



**Deering Pavilion
880 Forest Ave
Portland, Me**

SUBMITTAL COVER SHEET

HVAC Controls

Note: VS-2313-536-9-05 is the same price and normally open in the event you prefer this over the one we have in the package.

Also we do not have graphic interface, if this is something wanted we can provide this at time of installation for an additional costs of \$550.00 so you could see on system in place

Date: March 17, 2015

**Contractor:
Dicon
54 Warren Ave
Portland, ME 04103**

**Architects
Richard Curtis & Associates
PO Box 9739-1150
Portland, Me 04104**

MNL-100, MNL-150, MNL-200 Series Controllers



SPECIFICATIONS

HARDWARE

Dimensions

4.37 in. W x 4.29 in. H x 2.00 in. D
(109 mm x 111 mm x 51 mm)

Enclosure

Conforms to NEMA-1 requirements.
Meets UL94-5V flammability for plenum application use.

Conduit Knockouts

Not applicable. Order optional MicroNet Enclosure, MNA-FLO-1, if wiring to flexible conduit is desired.

Mounting

35 mm DIN rail or panel.

Wiring Terminals

Screw terminals. Each terminal accepts one AWG #16 to #24 (1.31 to 0.205 mm² maximum) wire.

ELECTRICAL

Power Supply Input

20.4 to 30 Vac, 50/60 Hz.

Maximum Power Consumption

15 VA at 24 Vac, 50/60 Hz, excluding relay output power.

Surge Immunity Compliance

IEEE C62.41 (IEEE-587, Category A & B).

ENVIRONMENT

Operating Temperature

-40 to 140 °F (-40 to 60 °C)

Shipping and Storage Temperature

-40 to 160 °F (-40 to 71 °C)

Humidity

5 to 95% RH, non-condensing

I/A Series MicroNet MNL-100, MNL-150, MNL-200

The TAC I/A Series™ MicroNet™ MNL-100, MNL-150, and MNL-200 Series Controllers are interoperable controllers designed in accordance with LONMARK™ guidelines. When programmed using WorkPlace Tech Tool, or loaded with a pre-engineered application, these controllers provide control for packaged rooftops, heat pumps, fan coils, unit ventilators, and similar applications.

Controllers feature Sensor Link (S-Link) support, LED indication, screw terminal blocks, as well as DIN rail or panel mounting ability.

The MNL-100, MNL-150, and MNL-200 series controllers use the same physical packaging, but differ in the type and number of onboard I/O points they provide.

Stand Alone or Connected

These controllers can function in either standalone mode or as part of a LONWORKS™ TP/FT-10 Free Topology communications network. Using a TAC I/A Series MicroNet Sensor (MN-Sx series), the operator can monitor controller performance and edit operational values. The WorkPlace Tech Tool software is used to program the controllers.

AGENCY LISTINGS

US

FCC Part 15, Class A
UL 916, File #E71385 Category PAZX

Canadian

UL Listed to Canadian Safety Standards (CAN/CSA 22.2)

Australian

Meets requirements to bear the C-Tick Mark

European Community

EMC Directive 89/336/EEC, EN61326

INPUTS AND OUTPUTS

Digital Inputs

(MN 100 and MN 200 only) Dry Contact. Detection of closed switch requires less than 300 ohm. Detection of open switch requires more than 100K ohm.

Digital Outputs

Current Ratings

24 VA at 24 Vac, pilot duty.

Specifications continued on next page.

Specifications continued from first page.

Universal Inputs

1K ohm Balco Input

-40 to 250 °F (-40 to 121 °C) range. TSMN-81011, TS-8000 Series or equivalent.

1K ohm Platinum Input

-40 to 240 °F (-40 to 116 °C) range. TSMN-58011, TS-5800 Series or equivalent.

1k Resistance

0 to 1.5k ohms.

10K ohm Thermistor w/ 11K ohm Shunt Resistor

-40 to 250 °F (-40 to 121 °C) range. TSMN-57011-850, TS-5700-850 Series or equivalent.

10k Resistance

0 to 10.5k ohms.

Voltage

0 to 5 Vdc.

Current

0 to 20 mA requires an external 250 ohm shunt resistor.

Digital Input

Dry Contact. Detection of closed switch requires less than 300 ohms. Detection of open switch requires more than 1.5K ohms.

Analog Outputs

(MN 150 and MN 200 only).

Current

0 to 20 mA. (Output load from 80 to 550 ohms).

FEATURES

- Designed for new or existing system installations, the MN 100, 150, and 200 controllers provide control for: unit ventilators; series fan; heat pumps; fan coils; and packaged rooftops.
- Conforms to the LONMARK guidelines.
- HVAC interoperability achieved through use of LONMARK HVAC profiles.
- A complete, custom application can be designed for each controller, using WorkPlace Tech Tool.
- All controllers are field programmable, using WorkPlace Tech Tool, but controllers with satellite profiles are especially suited for a broad range of applications, providing solutions for your building control needs.
- Capability to function in standalone mode or as part of a LONWORKS TP/FT-10 Free Topology communications network.
- Multiple controllers on a LONWORKS FTT network creates a complex network of controllers for virtually any building control need.
- Proportional (P), Proportional Plus Integral (PI), and Proportional Plus Integral and Derivative (PID) control for cooling and heating.
- Onboard LED indication without cover removal.
- Plenum-rated enclosure allows direct mounting in plenum.
- Protective hinged covers provide access to field wiring terminals.

COMMUNICATIONS

LONWORKS Networks

A LONWORKS communications network uses a TP/FT-10 Free Topology configuration. Controllers on a LONWORKS network can communicate with each other in a peer-to-peer fashion. A LONWORKS network has a communications speed of 78 kbps, using unshielded, twisted-pair cabling, with connections that are not polarity sensitive.

S-Link

The Sensor Link (S-Link) communications wiring provides power and a communication interface for an MN-Sx MicroNet sensor. The various MN-Sx sensors can provide room temperature, room humidity, setpoint adjustment, and occupancy override. This connection uses two-wire, unshielded cable and is not polarity sensitive. Maximum wire length allowed between a controller and a MicroNet Sensor is 200 ft (61 m).

INPUTS FROM MN-SX I/A SERIES MICRONET SENSORS

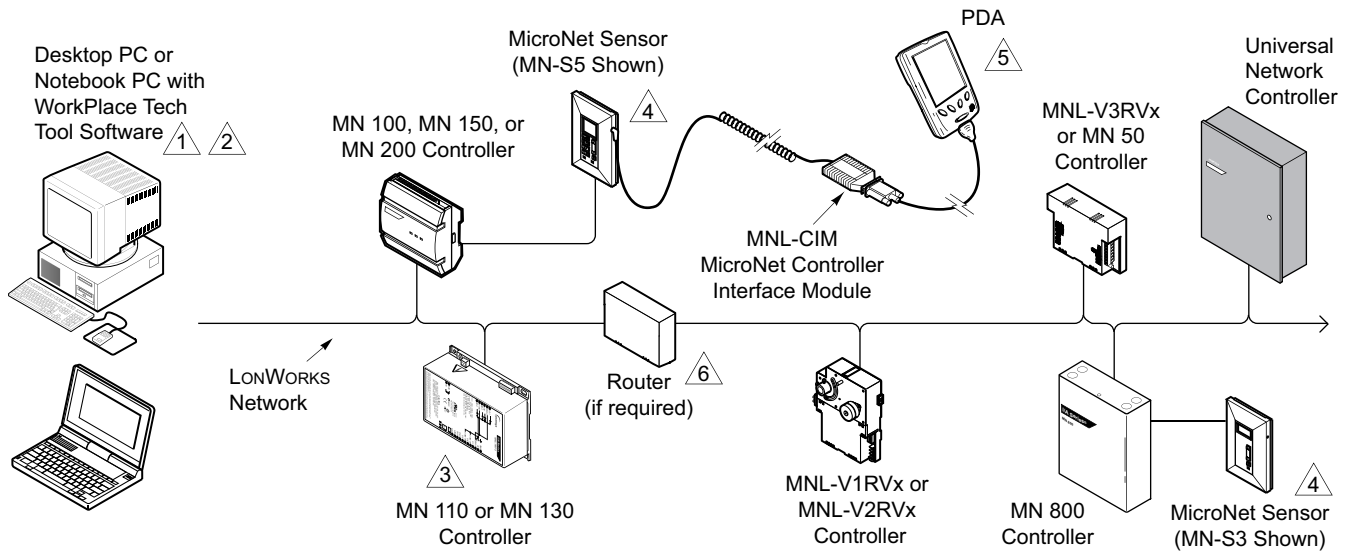
Inputs	Description	MN-Sx Sensor
Space Temperature	32 to 122 °F (0 to 50 °C)	MN-S1, MN-S1HT, MN-S2, MN-S2HT, MN-S3, MN-S3HT, MN-S4, MN-S4HT, MN-S4-FCS, MN-S4HT-FCS, MN-S5 and MN-S5HT
Space Humidity	5 to 95% RH, Non-condensing	MN-S1HT, MN-S2HT, MN-S3HT, MN-S4HT, MN-S4HT-FCS, and MN-S5HT
Adjustable Setpoint	40 to 95 °F (4 to 35°C)	MN-S3, MN-S3HT, MN-S4, MN-S4HT, MN-S4-FCS, MN-S4HT-FCS, MN-S5, and MN-S5HT
Override Pushbutton	For standalone occupancy control or remote status monitoring of local status condition.	MN-S2, MN-S2HT, MN-S3, MN-S3HT, MN-S4, MN-S4HT, MN-S5, and MN-S5HT
Fan Operation and Speed	Fan mode selection: On, Speed (Low/Medium/High), or Auto.	MN-S4, MN-S4HT, MN-S4-FCS, MN-S4HT-FCS, MN-S5, and MN-S5HT
System Mode	System mode selection: Heat, Cool, Off, or Auto.	MN-S4, MN-S4HT, MN-S5, and MN-S5HT
Emergency Heat	Emergency heat mode selection: Enable or Disable	MN-S5 and MN-S5HT

