Manuf.	QTY	Width [in]	Height [in]	Area [ft^2]	Req Torque	Manuf.	Model	Torque	Mod. /2-Pos.	Spring ret.	Fail Position	QTY
1	MD-1	Ice Rink Mech Rm 140B	Ice Rink Mech Rm 140B	Intake	In-Duct	Parallel	TAMCO 9000 (By Ainsworth)	1	17.72	69.88	8.60	60.18	Belimo	NFB24-S	90	2-Pos.	Yes	Close	1
2	MD-2	Plant Room 146B	Plant Room 146B	Intake	In-Duct	Parallel	TAMCO 9000 (By Ainsworth)	1	17.72	22.76	2.80	19.60	Belimo	LF24-S US	35	2-Pos.	Yes	Close	1
3	MD-3	Ice Rink	Ice Rink	Intake	In-Duct	Parallel	TAMCO 9000 (By Ainsworth)	1	70.87	53.15	26.16	183.09	Belimo	EFB24-S	270	2-Pos.	Yes	Close	1
4	MD-4	Ice Rink	Ice Rink	Intake	In-Duct	Parallel	TAMCO 9000 (By Ainsworth)	1	70.87	53.15	26.16	183.09	Belimo	EFB24-S	270	2-Pos.	Yes	Close	1
5	MD-5	New Ice Rink Roof	EF-01A	Exhaust	In-Duct	Parallel	TAMCO 9000 (By Ainsworth)	1	25.50	25.50	4.52	31.61	Belimo	NFB24-S	90	2-Pos.	Yes	Close	1
6	MD-6	New Ice Rink Roof	EF-01B	Exhaust	In-Duct	Parallel	TAMCO 9000 (By Ainsworth)	1	25.50	25.50	4.52	31.61	Belimo	NFB24-S	90	2-Pos.	Yes	Close	1
7	MD-7	Plant Room Roof	REF-01	Exhaust	In-Duct	Parallel	TAMCO 9000 (By Ainsworth)	1	25.50	25.50	4.52	31.61	Belimo	NFB24-S	90	2-Pos.	Yes	Close	1
8	MD-8	Ice Rink Mech Room Roof	REF-02	Exhaust	In-Duct	Parallel	TAMCO 9000 (By Ainsworth)	1	25.50	25.50	4.52	31.61	Belimo	NFB24-S	90	2-Pos.	Yes	Close	1

Notes

1. Dampers provided by Ainsworth will be ordered after confirmation and approval of damper sizes and connection type from Mechanical and Consultant engineer.
2. Damper Size need to be confirmed/Approved by Consultant/Mechanical before placing order.
3. Damper provided by Ainsworth, installed by others.
4. Ainsworth will provide and install all damper actuators.

PROJECT

City of Brampton-Chris Gibson Rec Centre - Addition

AINSWORTH

5525 Eglinton Ave. West, Suite 100, Toronto, Ontario, M9C 5K5

DRAWING TITLE:

MOTORIZED DAMPER SCHEDULE

PROJECT MANAGER	PROJECT DESIGNER
Noel Santana	Jingli An
PROJECT NO. P444D57	DATE May. 6, 2024
VERSION 1.0	DRAWING NO. DWG-3

AHU Damper Schedule

#	Name	Serve Location	Area Served	Damper									Actuator						
				Application	Connection Type	Blade Type	Manuf.	QTY	Width [in]	Height [in]	Area [ft^2]	Req Torque	*Manuf.*	*Model*	*Torque*	*Mod. /2-Pos.*	*Spring ret.*	*Fail Position*	*QTY*
1	MD-AUH-OA	AHU-A-2	AHU-A-2 Outdoor Air	Intake	Integral		Standard Daikin Dampers c/w Unit	1	32.00	46.00	10.22	71.56	Belimo	NFB24-SR	90	Mod	Yes	Close	1
2	MD-AHU-RA	AHU-A-2	AHU-A-2 Return Air	Return	Integral		Standard Daikin Dampers c/w Unit	1	8.00	40.00	2.22	15.56	Belimo	NFB24-SR	90	Mod	Yes	Open	1
3	MD-AHU-EA	AHU-A-2	AHU-A-2 Exhaust Air	Exhaust	Integral		Standard Daikin Dampers c/w Unit	1	20.00	40.00	5.56	38.89	Belimo	NFB24-SR	90	Mod	Yes	Close	1
4	MD-AHU-BA	AHU-A-2	AHU-A-2 HW Bypass Air	Bypass	Integral		Standard Daikin Dampers c/w Unit	2	10.00	46.00	6.39	44.72	Belimo	NFB24-SR	90	Mod	Yes	Open	1
5	MD-AUH-OA	AHU-A-3	AHU-A-3 Outdoor Air	Intake	Integral		Standard Daikin Dampers c/w Unit	1	48.00	36.00	12.00	84.00	Belimo	NFB24-SR	90	Mod	Yes	Close	1
6	MD-AHU-RA	AHU-A-3	AHU-A-3 Return Air	Return	Integral		Standard Daikin Dampers c/w Unit	1	14.00	58.00	5.64	39.47	Belimo	NFB24-SR	90	Mod	Yes	Open	1
7	MD-AHU-EA	AHU-A-3	AHU-A-3 Exhaust Air	Exhaust	Integral		Standard Daikin Dampers c/w Unit	1	24.00	58.00	9.67	67.67	Belimo	NFB24-SR	90	Mod	Yes	Close	1
8	MD-AHU-BA	AHU-A-3	AHU-A-3 HW Bypass Air	Bypass	Integral		Standard Daikin Dampers c/w Unit	2	10.00	64.00	8.89	62.22	Belimo	NFB24-SR	90	Mod	Yes	Open	1
9	MD-AHU-OA	AHU-A-4	AHU-A-4 Outdoor Air	Intake	Integral		Standard Daikin Dampers c/w Unit	1	32.00	36.00	8.00	56.00	Belimo	NFB24-SR	90	Mod	Yes	Close	1
10	MD-AHU-RA	AHU-A-4	AHU-A-4 Return Air	Return	Integral		Standard Daikin Dampers c/w Unit	1	44.00	26.00	7.94	55.61	Belimo	NFB24-SR	90	Mod	Yes	Open	1
11	MD-AHU-EA	AHU-A-4	AHU-A-4 Exhaust Air	Exhaust	Integral		Standard Daikin Dampers c/w Unit	1	32.00	28.00	6.22	43.56	Belimo	NFB24-SR	90	Mod	Yes	Close	1
12	MD-AUH-OA	AHU-A-3	AHU-A-3 Outdoor Air	Intake	Integral		Standard Daikin Dampers c/w Unit	1	50.00	24.00	8.33	58.33	Belimo	NFB24-SR	90	Mod	Yes	Close	1
13	MD-AHU-RA	AHU-A-3	AHU-A-3 Return Air	Return	Integral		Standard Daikin Dampers c/w Unit	1	42.00	18.00	5.25	36.75	Belimo	NFB24-SR	90	Mod	Yes	Open	1
14	MD-AHU-EA	AHU-A-3	AHU-A-3 Exhaust Air	Exhaust	Integral		Standard Daikin Dampers c/w Unit	1	20.00	42.00	5.83	40.83	Belimo	NFB24-SR	90	Mod	Yes	Close	1
15	MD-AHU-BA	AHU-A-3	AHU-A-3 HW Bypass Air	Bypass	Integral		Standard Daikin Dampers c/w Unit	2	12.00	48.00	8.00	40.00	Belimo	NFB24-SR	90	Mod	Yes	Open	1

Notes

1. Damper Schedule need to be confirmed/ Approved by Consultant/ Mechanical before placing order for actuators.
2. All damper for AHU's provided and installed by Daikin Unit supllier.

PROJECT

City of Brampton-Chris Gibson Rec Centre - Addition

AINSWORTH

5525 Eglinton Ave. West, Suite 100, Toronto, Ontario, M9C 5K5

DRAWING TITLE:

AHU DAMPER SCHEDULE

PROJECT MANAGER	PROJECT DESIGNER
Noel Santana	Jingli An
PROJECT NO. P444D57	DATE May. 6, 2024
VERSION 1.0	DRAWING NO. DWG-4

100 – 5525 Eglinton Avenue W
Toronto ON Canada M9C5K5
Telephone +1 647.789.2600
Facsimile +1 647.789.2557

Control Vale Cutsheets

V-1 Valve Body

5-year warranty

Type overview

Type	DN
G250B-N	50

Technical data

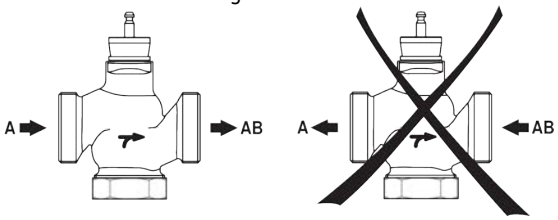
Functional data	Valve Size	2" [50]
	Fluid	chilled or hot water, up to 60% glycol, steam
	Fluid Temp Range (water)	20...280°F [-7...138°C]
	Body Pressure Rating	ANSI Class 250, up to 400 psi below 150°F
	Flow characteristic	modified equal percentage
	Servicing	repack kits available
	Rangeability Sv	100:1
	Max Differential Pressure (Steam)	20 psi [103 kPa]
	Flow Pattern	2-way
	Leakage rate	ANSI Class VI
	Controllable flow range	stem up - open A – AB
	Cv	40
	Maximum Inlet Pressure (Steam)	35 psi [241 kPa]
	ANSI Class	250
	Body pressure rating note	up to 400 psi below 150°F
Materials	Valve body	Bronze
	Valve plug	brass
	Stem	stainless steel
	Stem seal	EPDM O-ring
	Seat	Bronze
	Pipe connection	NPT female ends
Suitable actuators	Non-Spring	LVB(X)
	Electronic fail-safe	LVKB(X)

Safety notes

- WARNING: This product can expose you to lead which is known to the State of California to cause cancer and reproductive harm. For more information go to www.p65warnings.ca.gov
- The valve has been designed for use in stationary heating, ventilation and air-conditioning systems and must not be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.
- Only authorised specialists may carry out installation. All applicable legal or institutional installation regulations must be complied during installation.
- The valve does not contain any parts that can be replaced or repaired by the user.
- When determining the flow rate characteristic of controlled devices, the recognised directives must be observed.

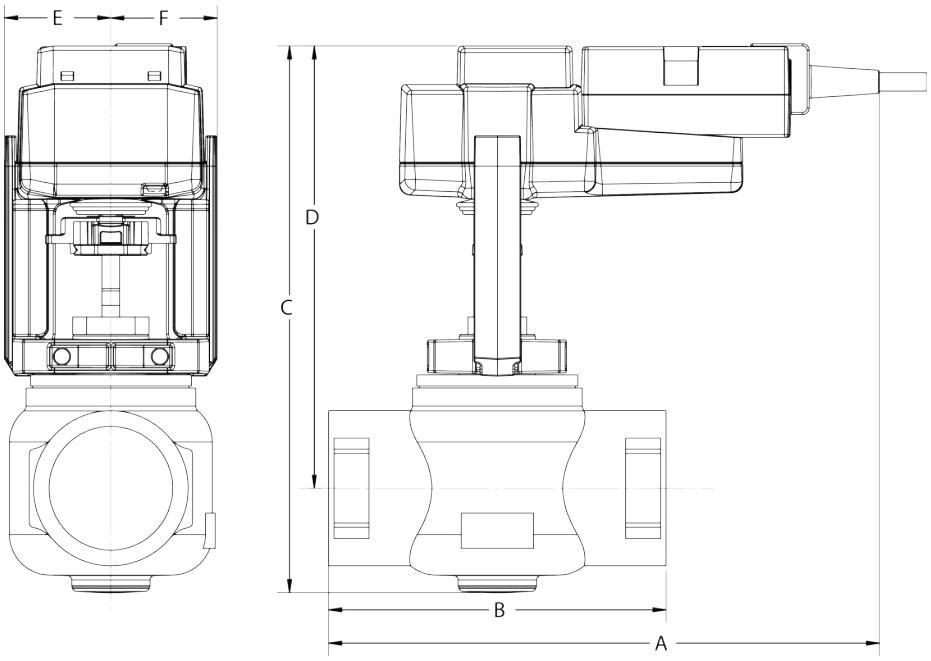
Installation notes

Flow direction The direction of flow, specified by an arrow on the housing, is to be complied with, since otherwise the valve could become damaged.



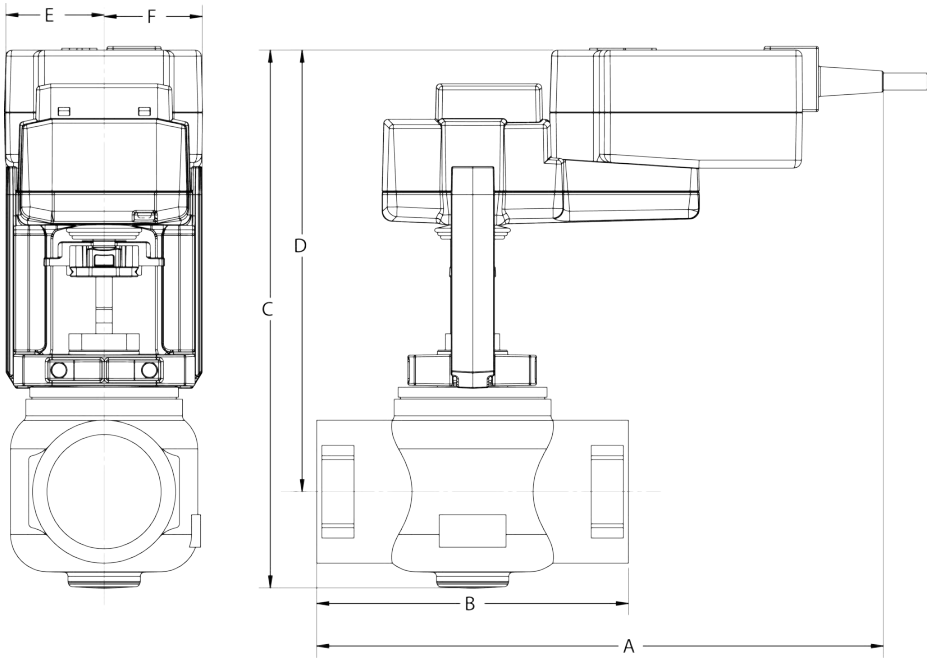
Dimensions

Dimensional drawings



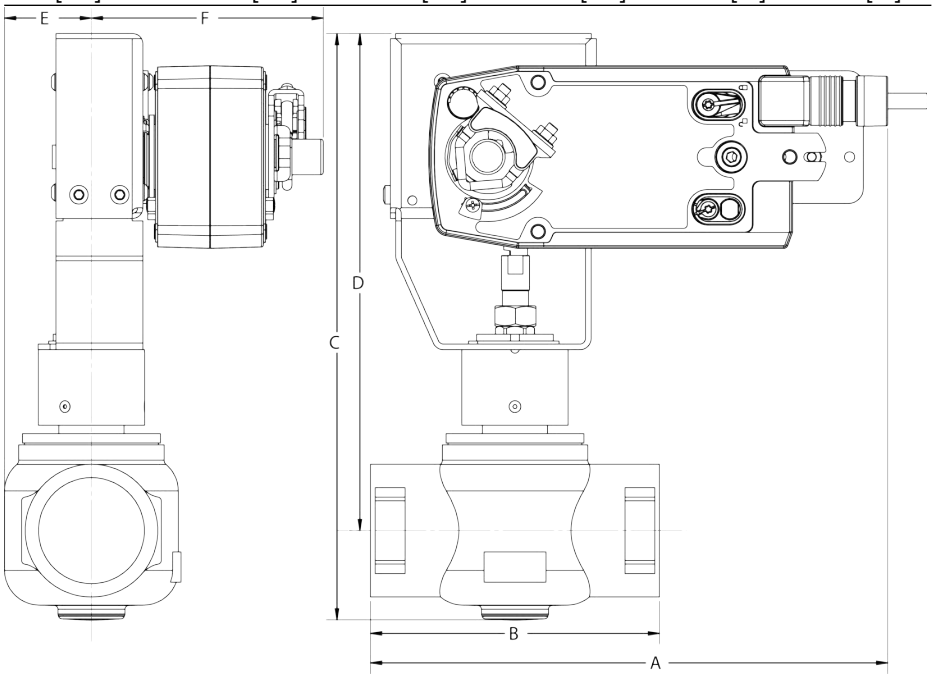
LV

A	B	C	D	E	F
10.0" [254]	6.1" [156]	9.9" [252]	8.0" [203]	1.9" [48]	1.9" [48]



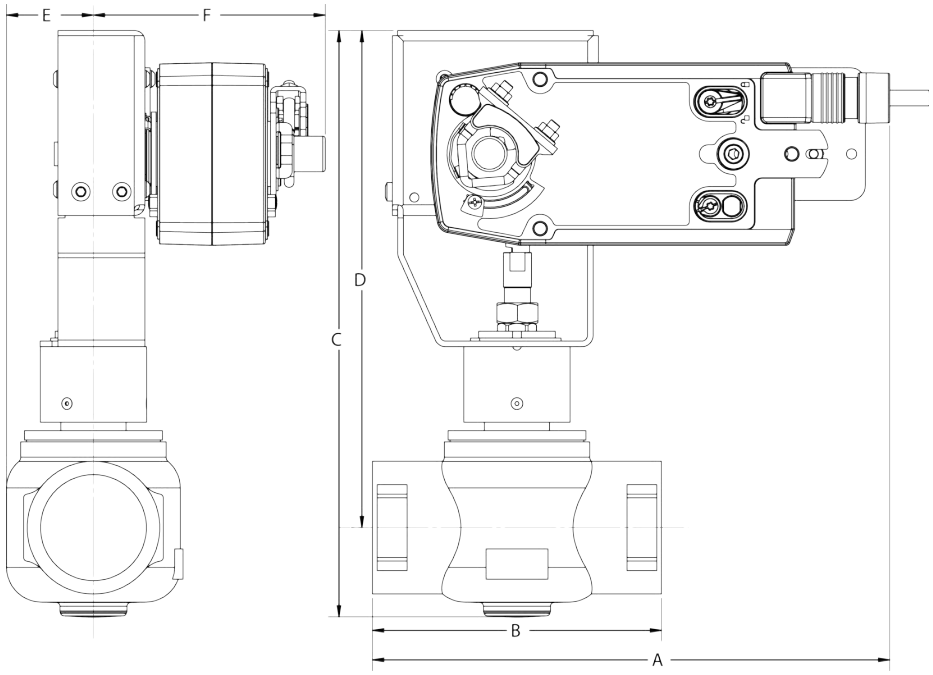
LVK

A	B	C	D	E	F
11.0" [280]	6.1" [156]	10.5" [267]	8.8" [224]	1.9" [48]	1.9" [48]



NF

A	B	C	D	E	F
10.9" [277]	6.1" [156]	12.4" [314]	10.5" [267]	1.8" [46]	4.9" [125]



NF

A	B	C	D	E	F
10.9" [277]	6.1" [156]	12.4" [314]	10.5" [267]	1.8" [46]	4.9" [125]

V-22 Valve Body

5-year warranty

Type overview

Type	DN
G250S-N	50

Technical data

Functional data	Valve Size	2" [50]
	Fluid	chilled or hot water, up to 60% glycol, steam
	Fluid Temp Range (water)	20...338°F [-7...170°C]
	Fluid Temp Range (steam)	32...338°F [0...170°C]
	Body Pressure Rating	ANSI Class 250, up to 400 psi below 150°F
	Flow characteristic	modified equal percentage
	Servicing	repack kits available
	Rangeability Sv	100:1
	Maximum differential pressure (water)	50 psi [345 kPa]
	Max Differential Pressure (Steam)	50 psi [345 kPa]
	Flow Pattern	2-way
	Leakage rate	ANSI Class VI
	Controllable flow range	stem up - open A – AB
	Cv	40
	Maximum Inlet Pressure (Steam)	100 psi [690 kPa]
	ANSI Class	250
	Body pressure rating note	up to 400 psi below 150°F
Materials	Valve body	Bronze
	Valve plug	316 stainless steel
	Stem	316 stainless steel
	Stem seal	EPDM O-ring
	Seat	Stainless steel AISI 316
	Pipe connection	NPT female ends
Suitable actuators	Non-Spring	LVB(X)
	Electronic fail-safe	LVKB(X)

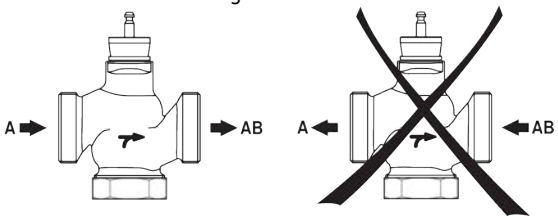
Safety notes

- WARNING: This product can expose you to lead which is known to the State of California to cause cancer and reproductive harm. For more information go to www.p65warnings.ca.gov
- The valve has been designed for use in stationary heating, ventilation and air-conditioning systems and must not be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.
- Only authorised specialists may carry out installation. All applicable legal or institutional installation regulations must be complied during installation.
- The valve does not contain any parts that can be replaced or repaired by the user.
- When determining the flow rate characteristic of controlled devices, the recognised directives must be observed.

Installation notes

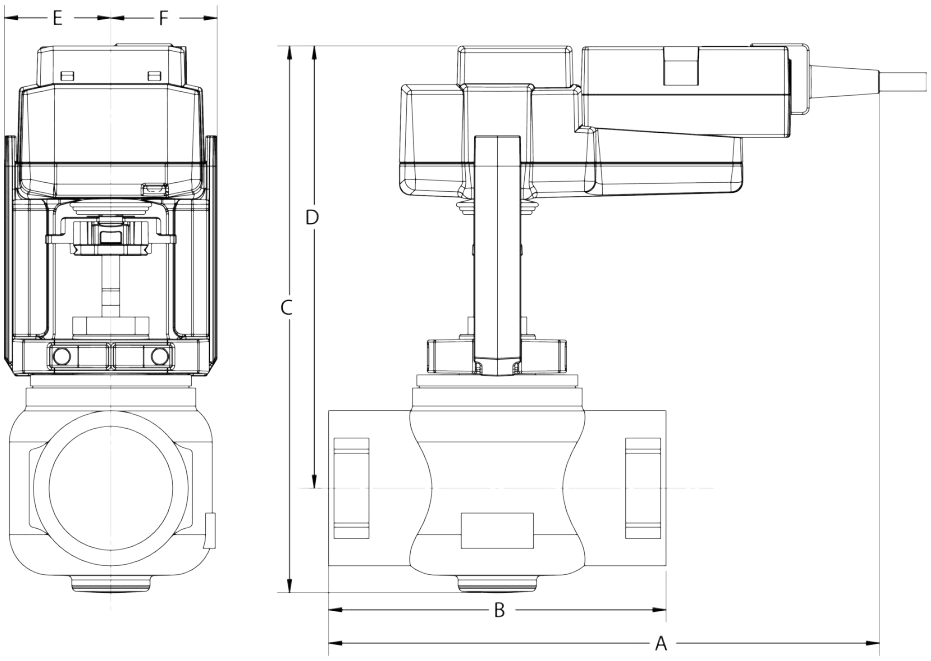
Flow direction

The direction of flow, specified by an arrow on the housing, is to be complied with, since otherwise the valve could become damaged.