MODELS

Part Number	Description	Inputs/Outputs	Profiles
MNL-10Rxx ^a	TAC I/A Series MicroNet 100 series controller	1 Digital Input (DI)	Heat Pump Fan Coil Packaged Rooftop Satellite
		2 Universal Inputs (UI)	
		4 Digital Outputs (DO)	
MNL-15Rxx ^a	TAC I/A Series MicroNet 150 series controller	3 Universal Inputs (UI)	
		2 Digital Outputs (DO)	
		2 Analog Outputs (AO)	
MNL-20Rxx ^a	TAC I/A Series MicroNet 200 series controller	2 Digital Inputs (DI)	
		3 Universal Inputs (UI)	
		6 Digital Outputs (DO)	
		2 Analog Outputs (AO)	

^a "xx" denotes LONMARK profile and profile version (F=Fan Coil, H=Heat Pump, R=Rooftop, S=Satellite). Satellite profile is based on Rooftop profile.

ARCHITECTURE



1 A PC can be connected to the LONWORKS TP/FT-10 Network, either directly or through the LONWORKS network jack of a LONWORKS controller or MN-Sxxx Wall Sensor. The PC must have an Echelon™ LONTALK™ adapter card.

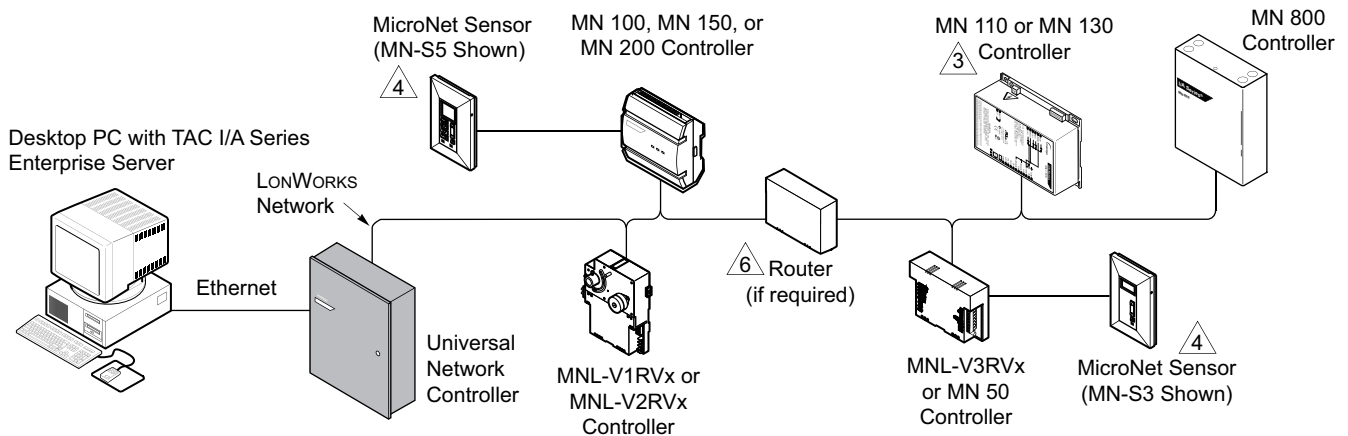
2 Programming any of the TAC I/A Series controllers, or the TAC I/A Series MN 800 controller, requires WorkPlace Tech Tool.

3 This controller is not suitable for exposed mounting on a wall or panel, or in any other easily accessible place due to the possibility of personal contact with the high-voltage terminals. It must be mounted inside a suitable grounded metal enclosure.

4 MicroNet Sensors can be connected to any MN controller.

5 A PDA running the Pocket I/A interface software may be used to communicate with TAC I/A Series MicroNet controllers.

6 When routers are used, WP Tech is able to communicate through them to any of the TAC I/A Series devices on the network.



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On October 1st, 2009, TAC became the Buildings Business of its parent company Schneider Electric. This document reflects the visual identity of Schneider Electric, however there remain references to TAC as a corporate brand in the body copy. As each document is updated, the body copy will be changed to reflect appropriate corporate brand changes.

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Schneider Electric 1354 Clifford Avenue, P.O. Box 2940, Loves Park, IL 61132-2940, USA 1-888-444-1311 www.schneider-electric.com/buildings

[Temperature Sensors]

ET Series



SPECIFICATIONS

	For TAC Vista, I/NET, Continuum, and I/A	1000 Ohm Platinum	1000 Ohm BALCO
Output	1.8K Ohms @ 77° F (25° C) Vista 10K Ohms @ 77° F (25° C) I/Net 10K Ohms @ 77° F (25° C) Continuum 10K Ohms @ 77° F (25° C) with 11K Ohms shunt resistor I/A	1K Ohms @ 32°F (0°C)	1000 Ohms @ 70°F (21°C)
Temperature Range	-40° to 302° F (-40° to 150° C)	-58° to 392°F (-50 to 200°C) -50° to 275°F (-45.5° to 134.8°C)	-40° to 240°F (-40° to 116°C)
Interchangeability	+/- 0.2 C (0° to 70° C)		
Temperature Coefficient		0.00385 Ohm/Ohm/°C	2.2 Ohms/°F
Dissipation Constant Stability	3 mW / C		
Accuracy	+/- 0.2° C (0° to 70° C) +/- 0.4° F (32° to 158° C)	+/- 0.06% @ 32°F (0°C) Single Point +/- 1.0 Ohm @ 70°F (Averaging)	+/- 0.1%
Operating Humidity	0 to 90% RH non-condensing		

Application

Thermistors offer high accuracy and interchangeability over a wide temperature range. The ET series can be used in the following applications:

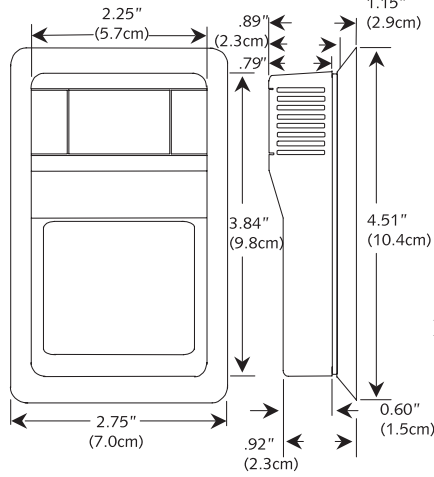
- Space
- Duct
- Immersion
- Averaging
- Strap-On
- Bead/Bullet
- Outdoor Air

Features

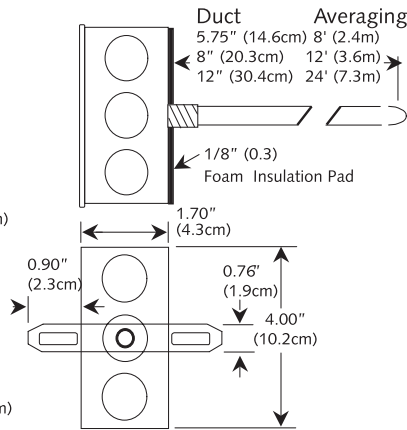
- Offer high accuracy and interchangeability over a wide temperature range.
- Non-polarity sensitive

DIMENSIONS

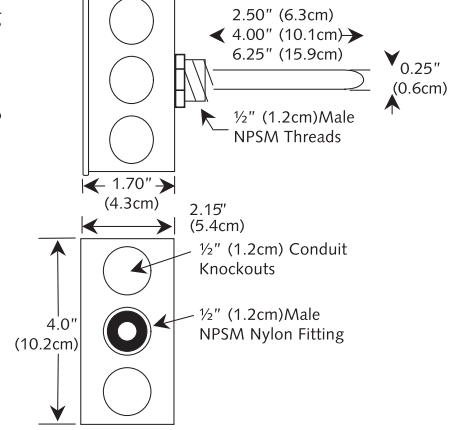
Room



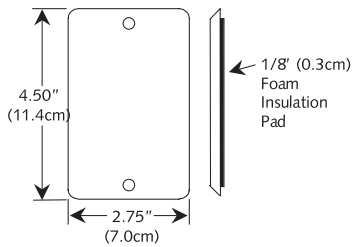
Duct / Averaging



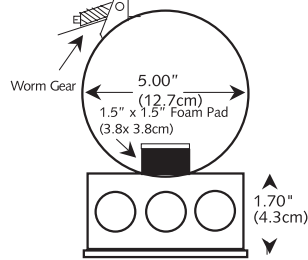
Immersion



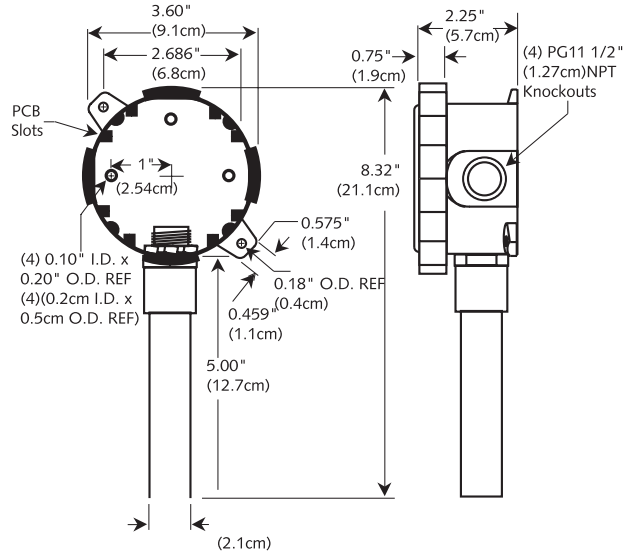
Stainless Plate



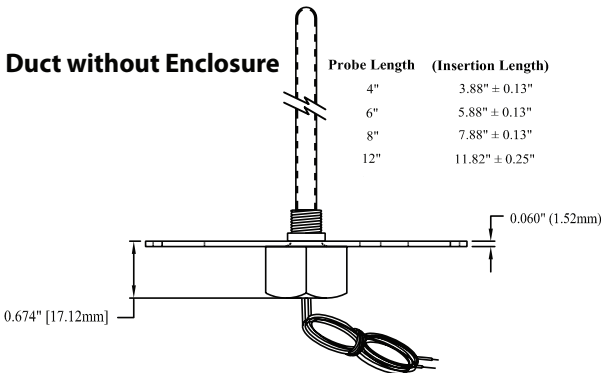
Strap-On



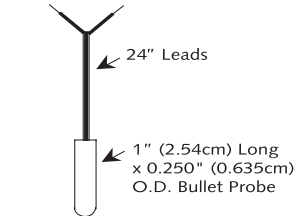
Outside Air



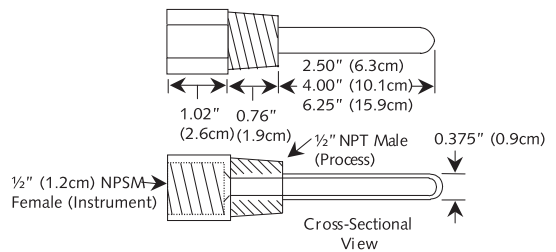
Duct without Enclosure



Bullet Probe



Thermowell



INSTALLATION

Room Temperature Sensors

This unit is suitable for either drywall mounting or junction box mounting. The room sensor is provided with screw terminal blocks for all connections. Remove the cover from the unit and mount the housing base to the wall using the (2) 6/32" x 1" machine screws. Replace the cover and tighten down, using the (2) 1/16" Allen Screws located on the bottom of the enclosure.

Duct and Duct Averaging Sensors

Duct temperature sensors - drill a 3/8" hole in the duct and insert the probe through the hole until the foam pad is tight to the duct. Now insert (2) screws through the mounting holes in flange and tighten them until the unit is held firmly to the duct. Duct Averaging sensors - Drill a 3/8" hole in the duct and insert the averaging element through the hole until the foam pad is tight to the duct. Now insert the (2) screws through the holes in the mounting flange and tighten until the unit is held firmly to the duct. The sensor should then be strung in a criss-cross pattern throughout the duct using the mounting clips provided, in a pattern that covers the greatest surface area of the duct, to insure that there is no stratification. When bending the copper tubing, be careful that you use a gradual bend and that you DO NOT kink the copper tubing.

Immersion Temperature Sensors

The Fluid Immersion-type sensors are provided with a 2 1/2", 4", or 6 1/4" insertion length, 304 series stainless steel thermowell. The thermowell has a 1/2" NPT external or process thread and a 1/2" NPS Female process thread. Heat transfer compound may be used but it is not necessary.

Strap-On Temperature Sensors

The TAC Strap-On sensors, are provided in a NEMA 1 rated junction box with an adjustable 2" to 5" pipe clamp. The unit should be mounted on the bottom side of the pipe to ensure proper heat transfer and a true temperature reading. Heat transfer compound and insulating the sensor will help the overall accuracy of the sensor. By ordering extra straps, and fastening them together, it is possible to make them fit larger pipes.

Outside Air Temperature Sensors

The TAC Outdoor Air temperature sensors are provided in a weatherproof enclosure. An optional weatherproof Aluminum Bell Box or NEMA 4X Polycarbonate enclosure is also available upon request for an additional charge. All of the mounting hardware is provided with the sensor. Be sure to mount the sensor out of direct sunlight, with the sensor probe pointing downward.

Stainless Plate Temperature Sensors

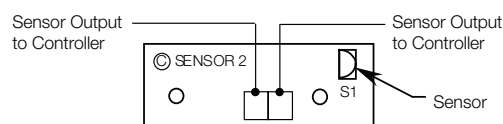
The TAC Stainless Plate temperature sensors are mounted on the back of a 1 Gang stainless steel plate. The foam pad will insulate the sensor from any drafts in the wall. (2) 6/32" x 1" machine screws are provided for junction box mounting. Be sure that the sensor is not mounted on an outside wall, due to the extreme temperature changes from either drafts or heat transfer.