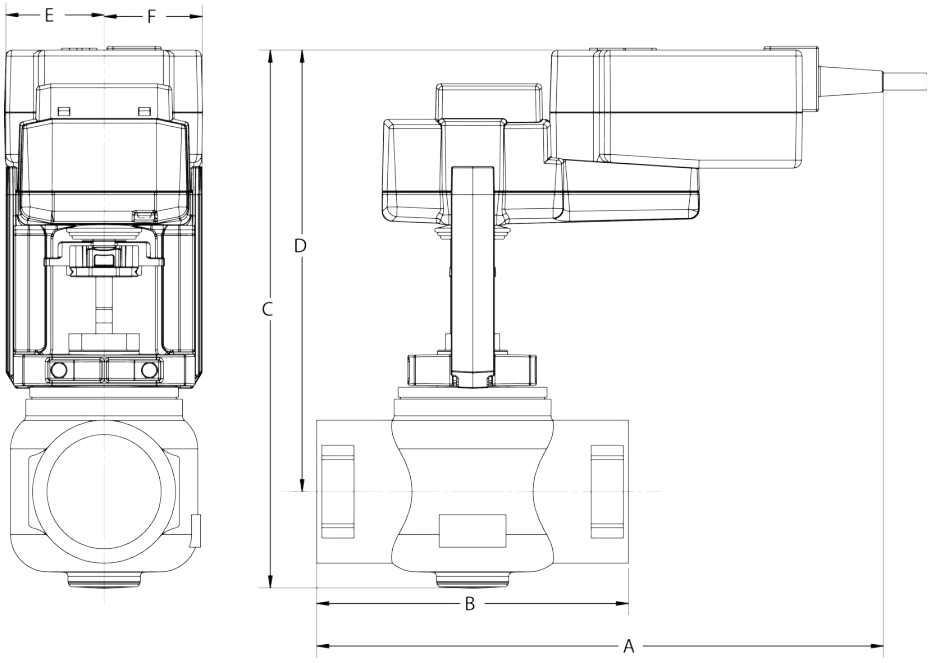
Dimensions

Dimensional drawings



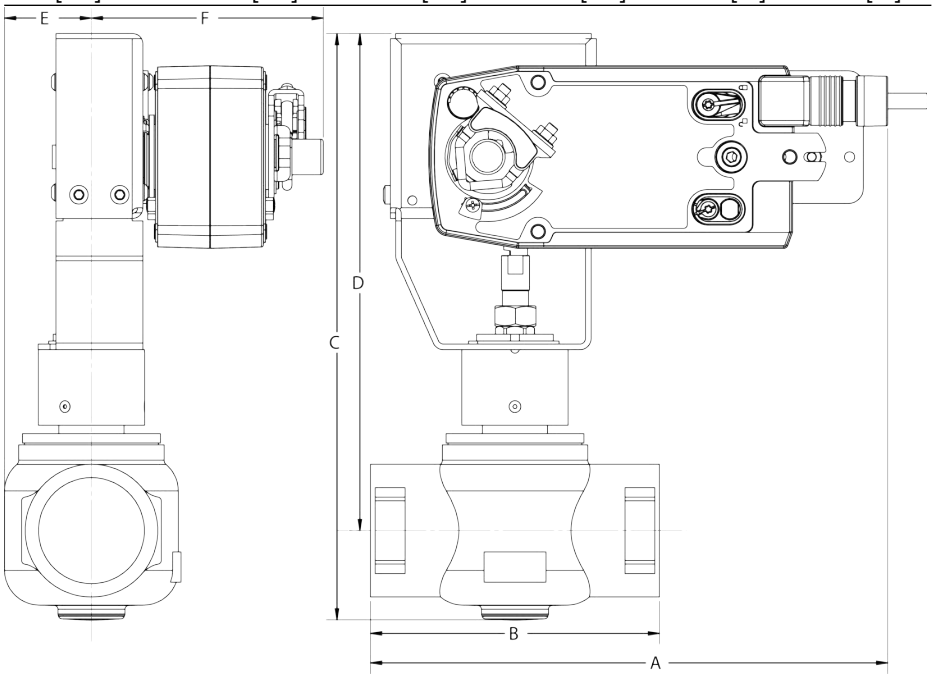
LV

A	B	C	D	E	F
10.0" [254]	6.1" [156]	9.9" [252]	8.0" [203]	1.9" [48]	1.9" [48]



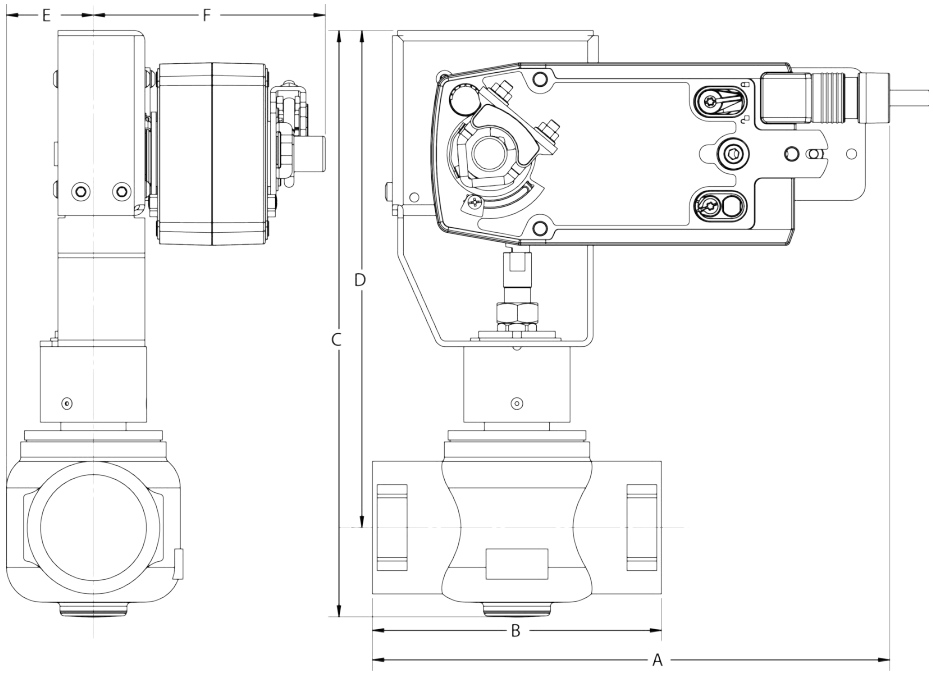
LVK

A	B	C	D	E	F
11.0" [280]	6.1" [156]	10.5" [267]	8.8" [224]	1.9" [48]	1.9" [48]



NF

A	B	C	D	E	F
10.9" [277]	6.1" [156]	12.4" [314]	10.5" [267]	1.8" [46]	4.9" [125]



NF

A	B	C	D	E	F
10.9" [277]	6.1" [156]	12.4" [314]	10.5" [267]	1.8" [46]	4.9" [125]

BELIMO

Modulating, Spring Return, AC 24 V/DC, for DC 2...10 V or 4...20 mA Control Signal

V-1, V-22
Actuator

Technical data sheet NFB24-SR-X1

5-year warranty

Technical data

Electrical data	Nominal voltage	AC/DC 24 V
	Nominal voltage frequency	50/60 Hz
	Power consumption in operation	3.5 W
	Power consumption in rest position	2.5 W
	Transformer sizing	6 VA (class 2 power source)
	Electrical Connection	18 GA appliance cable, 3 ft [1 m], with 1/2" conduit connector
	Overload Protection	electronic throughout 0...95° rotation
Functional data	Operating range Y	2...10 V
	Operating range Y note	4...20 mA w/ ZG-R01 (500 Ω, 1/4 W resistor)
	Position feedback U	2...10 V
	Position feedback U note	Max. 0.5 mA
	Direction of motion motor	selectable with switch 0/1
	Direction of motion fail-safe	reversible with cw/ccw mounting
	Manual override	5 mm hex crank (3/16" Allen), supplied
	Angle of rotation	95°,
	Running Time (Motor)	95 s
	Running time fail-safe	<20 s @ -4...122°F [-20...50°C], <60 s @ -22°F [-30°C]
	Noise level, motor	50 dB(A)
	Noise level, fail-safe	62 dB(A)
	Position indication	Mechanical
Safety data	Degree of protection IEC/EN	IP54
	Degree of protection NEMA/UL	NEMA 2 UL Enclosure Type 2
	Agency Listing	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2014/30/EU and 2014/35/EU; Listed to UL 2043 - suitable for use in air plenums per Section 300.22(c) of the NEC and Section 602.2 of the IMC
	Quality Standard	ISO 9001
	Ambient temperature	-22...122°F [-30...50°C]
	Storage temperature	-40...176°F [-40...80°C]
	Ambient humidity	max. 95% r.H., non-condensing
	Servicing	maintenance-free
Weight	Weight	4.1 lb [1.9 kg]
Materials	Housing material	Galvanized steel and plastic housing

Safety notes

- Base plate for ZS-100.
- PVC W'Shld for GV w/UGLK (LF)
- ZS-300 Mounting Bracket Set
- 120 to 24 VAC, 40 VA transformer.
- Cable for ZTH US to actuators w/o diagnostics socket.
- PC Tool computer programming interface, serial port.

Electrical installation

INSTALLATION NOTES

A Actuators with appliance cables are numbered.

1 Provide overload protection and disconnect as required.

3 Actuators may also be powered by 24 VDC.

5 Only connect common to negative (-) leg of control circuits.

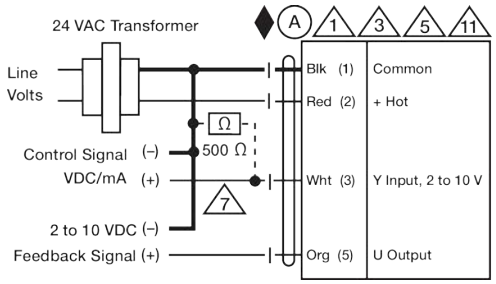
7 A 500 Ω resistor (ZG-R01) converts the 4...20 mA control signal to 2...10 V.

11 Actuators may be connected in parallel if not mechanically linked. Power consumption and input impedance must be observed.

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 V / 4...20 mA Control

BELIMO

Stainless Steel Ball and Stem

V-2, V-27
Valve Body

Technical data sheet B239

5-year warranty

Technical data

Functional data	Valve Size	1.5" [40]
	Fluid	chilled or hot water, up to 60% glycol
	Fluid Temp Range (water)	0...250°F [-18...120°C]
	Body Pressure Rating	400 psi
	Close-off pressure Δps	200 psi
	Flow characteristic	equal percentage
	Servicing	maintenance-free
	Flow Pattern	2-way
	Leakage rate	0% for A – AB
	Controllable flow range	75°
	Cv	29
	Body pressure rating note	400 psi
	Cv Flow Rating	A-port: as stated in chart B-port: 70% of A – AB Cv
Materials	Valve body	Nickel-plated brass body
	Stem seal	EPDM (lubricated)
	Seat	PTFE
	Pipe connection	NPT female ends
	O-ring	EPDM (lubricated)
	Ball	stainless steel
Suitable actuators	Non-Spring	ARB(X) NRQB(X)

Safety notes

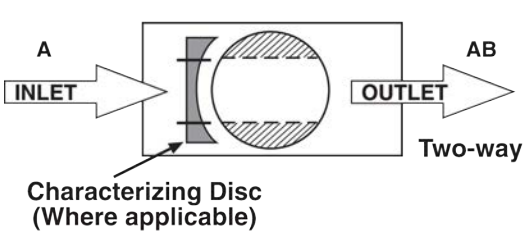
- WARNING: This product can expose you to lead which is known to the State of California to cause cancer and reproductive harm. For more information go to www.p65warnings.ca.gov

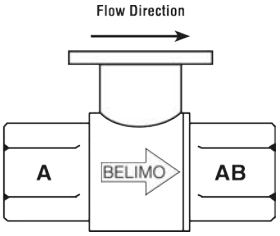
Product features

Application

This valve is typically used in air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in a hydronic system with variable flow.

Flow/Mounting details

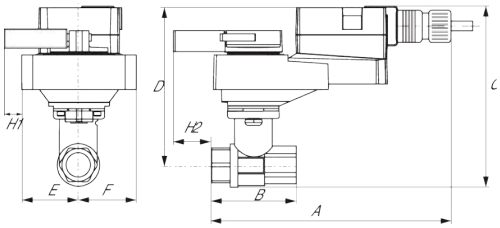




Dimensions

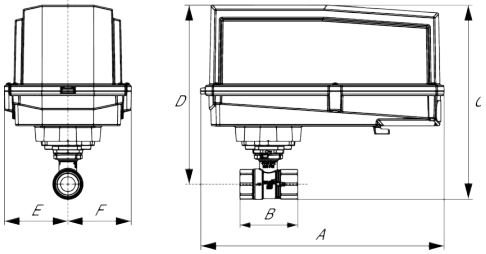
Dimensional drawings

ARB, ARX



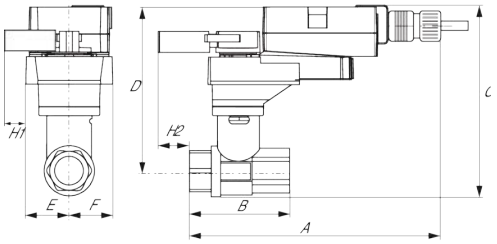
A	B	C	D	E	F	H1	H2
11.0" [280]	3.9" [100]	6.4" [163]	5.3" [134]	1.7" [44]	1.7" [44]	1.2" [30]	0.6" [15]

ARB N4, ARX N4, NRB N4, NRX N4



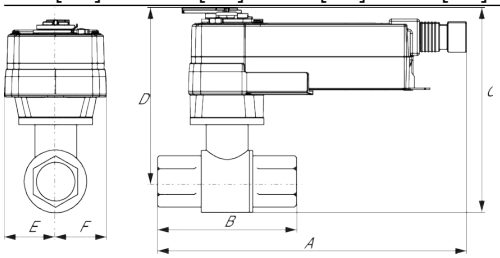
A	B	C	D	E	F
11.4" [289]	3.9" [100]	8.5" [217]	7.3" [185]	3.1" [80]	3.1" [80]

NRQB, NRQX



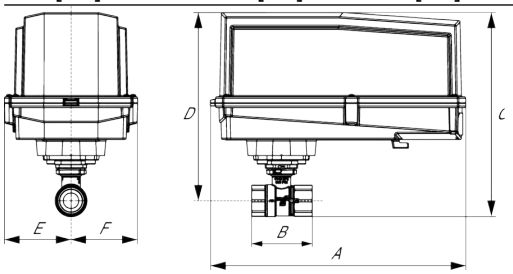
A	B	C	D	E	F	H1	H2
11.0" [280]	3.9" [100]	7.1" [181]	6.0" [152]	1.7" [44]	1.7" [44]	1.4" [34]	0.6" [15]

AFRB, AFRX



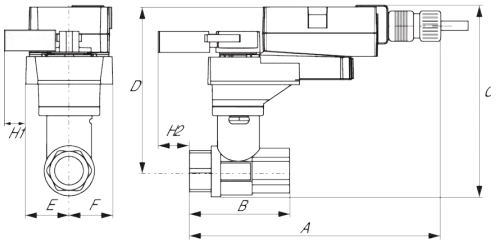
A	B	C	D	E	F
10.8" [275]	3.9" [100]	9.0" [229]	7.8" [198]	2.0" [51]	2.0" [51]

AFRB N4, AFRX N4



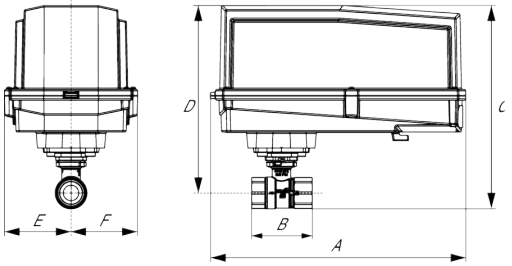
A	B	C	D	E	F
13.0" [330]	3.9" [100]	10.3" [262]	8.5" [216]	3.4" [86]	3.4" [86]

NRQB, NRQX



A	B	C	D	E	F	H1	H2
11.0" [280]	3.9" [100]	7.1" [181]	6.0" [152]	1.7" [44]	1.7" [44]	1.4" [34]	0.6" [15]

AFRB N4, AFRX N4



A	B	C	D	E	F
13.0" [330]	3.9" [100]	10.3" [262]	8.5" [216]	3.4" [86]	3.4" [86]

BELIMO

Stainless Steel Ball and Stem

Technical data sheet B238

V-26, V-30, V-32,
V-40, V-41
Valve Body

5-year warranty

Technical data

Functional data	Valve Size	1.5" [40]
	Fluid	chilled or hot water, up to 60% glycol
	Fluid Temp Range (water)	0...250°F [-18...120°C]
	Body Pressure Rating	400 psi
	Close-off pressure Δps	200 psi
	Flow characteristic	equal percentage
	Servicing	maintenance-free
	Flow Pattern	2-way
	Leakage rate	0% for A – AB
	Controllable flow range	75°
	Cv	19
	Body pressure rating note	400 psi
	Cv Flow Rating	A-port: as stated in chart B-port: 70% of A – AB Cv
Materials	Valve body	Nickel-plated brass body
	Stem seal	EPDM (lubricated)
	Seat	PTFE
	Pipe connection	NPT female ends
	O-ring	EPDM (lubricated)
	Ball	stainless steel
Suitable actuators	Non-Spring	ARB(X) NRQB(X)

Safety notes

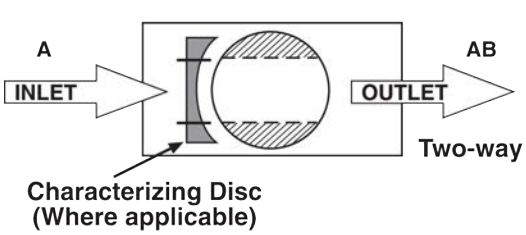
- WARNING: This product can expose you to lead which is known to the State of California to cause cancer and reproductive harm. For more information go to www.p65warnings.ca.gov

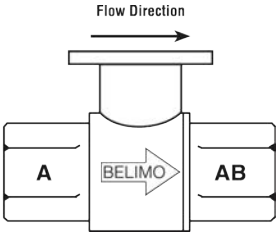
Product features

Application

This valve is typically used in air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in a hydronic system with variable flow.

Flow/Mounting details

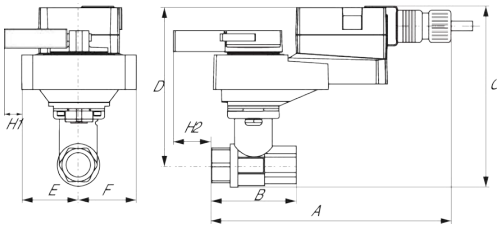




Dimensions

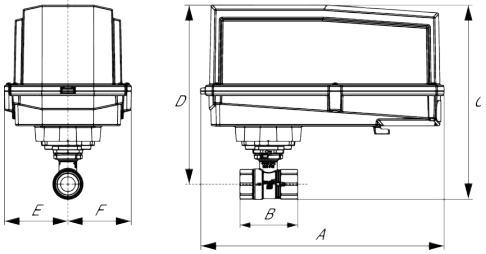
Dimensional drawings

ARB, ARX



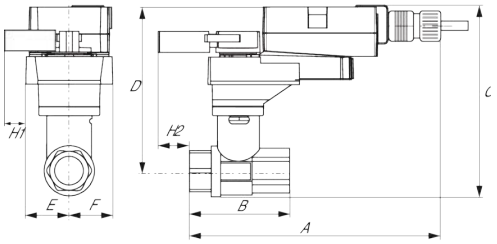
A	B	C	D	E	F	H1	H2
11.0" [280]	3.9" [100]	6.4" [163]	5.3" [134]	1.7" [44]	1.7" [44]	1.2" [30]	0.6" [15]

ARB N4, ARX N4, NRB N4, NRX N4



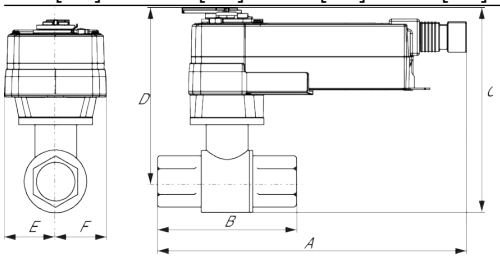
A	B	C	D	E	F
11.4" [289]	3.9" [100]	8.5" [217]	7.3" [185]	3.1" [80]	3.1" [80]

NRQB, NRQX



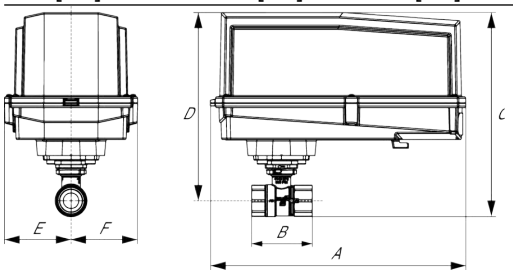
A	B	C	D	E	F	H1	H2
11.0" [280]	3.9" [100]	7.1" [181]	6.0" [152]	1.7" [44]	1.7" [44]	1.4" [34]	0.6" [15]

AFRB, AFRX



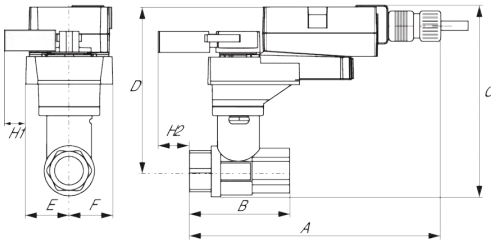
A	B	C	D	E	F
10.8" [275]	3.9" [100]	9.0" [229]	7.8" [198]	2.0" [51]	2.0" [51]

AFRB N4, AFRX N4



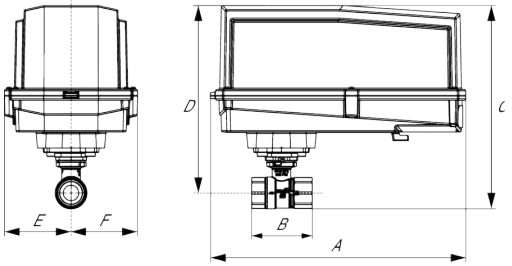
A	B	C	D	E	F
13.0" [330]	3.9" [100]	10.3" [262]	8.5" [216]	3.4" [86]	3.4" [86]

NRQB, NRQX



A	B	C	D	E	F	H1	H2
11.0" [280]	3.9" [100]	7.1" [181]	6.0" [152]	1.7" [44]	1.7" [44]	1.4" [34]	0.6" [15]

AFRB N4, AFRX N4



A	B	C	D	E	F
13.0" [330]	3.9" [100]	10.3" [262]	8.5" [216]	3.4" [86]	3.4" [86]

BELIMO

Stainless Steel Ball and Stem

Technical data sheet B249

V-28, V-33, V-42
Valve Body

5-year warranty

Technical data

Functional data	Valve Size	2" [50]
	Fluid	chilled or hot water, up to 60% glycol
	Fluid Temp Range (water)	0...250°F [-18...120°C]
	Body Pressure Rating	400 psi
	Close-off pressure Δps	200 psi
	Flow characteristic	equal percentage
	Servicing	maintenance-free
	Flow Pattern	2-way
	Leakage rate	0% for A – AB
	Controllable flow range	75°
	Cv	46
	Body pressure rating note	400 psi
Materials	Valve body	Nickel-plated brass body
	Stem seal	EPDM (lubricated)
	Seat	PTFE
	Pipe connection	NPT female ends
	O-ring	EPDM (lubricated)
	Ball	stainless steel
Suitable actuators	Non-Spring	ARB(X)

Safety notes

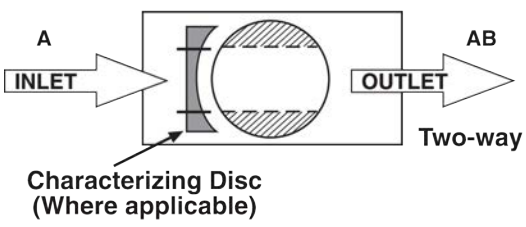
- WARNING: This product can expose you to lead which is known to the State of California to cause cancer and reproductive harm. For more information go to www.p65warnings.ca.gov

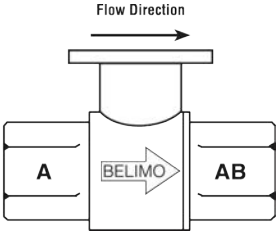
Product features

Application

This valve is typically used in air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in a hydronic system with variable flow.

Flow/Mounting details

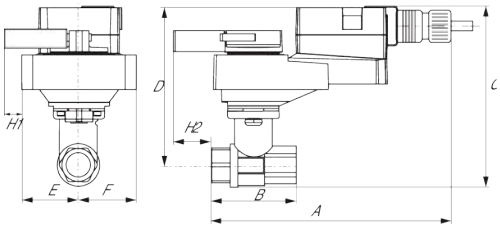




Dimensions

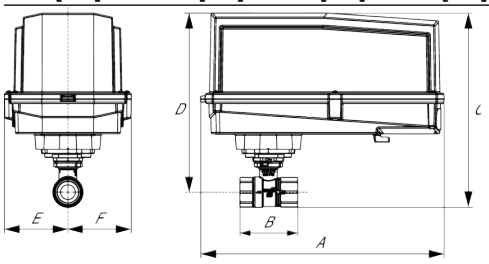
Dimensional drawings

ARB, ARX



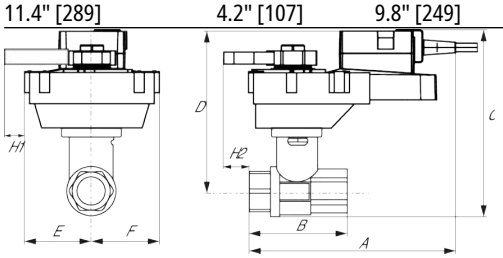
A	B	C	D	E	F	H1	H2
11.0" [280]	4.2" [107]	6.9" [175]	5.5" [140]	1.7" [44]	1.7" [44]	1.2" [30]	0.6" [15]

ARB N4, ARX N4, NRB N4, NRX N4



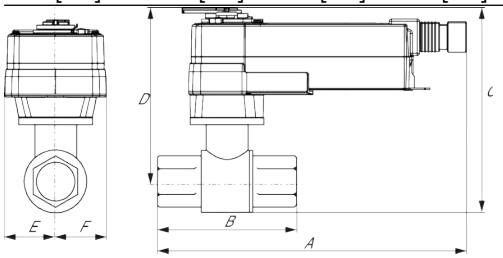
A	B	C	D	E	F
11.4" [289]	4.2" [107]	9.8" [249]	7.6" [194]	3.1" [80]	3.1" [80]

ARQB, ARQX



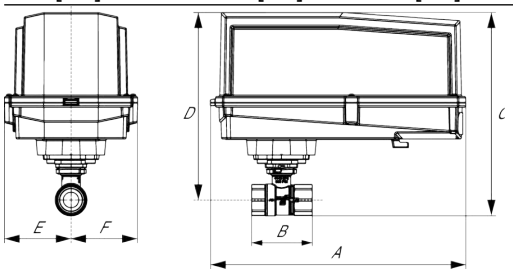
A	B	C	D	E	F	H1	H2
11.0" [280]	4.2" [107]	7.5" [191]	6.1" [155]	2.3" [58]	2.3" [58]	0.8" [20]	0.6" [15]

AFRB, AFRX



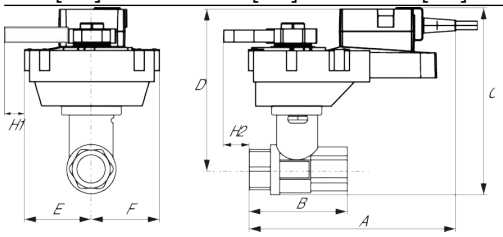
A	B	C	D	E	F
10.8" [275]	4.2" [107]	9.5" [241]	8.1" [206]	2.0" [51]	2.0" [51]

AFRB N4, AFRX N4



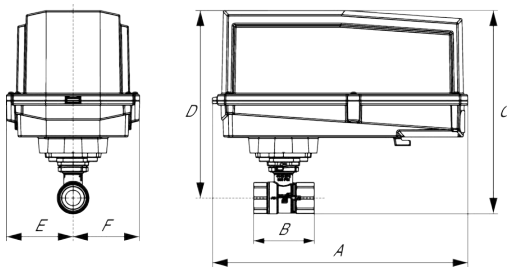
A	B	C	D	E	F
13.0" [330]	4.9" [125]	10.3" [262]	9.3" [235]	3.4" [86]	3.4" [86]

ARQB, ARQX



A	B	C	D	E	F	H1	H2
11.0" [280]	4.2" [107]	7.5" [191]	6.1" [155]	2.3" [58]	2.3" [58]	0.8" [20]	0.6" [15]

AFRB N4, AFRX N4



A	B	C	D	E	F
13.0" [330]	4.9" [125]	10.3" [262]	9.3" [235]	3.4" [86]	3.4" [86]

BELIMO

Stainless Steel Ball and Stem

Technical data sheet B330

V-23, V-24
Valve Body

5-year warranty

Type overview

Type	DN
B330	32

Technical data

Functional data	Valve size [mm]	1.25" [32]
	Fluid	chilled or hot water, up to 60% glycol
	Fluid Temp Range (water)	0...250°F [-18...120°C]
	Body Pressure Rating	400 psi
	Close-off pressure Δps	200 psi
	Flow	A-port: as stated in chart B-port: 70% of A – AB Cv
	Flow characteristic	A-port equal percentage, B-port modified for constant common port flow
	Servicing	maintenance-free
	Flow Pattern	3-way Mixing/Diverting
	Leakage rate	0% for A – AB, <2.0% for B – AB
	Controllable flow range	75°
	Cv	19
Materials	Valve body	Nickel-plated brass body
	Stem	stainless steel
	Stem seal	EPDM (lubricated)
	Seat	PTFE
	Characterized disc	TEFZEL®
	Pipe connection	NPT
	O-ring	EPDM (lubricated)
	Ball	stainless steel
Suitable actuators	Non-Spring	ARB(X)
	Spring	AF

Safety notes

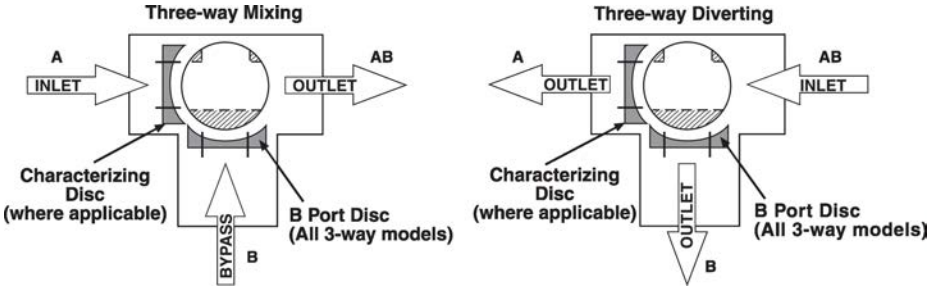
- WARNING: This product can expose you to lead which is known to the State of California to cause cancer and reproductive harm. For more information go to www.p65warnings.ca.gov

Product features

Application

This valve is typically used in air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in a hydronic system with variable or constant flow.

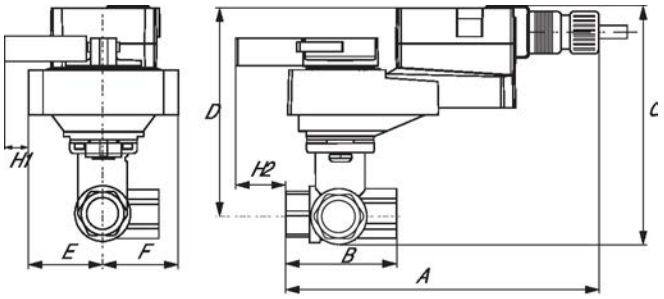
Flow/Mounting details



Dimensions

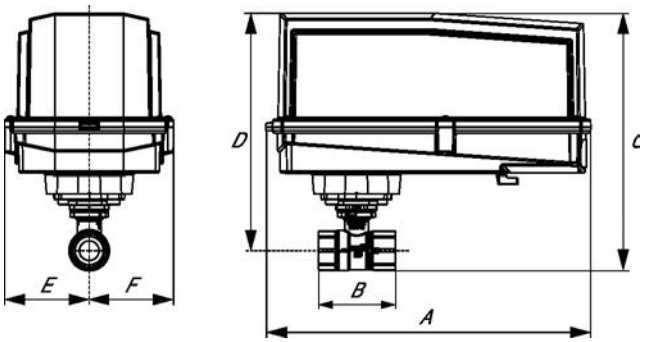
Type	DN	Weight
B330	32	2.43 lb [1.1 kg]

ARB, ARX



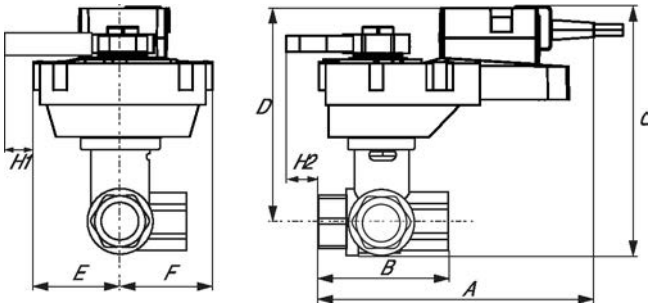
A	B	C	D	E	F	H1	H2
10.0" [254]	4.0" [101]	6.8" [172]	5.5" [140]	1.7" [44]	2.1" [54]	0.8" [20]	0.6" [15]

ARB N4, ARX N4, NRB N4, NRX N4



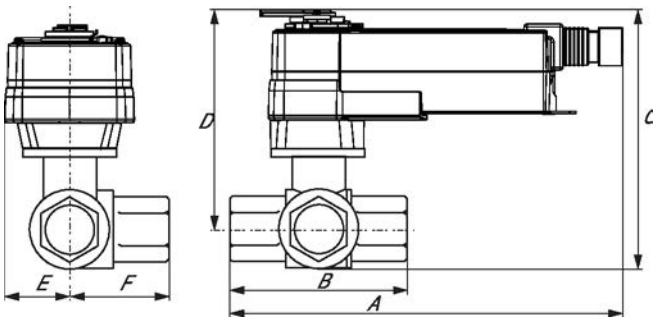
A	B	C	D	E	F
11.4" [289]	4.0" [101]	8.9" [226]	7.6" [194]	3.1" [80]	3.1" [80]

ARQB, ARQX



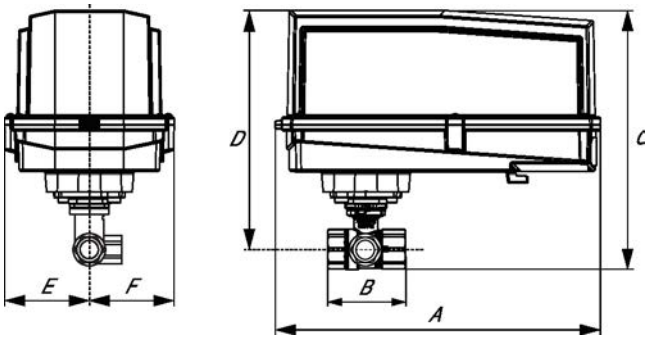
A	B	C	D	E	F	H1	H2
9.7" [246]	4.0" [101]	7.5" [191]	6.2" [158]	1.7" [44]	2.1" [54]	1.4" [34]	0.8" [20]

AFRB, AFRX



A	B	C	D	E	F
10.6" [269]	4.0" [101]	6.9" [175]	5.7" [146]	2.1" [54]	1.3" [33]

AFRB N4, AFRX N4



A	B	C	D	E	F
13.0" [330]	4.0" [101]	10.5" [267]	9.5" [241]	3.7" [95]	3.7" [95]

BELIMO

Modulating, Spring Return, AC 24 V for DC 2...10 V or 4...20 mA Control Signal

V-2, V-23, V-24, V-26, V-27, V-28, V-30, V-32, V-33, V-40, V-41, V-42 Actuator

Technical data sheet AFRB24-SR

5-year warranty

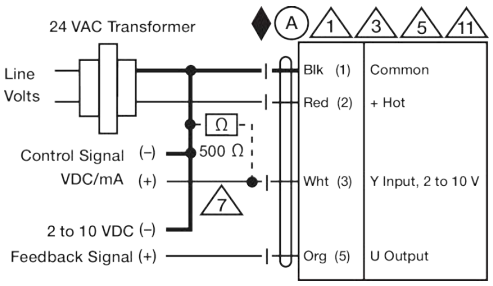
Technical data

Electrical data	Nominal voltage	AC/DC 24 V
	Nominal voltage frequency	50/60 Hz
	Power consumption in operation	5.5 W
	Power consumption in rest position	3 W
	Transformer sizing	8.5 VA (class 2 power source)
	Electrical Connection	18 GA appliance cable, 3 ft [1 m], with 1/2" conduit connector
	Overload Protection	electronic throughout 0...95° rotation
Functional data	Operating range Y	2...10 V
	Operating range Y note	4...20 mA w/ ZG-R01 (500 Ω, 1/4 W resistor)
	Input Impedance	100 kΩ for 2...10 V (0.1 mA), 500 Ω for 4...20 mA
	Position feedback U	2...10 V
	Position feedback U note	Max. 0.5 mA
	Direction of motion motor	selectable with switch
	Direction of motion fail-safe	reversible with cw/ccw mounting
	Manual override	5 mm hex crank (3/16" Allen), supplied
	Angle of rotation	90°
	Running Time (Motor)	95 s
	Running time fail-safe	<20 s
	Noise level, motor	45 dB(A)
	Noise level, fail-safe	62 dB(A)
	Position indication	Mechanical
Safety data	Degree of protection IEC/EN	IP54
	Degree of protection NEMA/UL	NEMA 2 UL Enclosure Type 2
	Agency Listing	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2014/30/EU and 2014/35/EU; Listed to UL 2043 - suitable for use in air plenums per Section 300.22(c) of the NEC and Section 602.2 of the IMC
	Quality Standard	ISO 9001
	Ambient temperature	-22...122°F [-30...50°C]
	Storage temperature	-40...176°F [-40...80°C]
	Ambient humidity	max. 95% r.H., non-condensing
	Servicing	maintenance-free
Weight	Weight	5.4 lb [2.4 kg]

Electrical installation

INSTALLATION NOTES

Ⓐ Actuators with appliance cables are numbered.
△1 Provide overload protection and disconnect as required.
△3 Actuators may also be powered by 24 VDC.
△5 Only connect common to negative (-) leg of control circuits.
△7 A 500 Ω resistor (ZG-R01) converts the 4...20 mA control signal to 2...10 V.
△11 Actuators may be connected in parallel if not mechanically linked. Power consumption and input impedance must be observed.
◆ 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 V / 4...20 mA Control

V-3, V-4, V-5, V-20, V-21 Valve Body

5-year warranty

Type overview

Type	DN
G6100C	100

Technical data

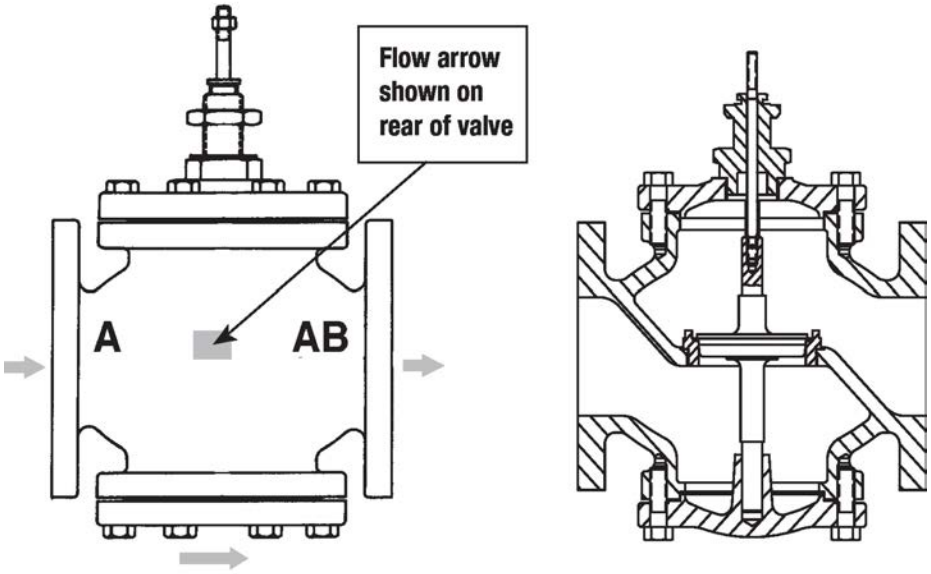
Functional data	Valve size [mm]	4" [100]
	Fluid	chilled or hot water, up to 60% glycol, steam
	Fluid Temp Range (water)	32...338°F [0...138°C]
	Fluid Temp Range (steam)	32...280°F [0...138°C]
	Body Pressure Rating	ANSI Class 125, up to 175 psi below 150°F
	Flow characteristic	equal percentage
	Servicing	repack/rebuild kits available
	Rangeability Sv	98:1
	Max Differential Pressure (Steam)	15 psi [103 kPa]
	Flow Pattern	2-way
	Leakage rate	ANSI Class III
	Controllable flow range	stem up - open A – AB
	Cv	170
	Maximum Inlet Pressure (Steam)	35 psi [241 kPa]
Materials	Valve body	Cast iron - ASTM A126 Class B
	Valve plug	brass
	Stem	stainless steel
	Stem seal	NLP EPDM (no lip packing)
	Seat	Stainless steel AISI 316
	Pipe connection	125 lb flanged
Suitable actuators	Non-Spring	EVB(X)
	Spring	(2*AFB(X))
	Electrical fail-safe	AVKB(X)

Safety notes

- WARNING: This product can expose you to lead which is known to the State of California to cause cancer and reproductive harm. For more information go to www.p65warnings.ca.gov
- The valve has been designed for use in stationary heating, ventilation and air-conditioning systems and must not be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.
- Only authorized specialists may carry out installation. All applicable legal or institutional installation regulations must be complied during installation.
- The valve does not contain any parts that can be replaced or repaired by the user.
- When determining the flow rate characteristic of controlled devices, the recognised directives must be observed.

Product features

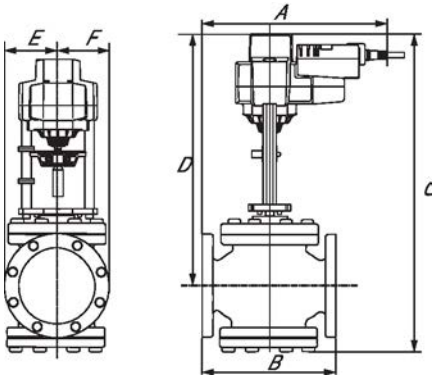
Flow/Mounting details



Dimensions

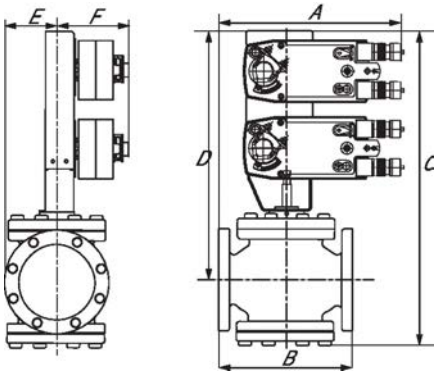
Type	DN	Weight
G6100C	100	125.69 lb [57 kg]

EVB, EVX, RVB, RVX



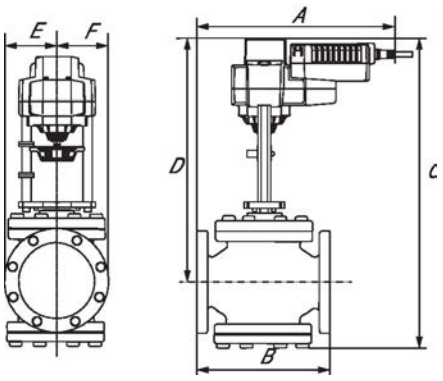
A	B	C	D	E	F	Number of Bolt Holes
13.7" [349]	13.0" [330]	26.6" [676]	19.8" [502]	4.5" [114]	4.5" [114]	8

2*AFB, 2*AFX



A	B	C	D	E	F	Number of Bolt Holes
13.7" [349]	13.0" [330]	30.0" [762]	23.2" [590]	4.5" [114]	5.3" [135]	8

AVKB, AVKX



A	B	C	D	E	F	Number of Bolt Holes
13.7" [349]	13.0" [330]	26.6" [676]	19.8" [502]	4.5" [114]	4.5" [114]	8

BELIMO

Technical data sheet G6125C

V-6, V-7, V-10, V-11, V-12, V-13, V-14, V-15, V-16, V-17
Valve Body

5-year warranty

Type overview

Type	DN
G6125C	125

Technical data

Functional data	Valve size [mm]	5" [125]
	Fluid	chilled or hot water, up to 60% glycol, steam
	Fluid Temp Range (water)	32...338°F [0...138°C]
	Fluid Temp Range (steam)	32...280°F [0...138°C]
	Body Pressure Rating	ANSI Class 125, up to 175 psi below 150°F
	Flow characteristic	equal percentage
	Servicing	repack/rebuild kits available
	Rangeability Sv	100:1
	Max Differential Pressure (Steam)	15 psi [103 kPa]
	Flow Pattern	2-way
	Leakage rate	ANSI Class III
	Controllable flow range	stem up - open A – AB
	Cv	263
	Maximum Inlet Pressure (Steam)	35 psi [241 kPa]
Materials	Valve body	Cast iron - ASTM A126 Class B
	Valve plug	brass
	Stem	stainless steel
	Stem seal	NLP EPDM (no lip packing)
	Seat	Stainless steel AISI 316
	Pipe connection	125 lb flanged
Suitable actuators	Non-Spring	EVB(X)
	Spring	(2*AFB(X))
	Electrical fail-safe	AVKB(X)

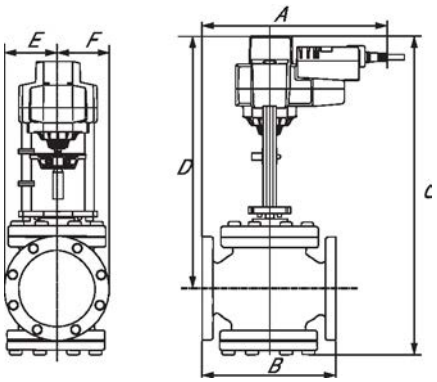
Safety notes

- WARNING: This product can expose you to lead which is known to the State of California to cause cancer and reproductive harm. For more information go to www.p65warnings.ca.gov
- The valve has been designed for use in stationary heating, ventilation and air-conditioning systems and must not be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.
- Only authorized specialists may carry out installation. All applicable legal or institutional installation regulations must be complied during installation.
- The valve does not contain any parts that can be replaced or repaired by the user.
- When determining the flow rate characteristic of controlled devices, the recognised directives must be observed.

Dimensions

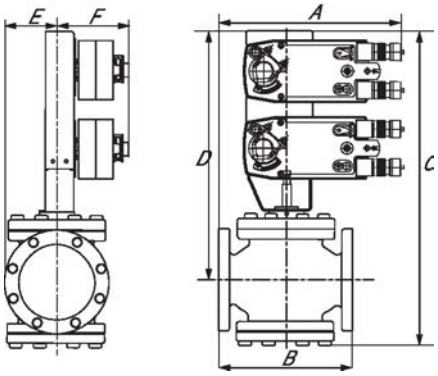
Type	DN	Weight
G6125C	125	147.74 lb [67 kg]

EVB, EVX, RVB, RVX



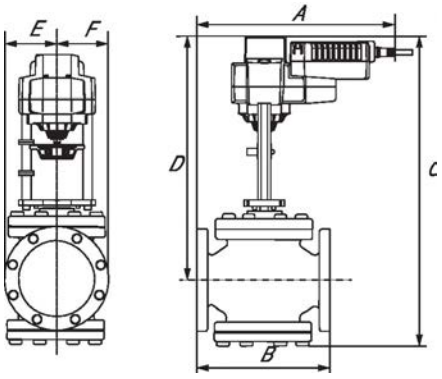
A	B	C	D	E	F	Number of Bolt Holes
15.7" [400]	15.1" [383]	25.4" [646]	17.5" [445]	5.0" [127]	5.0" [127]	8

2*AFB, 2*AFX



A	B	C	D	E	F	Number of Bolt Holes
15.1" [383]	15.7" [400]	28.7" [730]	21.0" [533]	5.0" [127]	5.3" [135]	8

AVKB, AVKX



A	B	C	D	E	F	Number of Bolt Holes
15.1" [383]	15.7" [400]	25.4" [646]	17.5" [445]	5.0" [127]	5.0" [127]	8

BELIMO

Modulating, Spring Return, 24 V, Multi-Function Technology®

V-3, V-4, V-5, V-20, V-21
V-6, V-7, V-10, V-11,
V-12, V-13, V-14, V-15,
V-16, V-17
Actuator

Technical data sheet 2*AFX24-MFT-X1

5-year warranty

Technical data

Electrical data	Nominal voltage	AC/DC 24 V
	Nominal voltage frequency	50/60 Hz
	Nominal voltage range	AC 19.2...28.8 V / DC 21.6...28.8 V
	Power consumption in operation	7.5 W
	Power consumption in rest position	3 W
	Transformer sizing	20 VA
	Electrical Connection	18 GA appliance cable, 1 m, 3 m or 5 m, with 1/2" conduit connector, degree of protection NEMA 2 / IP54
	Overload Protection	electronic throughout 0...95° rotation
Functional data	Operating range Y	2...10 V
	Operating range Y note	4...20 mA w/ ZG-R01 (500 Ω, 1/4 W resistor)
	Input Impedance	100 kΩ for 2...10 V (0.1 mA), 500 Ω for 4...20 mA, 1500 Ω for PWM, On/Off and Floating point
	Operating range Y variable	Start point 0.5...30 V End point 2.5...32 V
	Operating modes optional	variable (VDC, PWM, on/off, floating point)
	Position feedback U	2...10 V
	Position feedback U note	Max. 0.5 mA
	Position feedback U variable	VDC variable
	Direction of motion motor	selectable with switch 0/1
	Direction of motion fail-safe	reversible with cw/ccw mounting
	Manual override	5 mm hex crank (3/16" Allen), supplied
	Angle of rotation	95°
	Angle of rotation note	adjustable with mechanical end stop, 35...95°
	Running Time (Motor)	150 s / 90°
	Running time motor variable	70...220 s
	Running time fail-safe	<20 s
	Override control	MIN (minimum position) = 0% MID (intermediate position) = 50% MAX (maximum position) = 100%
	Noise level, motor	40 dB(A)
	Noise level, fail-safe	62 dB(A)
	Position indication	Mechanical
Safety data	Power source UL	Class 2 Supply
	Degree of protection IEC/EN	IP54
	Degree of protection NEMA/UL	NEMA 2
	Enclosure	UL Enclosure Type 2
	Agency Listing	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2014/30/EU

Safety data	Quality Standard	ISO 9001
	UL 2043 Compliant	Suitable for use in air plenums per Section 300.22(C) of the NEC and Section 602 of the IMC
	Ambient humidity	Max. 95% RH, non-condensing
	Ambient temperature	-22...122°F [-30...50°C]
	Storage temperature	-40...176°F [-40...80°C]
	Servicing	maintenance-free
Weight	Weight	9.26 lb [4.2 kg]
Materials	Housing material	Galvanized steel and plastic housing

Footnotes *Variable when configured with MFT options.

Accessories

Gateways	**Description**	**Type**
	Gateway MP to BACnet MS/TP	UK24BAC
	Gateway MP to Modbus RTU	UK24MOD
	Gateway MP to LonWorks	UK24LON

Electrical accessories	**Description**	**Type**
	Service Tool, with ZIP-USB function, for programmable and communicative Belimo actuators, VAV controller and HVAC performance devices	ZTH US

Tools	**Description**	**Type**
	Connection cable 10 ft [3 m], A: RJ11 6/4 ZTH EU, B: 3-pin Weidmüller and supply connection	ZK4-GEN
	Service Tool, with ZIP-USB function, for programmable and communicative Belimo actuators, VAV controller and HVAC performance devices	ZTH US

Electrical installation

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.

(A) Actuators with appliance cables are numbered.

Meets cULus requirements without the need of an electrical ground connection.

1 Provide overload protection and disconnect as required.

3 Actuators may also be powered by DC 24 V.

5 Only connect common to negative (-) leg of control circuits.

7 A 500 Ω resistor (ZG-R01) converts the 4...20 mA control signal to 2...10 V.

8 Control signal may be pulsed from either the Hot (Source) or Common (Sink) 24 V line.

10 For triac sink the Common connection from the actuator must be connected to the Hot connection of the controller. Position feedback cannot be used with a triac sink controller; the actuator internal common reference is not compatible.

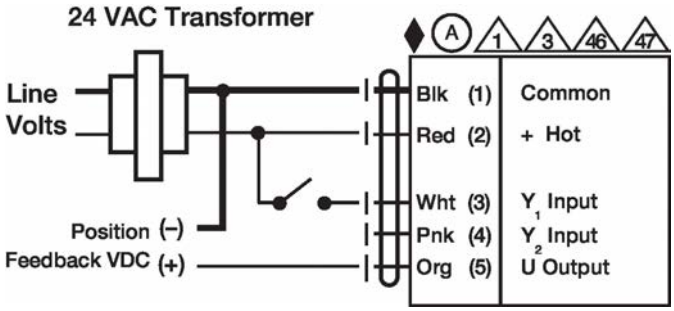
12 IN4004 or IN4007 diode. (IN4007 supplied, Belimo part number 40155).

46 Actuators may be controlled in parallel. Current draw and input impedance must be observed.

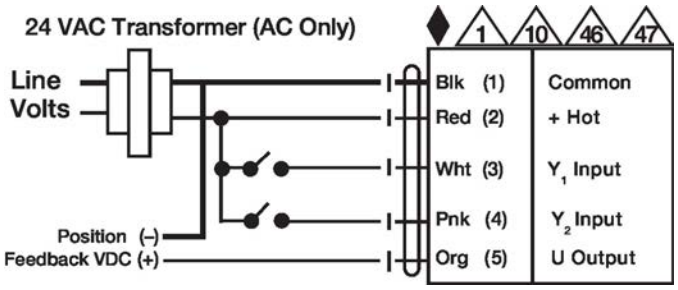
47 Master-Slave wiring required for piggy-back applications. Feedback from Master to control input(s) of Slave(s).