WIRING

For wiring information on room temperature sensors, please refer to the following documents:

System	F-Number
Vista	F-27616
I/NET	F-27617
Continuum	F-27618
I/A	F-27619

Diagram for ET Sensors Except ETR



ORDERING INFORMATION

Temperature Sensor Description	TAC Vista	I/NET	Continuum	I/A	1000 Ohm Platinum	1000 Ohm BALCO
Room	ETR100	ETR200	ETR500	ETR800	-	-
Room with Setpoint	ETR101	ETR201	ETR501	ETR801	-	-
Room with Override Pushbutton	ETR102	ETR202	ETR502	ETR802	-	-
Room with Setpoint and Override Pushbutton	ETR103	ETR203	ETR503	ETR803	-	-
Wallplate (Stainless Steel)	ETP100	ETP200	ETP500	ETP800		
4" Duct (Galvanized Steel Enclosure)	ETD100-4	ETD200-4	ETD500-4	ETD800-4	ETDPK0-4	ETDBK0-4
6" Duct Galvanized Steel Enclosure)	ETD100-6	ETD200-6	ETD500-6	ETD800-6	ETDPK0-6	ETDBK0-6
8" Duct (Galvanized Steel Enclosure)	ETD100-8	ETD200-8	ETD500-8	ETD800-8	ETDPK0-8	ETDBK0-8
12" Duct (Galvanized Steel Enclosure)	ETD100-12	ETD200-12	ETD500-12	ETD800-12	ETDPK0-12	ETDBK0-12
4" Duct without Enclosure	ETD100-NE-4	ETD200-NE-4	ETD500-NE-4	ETD800-NE-4	ETDPK0-NE-4	ETDBK0-NE-4
6" Duct without Enclosure	ETD100-NE-6	ETD200-NE-6	ETD500-NE-6	ETD800-NE-6	ETDPK0-NE-6	ETDBK0-NE-6
8" Duct without Enclosure	ETD100-NE-8	ETD200-NE-8	ETD500-NE-8	ETD800-NE-8	ETDPK0-NE-8	ETDBK0-NE-8
12" Duct without Enclosure	ETD100-NE-12	ETD200-NE-12	ETD500-NE-12	ETD800-NE-12	ETDPK0-NE-12	ETDBK0-NE-12
2.5" Immersion (Galvanized Steel Enclosure)*	ETI100-2	ETI200-2	ETI500-2	ETI800-2	ETIPK0-2	ETIBK0-2
4" Immersion (Galvanized Steel Enclosure)*	ETI100-4	ETI200-4	ETI500-4	ETI800-4	ETIPK0-4	ETIBK0-4
6.25" Immersion (Galvanized Steel Enclosure)*	ETI100-6	ETI200-6	ETI500-6	ETI800-6	ETIPK0-6	ETIBK0-6
8' Averaging (Flexible Copper)	ETA100-8	ETA200-8	ETA500-8	ETA800-8	-	-
12' Averaging (Flexible Copper)	ETA100-12	ETA200-12	ETA500-12	ETA800-12	ETAPK0-12	ETABK0-12
24' Averaging (Flexible Copper)	ETA100-24	ETA200-24	ETA500-24	ETA800-24	ETAPK0-24	ETABK0-24
Outside Air	ETO100	ETO200	ETO500	ETO800	-	-
Strap On	ETS100	ETS200	ETS500	ETS800	-	-
Bead / Bullet	ETB100	ETB200	ETB500	ETB800	-	-

* Length indicates immersion depth.

Miscellaneous Options	Code
LCD Display in Fahrenheit (for room units only)	-LCD
LED Indicator* (for room units with override only)	-LED
Thermometer Indicator (for room units only)	-TI
RS232 Communication Jack (for use with I/NET systems only)	-RS232
Four-Pin RJ11 Communication Jack (for use with TAC Vista and Continuum systems only)	-RJ4

Well Type	Part Number
2.5" Stainless Steel Well*	ETI-WELL-2S
4" Stainless Steel Well*	ETI-WELL-4S
6.25" Stainless Steel Well*	ETI-WELL-6S

* Length indicates immersion depth.

* Not available on I/A, 1000 Ohm Platinum, or 1000 Ohm BALCO.



Vx-2x13-5xx-9-xx Series
Vx-2x13-8xx-9-xx Series
VB-2x13-500-9-xx Series

Ball Valve Assemblies with Schneider Electric DuraDrive® Actuators
Ball Valve Body/Linkage Assemblies

Selection Guide

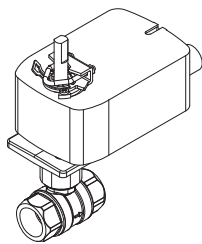
Schneider Electric Ball Valve Assemblies

The Schneider Electric VA, VF, and VS-2x13-xxx-9-xx series Ball Valve Assemblies are complete actuator/valve assemblies that accept two-position, floating, or proportional control signals from a DDC system or a thermostat, for control of hot or chilled water, or solutions of up to 50% glycol. They consist of direct-coupled, Schneider Electric DuraDrive, spring return or non-spring return actuators mounted on 2-way (1" to 3") and 3-way (1" to 2") ball valve bodies.

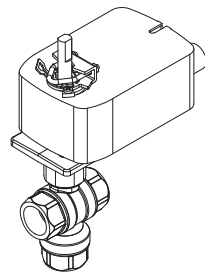
Typical applications include reheat on VAV boxes, fan coil units, hot and chilled water coils in air handling units, and unit ventilators.

Ball Valve Assemblies with Schneider Electric DuraDrive

Vx-2x13-5xx-9-xx series ball valve assemblies are available with either spring return or non-spring return Schneider Electric DuraDrive actuators.

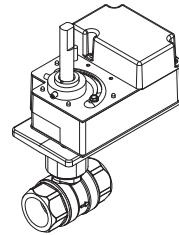


Vx-2213-5xx-9-xx
2-Way Assembly with Spring Return Actuator

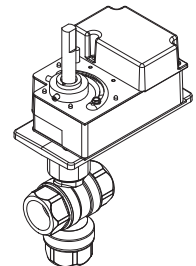


Vx-2313-5xx-9-xx
3-Way Assembly with Spring Return Actuator

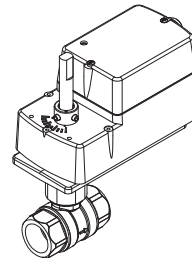
Vx-2x13-880-9-xx and Vx-2x13-8xx-9-xx series ball valve assemblies are equipped with MF4E series or Mx4D series actuators, respectively.



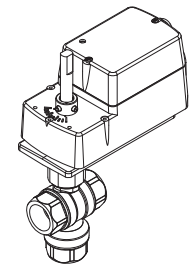
VF-2213-880-9-xx
2-Way Assembly with MF4E Series Actuator



VF-2313-880-9-xx
3-Way Assembly with MF4E Series Actuator



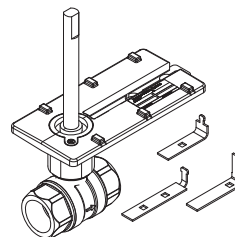
Vx-2213-8xx-9-xx
2-Way Assembly with Mx4D Series Actuator



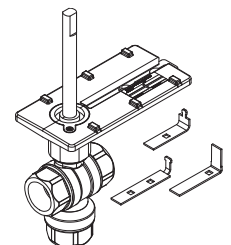
Vx-2313-8xx-9-xx
3-Way Assembly with Mx4D Series Actuator

Ball Valve Body/Linkage Assemblies

Ball valve body/linkage assemblies allow field mounting of Schneider Electric DuraDrive actuators.



VB-2213-500-9-xx
Body/Linkage Assembly with 2-Way Ball Valve



VB-2313-500-9-xx
Body/Linkage Assembly with 3-Way Ball Valve

Applicable Literature

F-Number	Description	Audience	Purpose
F-26642	MA40-704x, MA4x-707x, MA4x-715x DuraDriveSeries Spring Return Two-Position Actuators General Instructions	<ul style="list-style-type: none"> – Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians 	Describes the actuator's features, specifications, and possible applications. Provides step-by-step mounting instructions.
F-26644	MF4x-7xx3, MF4x-7xx3-50x DuraDrive Series Spring Return Floating Actuator General Instructions		
F-26645	MS4x-7xx3, MS4x-7xx3-50x DuraDrive Series Spring Return Proportional Actuator General Instructions		
F-27213	MF41-6043, MF41-6083 DuraDrive Series Non-Spring Return Rotary 24 Vac Three-Position Control General Instructions		
F-27373	MF4E-60430-100, MF4E-60830-100 DuraDrive Series Non-Spring Return Floating Actuator General Instructions		
F-27170	MA4D-xxxx, MF4D-xxxx, MS4D-xxxx DuraDrive Series Rotary Overshaft Actuators General Instructions		
F-27214	MS41-6043, MS41-6083 DuraDrive Series Non-Spring Return Rotary 24 Vac Modulating Control 0 to 10 Vdc Electronic Damper Actuators General Instructions		
F-27003	Mx40-704x DuraDrive Series 35 lb-in. Spring Return Actuators Mounting and Wiring Instructions	<ul style="list-style-type: none"> – Application Engineers – Installers – Service Personnel – Start-up Technicians 	Describes the actuator's specifications and possible applications. Provides step-by-step mounting instructions.
F-26646	Mx41-6043, Mx4x-7xxx, Mx41-6xxx DuraDrive Series Actuator Selection Guide	<ul style="list-style-type: none"> – Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians 	Provides actuator specifications and part number cross referencing of phased out actuators with the new Schneider Electric direct-coupled actuators.
F-26737	Mx41-6043 DuraDrive Series Non-Spring Return 35 lb-in. Actuators Specification Data Sheet	<ul style="list-style-type: none"> – Sales Personnel – Application Engineers 	Describes features and specifications of the Mx41-6043 series actuators.
F-27216	Mx41-6043 DuraDrive Series Non-Spring Return 35 lb-in. Actuators Submittal Sheet	<ul style="list-style-type: none"> – Sales Personnel – Application Engineers 	Describes features and specifications of the Mx41-6043 series actuators.
F-27087	Vx-2x13-5xx-9-xx Series Ball Valve Assemblies and VB-2x13-500-9-xx Ball Valve Body/Linkage Assemblies Installation Instructions	<ul style="list-style-type: none"> – Sales Personnel – Application Engineers – Installers – Service Personnel – Start-up Technicians 	Describes the ball valve assembly's features, specifications, and possible applications. Provides step-by-step mounting instructions.
F-26080	EN-205 Water System Guidelines	<ul style="list-style-type: none"> – Application Engineers – Installers – Service Personnel – Start-up Technicians 	Describes Schneider Electric approved water treatment practices.

Selection Guide Contents

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Features and Benefits

Features	Benefits
Close-offs of 40 to 100 psi.	Accommodates most close-off requirements.
Available in full range of line sizes, 1 in. to 3 in. for 2-way valves and 1 in. to 2 in. for 3-way valves.	Satisfies a wide range of applications.
Cv's from 0.40 to 266.	Permits optimal valve sizing, minimizing the need for pipe reducers.
Flow characterizing insert, made of glass-filled Noryl™.	Provides equal percentage flow characteristic so that the heat output of the coil is linear with respect to valve position.
Available in both spring return and non-spring return models.	Allows power loss mode requirement to be met for any given application.
Utilizes Schneider Electric DuraDrive actuators with two-position, floating, and proportional control.	Models to fit a wide range of applications.
All models equipped with pigtail leads.	Eases installation. Reduced electrician costs.
Low-friction seals and o-rings.	Allows the use of lower-torque actuators, reducing cost.
Valve body made of forged brass ASTM B283.	Rated for static pressure of 360 psi at fluid temperatures of 20 to 250 °F (-7 to 121 °C).
ANSI Class IV (0.01% of Cv) shutoff with 2-way valves.	Allows accurate control, saves energy.
Choices of spring return direction.	Provides Normally Closed or Normally Open spring return.
Thermally isolated mounting plate.	Protects the actuator from excess cold or heat from chilled or hot water passing through the valve. Discourages condensation.
Ball Valve Body/Linkage Assemblies are available separately. They include anti-rotation clips for Schneider Electric DuraDrive actuators.	Increases flexibility and minimizes inventory.

Ball Valve Assembly Selection Procedure

When selecting a ball valve assembly, you must determine the applicable codes for the control signal type, valve body configuration, end connection, port size, and actuator. Select a ball valve assembly part number as follows:

1. Control Signal Type, Valve Body Configuration, and End Connection

Referring to “Part Numbering System” on page 4 or page 5, select the appropriate codes for these part number fields.

2. Valve Size (Flow Coefficient)

If the required flow coefficient (Cv) has not yet been determined, do so as follows:

- Refer to the “Sizing and Selection” section on pages 28 to 32, to calculate the required Cv.
- Select the nearest available Cv and corresponding valve body port code from Table-1 (2-way) or Table-2 (3-way) on page 6.

Note: If this results in a valve that is smaller than pipe size, the actual effective Cv of the installed valve will vary from the nominal Cv as shown in Table-9 on page 31 (2-way valves) and Table-10 on page 32 (3-way valves).

3. Actuator

Select the appropriate actuator and code, according to “Part Numbering System” on page 4 or page 5, based on the control signal type, required valve normal position, and voltage requirements. For detailed actuator information, refer to the applicable actuator specifications on page 12, 15, 18, 21, or 24.

Note: Ball Valve Assemblies with Schneider Electric DuraDrive actuators use the basic actuators. However, if an actuator with auxiliary switch(es) is required, you may field-assemble a ball valve assembly using a ball valve body/linkage assembly (VB-2x13-500-9-xx). For information on switch-equipped actuators, refer to page 12 or page 21.

4. Close-off Pressure

Confirm in Table-4, Table-5, Table-6, or Table-7 that the selected actuator and valve body combination provides sufficient close-off pressure. If no close-off pressure is shown, the valve body/actuator combination is not valid.

5. Available Space

If available space is a consideration, check the appropriate dimensional figure (Figure-1 through Figure-10) and its accompanying table for any potential fit problems.

Part Numbering System

Ball Valve Assemblies Using Schneider Electric DuraDrive Actuators

V x - 2 x 1 3 - 5 x x - 9 - x x

Control Signal Type
 A = Two Position
 F = Floating
 S = Proportional
 B = Valve Body & Linkage (less actuator)

Connection
 3 = Threaded NPT

Port Code
 Refer to separate Port Code table

Configuration
 2 = 2-Way
 3 = 3-Way Mixing

Actuator Code ¹ ²				Valves Used On					
Model	Code	Normal Position	Voltage	1"		1-1/4"		1-1/2" to 3"	1-1/2" to 2"
				2-way	3-way	2-way	3-Way	2-Way	3-way
Two-Position									
MA40-7040	522	SR Close	120 Vac	N/A ^b	N/A ^b	X	X	X	X
MA40-7040	532	SR Open	120 Vac	N/A ^b	N/A ^b	X	X	X	X
MA40-7043	526	SR Close	24 Vac	N/A ^b	N/A ^b	X	X	X	X
MA40-7043	536	SR Open	24 Vac	N/A ^b	N/A ^b	X	X	X	X
Floating									
MF41-6043	505	NSR	24 Vac	N/A ^b	N/A ^b	N/A ^b	N/A ^b	—	—
MF41-6083	506	NSR	24 Vac	—	—	—	—	N/A ^b	N/A ^b
MF40-7043	526	SR Close	24 Vac	N/A ^b	N/A ^b	X	X	X	X
MF40-7043	536	SR Open	24 Vac	N/A ^b	N/A ^b	X	X	X	X
Proportional									
MS41-6043	505	NSR	24 Vac	N/A ^b	N/A ^b	X	X	—	—
MS41-6083	506	NSR	24 Vac	—	—	—	—	X	X
MS40-7043	526	SR Close	24 Vac	N/A ^b	N/A ^b	X	X	X	X
MS40-7043	536	SR Open	24 Vac	N/A ^b	N/A ^b	X	X	X	X
Valve Body/Linkage Assembly^a				VB-2213-500-9-xx, VB-2313-500-9-xx					

SR = Spring Return
 NSR = Non-Spring Return

^a Includes valve body, linkage, and anti-rotation clips for spring return and non-spring return TAC DuraDrive actuators, listed above.

^b Factory assemblies not available. Purchase actuator and VB-2x13-500-9-xx valve body/linkage separately and field assemble.

¹ Normal position for 3-way spring return ball valve assemblies refers to A to AB ports.

² Only the listed 35 lb-in. and 70 lb-in. TAC DuraDrive actuators are compatible with ball valve body/linkage assemblies.