Wiring diagrams

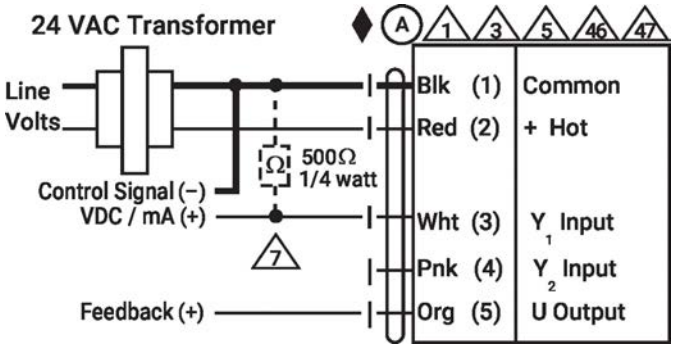
On/Off



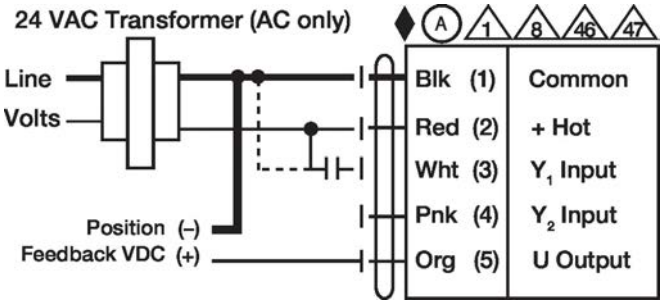
Floating Point



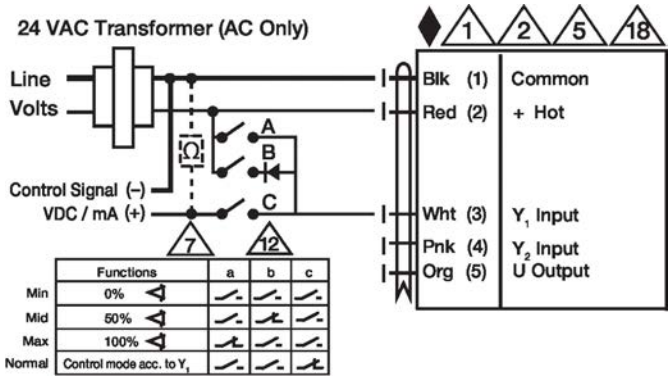
VDC/mA Control



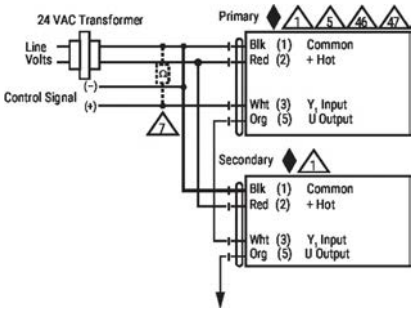
PWM Control



Override Control



Primary - Secondary



BELIMO

Technical data sheet G680C

V-8, V-18, V-19
Valve Body

5-year warranty

Type overview

Type	DN
G680C	80

Technical data

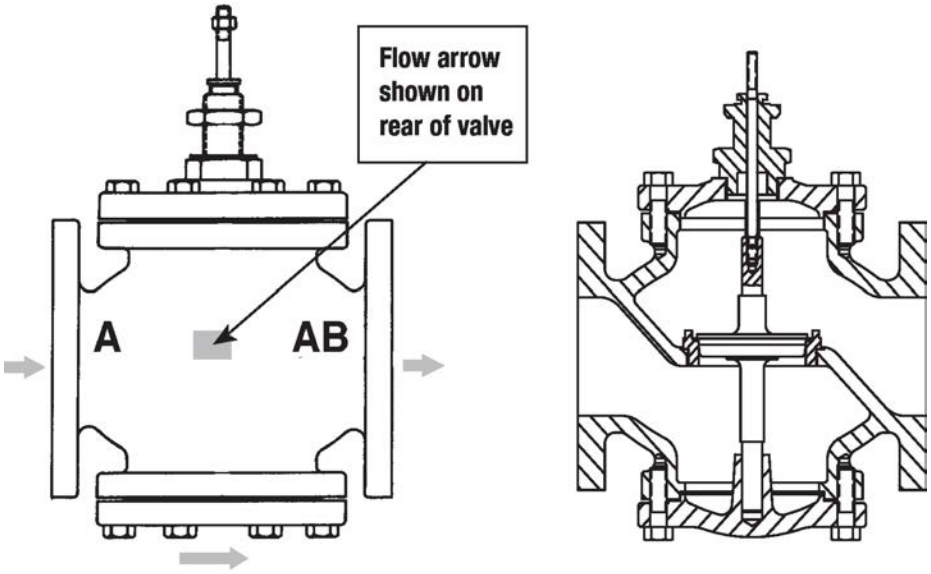
Functional data	Valve size [mm]	3" [80]
	Fluid	chilled or hot water, up to 60% glycol, steam
	Fluid Temp Range (water)	32...338°F [0...138°C]
	Fluid Temp Range (steam)	32...280°F [0...138°C]
	Body Pressure Rating	ANSI Class 125, up to 175 psi below 150°F
	Flow characteristic	equal percentage
	Servicing	repack/rebuild kits available
	Rangeability Sv	91:1
	Max Differential Pressure (Steam)	15 psi [103 kPa]
	Flow Pattern	2-way
	Leakage rate	ANSI Class III
	Controllable flow range	stem up - open A – AB
	Cv	90
	Maximum Inlet Pressure (Steam)	35 psi [241 kPa]
Materials	Valve body	Cast iron - ASTM A126 Class B
	Valve plug	brass
	Stem	stainless steel
	Stem seal	NLP EPDM (no lip packing)
	Seat	Stainless steel AISI 316
	Pipe connection	125 lb flanged
Suitable actuators	Non-Spring	EVB(X)
	Spring	AF
	Electrical fail-safe	AVKB(X)

Safety notes

- WARNING: This product can expose you to lead which is known to the State of California to cause cancer and reproductive harm. For more information go to www.p65warnings.ca.gov
- The valve has been designed for use in stationary heating, ventilation and air-conditioning systems and must not be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.
- Only authorized specialists may carry out installation. All applicable legal or institutional installation regulations must be complied during installation.
- The valve does not contain any parts that can be replaced or repaired by the user.
- When determining the flow rate characteristic of controlled devices, the recognised directives must be observed.

Product features

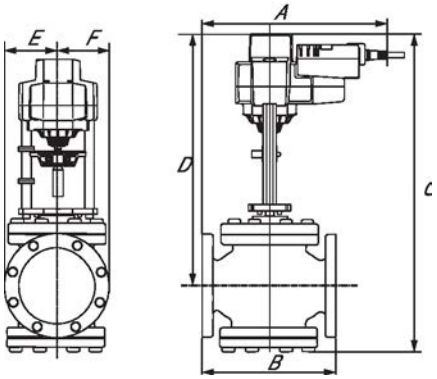
Flow/Mounting details



Dimensions

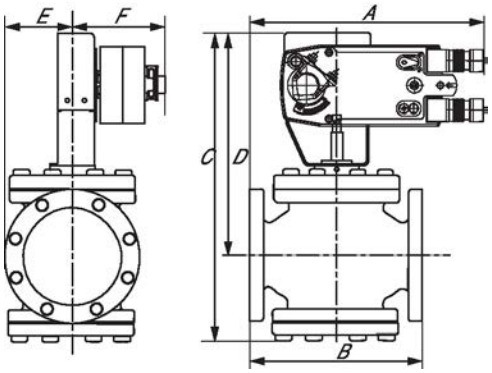
Type	DN	Weight
G680C	80	74.97 lb [34 kg]

EVB, EVX, RVB, RVX



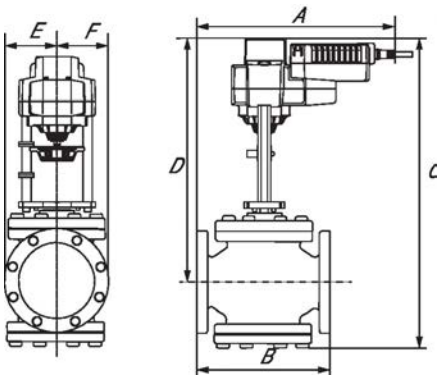
A	B	C	D	E	F	Number of Bolt Holes
12.2" [310]	10.0" [254]	24.6" [626]	19.3" [489]	3.9" [100]	3.9" [100]	4

AFB, AFX



A	B	C	D	E	F	Number of Bolt Holes
12.2" [310]	10.0" [254]	22.7" [577]	17.8" [453]	3.9" [100]	5.3" [135]	4

AVKB, AVKX



A	B	C	D	E	F	Number of Bolt Holes
12.2" [310]	10.0" [254]	24.6" [626]	19.3" [489]	3.9" [100]	3.9" [100]	4

BELIMO

Technical data sheet G665C

V-9
Valve Body

5-year warranty

Type overview

Type	DN
G665C	65

Technical data

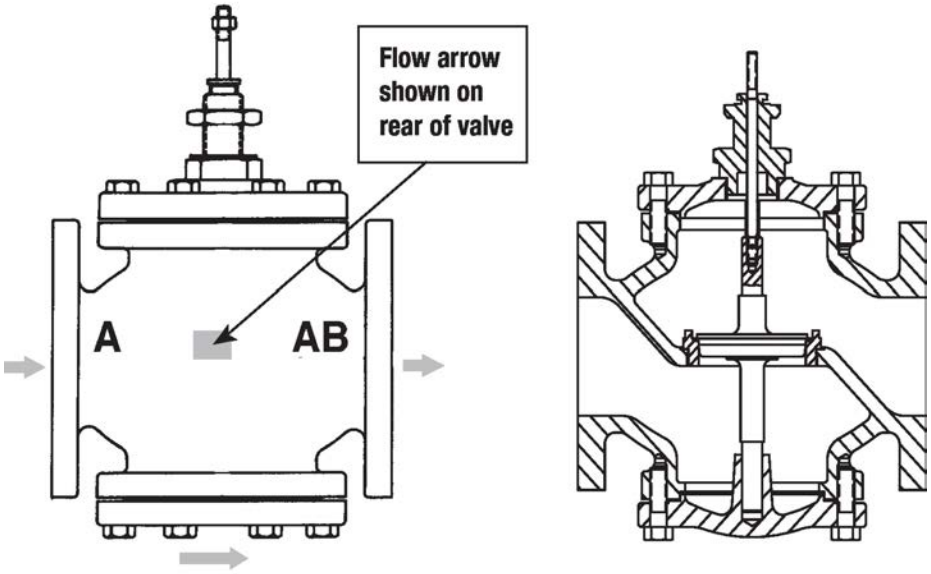
Functional data	Valve size [mm]	2.5" [65]
	Fluid	chilled or hot water, up to 60% glycol, steam
	Fluid Temp Range (water)	32...338°F [0...138°C]
	Fluid Temp Range (steam)	32...280°F [0...138°C]
	Body Pressure Rating	ANSI Class 125, up to 175 psi below 150°F
	Flow characteristic	equal percentage
	Servicing	repack/rebuild kits available
	Rangeability Sv	85:1
	Max Differential Pressure (Steam)	15 psi [103 kPa]
	Flow Pattern	2-way
	Controllable flow range	stem up - open A – AB
	Cv	65
	Maximum Inlet Pressure (Steam)	35 psi [241 kPa]
Materials	Valve body	Cast iron - ASTM A126 Class B
	Valve plug	brass
	Stem	stainless steel
	Stem seal	NLP EPDM (no lip packing)
	Seat	Stainless steel AISI 316
	Pipe connection	125 lb flanged
Suitable actuators	Non-Spring	EVB(X)
	Spring	AF
	Electrical fail-safe	AVKB(X)

Safety notes

- WARNING: This product can expose you to lead which is known to the State of California to cause cancer and reproductive harm. For more information go to www.p65warnings.ca.gov
- The valve has been designed for use in stationary heating, ventilation and air-conditioning systems and must not be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.
- Only authorized specialists may carry out installation. All applicable legal or institutional installation regulations must be complied during installation.
- The valve does not contain any parts that can be replaced or repaired by the user.
- When determining the flow rate characteristic of controlled devices, the recognised directives must be observed.

Product features

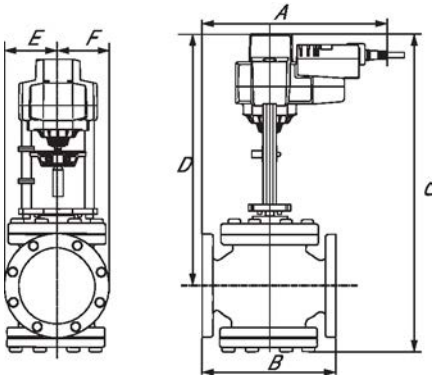
Flow/Mounting details



Dimensions

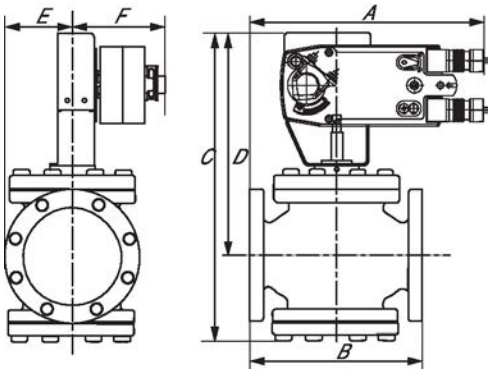
Type	DN	Weight
G665C	65	57.32 lb [26 kg]

EVB, EVX, RVB, RVX



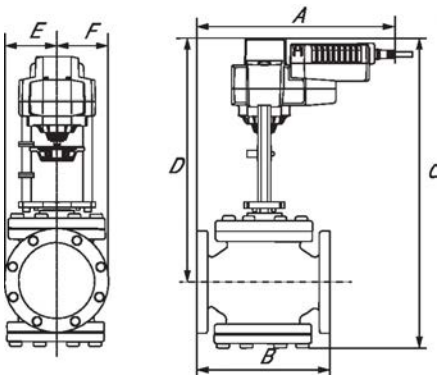
A	B	C	D	E	F	Number of Bolt Holes
11.7" [298]	9.0" [229]	23.0" [584]	18.3" [464]	3.6" [92]	3.6" [92]	4

AFB, AFX



A	B	C	D	E	F	Number of Bolt Holes
11.7" [298]	9.0" [229]	21.7" [550]	16.9" [428]	3.6" [92]	5.3" [135]	4

AVKB, AVKX



A	B	C	D	E	F	Number of Bolt Holes
11.7" [298]	9.0" [229]	23.0" [584]	18.3" [464]	3.6" [92]	3.6" [92]	4

BELIMO

Modulating, Spring Return, 24 V, Multi-Function Technology®

Technical data sheet AFX24-MFT-X1

V-8, V-9, V-18, V-19 Actuator

5-year warranty

MFT

Technical data

Electrical data	Nominal voltage	AC/DC 24 V
	Nominal voltage frequency	50/60 Hz
	Nominal voltage range	AC 19.2...28.8 V / DC 21.6...28.8 V
	Power consumption in operation	7.5 W
	Power consumption in rest position	3 W
	Transformer sizing	10 VA
	Electrical Connection	18 GA appliance cable, 1 m, 3 m or 5 m, with 1/2" conduit connector, degree of protection NEMA 2 / IP54
	Overload Protection	electronic throughout 0...95° rotation
Functional data	Operating range Y	2...10 V
	Operating range Y note	4...20 mA w/ ZG-R01 (500 Ω, 1/4 W resistor)
	Operating range Y variable	Start point 0.5...30 V End point 2.5...32 V
	Operating modes optional	variable (VDC, PWM, on/off, floating point)
	Position feedback U	2...10 V
	Position feedback U note	Max. 0.5 mA
	Position feedback U variable	VDC variable
	Direction of motion motor	selectable with switch 0/1
	Direction of motion fail-safe	reversible with cw/ccw mounting
	Manual override	5 mm hex crank (3/16" Allen), supplied
	Angle of rotation	95°
	Angle of rotation note	adjustable with mechanical end stop, 35...95°
	Running Time (Motor)	150 s / 90°
	Running time motor variable	70...220 s
	Running time fail-safe	<20 s
	Override control	MIN (minimum position) = 0% MID (intermediate position) = 50% MAX (maximum position) = 100%
	Noise level, motor	40 dB(A)
	Noise level, fail-safe	62 dB(A)
	Position indication	Mechanical
Safety data	Power source UL	Class 2 Supply
	Degree of protection IEC/EN	IP54
	Degree of protection NEMA/UL	NEMA 2
	Enclosure	UL Enclosure Type 2
	Agency Listing	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2014/30/EU
	Quality Standard	ISO 9001

Safety data	UL 2043 Compliant	Suitable for use in air plenums per Section 300.22(C) of the NEC and Section 602 of the IMC
	Ambient humidity	Max. 95% RH, non-condensing
	Ambient temperature	-22...122°F [-30...50°C]
	Storage temperature	-40...176°F [-40...80°C]
	Servicing	maintenance-free
Weight	Weight	4.6 lb [2.1 kg]
Materials	Housing material	Galvanized steel and plastic housing

Footnotes *Variable when configured with MFT options.

Accessories

Electrical accessories	Description	Type
	Service Tool, with ZIP-USB function, for programmable and communicative Belimo actuators, VAV controller and HVAC performance devices	ZTH US

Electrical installation

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.

Meets cULus requirements without the need of an electrical ground connection.

A Actuators with appliance cables are numbered.

1 Provide overload protection and disconnect as required.

3 Actuators may also be powered by DC 24 V.

5 Only connect common to negative (-) leg of control circuits.

7 A 500 Ω resistor (ZG-R01) converts the 4...20 mA control signal to 2...10 V.

8 Control signal may be pulsed from either the Hot (Source) or Common (Sink) 24 V line.

10 For triac sink the Common connection from the actuator must be connected to the Hot connection of the controller. Position feedback cannot be used with a triac sink controller; the actuator internal common reference is not compatible.

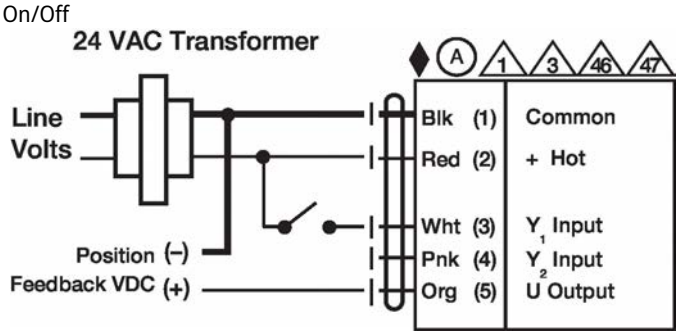
12 IN4004 or IN4007 diode. (IN4007 supplied, Belimo part number 40155).

46 Actuators may be controlled in parallel. Current draw and input impedance must be observed.

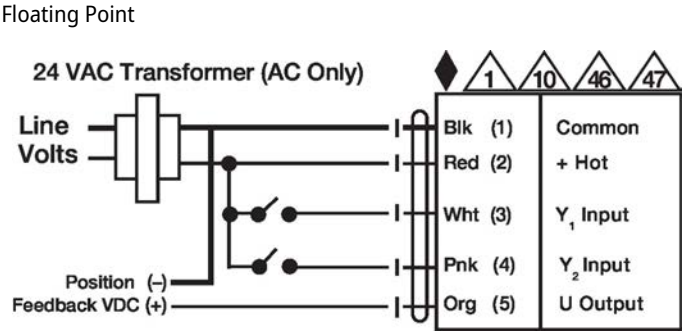
47 Master-Slave wiring required for piggy-back applications. Feedback from Master to control input(s) of Slave(s).

Wiring diagrams

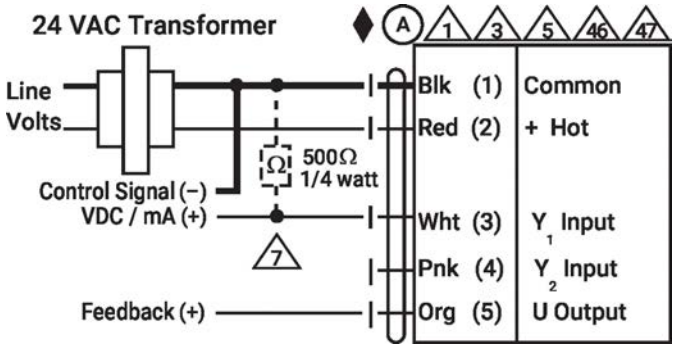
On/Off



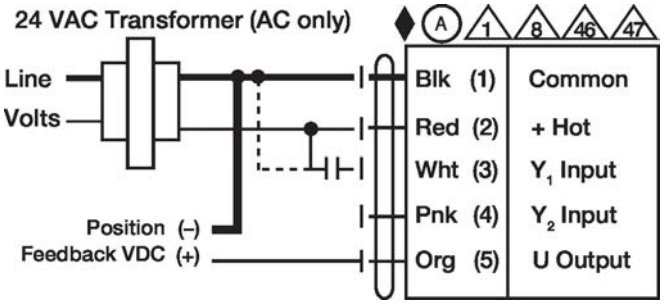
Floating Point



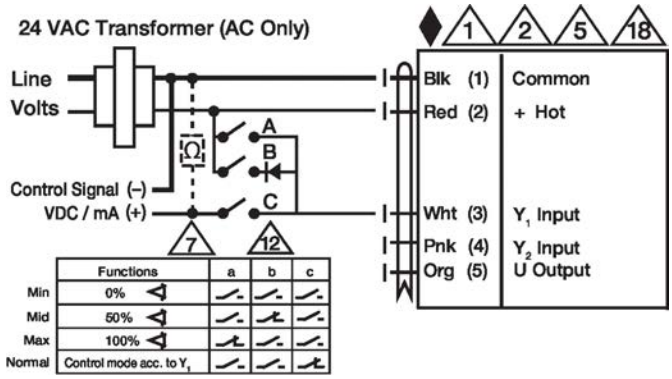
VDC/mA Control



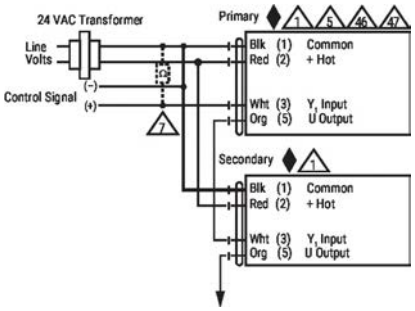
PWM Control



Override Control



Primary - Secondary



BELIMO

Stainless Steel Ball and Stem

V-25, V-29
Valve Body

Technical data sheet B223

5-year warranty

Type overview

Type	DN
B223	25

Technical data

Functional data	Valve size [mm]	1" [25]
	Fluid	chilled or hot water, up to 60% glycol
	Fluid Temp Range (water)	0...250°F [-18...120°C]
	Body Pressure Rating	600 psi
	Close-off pressure Δps	200 psi
	Flow characteristic	equal percentage
	Servicing	maintenance-free
	Flow Pattern	2-way
	Leakage rate	0% for A – AB
	Controllable flow range	75°
	Cv	10
Materials	Valve body	Nickel-plated brass body
	Stem	stainless steel
	Stem seal	EPDM (lubricated)
	Seat	PTFE
	Characterized disc	TEFZEL®
	Pipe connection	NPT
	O-ring	EPDM (lubricated)
	Ball	stainless steel
Suitable actuators	Non-Spring	LRB(X) NR
	Spring	LF

Safety notes

- WARNING: This product can expose you to lead which is known to the State of California to cause cancer and reproductive harm. For more information go to www.p65warnings.ca.gov

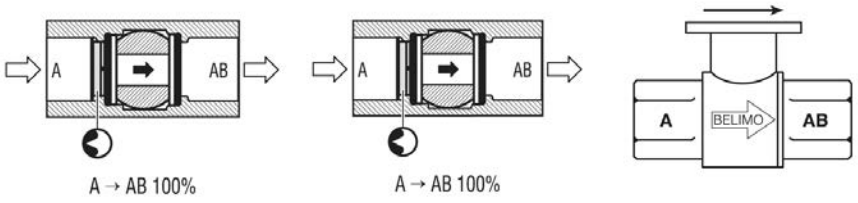
Product features

Application

This valve is typically used in air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in a hydronic system with variable flow.

Flow/Mounting details

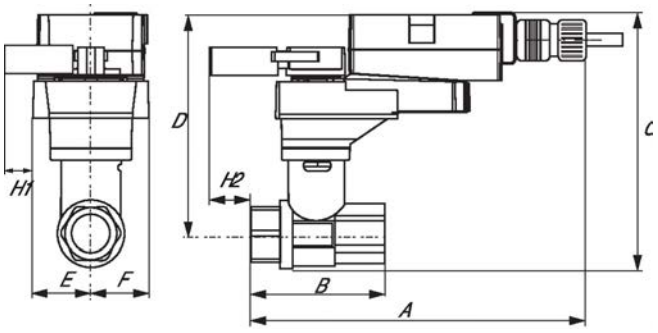
Two-way valves should be installed with the disc upstream.



Dimensions

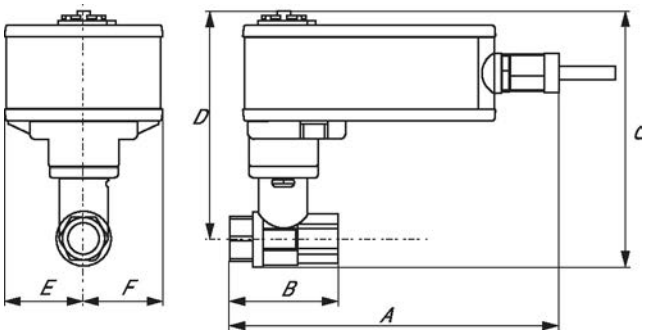
Type	DN	Weight
B223	25	1.1 lb [0.50 kg]

LRB, LRX



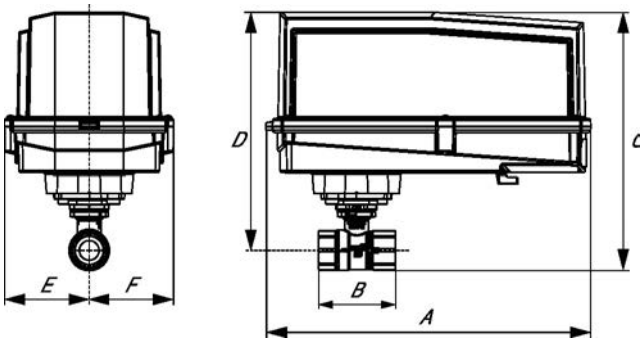
A	B	C	D	E	F	H1	H2
9.4" [239]	3.1" [78]	6.3" [159]	5.4" [137]	1.3" [33]	1.3" [33]	1.2" [30]	0.9" [23]

LF



A	B	C	D	E	F
8.1" [206]	3.1" [78]	6.5" [165]	5.6" [142]	1.8" [46]	1.8" [46]

ARB N4, ARX N4, NRB N4, NRX N4



A	B	C	D	E	F
11.4" [289]	3.1" [78]	7.8" [199]	7.1" [181]	3.1" [80]	3.1" [80]

BELIMO

Stainless Steel Ball and Stem

Technical data sheet B218

V-31 Valve Body

5-year warranty

Type overview

Type	DN
B218	20

Technical data

Functional data	Valve size [mm]	0.75" [20]
	Fluid	chilled or hot water, up to 60% glycol
	Fluid Temp Range (water)	0...250°F [-18...120°C]
	Body Pressure Rating	600 psi
	Close-off pressure Δps	200 psi
	Flow characteristic	equal percentage
	Servicing	maintenance-free
	Flow Pattern	2-way
	Leakage rate	0% for A – AB
	Controllable flow range	75°
	Cv	7.4
Materials	Valve body	Nickel-plated brass body
	Stem	stainless steel
	Stem seal	EPDM (lubricated)
	Seat	PTFE
	Characterized disc	TEFZEL®
	Pipe connection	NPT
	O-ring	EPDM (lubricated)
	Ball	stainless steel
Suitable actuators	Non-Spring	TR LRB(X) NR
	Spring	TFRB(X) LF

Safety notes

- WARNING: This product can expose you to lead which is known to the State of California to cause cancer and reproductive harm. For more information go to www.p65warnings.ca.gov

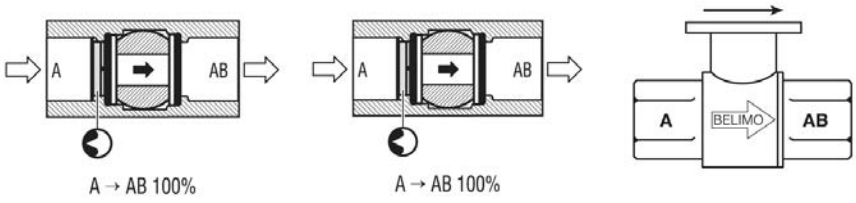
Product features

Application

This valve is typically used in air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in a hydronic system with variable flow.

Flow/Mounting details

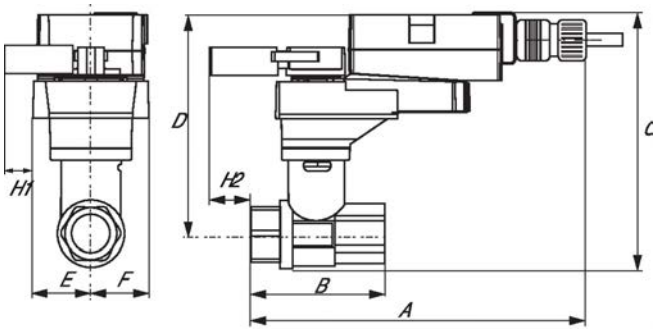
Two-way valves should be installed with the disc upstream.



Dimensions

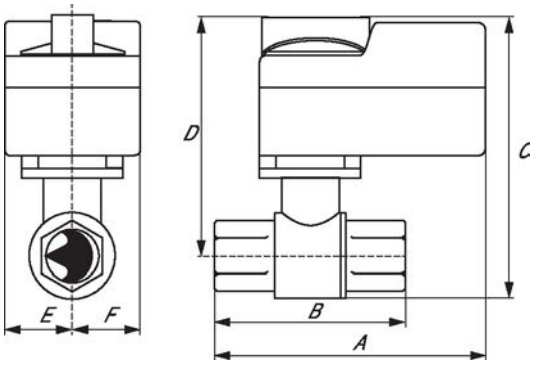
Type	DN	Weight
B218	20	0.66 lb [0.30 kg]

LRB, LRX



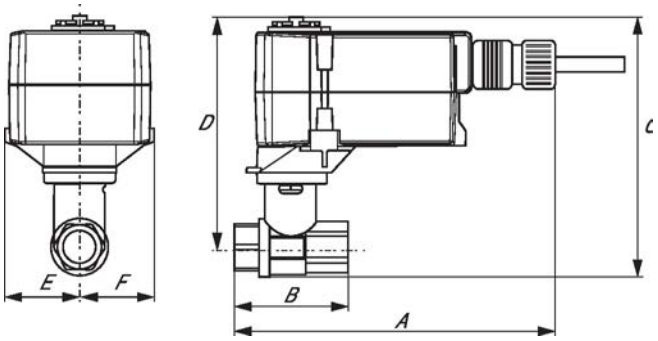
A	B	C	D	E	F	H1	H2
9.4" [239]	2.7" [69]	5.8" [147]	5.1" [129]	1.3" [33]	1.3" [33]	1.2" [30]	1" [25]

TR



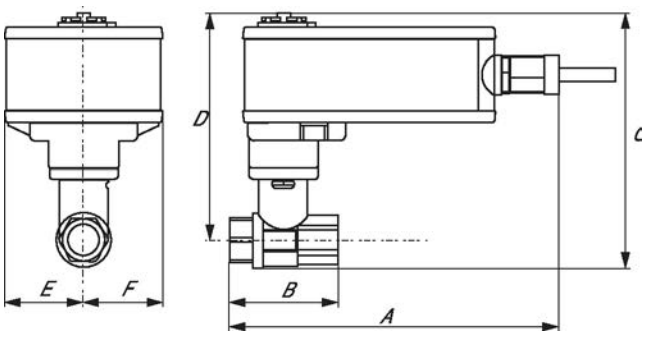
A	B	C	D	E	F
4.0" [102]	2.7" [69]	5.4" [137]	5.1" [129]	1.3" [33]	1.3" [33]

TFRB, TFRX



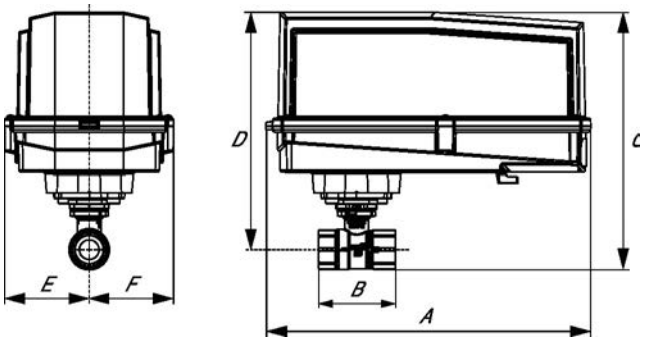
A	B	C	D	E	F
7.0" [178]	2.7" [69]	5.5" [139]	4.8" [122]	1.5" [39]	1.5" [39]

LF



A	B	C	D	E	F
8.6" [218]	2.7" [69]	6.3" [159]	5.6" [142]	1.8" [46]	1.8" [46]

ARB N4, ARX N4, NRB N4, NRX N4



A	B	C	D	E	F
11.4" [289]	2.7" [69]	7.8" [199]	7.1" [181]	3.1" [80]	3.1" [80]

BELIMO

Modulating, Spring Return, AC 24 V for DC 2...10 V or 4...20 mA Control Signal

V-25, V-29, V-31 Actuator

Technical data sheet LF24-SR US

5-year warranty

Technical data

Electrical data	Nominal voltage	AC/DC 24 V
	Nominal voltage frequency	50/60 Hz
	Nominal voltage range	AC 19.2...28.8 V / DC 21.6...28.8 V
	Power consumption in operation	2.5 W
	Power consumption in rest position	1 W
	Transformer sizing	5 VA
	Electrical Connection	18 GA plenum cable, 1 m, with 1/2" conduit connector
	Overload Protection	electronic throughout 0...95° rotation
Functional data	Operating range Y	2...10 V
	Operating range Y note	4...20 mA w/ ZG-R01 (500 Ω, 1/4 W resistor)
	Input Impedance	100 kΩ for 2...10 V (0.1 mA), 500 Ω for 4...20 mA
	Position feedback U	2...10 V
	Position feedback U note	Max. 0.7 mA
	Direction of motion motor	selectable with switch 0/1
	Direction of motion fail-safe	reversible with cw/ccw mounting
	Angle of rotation	90°
	Running Time (Motor)	150 s / 90°
	Running time motor note	constant, independent of load
	Running time fail-safe	<25 s @ -4...122°F [-20...50°C], <60 s @ -22°F [-30°C]
	Noise level, motor	50 dB(A)
	Noise level, fail-safe	62 dB(A)
	Position indication	Mechanical
Safety data	Power source UL	Class 2 Supply
	Degree of protection IEC/EN	IP54
	Degree of protection NEMA/UL	NEMA 2
	Enclosure	UL Enclosure Type 2
	Agency Listing	cULus acc. To UL 873 and CAN/CSA C22.2 No. 24-93
	Quality Standard	ISO 9001
	UL 2043 Compliant	Suitable for use in air plenums per Section 300.22(C) of the NEC and Section 602 of the IMC
	Ambient humidity	Max. 95% RH, non-condensing
	Ambient temperature	-22...122°F [-30...50°C]
	Storage temperature	-40...176°F [-40...80°C]
	Servicing	maintenance-free
Weight	Weight	3.4 lb [1.5 kg]
Materials	Housing material	galvanized steel

Footnotes †Rated Impulse Voltage 800V, Type of action 1.AA, Control Pollution Degree 3

Electrical installation

INSTALLATION NOTES

A Actuators with appliance cables are numbered.

1 Provide overload protection and disconnect as required.

3 Actuators may also be powered by DC 24 V.

5 Only connect common to negative (-) leg of control circuits.

7 A 500 Ω resistor (ZG-R01) converts the 4...20 mA control signal to 2...10 V.

11 Actuators may be connected in parallel if not mechanically linked. Power consumption and input impedance must be observed.

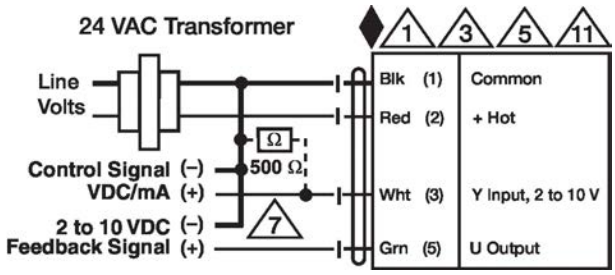
Meets cULus requirements without the need of an electrical ground connection.

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.

Wiring diagrams

2...10 V / 4...20 mA Control



BELIMO

Stainless Steel Ball and Stem

Technical data sheet B210

V-35 Valve Body

5-year warranty

Technical data

Functional data	Valve Size	0.5" [15]
	Fluid	chilled or hot water, up to 60% glycol
	Fluid Temp Range (water)	0...250°F [-18...120°C]
	Body Pressure Rating	600 psi
	Close-off pressure Δps	200 psi
	Flow characteristic	equal percentage
	Servicing	maintenance-free
	Flow Pattern	2-way
	Leakage rate	0% for A – AB
	Controllable flow range	75°
	Cv	1.2
	Body pressure rating note	600 psi
	Cv Flow Rating	A-port: as stated in chart B-port: 70% of A – AB Cv
Materials	Valve body	Nickel-plated brass body
	Stem seal	EPDM (lubricated)
	Seat	PTFE
	Pipe connection	NPT female ends
	O-ring	EPDM (lubricated)
	Ball	stainless steel
Suitable actuators	Non-Spring	TR LRB(X) NR

Safety notes

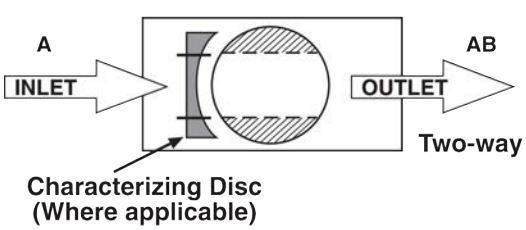
- WARNING: This product can expose you to lead which is known to the State of California to cause cancer and reproductive harm. For more information go to www.p65warnings.ca.gov

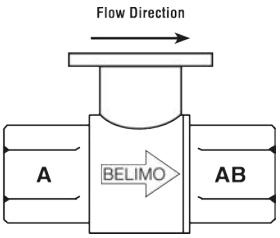
Product features

Application

This valve is typically used in air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in a hydronic system with variable flow.

Flow/Mounting details

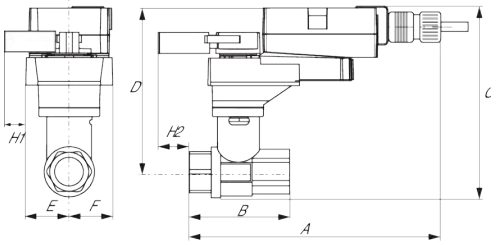




Dimensions

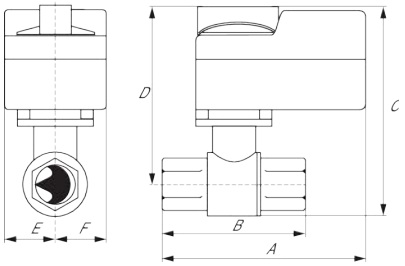
Dimensional drawings

LRB, LRX



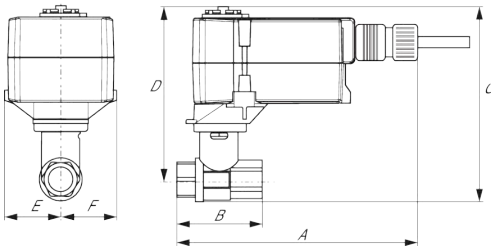
A	B	C	D	E	F	H1	H2
9.4" [239]	2.4" [60]	5.2" [132]	4.6" [117]	1.3" [33]	1.3" [33]	1.2" [30]	1.1" [28]

TR



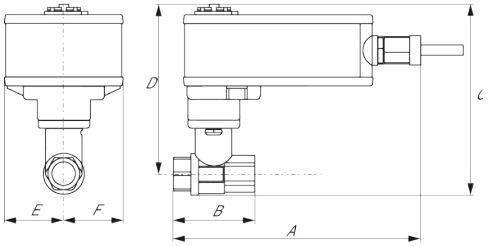
A	B	C	D	E	F
3.7" [95]	2.4" [60]	4.8" [122]	4.2" [107]	1.3" [33]	1.3" [33]

TFRB, TFRX



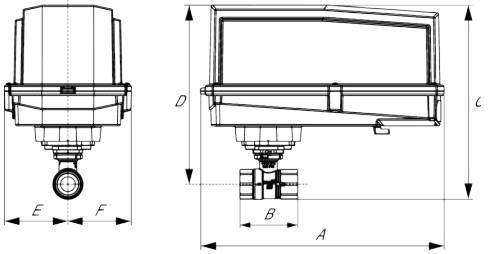
A	B	C	D	E	F
6.6" [167]	2.4" [60]	4.9" [124]	4.3" [110]	1.5" [39]	1.5" [39]

LF



A	B	C	D	E	F
7.9" [200]	2.4" [60]	5.7" [146]	5.1" [129]	1.8" [46]	1.8" [46]

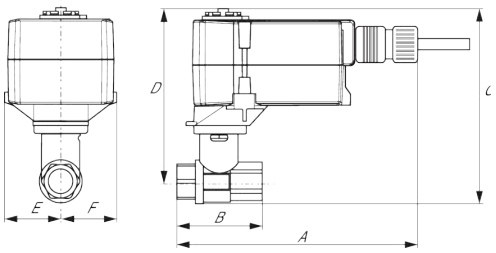
ARB N4, ARX N4, NRB N4, NRX N4



A	B	C	D	E	F
11.4" [289]	2.4" [60]	7.7" [196]	7.0" [179]	3.1" [80]	3.1" [80]

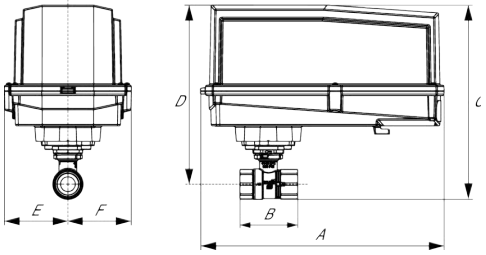
A	B	C	D	E	F
7.9" [200]	2.4" [60]	5.7" [146]	5.1" [129]	1.8" [46]	1.8" [46]

TFRB, TFRX



A	B	C	D	E	F
6.6" [167]	2.4" [60]	4.9" [124]	4.3" [110]	1.5" [39]	1.5" [39]

ARB N4, ARX N4, NRB N4, NRX N4



A	B	C	D	E	F
11.4" [289]	2.4" [60]	7.7" [196]	7.0" [179]	3.1" [80]	3.1" [80]

BELIMO

Stainless Steel Ball and Stem

Technical data sheet B217

V-36, V-38
Valve Body

5-year warranty

Technical data

Functional data	Valve Size	0.75" [20]
	Fluid	chilled or hot water, up to 60% glycol
	Fluid Temp Range (water)	0...250°F [-18...120°C]
	Body Pressure Rating	600 psi
	Close-off pressure Δps	200 psi
	Flow characteristic	equal percentage
	Servicing	maintenance-free
	Flow Pattern	2-way
	Leakage rate	0% for A – AB
	Controllable flow range	75°
	Cv	4.7
	Body pressure rating note	600 psi
	Cv Flow Rating	A-port: as stated in chart B-port: 70% of A – AB Cv
Materials	Valve body	Nickel-plated brass body
	Stem seal	EPDM (lubricated)
	Seat	PTFE
	Pipe connection	NPT female ends
	O-ring	EPDM (lubricated)
	Ball	stainless steel
Suitable actuators	Non-Spring	TR LRB(X) NR

Safety notes

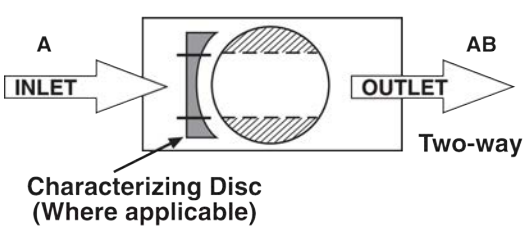
- WARNING: This product can expose you to lead which is known to the State of California to cause cancer and reproductive harm. For more information go to www.p65warnings.ca.gov

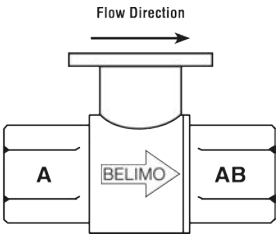
Product features

Application

This valve is typically used in air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in a hydronic system with variable flow.

Flow/Mounting details

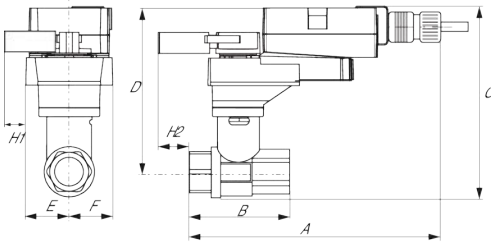




Dimensions

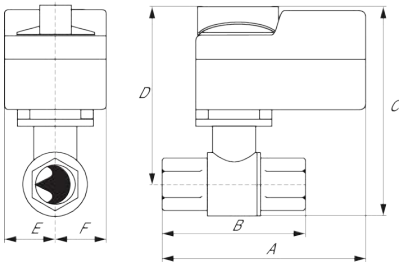
Dimensional drawings

LRB, LRX



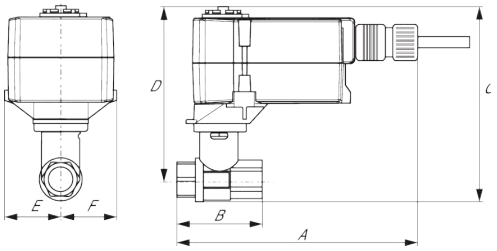
A	B	C	D	E	F	H1	H2
9.4" [239]	2.7" [69]	5.8" [147]	5.1" [129]	1.3" [33]	1.3" [33]	1.2" [30]	1" [25]

TR



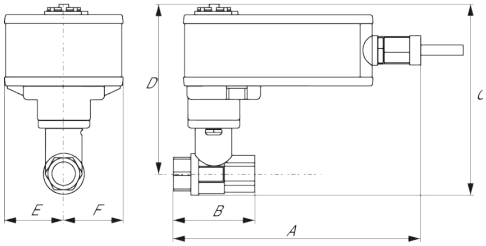
A	B	C	D	E	F
4.0" [102]	2.7" [69]	5.4" [137]	5.1" [129]	1.3" [33]	1.3" [33]

TFRB, TFRX



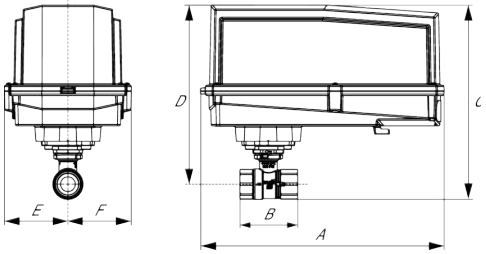
A	B	C	D	E	F
7.0" [178]	2.7" [69]	5.5" [139]	4.8" [122]	1.5" [39]	1.5" [39]

LF



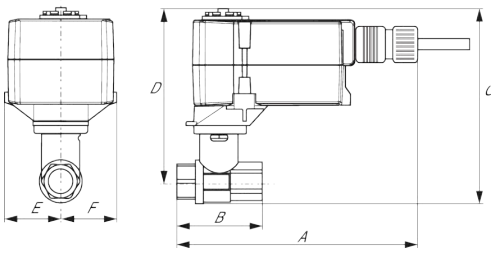
A	B	C	D	E	F
8.6" [218]	2.7" [69]	6.3" [159]	5.6" [142]	1.8" [46]	1.8" [46]

ARB N4, ARX N4, NRB N4, NRX N4



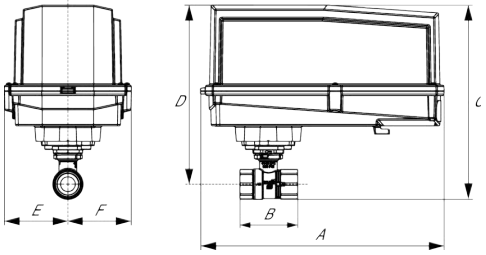
A	B	C	D	E	F
11.4" [289]	2.7" [69]	7.8" [199]	7.1" [181]	3.1" [80]	3.1" [80]

TFRB, TFRX



A	B	C	D	E	F
7.0" [178]	2.7" [69]	5.5" [139]	4.8" [122]	1.5" [39]	1.5" [39]

ARB N4, ARX N4, NRB N4, NRX N4



A	B	C	D	E	F
11.4" [289]	2.7" [69]	7.8" [199]	7.1" [181]	3.1" [80]	3.1" [80]

BELIMO

Stainless Steel Ball and Stem

Technical data sheet B219

V-39
Valve Body

5-year warranty

Technical data

Functional data	Valve Size	0.75" [20]
	Fluid	chilled or hot water, up to 60% glycol
	Fluid Temp Range (water)	0...250°F [-18...120°C]
	Body Pressure Rating	600 psi
	Close-off pressure Δps	200 psi
	Flow characteristic	equal percentage
	Servicing	maintenance-free
	Flow Pattern	2-way
	Leakage rate	0% for A – AB
	Controllable flow range	75°
	Cv	10
	Body pressure rating note	600 psi
	Cv Flow Rating	A-port: as stated in chart B-port: 70% of A – AB Cv
Materials	Valve body	Nickel-plated brass body
	Stem seal	EPDM (lubricated)
	Seat	PTFE
	Pipe connection	NPT female ends
	O-ring	EPDM (lubricated)
	Ball	stainless steel
Suitable actuators	Non-Spring	TR LRB(X) NR

Safety notes

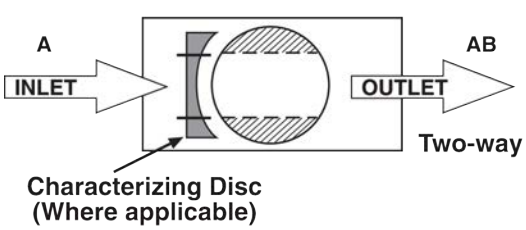
- WARNING: This product can expose you to lead which is known to the State of California to cause cancer and reproductive harm. For more information go to www.p65warnings.ca.gov

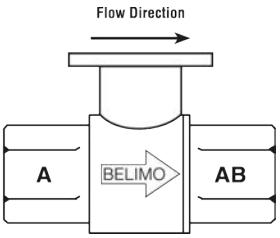
Product features

Application

This valve is typically used in air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in a hydronic system with variable flow.