Part Numbering System

Ball Valve Assemblies Using Schneider Electric DuraDrive Actuators

V x - 2 x 1 3 - x x x - 9 - x x

Control Signal Type

A = Two Position
F = Floating
S = Proportional
B = Valve Body & Linkage (less actuator)

Configuration

2 = 2-Way
3 = 3-Way Mixing

Connection

3 = Threaded NPT

Port Code
Refer to separate Port Code table

Actuator Code ¹ ²				Valves Used On				
Model ^a	Code	Normal Position	Voltage	Type	1"		1-1/4" to 3"	1-1/4" to 2"
					2-way	3-way	2-way	3-way
Two-Position								
MA4D-7030-000	815	SR Open	120 Vac	—	X	X	—	—
MA4D-7031-000	816	SR Open	230 Vac	—	X	X	—	—
MA4D-8030-000	817	SR Closed	120 Vac	—	X	X	—	—
MA4D-8031-000	818	SR Closed	230 Vac	—	X	X	—	—
MA4D-7033-000	N/A ^b	SR Open	24 Vac	—	—	—	—	—
MA4D-7033-100	821	SR Open	24 Vac	—	X	X	—	—
MA4D-8033-000	N/A ^b	SR Closed	24 Vac	—	—	—	—	—
MA4D-8033-100	831	SR Closed	24 Vac	—	X	X	—	—
Floating								
MF4D-7033-000	N/A ^b	SR Open	24 Vac	—	—	—	—	—
MF4D-7033-100	821	SR Open	24 Vac	—	X	X	—	—
MF4D-8033-000	N/A ^b	SR Closed	24 Vac	—	—	—	—	—
MF4D-8033-100	831	SR Closed	24 Vac	—	X	X	—	—
MF4D-6083-000	N/A ^b	NSR	24 Vac	—	—	—	—	—
MF4D-6083-100	N/A ^b	NSR	24 Vac	—	X	X	X	X
MF4E-60830-100	880	NSR	24 Vac	—	X	X	X	X
Proportional								
MS4D-7033-000	N/A ^b	SR Open	24 Vac	2-10 Vdc	—	—	—	—
MS4D-7033-100	821	SR Open	24 Vac	2-10 Vdc	X	X	—	—
MS4D-7033-020	N/A ^b	SR Open	24 Vac	0-3 Vdc	—	—	—	—
MS4D-7033-120	N/A ^b	SR Open	24 Vac	0-3 Vdc	X	X	—	—
MS4D-7033-030	N/A ^b	SR Open	24 Vac	6-9 Vdc	—	—	—	—
MS4D-7033-130	825	SR Open	24 Vac	6-9 Vdc	X	X	—	—
MS4D-7033-050	N/A ^b	SR Open	24 Vac	0-10 Vdc	—	—	—	—
MS4D-7033-150	827	SR Open	24 Vac	0-10 Vdc	X	X	—	—
MS4D-7033-060	N/A ^b	SR Open	24 Vac	4-20 mA	—	—	—	—
MS4D-7033-160	829	SR Open	24 Vac	4-20 mA	X	X	—	—
MS4D-8033-000	N/A ^b	SR Closed	24 Vac	2-10 Vdc	—	—	—	—
MS4D-8033-100	831	SR Closed	24 Vac	2-10 Vdc	X	X	—	—
MS4D-8033-020	N/A ^b	SR Closed	24 Vac	0-3 Vdc	—	—	—	—
MS4D-8033-120	N/A ^b	SR Closed	24 Vac	0-3 Vdc	X	X	—	—
MS4D-8033-030	N/A ^b	SR Closed	24 Vac	6-9 Vdc	—	—	—	—
MS4D-8033-130	835	SR Closed	24 Vac	6-9 Vdc	X	X	—	—
MS4D-8033-050	N/A ^b	SR Closed	24 Vac	0-10 Vdc	—	—	—	—
MS4D-8033-150	837	SR Closed	24 Vac	0-10 Vdc	X	X	—	—
MS4D-8033-060	N/A ^b	SR Closed	24 Vac	4-20 mA	—	—	—	—
MS4D-8033-160	839	SR Closed	24 Vac	4-20 mA	X	X	—	—
MS4D-6083-000	N/A ^b	NSR	24 Vac	2-10 Vdc	—	—	—	—
MS4D-6083-100	841	NSR	24 Vac	2-10 Vdc	X	X	X	X
MS4D-6083-020	N/A ^b	NSR	24 Vac	0-3 Vdc	—	—	—	—
MS4D-6083-120	N/A ^b	NSR	24 Vac	0-3 Vdc	X	X	X	X
MS4D-6083-030	N/A ^b	NSR	24 Vac	6-9 Vdc	—	—	—	—
MS4D-6083-130	845	NSR	24 Vac	6-9 Vdc	X	X	X	X
MS4D-6083-050	N/A ^b	NSR	24 Vac	0-10 Vdc	—	—	—	—
MS4D-6083-150	847	NSR	24 Vac	0-10 Vdc	X	X	X	X
MS4D-6083-060	N/A ^b	NSR	24 Vac	4-20 mA	—	—	—	—
MS4D-6083-160	849	NSR	24 Vac	4-20 mA	X	X	X	X
Valve Body/Linkage Assembly ^c VB-2213-500-9-xx, VB-2313-500-9-xx								

SR = Spring Return NSR = Non-Spring Return

^a "-0X0" models have appliance cables. "-1X0" models have plenum cables.

^b Factory assemblies not available. Purchase actuator and valve body separately and field assemble.

^c Includes valve body, linkage, and anti-rotation clips for spring return and non-spring return TAC DuraDrive actuators, listed above.

Port Codes for Schneider Electric DuraDrive Ball Valve Assemblies

Table-1 2-Way Schneider Electric Ball Valve Assemblies—Sizes, Port Codes, and Cv's.

Size	2-Way		
	Port Code	C _v ^a	k _{vs} ^a
1"	21	4.4	3.8
	22	9.0	7.8
	23	15.3	13.2
	24	26.1	22.6
	25	28.4 ^b	24.6
	26	43.9 ^b	38.0
	27	54.2 ^b	46.9
1-1/4"	41	4.4	3.8
	42	8.3	7.2
	43	14.9	12.9
	44	36.5	31.6
	45	41.1 ^b	35.6
	46	102.3 ^b	88.5
1-1/2"	51	22.8	19.7
	52	41.3	35.7
	53	73.9 ^b	63.9
	54	171.7 ^b	148.5
2"	61	41.7	36.1
	63	71.1	61.5
	65	108 ^b	93.4
	66	210	181.7
	67	266 ^b	230.1
2-1/2"	71	45	38.9
	72	55	47.6
	73	72.3	62.5
	74	101	87.4
	75	162	140.1
	76	202 ^b	174.7
3"	82	63	54.5
	85	145 ^b	125.4

^a $C_v = \frac{gpm}{\sqrt{\Delta P}}$ (where ΔP is measured in psi) $k_{vs} = C_v / 1.156$

$k_{vs} = \frac{m^3/h}{\sqrt{\Delta P}}$ (where ΔP is measured in bar; 1 bar = 100 kPa)

^b Denotes a full port valve, without the characterized insert.

Table-2 3-Way Schneider Electric Ball Valve Assemblies—Sizes, Port Codes, and Cv's

Size	3-Way		
	Port Code	A Port C _v ^{a b}	k _{vs} ^a
1"	21	0.40	0.35
	22	0.65	0.56
	23	1.3	1.1
	24	2.3	2.0
	25	3.5	3.0
	26	4.5	3.9
	27	8.6	7.4
	28	10 ^c	8.6
	29	14.9	12.9
	30	22.3 ^c	19.3
	31	30.8 ^c	26.6
1-1/4"	41	4.1	3.5
	43	8.7	7.5
	44	12.7	11.0
	45	19.4 ^c	16.8
	46	34.1 ^c	29.5
1-1/2"	51	4	3.5
	52	8.3	7.2
	53	13.4	11.6
	54	23.5	20.3
	55	32 ^c	27.7
	56	61.1 ^c	52.8
2"	61	23.9	20.7
	62	38.2	33.0
	63	56.7 ^c	49.0
	64	108.5 ^c	93.8

^a $C_v = \frac{gpm}{\sqrt{\Delta P}}$ (where ΔP is measured in psi) $k_{vs} = C_v / 1.156$

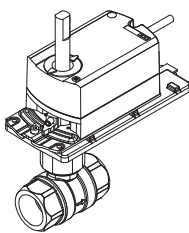
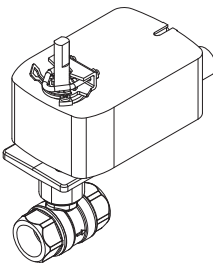
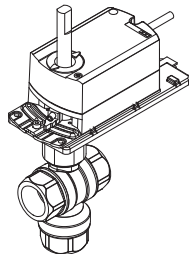
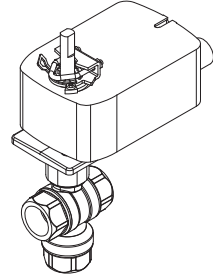
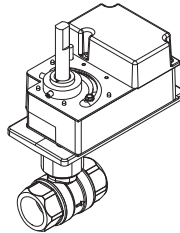
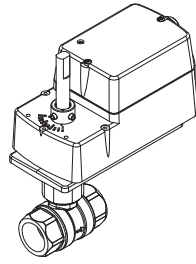
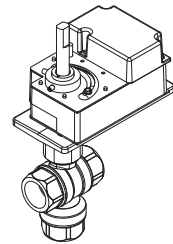
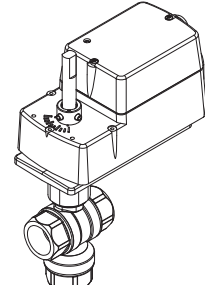
$k_{vs} = \frac{m^3/h}{\sqrt{\Delta P}}$ (where ΔP is measured in bar; 1 bar = 100 kPa)

^b B port Cv is 80% of A port Cv.

^c Denotes a full port valve, without the characterized insert.

Ball Valve Specifications

Table-3 Specifications for Schneider Electric Ball Valve Assemblies.

Valve Assembly Series		2-Way	3-Way Mixing
Ball Valve Assemblies using Schneider Electric DuraDrive Actuators		 Non-Spring Return Vx-2213-505-9-P Vx-2213-506-9-P	 Spring Return Vx-2213-5xx-9-P
		 Non-Spring Return Vx-2313-505-9-P Vx-2313-506-9-P	 Spring Return Vx-2313-5xx-9-P
		 Non-Spring Return VF-2213-880-9-P	 Spring Return Vx-2213-81x-9-P Vx-2213-82x-9-P Vx-2213-83x-9-P Non-Spring Return Vx-2213-84x-9-P
		 Non-Spring Return VF-2313-880-9-P	 Spring Return Vx-2313-81x-9-P Vx-2313-82x-9-P Vx-2313-83x-9-P Non-Spring Return Vx-2313-84x-9-P
Applications		Chilled or Hot Water, up to 50% Glycol Solution	
Type of End Fitting		NPT Screwed	
Size		1 in. through 3 in.	1 in. through 2 in.
Valve Assembly Series		Vx-2213-xxx-9-P	Vx-2313-xxx-9-P
Flow Type		Equal Percentage	
Material	Body	Forged Brass (ASTM B283)	
	Ball	Nickel/Chromium-Plated Brass	
	Characterizing Insert	Glass-filled Noryl	
	Stem	Brass	
	Ball Seals	Reinforced Teflon® Seals with EPDM O-Rings	
	Stem Seals	EPDM O-Rings	
	Mounting Plate	Glass-filled Polymer	
Maximum Static Pressure		360 psig (25 bar)	
Maximum Operating Differential Pressure		Same as close-off pressures shown in Table-4 or Table-6. Refer to "Cavitation Limitations on Valve Pressure Drop" on page 30.	Same as close-off pressures shown in Table-5 or Table-7. Refer to "Cavitation Limitations on Valve Pressure Drop" on page 30.
Seat Leakage		ANSI Class IV (0.01% of C _v)	ANSI Class IV (0.01% of C _v), piped coil-side outlet to A only
Fluid (water) Temperature	Minimum^a	20 °F (-7 °C)	
	Maximum	250 °F (121 °C)	

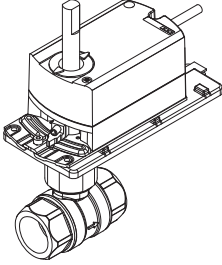
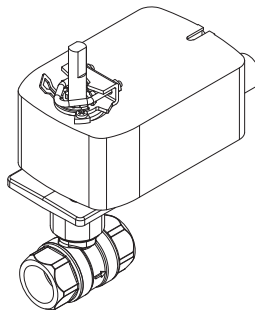
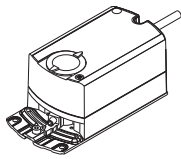
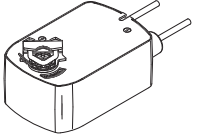
^a Freeze protection required.

Valve/Actuator Combinations

2-Way Ball Valve Assemblies Using Schneider Electric DuraDrive Actuators

Note: All valve sizes — ANSI Class IV (0.01% of C_v) shut-off

Table-4 Selection Chart—2-Way Ball Valve Assemblies with Schneider Electric DuraDrive Actuators.

2-Way Ball Valve Assemblies with Schneider Electric DuraDrive			Non-Spring Return ^a		Spring Return
 Vx-2213-505-9-P  Vx-2213-5xx-9-P					
Actuator Models (Actuator Codes)					
			24 Vac	24 Vac	24 Vac
			Floating MF41-6043 (505) Proportional MS41-6043 (505)	Floating MF41-6083 (506) Proportional MS41-6083 (506)	Two-Position MA40-7043 (N.C.) (526) MA40-7043 (N.O.) (536) Floating MF40-7043 (N.C.) (526) MF40-7043 (N.O.) (536) Proportional MS40-7043 (N.C.) (526) MS40-7043 (N.O.) (536)
			120 Vac Two-Position MA40-7040 (N.C.) (522) MA40-7040 (N.O.) (532)		
Valve Assembly Part Number	Valve Size (in.)	P Code ^b	Close-Off Pressure, psi (kPa)		
Ball Valve Assembly with Schneider Electric DuraDrive Vx-2213-5xx-9-P^c Valve/Linkage Assembly VB-2213-500-9-P	1	21, 22, 23, 24, 25, 26, 27	100 (689) (field assemble ^d)	—	100 (689) (field assemble ^d)
	1-1/4	41, 42, 43, 44, 45, 46	70 (482) (field assemble ^d)	—	70 (482)
	1-1/2	51, 52, 53, 54	—	70 (482) (field assemble ^d)	70 (482)
	2	61, 63, 65, 66, 67	—	70 (482) (field assemble ^d)	70 (482)
	2-1/2	71, 72, 73, 74, 75, 76	—	70 (482) (field assemble ^d)	70 (482)
	3	82, 85	—	70 (482) (field assemble ^d)	70 (482)

^a Non-spring return 2-way ball valve assemblies are shipped open, voltage rise to close.

^b To find the corresponding flow coefficients for these port codes, refer to "Port Codes for Schneider Electric DuraDrive Ball Valve Assemblies" on page 6.

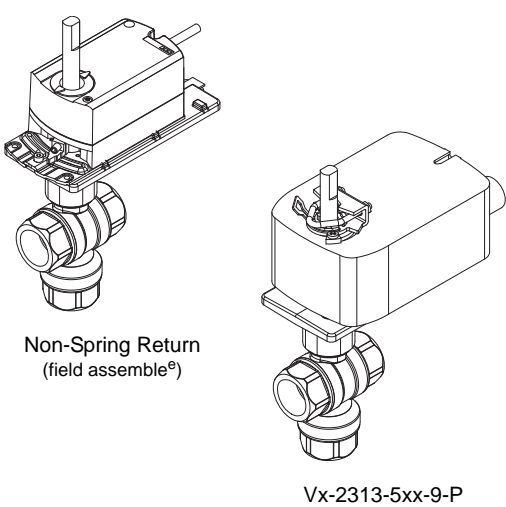
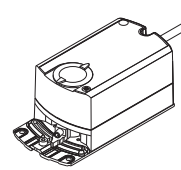
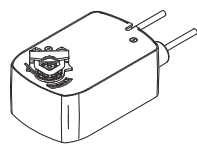
^c To determine a specific part number, identify the actuator's control signal type ("A," "F," or "S"), actuator code, and P code. Refer to "Part Numbering System" on page 4.

^d Factory assemblies not available. Purchase actuator and VB-2213-500-0-xx valve body/linkage and field assemble.

3-Way Ball Valve Assemblies Using Schneider Electric DuraDrive Actuators

Note: All valve sizes — ANSI Class IV (0.01% of C_v) shut off, piped coil-side outlet to A.

Table-5 Selection Chart—3-Way Mixing Ball Valve Assemblies with Schneider Electric DuraDrive Actuators.