Flow/Mounting details

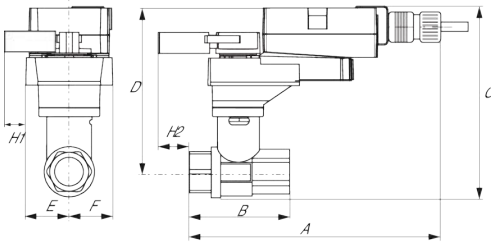




Dimensions

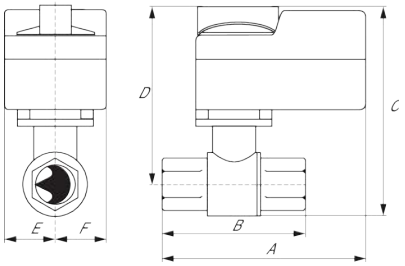
Dimensional drawings

LRB, LRX



A	B	C	D	E	F	H1	H2
9.4" [239]	2.7" [69]	5.8" [147]	5.1" [129]	1.3" [33]	1.3" [33]	1.2" [30]	1" [25]

TR



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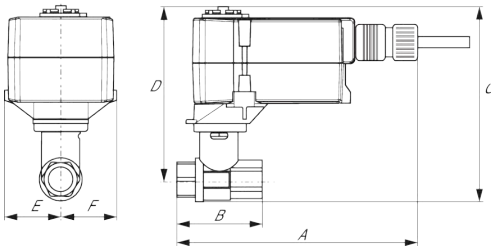

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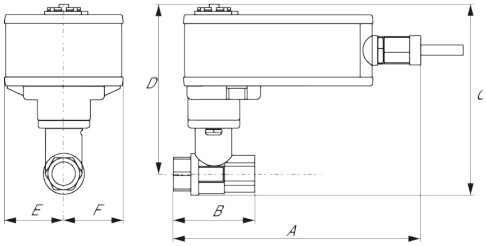
LF



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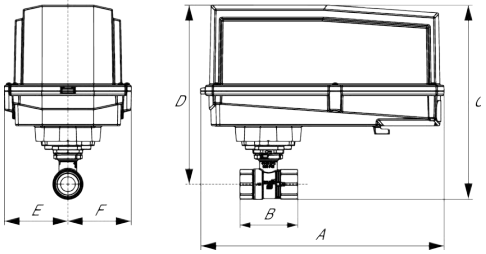
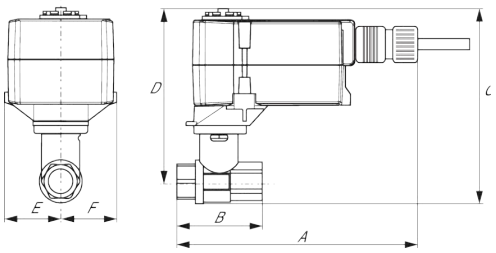
ARB N4, ARX N4, NRB N4, NRX N4



A	B	C	D	E	F
11.4" [289]	2.7" [69]	7.8" [199]	7.1" [181]	3.1" [80]	3.1" [80]

TFRB, TFRX



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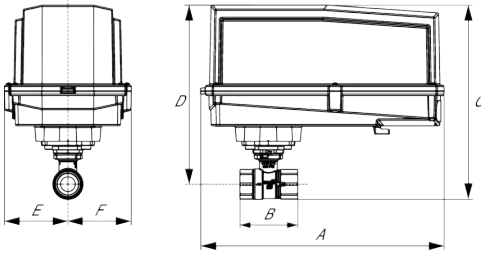

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BELIMO

Modulating, Spring Return, AC 24 V for DC 2...10 V or 4...20 mA Control Signal

V-35, V-36, V-38, V-39 Actuator

Technical data sheet TFRB24-SR

5-year warranty

Technical data

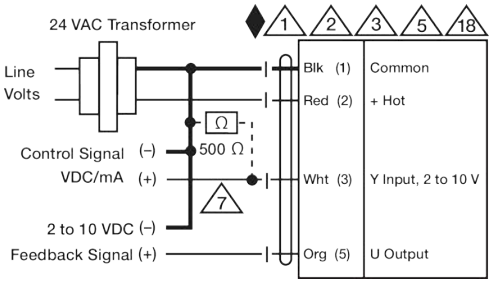
Electrical data	Nominal voltage	AC/DC 24 V
	Nominal voltage frequency	50/60 Hz
	Power consumption in operation	2 W
	Power consumption in rest position	1 W
	Transformer sizing	4 VA (class 2 power source)
	Electrical Connection	18 GA plenum cable, 3 ft [1 m], with 1/2" conduit connector
	Overload Protection	electronic throughout 0...95° rotation
Functional data	Operating range Y	2...10 V
	Operating range Y note	4...20 mA w/ ZG-R01 (500 Ω, 1/4 W resistor)
	Input Impedance	100 kΩ for 2...10 V (0.1 mA), 500 Ω for 4...20 mA
	Position feedback U	2...10 V
	Position feedback U note	Max. 0.5 mA
	Direction of motion motor	selectable with switch 0/1
	Direction of motion fail-safe	reversible with cw/ccw mounting
	Angle of rotation	Max. 95°, 90°
	Angle of rotation note	90°
	Running Time (Motor)	95 s
	Running time fail-safe	<25 s tamb = 68°F [20°C]
	Noise level, motor	35 dB(A)
	Noise level, fail-safe	62 dB(A)
	Position indication	Mechanical
Safety data	Degree of protection IEC/EN	IP42
	Degree of protection NEMA/UL	NEMA 2 UL Enclosure Type 2
	Agency Listing	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02, CE acc. to 2014/30/EU and 2014/35/EU; Listed to UL 2043 - suitable for use in air plenums per Section 300.22(c) of the NEC and Section 602.2 of the IMC
	Quality Standard	ISO 9001
	Ambient temperature	-22...122°F [-30...50°C]
	Storage temperature	-40...176°F [-40...80°C]
	Ambient humidity	max. 95% r.H., non-condensing
	Servicing	maintenance-free
Weight	Weight	1.6 lb [0.80 kg]
Materials	Housing material	UL94-5VA

Electrical installation

INSTALLATION NOTES

1 Provide overload protection and disconnect as required.
2 Actuators may be connected in parallel. Power consumption and input impedance must be observed.
3 Actuators may also be powered by 24 VDC.
5 Only connect common to negative (-) leg of control circuits.
7 A 500 Ω resistor (ZG-R01) converts the 4...20 mA control signal to 2...10 V.
18 Actuators with plenum cable do not have numbers; use color codes instead.
◆ 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 V / 4...20 mA Control

100 – 5525 Eglinton Avenue W
Toronto ON Canada M9C5K5
Telephone +1 647.789.2600
Facsimile +1 647.789.2557

Damper & Actuator Cutsheets

BELIMO

Technical data sheet NFB24-S

Basic Fail-Safe actuator for controlling dampers in typical commercial HVAC applications.

- **Torque motor 90 in-lb [10 Nm]**
- **Nominal voltage AC/DC 24 V**
- **Control On/Off**
- **2x SPDT**

MD-1,5,6,7,8
Damper Actuator

5-year warranty

Technical data

Electrical data	Nominal voltage	AC/DC 24 V
	Nominal voltage frequency	50/60 Hz
	Nominal voltage range	AC 19.2...28.8 V / DC 21.6...28.8 V
	Power consumption in operation	6 W
	Power consumption in rest position	2.5 W
	Transformer sizing	8.5 VA
	Auxiliary switch	2x SPDT, 1 mA...3 A (0.5 A inductive), DC 5 V...AC 250 V, one set at 10°, one adjustable 10...90°
	Switching capacity auxiliary switch	1 mA...3 A (0.5 A inductive), DC 5 V...AC 250 V
	Electrical Connection	(2) 18 GA appliance cables, 1 m, with 1/2" NPT conduit connectors
	Overload Protection	electronic throughout 0...95° rotation
	Electrical Protection	actuators are double insulated
Functional data	Torque motor	90 in-lb [10 Nm]
	Direction of motion motor	selectable by ccw/cw mounting
	Direction of motion fail-safe	reversible with cw/ccw mounting
	Manual override	5 mm hex crank (3/16" Allen), supplied
	Angle of rotation	95°
	Angle of rotation note	adjustable with mechanical end stop, 35...95°
	Running Time (Motor)	75 s / 90°
	Running time fail-safe	<20 s @ -4...122°F [-20...50°C], <60 s @ -22°F [-30°C]
	Noise level, motor	50 dB(A)
	Noise level, fail-safe	62 dB(A)
	Position indication	Mechanical
Safety data	Power source UL	Class 2 Supply
	Degree of protection IEC/EN	IP54
	Degree of protection NEMA/UL	NEMA 2
	Enclosure	UL Enclosure Type 2
	Agency Listing	cULus listed to UL60730-1A:02; UL 60730-2-14:02 and CAN/CSA-E60730-1:02
	Quality Standard	ISO 9001
	UL 2043 Compliant	Suitable for use in air plenums per Section 300.22(C) of the NEC and Section 602 of the IMC
	Ambient humidity	Max. 95% RH, non-condensing
	Ambient temperature	-22...122°F [-30...50°C]
	Storage temperature	-40...176°F [-40...80°C]
	Servicing	maintenance-free

Weight	Weight	5.4 lb [2.4 kg]
Materials	Housing material	Galvanized steel and plastic housing

Footnotes †Rated Impulse Voltage 800V, Type of Action 1.AA.B, Control Pollution Degree 3.

Product features

Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact or a manual switch. The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

Operation

The NF..24-S series actuators provide true spring return operation for reliable failsafe application and positive close off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator. The NF..24-S series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. The NF..24-S versions are provided with two built-in auxiliary switches. These SPDT switches are provided for safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at 10°, the other switch function is adjustable between 10° to 90°. The NF..24-S actuator is shipped at 5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.

Typical specification

On/Off spring return damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a jackshaft up to a 1.05” diameter. The actuators must be designed so that they may be used for either clockwise or counter clockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, two SPDT auxiliary switch shall be provided having the capability of one being adjustable. Actuators with auxiliary switches must be constructed to meet the requirements for Double Insulation so an electrical ground is not required to meet agency listings. Actuators shall be cULus listed and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

Accessories

Electrical accessories

Description	Type
Auxiliary switch, mercury-free	P475
Auxiliary switch, mercury-free	P475-1
Signal simulator, Power supply AC 120 V	PS-100
Cable conduit connector 1/2"	TF-CC US
Transformer, AC 120 V to AC 24 V, 40 VA	ZG-X40

Mechanical accessories

Description	Type
Anti-rotation bracket, for AF / NF	AF-P
Shaft extension 240 mm ø20 mm for damper shaft ø8...22.7 mm	AV8-25
End stop indicator	IND-AFB
Shaft clamp reversible, for central mounting, for damper shafts ø12.7 / 19.0 / 25.4 mm	K7-2
Ball joint suitable for damper crank arm KH8 / KH10	KG10A
Ball joint suitable for damper crank arm KH8	KG8
Damper crank arm Slot width 8.2 mm, clamping range ø14...25 mm	KH10
Damper crank arm Slot width 8.2 mm, for ø1.05"	KH12
Damper crank arm Slot width 8.2 mm, clamping range ø10...18 mm	KH8
Actuator arm, for 3/4" shafts, clamping range ø10...22 mm, Slot width 8.2 mm	KH-AFB
Push rod for KG10A ball joint 36" L, 3/8" diameter	SH10
Push rod for KG6 & KG8 ball joints (36" L, 5/16" diameter).	SH8
Wrench 0.32 in and 0.39 in [8 mm and 10 mm]	TOOL-06
Retrofit clip	Z-AF
Mounting bracket for AF..	ZG-100
Mounting bracket	ZG-101
Mounting bracket	ZG-109
Linkage kit	ZG-110
Mounting bracket for AF / NF	ZG-118
Jackshaft mounting bracket.	ZG-120
Mounting kit for linkage operation for flat and side installation	ZG-AFB
Mounting kit for foot mount installation	ZG-AFB118
Damper clip for damper blade, 3.5" width.	ZG-DC1
Damper clip for damper blade, 6" width.	ZG-DC2
1" diameter jackshaft adaptor (11" L).	ZG-JSA-1
1-5/16" diameter jackshaft adaptor (12" L).	ZG-JSA-2
1.05" diameter jackshaft adaptor (12" L).	ZG-JSA-3
Weather shield 13x8x6" [330x203x152 mm] (LxWxH)	ZS-100
Baseplate, for ZS-100	ZS-101
Weather shield 406x213x102 mm [16x8-3/8x4"] (LxWxH)	ZS-150
Explosion proof housing 16x10x6.435" [406x254x164 mm] (LxWxH), UL and CSA, Class I, Zone 1&2, Groups B, C, D, (NEMA 7), Class III, Hazardous (classified) Locations	ZS-260
Weather shield 17-1/4x8-3/4x5-1/2" [438x222x140 mm] (LxWxH), NEMA 4X, with mounting brackets	ZS-300
Weather shield 17-1/4x8-3/4x5-1/2" [438x222x140 mm] (LxWxH), NEMA 4X, with mounting brackets	ZS-300-5
Shaft extension 1/2"	ZS-300-C1
Shaft extension 3/4"	ZS-300-C2
Shaft extension 1"	ZS-300-C3
Baseplate extension	Z-SF
Linkage kit	ZG-JSL
Jackshaft Retrofit Linkage with Belimo Rotary Actuators	

Electrical installation

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.

Meets cULus requirements without the need of an electrical ground connection.

Apply only AC line voltage or only UL-Class 2 voltage to the terminals of auxiliary switches. Mixed or combined operation of line voltage/safety extra low voltage is not allowed.

(A) Actuators with appliance cables are numbered.

1 Provide overload protection and disconnect as required.

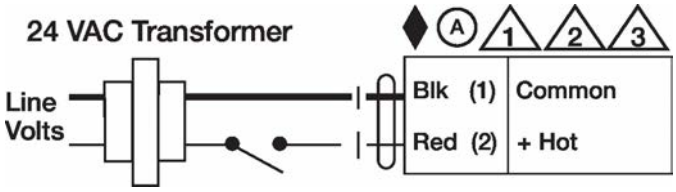
3 Actuators may also be powered by DC 24 V.

4 Two built-in auxiliary switches (2x SPDT), for end position indication, interlock control, fan startup, etc.

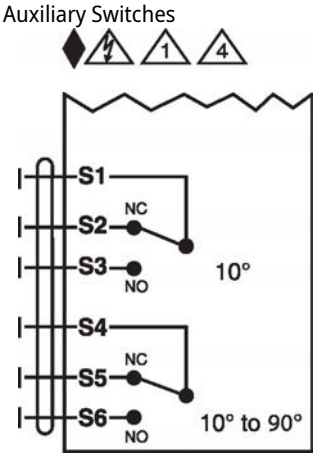
11 Actuators may be connected in parallel if not mechanically linked. Power consumption and input impedance must be observed.

Wiring diagrams

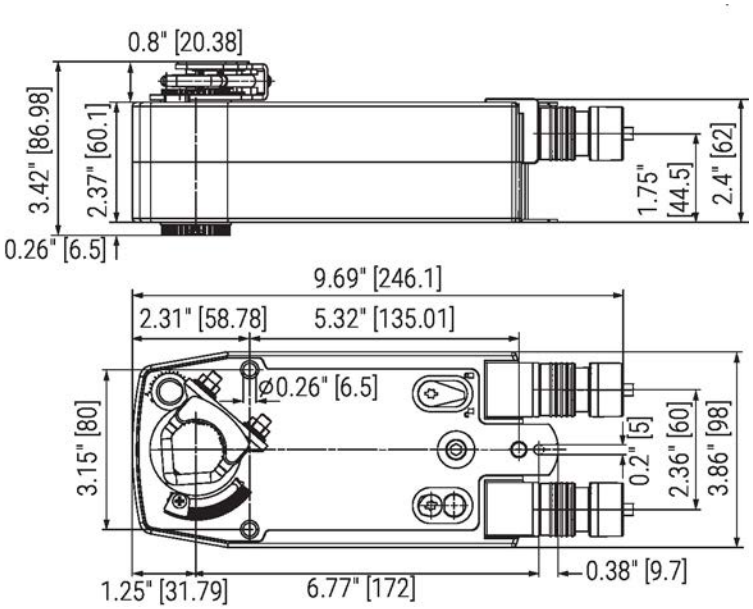
On/Off



Auxiliary Switches



Dimensions



Basic Fail-Safe actuator for controlling dampers in typical commercial HVAC applications.

- Torque motor 35 in-lb [4 Nm]
- Nominal voltage AC/DC 24 V
- Control On/Off
- 1x SPDT

MD-2
Damper Actuator

5-year warranty

Technical data

Electrical data	Nominal voltage	AC/DC 24 V
	Nominal voltage frequency	50/60 Hz
	Nominal voltage range	AC 19.2...28.8 V / DC 21.6...28.8 V
	Power consumption in operation	5 W
	Power consumption in rest position	2.5 W
	Transformer sizing	7 VA
	Auxiliary switch	1x SPDT, 1 mA...3 A (0.5 A inductive), DC 5 V...AC 250 V, adjustable 0...95°
	Switching capacity auxiliary switch	1 mA...3 A (0.5 A inductive), DC 5 V...AC 250 V
	Electrical Connection	(2) 18 GA appliance cables, 3 ft [1 m], with 1/2" NPT conduit connectors
	Overload Protection	electronic throughout 0...95° rotation
	Electrical Protection	actuators are double insulated
Functional data	Torque motor	35 in-lb [4 Nm]
	Direction of motion motor	selectable with switch 0/1
	Direction of motion fail-safe	reversible with cw/ccw mounting
	Angle of rotation	Max. 95°
	Running Time (Motor)	75 s / 90°
	Running time fail-safe	<25 s @ -4...122°F [-20...50°C], <60 s @ -22°F [-30°C]
	Noise level, motor	50 dB(A)
	Noise level, fail-safe	62 dB(A)
	Position indication	Mechanical
Safety data	Power source UL	Class 2 Supply
	Degree of protection IEC/EN	IP54
	Degree of protection NEMA/UL	NEMA 2
	Enclosure	UL Enclosure Type 2
	Agency Listing	cULus acc. To UL 873 and CAN/CSA C22.2 No. 24-93
	Quality Standard	ISO 9001
	UL 2043 Compliant	Suitable for use in air plenums per Section 300.22(C) of the NEC and Section 602 of the IMC
	Ambient humidity	Max. 95% RH, non-condensing
	Ambient temperature	-22...122°F [-30...50°C]
	Storage temperature	-40...176°F [-40...80°C]

Technical data

Safety data	Servicing	maintenance-free
Weight	Weight	3.7 lb [1.7 kg]
Materials	Housing material	galvanized steel

Footnotes †Rated Impulse Voltage 800V, Type of Action 1.AA.B, Control Pollution Degree 3.

Product features

Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact or a manual switch. The actuator is mounted directly to a damper shaft from 3/8" up to 1/2" in diameter by means of its universal clamp, 1/2" shaft centered at delivery. For shafts up to 3/4" use K6-1 accessory. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

Operation

The LF series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides consistent torque to the damper with, and without, power applied to the actuator. The LF series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. Power consumption is reduced in holding mode. The LF24-S US version is provided with one built in auxiliary switch. This SPDT switch is provided for safety interfacing or signaling, for example, for fan start-up. The switching function is adjustable between 0° and 95°. The auxiliary switch in the LF24-S US is double insulated so an electrical ground connection is not necessary.

Typical specification

On/Off spring return damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a shaft up to a 3/4" diameter and center on a 1/2" shaft (default). Actuator shall deliver a minimum output torque of 35 in-lbs. The actuator must be designed so that they may be used for either clockwise or counter clockwise failsafe operation. Actuators shall be protected from overload at all angles of rotation. If required, one SPDT auxiliary switch shall be provided with one switch having the capability of being adjustable. Actuators with auxiliary switch must be constructed to meet the requirement for Double Insulation so an electrical ground connection is not required to meet agency listings. Actuators shall be cULus listed, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

Accessories

Electrical accessories

Description	Type
Auxiliary switch, mercury-free	P475
Auxiliary switch, mercury-free	P475-1
Signal simulator, Power supply AC 120 V	PS-100
Conduit box converter	ZG-CBLS
Electrical junction box	
Transformer, AC 120 V to AC 24 V, 40 VA	ZG-X40

Mechanical accessories

Description	Type
Shaft extension 170 mm ø10 mm for damper shaft ø6...16 mm	AV6-20
End stop indicator	IND-LF
Shaft clamp	K6 US
for LF..	
Shaft clamp reversible, clamping range ø16...20 mm	K6-1
Ball joint suitable for damper crank arm KH8 / KH10	KG10A
Ball joint suitable for damper crank arm KH8	KG6
Ball joint suitable for damper crank arm KH8	KG8

Accessories

Description	Type
Damper crank arm Slot width 8.2 mm, for ø1.05"	KH12
Damper crank arm Slot width 6.2 mm, clamping range ø10...18 mm	KH6
Damper crank arm Slot width 8.2 mm, clamping range ø10...18 mm	KH8
Actuator arm, clamping range ø8...16 mm, Slot width 8.2 mm	KH-LF
V-bolt Kit for KH-LF.	KH-LFV
Anti-rotation bracket LF.	LF-P
Push rod for KG10A ball joint 36" L, 3/8" diameter	SH10
	SH8
Wrench 0.32 in and 0.39 in [8 mm and 10 mm]	TOOL-06
Angle of rotation limiter, with end stop	ZDB-LF
Form fit adapter 8x8 mm	ZF8-LF
Mounting bracket	ZG-109
Linkage kit	ZG-110
Mounting bracket for LF..	ZG-112
Damper clip for damper blade, 3.5" width.	ZG-DC1
	ZG-DC2
LF crankarm adaptor kit (includes ZG-112).	ZG-LF112
LF crankarm adaptor kit (T bracket included).	ZG-LF2
Shaft extension for 3/8" diameter shafts (4" L).	ZG-LMSA-1
Shaft extension for 1/2" diameter shafts (5" L).	ZG-LMSA-1/2-5
Weather shield 13x8x6" [330x203x152 mm] (LxWxH)	ZS-100
Baseplate, for ZS-100	ZS-101
Weather shield 406x213x102 mm [16x8-3/8x4"] (LxWxH)	ZS-150
Explosion proof housing 16x10x6.435" [406x254x164 mm] (LxWxH), UL and CSA, Class I, Zone 1&2, Groups B, C, D, (NEMA 7), Class III, Hazardous (classified) Locations	ZS-260
Weather shield 17-1/4x8-3/4x5-1/2" [438x222x140 mm] (LxWxH), NEMA 4X, with mounting brackets	ZS-300
Weather shield 17-1/4x8-3/4x5-1/2" [438x222x140 mm] (LxWxH), NEMA 4X, with mounting brackets	ZS-300-5
Shaft extension 1/2"	ZS-300-C1
Shaft extension 3/4"	ZS-300-C2
Shaft extension 1"	ZS-300-C3
Linkage kit	ZG-JSL
Jackshaft RetroFIT+ Linkage with Belimo Rotary Actuators	

Electrical installation

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.

Meets cULus requirements without the need of an electrical ground connection.

Apply only AC line voltage or only UL-Class 2 voltage to the terminals of auxiliary switches. Mixed or combined operation of line voltage/safety extra low voltage is not allowed.

Actuators with appliance cables are numbered.

Provide overload protection and disconnect as required.

Actuators may also be powered by DC 24 V.

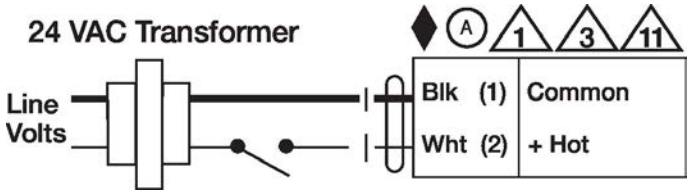
Actuators may be connected in parallel if not mechanically linked. Power consumption and input impedance must be observed.

One built-in auxiliary switch (1x SPDT), for end position indication, interlock control, fan startup, etc.

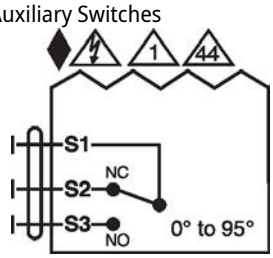
Electrical installation

Wiring diagrams

On/Off



Auxiliary Switches



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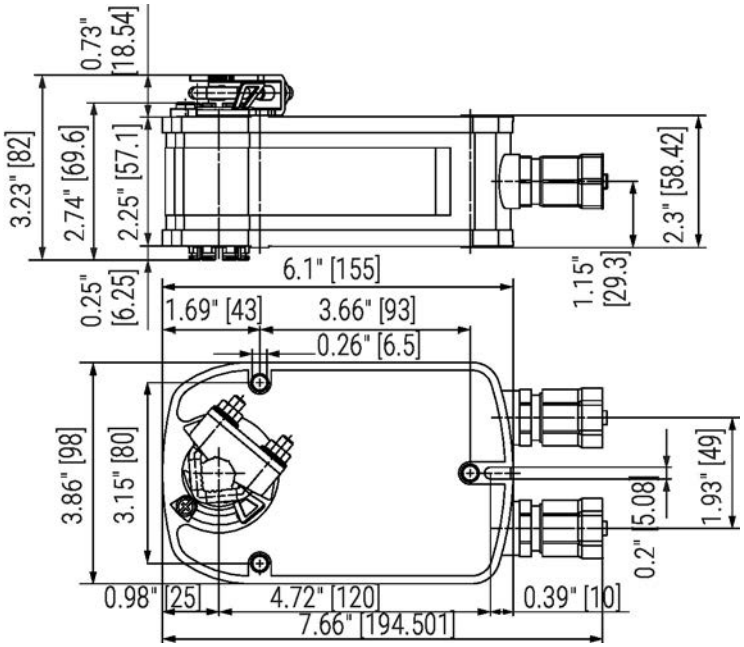


BELIMO

Technical data sheet EFB24-S

Basic Fail-Safe actuator for controlling dampers in typical commercial HVAC applications.

- **Torque motor 270 in-lb [30 Nm]**
- **Nominal voltage AC/DC 24 V**
- **Control On/Off**
- **2x SPDT**

MD-3
Damper Actuator

5-year warranty

Technical data

Electrical data	Nominal voltage	AC/DC 24 V
	Nominal voltage frequency	50/60 Hz
	Nominal voltage range	AC 19.2...28.8 V / DC 21.6...28.8 V
	Power consumption in operation	9.5 W
	Power consumption in rest position	4.5 W
	Transformer sizing	16 VA
	Auxiliary switch	2x SPDT, 1 mA...3 A (0.5 A inductive), DC 5 V...AC 250 V, one set at 10°, one adjustable 10...90°
	Switching capacity auxiliary switch	1 mA...3 A (0.5 A inductive), DC 5 V...AC 250 V
	Electrical Connection	(2) 18 GA appliance cables, 1 m, with 1/2" NPT conduit connectors
	Overload Protection	electronic throughout 0...95° rotation
	Electrical Protection	actuators are double insulated
Functional data	Torque motor	270 in-lb [30 Nm]
	Direction of motion motor	selectable by ccw/cw mounting
	Direction of motion fail-safe	reversible with cw/ccw mounting
	Manual override	5 mm hex crank (3/16" Allen), supplied
	Angle of rotation	Max. 95°
	Angle of rotation note	adjustable with mechanical end stop, 35...95°
	Running Time (Motor)	75 s / 90°
	Running time fail-safe	<20 s @ -4...122°F [-20...50°C], <60 s @ -22°F [-30°C]
	Noise level, motor	56 dB(A)
	Noise level, fail-safe	71 dB(A)
	Position indication	Mechanical
Safety data	Power source UL	Class 2 Supply
	Degree of protection IEC/EN	IP54
	Degree of protection NEMA/UL	NEMA 2
	Enclosure	UL Enclosure Type 2
	Agency Listing	cULus acc. to UL60730-1A/-2-14, CAN/CSA E60730-1:02 CE acc. to 2014/30/EU and 2014/35/EU
	Quality Standard	ISO 9001
	UL 2043 Compliant	Suitable for use in air plenums per Section 300.22(C) of the NEC and Section 602 of the IMC
	Ambient humidity	Max. 95% RH, non-condensing
	Ambient temperature	-22...122°F [-30...50°C]
	Storage temperature	-40...176°F [-40...80°C]
	Servicing	maintenance-free

Weight	Weight	12 lb [5.3 kg]
Materials	Housing material	Die cast aluminium and plastic casing

Footnotes †Rated Impulse Voltage 800V, Type of Action 1.AA.B, Control Pollution Degree 3.

Product features

Application

For On/Off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is On/Off from an auxiliary contact or a manual switch. The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft. Maximum of two EF's can be piggybacked for torque loads of up to 540 in-lbs. Minimum 3/4" diameter shaft and parallel wiring.

Operation

The EF..24-S series actuators provide true spring return operation for reliable failsafe application and positive close off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator. The EF..24-S series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. The EF..24-S versions are provided with two built-in auxiliary switches. These SPDT switches are provided for safety interfacing or signaling, for example, for fan start-up. The switching function at the fail-safe position is fixed at 10°, the other switch function is adjustable between 10° to +85°. The EF..24-S actuator is shipped at 5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.

Installation Note: Use flexible metal conduit. Push the UL listed conduit fitting device over the actuator's cable to butt against the enclosure. Screw in conduit connector. Jacket the actuator's input wiring with UL listed flexible conduit. Properly terminate the conduit in a suitable junction box.

Typical specification

On/Off spring return damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a jackshaft up to a 1.05” diameter. The actuators must be designed so that they may be used for either clockwise or counter clockwise fail-safe operation. Actuators shall be protected from overload at all angles of rotation. If required, two SPDT auxiliary switch shall be provided having the capability of one being adjustable. Actuators with auxiliary switches must be constructed to meet the requirements for Double Insulation so an electrical ground is not required to meet agency listings. Actuators shall be cULus listed and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

Accessories

Electrical accessories

Description	Type
Auxiliary switch, mercury-free	P475
Auxiliary switch, mercury-free	P475-1
Signal simulator, Power supply AC 120 V	PS-100
Cable conduit connector 1/2"	TF-CC US
Transformer, AC 120 V to AC 24 V, 40 VA	ZG-X40

Mechanical accessories

Description	Type
Shaft extension 240 mm ø20 mm for damper shaft ø8...22.7 mm	AV8-25
Anti-rotation bracket EFB(X)/GKB(X)/GMB(X).	EF-P
End stop indicator	IND-EFB
Shaft clamp reversible, clamping range ø12...26.7 mm	K9-2
Ball joint suitable for damper crank arm KH8 / KH10	KG10A
Damper crank arm Slot width 8.2 mm, clamping range ø14...25 mm	KH10
Actuator arm Slot width 8.2 mm	KH-EFB
Push rod for KG10A ball joint 36" L, 3/8" diameter	SH10
Wrench 0.512 in. [13 mm]	TOOL-07
Mounting bracket for AF..	ZG-100
Jackshaft mounting bracket.	ZG-120
ZG-JSL support plate for EFB(X)	ZG-121
Damper clip for damper blade, 3.5" width.	ZG-DC1
Damper clip for damper blade, 6" width.	ZG-DC2
Mounting kit for linkage operation for flat and side installation	ZG-EFB
1.05" diameter jackshaft adaptor (12" L).	ZG-JSA-3

Electrical installation

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.

Meets cULus requirements without the need of an electrical ground connection.

Apply only AC line voltage or only UL-Class 2 voltage to the terminals of auxiliary switches. Mixed or combined operation of line voltage/safety extra low voltage is not allowed.

A Actuators with appliance cables are numbered.

1 Provide overload protection and disconnect as required.

3 Actuators may also be powered by DC 24 V.

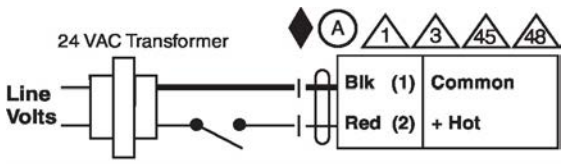
4 Two built-in auxiliary switches (2x SPDT), for end position indication, interlock control, fan startup, etc.

45 Actuators may be powered in parallel. Power consumption must be observed.

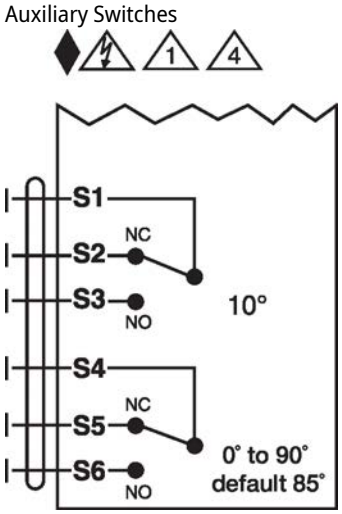
48 Parallel wiring required for piggy-back applications.

Wiring diagrams

On/Off



Auxiliary Switches



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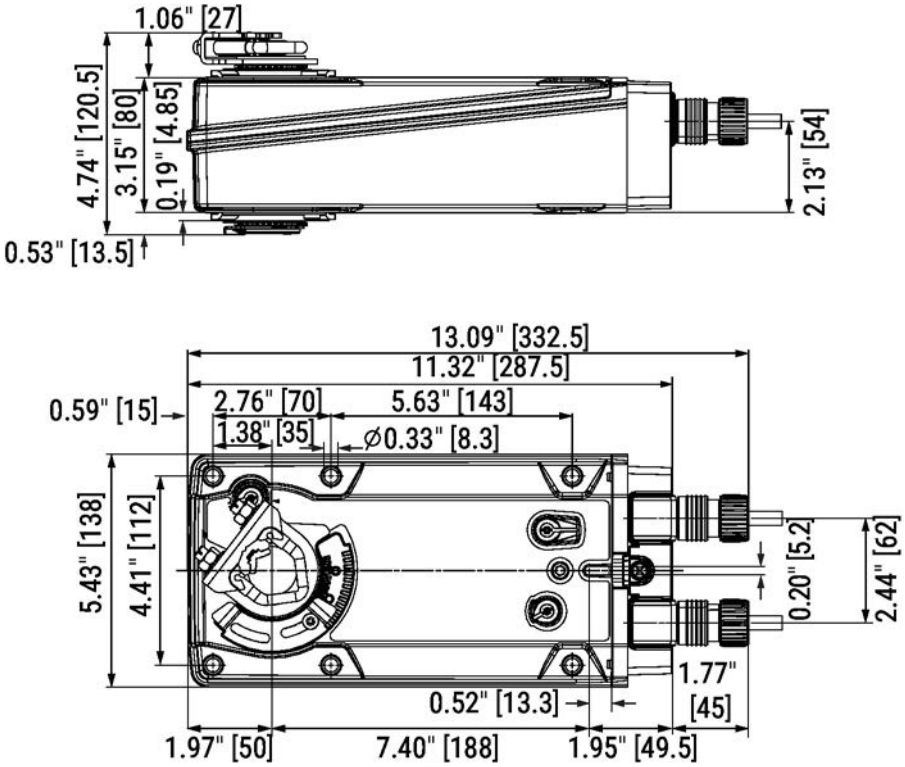
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11.32" [287.5]
0.59" [15]
2.76" [70]
5.63" [143]
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2.44" [62]
1.77"
[45]
0.52" [13.3]
1.97" [50]
7.40" [188]
1.95" [49.5]

BELIMO

Technical data sheet NFB24-SR

Basic Fail-Safe modulating actuator for controlling dampers in typical commercial HVAC applications.

- **Torque motor 90 in-lb [10 Nm]**
- **Nominal voltage AC/DC 24 V**
- **Control Modulating**
- **Position feedback 2...10 V**

AHU OA, EA, RA & Bypass Damper Actuator

5-year warranty

Technical data

Electrical data	Nominal voltage	AC/DC 24 V
	Nominal voltage frequency	50/60 Hz
	Nominal voltage range	AC 19.2...28.8 V / DC 21.6...28.8 V
	Power consumption in operation	3.5 W
	Power consumption in rest position	2.5 W
	Transformer sizing	6 VA
	Electrical Connection	18 GA appliance cable, 1 m, with 1/2" NPT conduit connector
	Overload Protection	electronic throughout 0...95° rotation
	Electrical Protection	actuators are double insulated
Functional data	Torque motor	90 in-lb [10 Nm]
	Operating range Y	2...10 V
	Operating range Y note	4...20 mA w/ ZG-R01 (500 Ω, 1/4 W resistor)
	Input impedance	100 kΩ for 2...10 V (0.1 mA), 500 Ω for 4...20 mA
	Position feedback U	2...10 V
	Position feedback U note	Max. 0.5 mA
	Direction of motion motor	selectable with switch 0/1
	Direction of motion fail-safe	reversible with cw/ccw mounting
	Manual override	5 mm hex crank (3/16" Allen), supplied
	Angle of rotation	95°
	Angle of rotation note	adjustable with mechanical end stop, 35...95°
	Running Time (Motor)	95 s / 90°
	Running time fail-safe	<20 s @ -4...122°F [-20...50°C], <60 s @ -22°F [-30°C]
	Noise level, motor	40 dB(A)
	Noise level, fail-safe	62 dB(A)
	Position indication	Mechanical
Safety data	Power source UL	Class 2 Supply
	Degree of protection IEC/EN	IP54
	Degree of protection NEMA/UL	NEMA 2
	Enclosure	UL Enclosure Type 2
	Agency Listing	cULus listed to UL60730-1A:02; UL 60730-2-14:02 and CAN/CSA-E60730-1:02
	Quality Standard	ISO 9001
	UL 2043 Compliant	Suitable for use in air plenums per Section 300.22(C) of the NEC and Section 602 of the IMC
	Ambient humidity	Max. 95% RH, non-condensing
	Ambient temperature	-22...122°F [-30...50°C]
	Storage temperature	-40...176°F [-40...80°C]

Safety data	Servicing	maintenance-free
Weight	Weight	5.3 lb [2.4 kg]
Materials	Housing material	Galvanized steel and plastic housing

Footnotes †Rated Impulse Voltage 800V, Type of action 1.AA, Control Pollution Degree 3

Product features

Application

For fail-safe, modulating control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. The actuator is mounted directly to a damper shaft up to 1.05" in diameter by means of its universal clamp. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft. The actuator operates in response to a 2 to 10 VDC or, with the addition of a 500Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. A 2 to 10 VDC feedback signal is provided for position indication. Not to be used for a master-slave application.

Operation

The NF..24-SR series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides constant torque to the damper with, and without, power applied to the actuator. The NF..24-SR series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 95°. The NF..24-SR uses a brushless DC motor which is controlled by an Application Specific Integrated Circuit (ASIC) and a microprocessor. The microprocessor provides the intelligence to the ASIC to provide a constant rotation rate and to know the actuator's exact fail-safe position. The ASIC monitors and controls the brushless DC motor's rotation and provides a digital rotation sensing function to prevent damage to the actuator in a stall condition. The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. The NF..24-SR actuator is shipped at 5° (5° from full fail-safe) to provide automatic compression against damper gaskets for tight shut-off.

Typical specification

Spring return control damper actuators shall be direct coupled type which require no crank arm and linkage and be capable of direct mounting to a jackshaft up to a 1.05" diameter. The actuator must provide modulating damper control in response to a 2 to 10 VDC or, with the addition of a 500Ω resistor, a 4 to 20 mA control input from an electronic controller or positioner. The actuators must be designed so that they may be used for either clockwise or counter clockwise fail-safe operation. Actuators shall use a brushless DC motor controlled by a microprocessor and be protected from overload at all angles of rotation. Run time shall be constant, and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position feedback. Actuators with auxiliary switches must be constructed to meet the requirements for Double Insulation so an electrical ground is not required to meet agency listings. Actuators shall be cULus listed and have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards. Actuators shall be as manufactured by Belimo.

Accessories

Electrical accessories

Description	Type
DC Voltage Input Rescaling Module	IRM-100
Auxiliary switch, mercury-free	P475
Auxiliary switch, mercury-free	P475-1
Signal simulator, Power supply AC 120 V	PS-100
Convert Pulse Width Modulated Signal to a 2...10 V Signal for Belimo Proportional Actuators	PTA-250
Positioner for wall mounting	SGA24
Positioner for front-panel mounting	SGF24
Cable conduit connector 1/2"	TF-CC US
Resistor, 500 Ω, 1/4" wire resistor with 6" pigtail wires	ZG-R01
Resistor kit, 50% voltage divider	ZG-R02
Transformer, AC 120 V to AC 24 V, 40 VA	ZG-X40

Mechanical accessories

Description	Type
Anti-rotation bracket, for AF / NF	AF-P
Shaft extension 240 mm ø20 mm for damper shaft ø8...22.7 mm	AV8-25
End stop indicator	IND-AFB
Shaft clamp reversible, for central mounting, for damper shafts ø12.7 / 19.0 / 25.4 mm	K7-2
Ball joint suitable for damper crank arm KH8 / KH10	KG10A
Ball joint suitable for damper crank arm KH8	KG8
Damper crank arm Slot width 8.2 mm, clamping range ø14...25 mm	KH10
Damper crank arm Slot width 8.2 mm, for ø1.05"	KH12
Damper crank arm Slot width 8.2 mm, clamping range ø10...18 mm	KH8
Actuator arm, for 3/4" shafts, clamping range ø10...22 mm, Slot width 8.2 mm	KH-AFB
Push rod for KG10A ball joint 36" L, 3/8" diameter	SH10
Push rod for KG6 & KG8 ball joints (36" L, 5/16" diameter).	SH8
Wrench 0.32 in and 0.39 in [8 mm and 10 mm]	TOOL-06
Retrofit clip	Z-AF
Mounting bracket for AF..	ZG-100
Mounting bracket	ZG-101
Mounting bracket	ZG-109
Linkage kit	ZG-110
Mounting bracket for AF / NF	ZG-118
Jackshaft mounting bracket.	ZG-120
Mounting kit for linkage operation for flat and side installation	ZG-AFB
Mounting kit for foot mount installation	ZG-AFB118
Damper clip for damper blade, 3.5" width.	ZG-DC1
Damper clip for damper blade, 6" width.	ZG-DC2
1" diameter jackshaft adaptor (11" L).	ZG-JSA-1
1-5/16" diameter jackshaft adaptor (12" L).	ZG-JSA-2
1.05" diameter jackshaft adaptor (12" L).	ZG-JSA-3
Weather shield 13x8x6" [330x203x152 mm] (LxWxH)	ZS-100
Baseplate, for ZS-100	ZS-101
Weather shield 406x213x102 mm [16x8-3/8x4"] (LxWxH)	ZS-150
Explosion proof housing 16x10x6.435" [406x254x164 mm] (LxWxH), UL and CSA, Class I, Zone 1&2, Groups B, C, D, (NEMA 7), Class III, Hazardous (classified) Locations	ZS-260
Weather shield 17-1/4x8-3/4x5-1/2" [438x222x140 mm] (LxWxH), NEMA 4X, with mounting brackets	ZS-300
Weather shield 17-1/4x8-3/4x5-1/2" [438x222x140 mm] (LxWxH), NEMA 4X, with mounting brackets	ZS-300-5
Shaft extension 1/2"	ZS-300-C1
Shaft extension 3/4"	ZS-300-C2
Shaft extension 1"	ZS-300-C3
Baseplate extension	Z-SF
Linkage kit	ZG-JSL
Jackshaft Retrofit Linkage with Belimo Rotary Actuators	

Electrical installation

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.

Meets cULus requirements without the need of an electrical ground connection.

(A) Actuators with appliance cables are numbered.

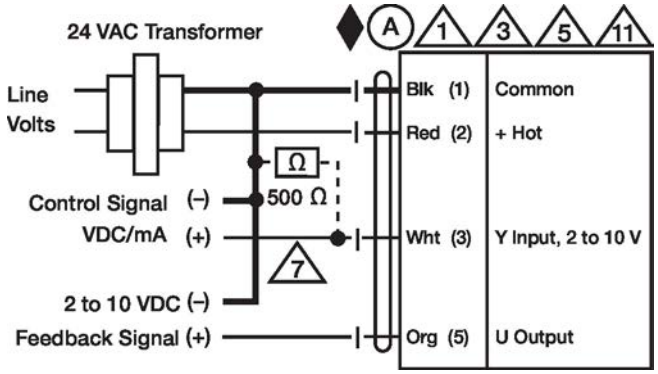
1 Provide overload protection and disconnect as required.

3 Actuators may also be powered by DC 24 V.

5 Only connect common to negative (-) leg of control circuits.

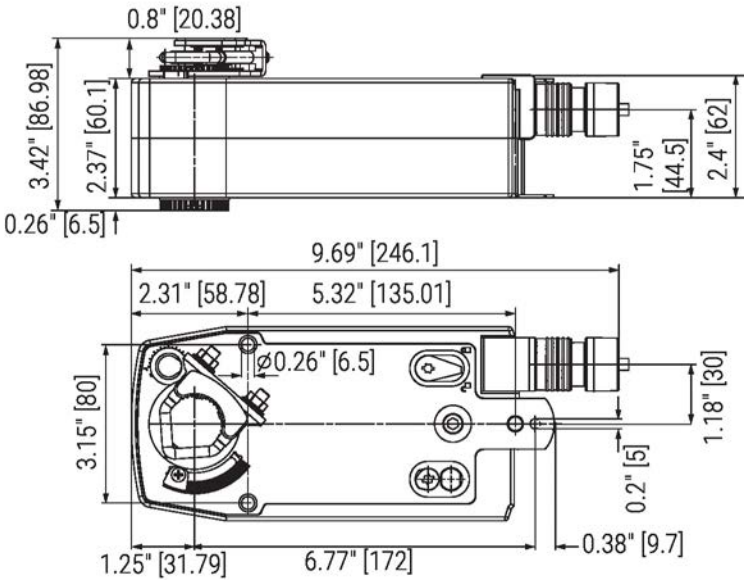
7 A 500 Ω resistor (ZG-R01) converts the 4...20 mA control signal to 2...10 V.

11 Actuators may be connected in parallel if not mechanically linked. Power consumption and input impedance must be observed.

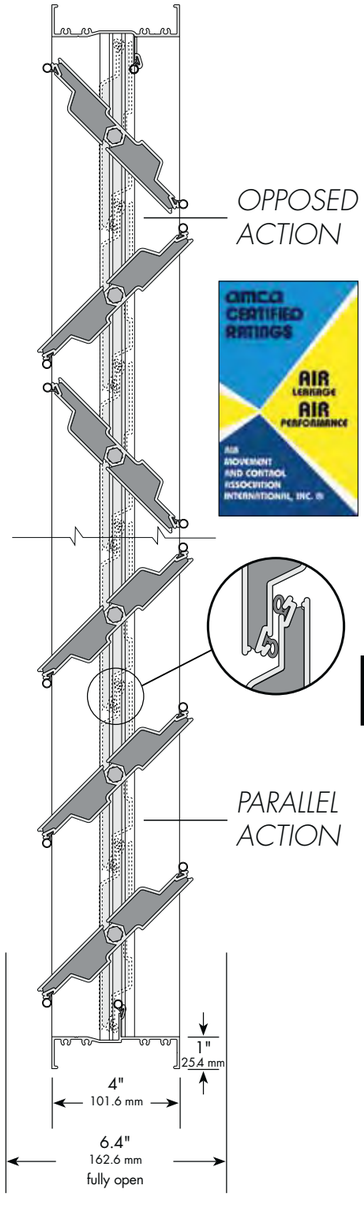


2...10 V / 4...20 mA Control

Dimensions



SPECIFICATIONS



S E R I E S 9 0 0 0

THERMALLY INSULATED DAMPER

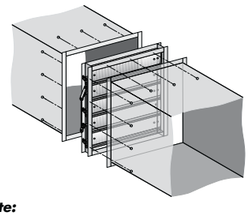
- Extruded aluminum (6063-T5) damper frame is not less than .080" (2.03 mm) in thickness. Damper frame is 4" (101.6 mm) deep x 1" (25.4 mm), with mounting flanges on both sides of frame.
- Blades are extruded aluminum (6063-T5) air-foil profiles, internally insulated with expanded polyurethane foam and thermally broken. Complete blade has an insulating factor of R-2.29 and a temperature index of 55.
- Blade seals are extruded EPDM. Frame seals are extruded silicone. Seals are secured in an integral slot within the aluminum extrusions. Blade and frame seals are mechanically fastened to prevent shrinkage and movement over the life of the damper.
- Bearings are composed of a Celcon inner bearing fixed to a 7/16" (11.11 mm) aluminum hexagon blade pivot pin, rotating within a polycarbonate outer bearing inserted in the frame, eliminating action between metal-to-metal or metal-to-plastic riding surfaces.
- Adjustable, 7/16" (11.11 mm) hexagonal drive rod, U-bolt fastener and hexagonal retaining nuts are zinc-plated steel. These provide a positive connection to blades and linkage.
- Linkage hardware is installed in frame side and constructed of aluminum and corrosion-resistant, zinc-plated steel, complete with cup-point trunnion screws for a slip-proof grip.
- Dampers are designed for operation in temperatures ranging between -40°F (-40°C) and 212°F (100°C).
- Leakage Class 1A at 1 in. w.g. (0.25 kPa) static pressure differential. Standard air leakage data is certified under the AMCA Certified Ratings Program.
- Dampers are custom made to required size, without blanking off free area.
- Dampers are available with either opposed blade action or parallel blade action.
- Dampers are available in two mounting types: i.e., Installed in Duct or Flanged to Duct.
- Installation of dampers must be in accordance with TAMCO's current installation guidelines, provided with each damper shipment. *(Note that all technical information available on TAMCO's web site at www.tamcodampers.com supersedes and takes precedence over all information contained within the printed catalog.)*
- Intermediate or tubular steel structural support is required to resist applied pressure loads for dampers that consist of two or more sections in both height and width. *(See TAMCO Aluminum Damper Installation Guidelines.)*

NOTE: *Reduced air leakage at colder temperatures is obtainable by upgrading to* ***Series 9000 SC Severe Cold Option****. Silicone gaskets & seals are supplied only if Series 9000 SC Severe Cold Option is specified. See Series 9000 SC Specification Sheet.*

FLANGED TO DUCT TYPE

2" (50.8 mm) added to duct width & height dimensions

Minimum section size:	4½"w x 4¼"h	*(115 mm x 108 mm)*
Maximum section size:	25 ft²	*(2.3 m²)*
	60"w x 60"h or	*(1524 mm x 1524 mm) or*
	48"w x 75"h	*(1220 mm x 1905 mm)*



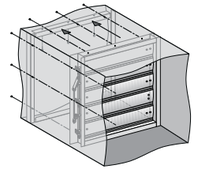
Note:

- *To reduce pressure drop, use Flanged to Duct mount type for sizes under 9 ft² (.83 m²).*
- *Suitable for operation in breathable air environments within stated temperature range.*
- *Dampers sized for duct openings exceeding 37½" (953 mm) in height are equipped with a stiffener bar at mid-height to strengthen and maintain air leakage tolerances.*
- *Series 9000 dampers are not available as "narrow profile" type (constructed using only 4" (101.6 mm) deep blades).*

INSTALLED IN DUCT TYPE

½" deducted for clearance from width & height dimensions, unless otherwise specified

Minimum section size:	6½"w x 6¾"h	*(166 mm x 172 mm)*
Maximum section size:	25 ft²	*(2.3 m²)*
	60"w x 60"h or	*(1524 mm x 1524 mm) or*
	48"w x 75"h	*(1220 mm x 1905 mm)*



For additional information, refer to:

- *Series 9000 SC Specification Sheet*
- *Series 9000 SW Specification Sheet*
- *Series 9000 BF, 9000 ECT, 9000, 9000 SC & 9000 SW Pressure Drop*
- *Series 9000 BF, 9000 ECT, 9000, 9000 SC & 9000 SW Free Area Charts*
- *Aluminum Standard Configurations*
- *TAMCO Aluminum Damper Torque Requirements*
- *Multiple-Section Horizontal Jack Shafts*
- *Configurations Using Vertical Jack Shafts*
- *Multiple-Section Damper Jumpers*
- *Square-to-Round Transition Option*
- *TAMCO Aluminum Damper Installation Guidelines*

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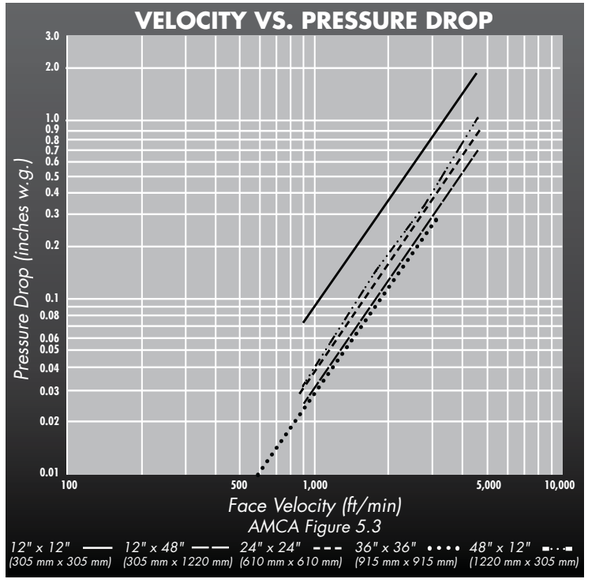
PERFORMANCE DATA

S E R I E S 9 0 0 0

THERMALLY INSULATED DAMPERS

T.A. Morrison & Co. Inc. certifies that the TAMCO Series 9000 Dampers shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to air performance ratings and air leakage ratings.



TAMCO LEAKAGE RATING

Damper Width inches (mm)	1 in. w.g. 0.25 kPa	4 in. w.g. 1.0 kPa
0.0 to 12.0 (0 - 305)	**1A**	**1**
12.1 to 36.0 (306 to 915)	**1A**	**1**
36.1 to 48.0 (916 to 1220)	**1A**	**1**
48.1 to 60.0 (1221 to 1524)	**1A**	**1**

LEAKAGE CLASS DEFINITIONS

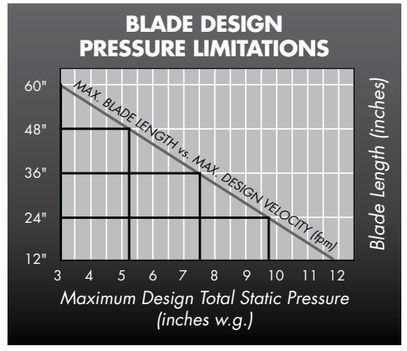
Pressure / Class	LEAKAGE ft³/min/ft² (l/s/m²) 1 in. w.g. 0.25 kPa	4 in. w.g. 1.0 kPa
1A	**3** (15.2)	**n/a**
1	**4** (20.3)	**8** (40.6)
2	**10** (50.8)	**20** (102)
3	**40** (203)	**80** (406)

Leakage testing was conducted in accordance with ANSI/AMCA Standard 500-D, Figure 5.4. Data are based on a torque of 10.8 in-lb/ft² (13.1 N-m/m²) and a minimum of 70 in-lb (7.9 N-m) applied to close and seat the opposed blade damper during the test. Air leakage is based on operation between 32°F (0°C) and 120°F (49°C).

The following sizes of TAMCO Series 9000 dampers were tested:
12" x 48" (305 mm x 1220 mm), 36" x 36" (915 mm x 915 mm), 48" x 36" (1220 mm x 915 mm), 60" x 36" (1524 mm x 915 mm).

Tested for Air Performance in accordance with ANSI/AMCA Standard 500-D, Figure 5.3.

The following sizes of TAMCO Series 9000 dampers were tested:
12" x 12" (305 mm x 305 mm), 12" x 48" (305 mm x 1220 mm), 24" x 24" (610 mm x 610 mm), 36" x 36" (915 mm x 915 mm), 48" x 12" (1220 mm x 305 mm).



Series 9000 dampers exceeding the maximum design pressure due to blade length may be used by reducing the width of the damper sections and/or by increasing the number of sections per damper to maintain a blade width compatible with the required system pressure.

Example: 1 section damper of 60"w x 36"h (1524 mm x 915 mm) at 5 in. w.g. (1.24 kPa) would need to be built in 2 sections of 30"w x 36"h (762 mm x 915 mm).

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1

TAMCO ALUMINUM CONTROL DAMPER | Installation Guidelines

Series 1000, 1500, 9000, 9000 BF, 1000 FB, 1500 FB, 9000 FB

FOR TAMCO JACKSHAFTS REFER TO INSTRUCTIONS PROVIDED IN PARTS BOX.
FOR TAMCO JUMPERS REFER TO INSTRUCTIONS PRINTED ON PARTS BOX.

VISIT OUR WEB PAGE AT
www.tamcodampers.com/inGde_videos.php
FOR VIDEO INSTALLATION GUIDELINES

FRONT / TOP END UP / RIGHT HAND

- TAMCO label is always adhered to the damper's drive blade, on the front (face) side of the damper.
- When labels on blades are viewed right side up, the damper orientation is Front/Top end up.
- When viewed as Front/Top end up, a right-hand (RH) damper has the drive rod as shown. Left-hand (LH) dampers have a drive rod on the left.
- The damper, as a complete unit, can be installed right side up, upside down, standing up, or lying flat.
- There is no specified air entry or air exhaust side for Series 1000, 1500, 9000, and 9000 BF dampers. This includes all applicable Options.
- The system must support the damper. The damper cannot support the system.
- Duct work construction and bracing must be sufficient to support the damper. Do not use the damper to square up duct work.
- Joiners and fasteners, provided by TAMCO to interconnect damper sections, are for alignment purposes only and may not be considered as structural supports.
- Ensure that the damper is installed to permit future access to the side linkage, as well as any damper jumper brackets, or jackshafts, if so supplied.
- For vertical blade applications, refer to the supplemental instructions provided in the Installing Vertical Blade Dampers document, available on the TAMCO website.
- A 12" long, hexagonal steel drive rod is provided as standard. Dampers are shipped with their drive rod inserted in the drive blade. Drive rods may be extended up to 8" beyond the outside edge of the frame by loosening the U-bolt, drawing out the rod to the desired length and then retightening the U-bolt.
- If required, 24" and 36" long zinc-plated, steel drive rods can be ordered.

TAMCO's all-aluminum dampers are constructed with maintenance-free bearing and linkage components.

Caution: Never use any lubricants, such as grease or silicone, on TAMCO dampers.

In applications where the humidity level is unusually elevated, or where there are extremely high levels of dust and dirt particles, TAMCO recommends that the damper linkage and bearing system should be cleaned once a year. This can be done by blowing away dust using compressed air. If needed, a domestic-strength steam cleaner can be used to loosen dirt, which can then be blown out with compressed air, along with any remaining water droplets.

Note that all technical information available on TAMCO's website at www.tamcodampers.com supersedes and takes precedence over all information contained within the printed catalog.

CALL TAMCO CUSTOMER SERVICE WITH ANY QUESTIONS CONCERNING TAMCO DAMPERS

1-800-561-3449

DO NOT ADJUST LINKAGE MECHANISM. IF PROBLEM STILL EXISTS AFTER VERIFICATION AND CORRECT ACTION, CALL TAMCO CUSTOMER SERVICE.

2

VERIFY DAMPER OPERATION BEFORE INSTALLATION!

- ✓ Before installing, inspect damper for possible damage caused in shipping, and that it has not been racked or twisted. Measure the damper from corner to corner to verify that it is square.
- ✓ If minor damage has occurred to frame corners or flanges, correct by bending or hammering back into position. Ensure correct realignment of repair, as bent or twisted frames might not mate properly with mounting angles, or additional damper sections.
- ✓ Do not install damper if damage is more than superficial, if uncertain as to extent of damage, or if damper does not seal correctly. **Call TAMCO Customer Service at 1-800-561-3449.**
- ✓ Operate damper section manually *(on a flat section of floor)* to verify correct blade action and sealing.

(A) To correctly verify sealing action, loosen hex nuts of U-bolt located on drive blade. Extend steel drive rod to maximum of 8" beyond the outside edge of the frame. Re-tighten hex nuts on U-bolt.

(B) Using drive rod, slowly apply closing torque, while ensuring that damper frame does not twist due to torque being applied. Larger dampers may require additional person to hold damper frame square and true.

(C) If possible, use daylight or inside light source as a backdrop while verifying blade operation. No light should be visible through damper.

CAUTION SHOULD BE EXERCISED TO ENSURE FINGERS ARE NOT IN WAY OF MOVING LINKAGE PARTS OR BLADES.

INSTALLATION OF DAMPER TYPES

INSTALLED IN DUCT TYPE

- Damper must be installed square.
- Damper is manufactured so that finished O.D. is ½" *(12.7 mm)* smaller than opening width and height dimensions.
- Ensure that duct is square and/or large enough to allow damper to be installed square.
- Make hole in duct work, if required, to allow extension of drive rod.
- Bottom of frame must sit flat on floor of duct to prevent twisting, sagging, or bowing, as this could cause leakage between bottom frame and bottom blade.
- Verify that damper is square and then secure bottom frame to floor of duct using a 90° mounting angle. Operate damper manually to confirm proper blade sealing.
- As each mounting angle is installed, verify operation to ensure damper blades are sealing correctly.
- Caulk all connections/joints between damper frame and duct to minimize installation leakage.

FLANGED TO DUCT TYPE

- Damper must be installed square.
- Front and rear damper flanges are 1" *(25.4 mm)* larger than duct or opening, around entire perimeter.
- Damper is manufactured so that finished O.D. is 2" *(50.8 mm)* greater than opening width and height dimensions.
- Do not assume that duct is square. Verify that duct flange is square, flat and even.
- Verify that damper is square. Operate damper manually to verify free movement of blades and correct sealing.
- Fasten damper to duct. Re-verify that damper is square.
- Repeat procedure for other flange, if ducted on both sides.
- Caulk all connections/joints between damper frame and duct to minimize installation leakage.

EXTENDED REAR FLANGE TYPE

- Damper must be installed square.
- Rear damper flange is 2" *(50.8 mm)* larger than duct or opening, around entire perimeter, providing a larger fastening surface.
- Front damper flange is 1" *(25.4 mm)* larger than duct or opening, around entire perimeter. ***(Note that Extended Rear Flange Install Type dampers are not designed so that the front of the damper may be inserted into an opening, as the side frame members extend to the full height of the rear flange.)***
- Damper is manufactured so that finished O.D. is 4" *(101.6 mm)* greater than opening width and height dimensions.
- Do not assume that opening is square. Verify that opening or duct flange is square, flat and even.
- Verify that damper is square. Operate damper manually to verify free movement of blades and correct sealing.
- Fasten damper to opening surface or duct. Re-verify that damper is square.
- Repeat procedure for other flange, if ducted on both sides.
- Caulk all connections/joints between damper frame and opening or duct to minimize installation leakage.

INSTALLING MULTI-SECTION DAMPERS

IF JACKSHAFTS ARE TO BE FITTED, SEE JACKSHAFT INSTRUCTIONS PRIOR TO INSTALLING DAMPERS

TWO SECTIONS WIDE

- Frame members are designed to overlap and are manufactured with two aligned positioning holes. When dampers are correctly positioned, holes will be aligned.
- Bolt alignment fasteners are shipped attached to the offset overlapping frame. *(Alignment holes are not meant to be structural. Bracing may be deemed necessary by installer.)*
- Ensure that both sections are straight, even, and aligned with each other.

ALL ILLUSTRATIONS SHOWN ARE FRONT/TOP END UP DAMPERS

RH = RIGHT-HAND DAMPER
LH = LEFT-HAND DAMPER

THREE SECTIONS WIDE

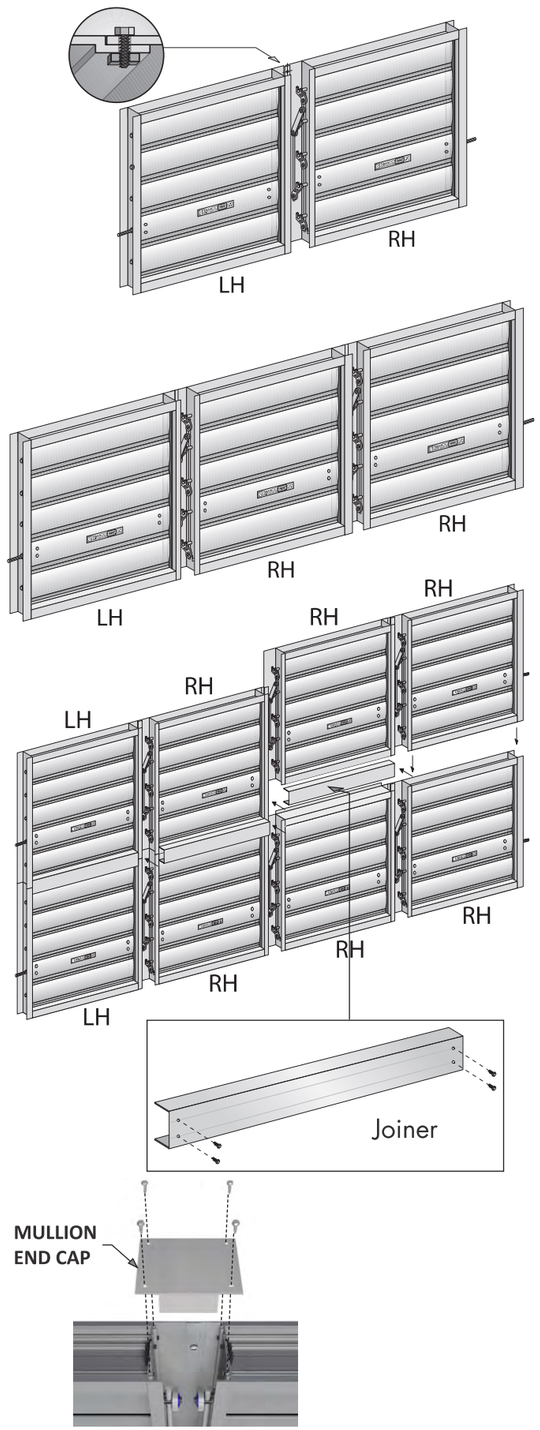
- Frame members are designed to overlap and are manufactured with two aligned positioning holes. When dampers are correctly positioned, holes will be aligned.
- Bolt alignment fasteners are shipped attached to the offset overlapping frame. *(Alignment holes are not meant to be structural. Bracing may be deemed necessary by installer.)*
- Ensure that all three sections are straight, even, and aligned with each other.

MULTIPLE SECTIONS WIDE BY MULTIPLE SECTIONS HIGH

- Install bottom tier damper section(s) first.
- Place second level of damper section(s) on top of bottom section(s), being careful that all sections are properly aligned.
- Install top damper section(s).
- Slide joiner(s) over frame member(s), where top and bottom section(s) meet(s).
- Using self-drilling screws, fasten joiner to damper frame member(s) through pre-punched holes in joiner. ***Caution: Joiner is not designed to be structural. Additional bracing may be required if deemed necessary by installer.***
- Repeat procedure for all additional section tiers.
- Ensure all sections are straight, even, and aligned with each other.

OPTIONAL MULLION END CAPS
FOR FLANGED TO DUCT TYPE, MULTI-SECTION DAMPER INSTALLATIONS

- Mullion end caps are provided with all multi-section dampers that are to be installed as Flanged to Duct install type.
- These are required to prevent air flow from passing through open channels. *(Mullion end caps are not intended for use as structural support.)*
- Caulk surfaces between mullion end caps and damper frame for an airtight seal.
- Mullion end caps are not required for Installed in Duct type nor for Extended Rear Flange install type dampers. As such they are not provided as standard, but may be ordered as separate parts.



MOTOR MOUNTING METHODS
Electric & Pneumatic Actuators

FOR RETROFIT APPLICATIONS, ACTUATORS MUST BE RELOCATED TO MATCH DAMPER DRIVE BLADE POSITION.
VISIT OUR WEB PAGE AT www.tamcodampers.com/inGde_videos.php **FOR VIDEO INSTALLATION GUIDELINES.**

ELECTRIC ACTUATORS

DIRECT-COUPLED MOUNTING
(EXTERNAL)

- If damper is In Duct Install Type, the motor is attached to the duct using the anti-rotation bracket supplied with the actuator. If the damper is Flanged to Duct Install Type the actuator is mounted to the damper's 4" frame using a TAMCO Motor Mounting Bracket. *(Part # AL-0001)*

JACKSHAFT MOUNTING
(EXTERNAL)

- Motor is mounted on a mounting bracket.
- Jackshaft measures 1" (25.4 mm) in diameter.

FACE MOUNTING
(INTERNAL)

- Motor is mounted in the airstream. Damper must be ordered with a TAMCO Face Blade Bracket. Required accessories: Belimo ZG-100 Universal Mounting Bracket *(Part # BE-8104)*, appropriate Belimo Crank Arm Adaptor Kit and Belimo Push Rod (dependent on actuator selected).

PNEUMATIC ACTUATORS

- Pneumatic motors must be installed and aligned so as to ensure proper rotation of clamp or crank arm. This requires the actuator to be installed at an angle to match blade rotation. Damper drive rod must not be subjected to pressure that may bow or bend rod out of line.
- Each pneumatic actuator requires accessories which are specific to its type, model, or brand. The accessories are necessary to mount the pneumatic actuator to the TAMCO damper hexagonal drive rod, or to the TAMCO 1" (25.4 mm) diameter jackshaft. Verify with the actuator manufacturer for a list of appropriate accessories.
- TAMCO supplies three sizes of Siemens pneumatic actuators (No. 3, No. 4 and No. 6). Models can be purchased with or without positioners. Required accessories are indicated beneath each pneumatic actuator mounting type image. (Refer to Pneumatic Actuator Mounting Accessories page for more details.)

DIRECT-COUPLED MOUNTING
(EXTERNAL)

- All mounting accessories required for direct-coupled mounting come with Siemens pneumatic actuators.

JACKSHAFT MOUNTING
(EXTERNAL)

- Required accessory: Pneumatic Actuator Jackshaft Clevis Arm. *(Part # PN-0006)*

STRUCTURAL DESIGN REQUIREMENTS

For Multi-Section Dampers

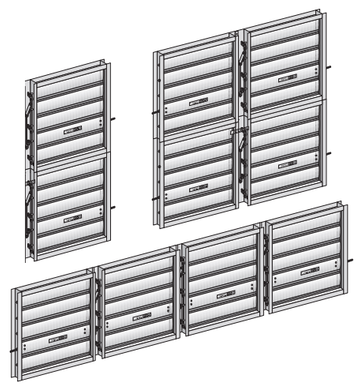
REQUIREMENTS:

- Intermediate structural support is required to resist applied velocity and pressure loads for dampers that consist of two or more sections in both height and width. *(See illustration to right.)*
- Field-supplied tubular structural steel support may be required for large multi-sectioned dampers.
- A non-insulated TAMCO damper weighs approximately 5 lbs/ft^2 *(24.41 kg/m^2)*. An insulated TAMCO dampers weighs approximately 6 lbs/ft^2 *(29.29 kg/m^2)*.

MAXIMUM DEFLECTION:

- The structure providing intermediate support must be designed to resist the highest pressure load, with deflection of less than L/230. This applies whether the pressure load is created by the mechanical system, by wind load, or if the damper is mounted on the exterior of the building.

INTERMEDIATE, FIELD-SUPPLIED, STRUCTURAL SUPPORT IS REQUIRED WHEN INSTALLING IN BOTH THE VERTICAL AND HORIZONTAL PLANES.



STRUCTURAL SUPPORT DESIGN FOR TAMCO DAMPERS

Example:

Design the structural support required to carry TAMCO dampers at the 17th story of a building in Ottawa, Ontario, Canada. (Assuming that the maximum internal pressure, as a result of the mechanical systems, is 2 inches of water, 10.4 psf or 500 Pa.)

Assumptions:

The subject building is 17 floors high and has plan dimension of 120' by 120' ***(36.6 m by 36.6 m)***. The dampers will be mounted on vertical framing members spanning from the 17th floor to the roof slab level.

Analysis:

Net wind pressure on damper = Exterior pressure or suction + Interior pressure in the mechanical plenum *(as specified by the mechanical engineer)*

$p = qC_eC_gC_p$ external + 10.4 psf 1997 OCB 4.1.8

Where: p = the specific external pressure acting statically and in a direction normal to the surface, either as a pressure directed towards the surface or as a suction directed away from the surface.

q = the reference velocity pressure based on a 1 in 30 probability of being exceeded in any one year for design of structural members for strength. $q_{1/30}$ = 7.72 psf *(0.37 kPa in Ottawa, Ontario)*.

C_e = exposure factor based on the height of the building *(1.4 for a 170 ft. high building)*.

C_g = gust factor *(2.5 for cladding elements and small structural components)*.

C_p = external pressure coefficient *(1.0 for high local suction)*.

$p = qC_eC_gC_p$ external + 10.4 psf

p = 7.72 psf (1.4) (2.5) (1.0) + 10.4 psf

p = 37.4 psf

Total net factored pressure:

p_f = 1.5 *(live wind load)*

p_f = 1.5 • (37.4)

p_f = 56.1 psf *(2.7 kPa)*

Factored distributed load over vertical support framing member:

w_f = 56.1 psf (5')

w_f = 281 lb./ft.

Factored maximum moment:

$M_f = w_f l^2/8$

M_f = 281 • (10)$^2/8$

M_f = 3513 lb./ft. *(4.8 kN•m)*

Resisting moment:

M_r has to be equal to or greater than M_f for an unsupported length of 10' *(3.05 m)*

Acceptable vertical support member:

C4 x 6.25 - 4" structural steel channel
(metric designation C100 x 9)

M_r = 3980 lb.ft. for an unsupported length (Lu) = 13'.

(M_r = 5.4 kNm at Lu = 4m)

Check deflection criteria:

Maximum allowable deflection is L/230 = 10'/230 = 0.52" *(13.2 mm)*

Maximum deflection at mid-height of the channel:

$$\Delta = \frac{5\ w\ l^4}{384\ E\ I}$$

For deflection, the reference velocity pressure, q, is based on a 1 in 10 probability of being exceeded in any one year. $q_{1/10}$ = 6.27 psf *(0.30 kPa in Ontario, Ontario)*.

$p = qCeCgCp$ external + 10.4 psf

p = 6.27 psf (1.4) (2.5) (1.0) + 10.4 psf

p = 32.3 psf

w = 32.3 psf (5')

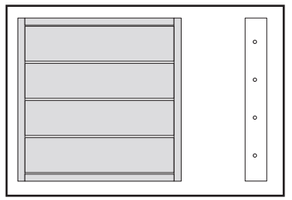
w = 162 lb./ft.

$$\Delta = \frac{5\ (162\ \text{lb./ft.})\ (10')^4}{384\ (29{,}000\ \text{ksi})\ (4.25\ \text{in}^4)}$$

$$\Delta = \frac{5\ (13.5\ \text{lb./ft.})\ (120")^4}{384\ (29 \bullet 106\ \text{psi})\ (4.25\ \text{in}^4)} = 0.30 \quad (7.6\ \text{mm})$$

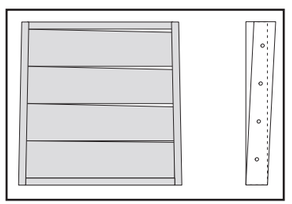
Therefore, an acceptable vertical support member for this example is a C4 x 6.25 *(metric designation C100 x 9)*.

GUIDE FOR TROUBLESHOOTING



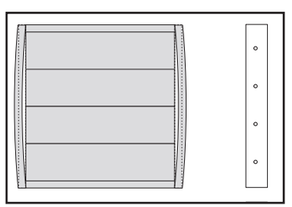
UNDER- OR OVER-ROTATION OF BLADES

- If light lines are present across the full length of the blade, check that closing torque being applied is neither too little nor too much.
- Under-rotation will not let blade gaskets compress, whereas over-rotation can cause blades to re-separate.



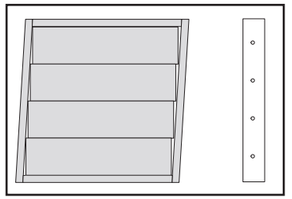
TWISTED FRAME

- If light lines are observed only along half of the blade length, square up the position of the top frame member, relative to the bottom frame, by pivoting the top frame member either in or out.
- A small movement in one of these two directions could seal light lines, by eliminating frame distortion caused by torque being applied to an unsecured damper.



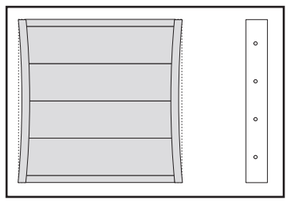
STRETCHED FRAME

- If light lines are observed between the side frame members and the blade ends of a damper, especially near the center line, verify measurements across the damper at the top, center, and bottom.
- If the measurements should vary by more than $^1/_{16}$" (2 mm), readjust the side mounting angles to bring the side frame members to the correct dimension, thus matching top and bottom dimensions.
- If light lines disappear, ensure that these matching dimensions are retained when fastening mounting angles during installation.



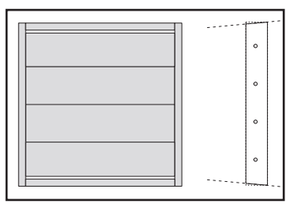
RACKED FRAME

- If light lines appear only near the top and bottom, on opposite sides of the damper, between the side frame members and the blade ends of a damper, verify square positioning with a tape measure and adjust if required.
- Move the top frame member either left or right to square up the damper. Light lines should disappear.



COMPRESSED FRAME

- If the damper is hard to operate by hand, verify that frame sides are not squeezed in or twisted.
- In either case, bearing life could be sharply reduced.
- Verify that frame sides are parallel by measuring across the damper at the top, center, and bottom.
- Also verify that dimensions on both sides of the damper are equal.



DISTORTED FRAME

- If light appears only between the last blade and the top or bottom of the damper frame, it may be due to the top or bottom frame member being distorted (twisted) when fastened to the duct work.
- Ensure that the top or bottom frame members are not distorted, by loosening fasteners and shimming the frame, if required.

DO NOT ADJUST LINKAGE MECHANISM. IF PROBLEM STILL EXISTS AFTER VERIFICATION AND CORRECT ACTION, CALL TAMCO CUSTOMER SERVICE

1-800-561-3449