3-Way Mixing Ball Valve Assemblies with Schneider Electric DuraDrive ^{a b}			Non-Spring Return		Spring Return			
 <p>Non-Spring Return (field assemble^e)</p> <p>Vx-2313-5xx-9-P</p>								
							Actuator Models (Actuator Codes)	
			24 Vac		24 Vac		24 Vac	
			Floating MF41-6043 Proportional MS41-6043		Floating MF41-6083 Proportional MS41-6083		Two-Position MA40-7043 (N.C.) (526) MA40-7043 (N.O.) (536) Floating MF40-7043 (N.C.) (526) MF40-7043 (N.O.) (536) Proportional MS40-7043 (N.C.) (526) MS40-7043 (N.O.) (536)	
			120 Vac					
			Two-Position MA40-7040 (N.C.) (522) MA40-7040 (N.O.) (532)					
Valve Assembly Part Number	Valve Size (in.)	P Code ^c	Close-Off Pressure, psi (kPa)					
Ball Valve Assembly with Schneider Electric DuraDrive Vx-2313-5xx-9-P^d Valve/Linkage Assembly VB-2313-500-9-P	1	21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31	50 (344) (field assemble ^e)	—	50 (344) (field assemble ^e)			
	1-1/4	41, 43, 44, 45, 46	40 (275) (field assemble ^e)	—	40 (275)			
	1-1/2	51, 52, 53, 54, 55, 56	—	40 (275) (field assemble ^e)	40 (275)			
	2	61, 62, 63, 64	—	40 (275) (field assemble ^e)	40 (275)			

^a Non-spring return 3-way mixing ball valve assemblies are shipped A to AB open, voltage rise to close.

^b Spring return 3-way mixing valves are normally A to AB closed.

^c To find the corresponding flow coefficients for these port codes, refer to "Port Codes for Schneider Electric DuraDrive Ball Valve Assemblies" on page 6.

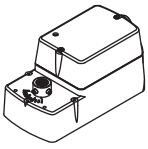
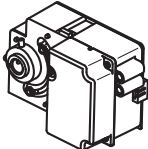
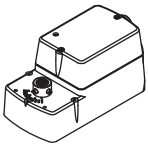
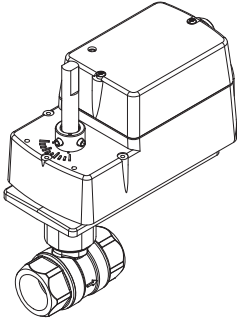
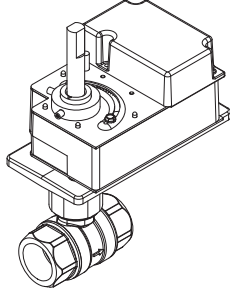
^d To determine a specific part number, identify the actuator's control signal type ("A," "F," or "S"), actuator code, and P code. Refer to "Part Numbering System" on page 4.

^e Factory assemblies not available. Purchase actuator and VB-2313-500-9-xx valve body/linkage and field assemble.

2-Way Ball Valve Assemblies Using Schneider Electric DuraDrive Actuators

Note: All valve sizes — ANSI Class IV (0.01% of C_v) shut-off

Table-6 Selection Chart—2-Way Ball Valve Assemblies with Schneider Electric DuraDrive Actuators.

			Non-Spring Return ^a		Spring Return
					
			Actuator Models (Actuator Codes)		
			24 Vac	24 Vac	24 Vac
 <p>Spring Return Vx-2213-81x-9-P Vx-2213-82x-9-P Vx-2213-83x-9-P</p>	 <p>Non-Spring Return VF-2213-880-9-P</p>		Floating MF4D-6083	Floating MF4E-60830-100 (880)	Two-Position MA4D-7033 (N.O.) (821) MA4D-8033 (N.C.) (831)
			Proportional MS4D-6083 (841) to (849)	Floating MF4D-7033 (N.O.) (821) MF4D-8033 (N.C.) (831)	Proportional MS4D-7033 (N.O.) (821) to (829) MS4D-8033 (N.C.) (831) to (839)
			120 Vac		
			Two-Position MA4D-7030 (N.O.) (815) MA4D-8030 (N.C.) (817)		
			230 Vac		
			Two-Position MA4D-7031 (N.O.) (816) MA4D-8031 (N.C.) (818)		
Valve Assembly Part Number	Valve Size (in.)	P Code ^b	Close-Off Pressure, psi (kPa)		
Ball Valve Assembly Vx-2213-8xx-9-P ^c Valve/Linkage Assembly VB-2213-500-9-P	1	21, 22, 23, 24, 25, 26, 27	100 (689)	100 (689)	100 (689)
	1-1/4	41, 42, 43, 44, 45, 46	70 (482)	70 (482)	—
	1-1/2	51, 52, 53, 54	70 (482)	70 (482)	—
	2	61, 63, 65, 66, 67	70 (482)	70 (482)	—
	2-1/2	71, 72, 73, 74, 75, 76	70 (482)	70 (482)	—
	3	82, 85	70 (482)	70 (482)	—

^a Non-spring return 2-way ball valve assemblies are shipped open, voltage rise to close.

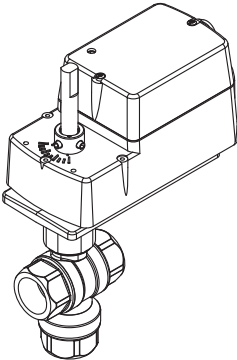
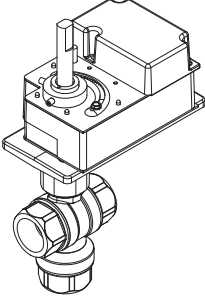
^b To find the corresponding flow coefficients for these port codes, refer to "Port Codes for Schneider Electric DuraDrive Ball Valve Assemblies" on page 6.

^c To determine a specific part number, identify the actuator's control signal type ("A," "F," or "S"), actuator code, and P code. Refer to "Part Numbering System" on page 5.

3-Way Mixing Ball Valve Assemblies Using Schneider Electric DuraDrive Actuators

Note: All valve sizes — ANSI Class IV (0.01% of C_v) shut off, piped coil-side outlet to A.

Table-7 Selection Chart—3-Way Mixing Ball Valve Assemblies with Schneider Electric DuraDrive Actuators.

3-Way Mixing Ball Valve Assemblies with Schneider Electric DuraDrive ^{a b}			Non-Spring Return		Spring Return				
			Actuator Models (Actuator Codes)						
			24 Vac	24 Vac	24 Vac	120 Vac			
 <p>Spring Return Vx-2313-81x-9-P Vx-2313-82x-9-P Vx-2313-83x-9-P</p> <p>Non-Spring Return Vx-2313-84x-9-P</p>			 <p>VF-2313-880-9-P</p>			<p>Floating MF4D-6083 (840) (841)</p> <p>Proportional MS4D-6083 (841) to (849)</p>	<p>Floating MF4E-60830-100 (880)</p>	<p>Two-Position MA4D-7033 (N.O.) (821) MA4D-8033 (N.C.) (831)</p> <p>Floating MF4D-7033 (N.O.) (821) MF4D-8033 (N.C.) (831)</p> <p>Proportional MS4D-7033 (N.O.) (821) to (829) MS4D-8033 (N.C.) (831) to (839)</p>	<p>Two-Position MA4D-7030 (N.O.) (815) MA4D-8030 (N.C.) (817)</p>
								<p>230 Vac</p> <p>Two-Position MA4D-7031 (N.O.) (816) MA4D-8031 (N.C.) (818)</p>	
Valve Assembly Part Number	Valve Size (in.)	P Code ^c	Close-Off Pressure, psi (kPa)						
<p>Ball Valve Assembly Vx-2313-8xx-9-P^d</p> <p>Valve/Linkage Assembly VB-2313-500-9-P</p>	1	21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31	50 (344)	50 (344)	50 (344)				
	1-1/4	41, 43, 44, 45, 46	40 (275)	40 (275)	—				
	1-1/2	51, 52, 53, 54, 55, 56	40 (275)	40 (275)	—				
	2	61, 62, 63, 64	40 (275)	40 (275)	—				

^a Non-spring return 3-way mixing ball valve assemblies are shipped A to AB open, voltage rise to close.

^b Spring return 3-way mixing valves are normally A to AB closed.

^c To find the corresponding flow coefficients for these port codes, refer to "Port Codes for Schneider Electric DuraDrive Ball Valve Assemblies" on page 6.

^d To determine a specific part number, identify the actuator's control signal type ("A," "F," or "S"), actuator code, and P code. Refer to "Part Numbering System" on page 5.

Actuator Specifications and Valve Assembly Mounting Dimensions

Valve Assemblies with MF41-6043, MF41-6083, MS41-6043, and MS41-6083 Non-Spring Return Schneider Electric DuraDrive Actuators

Actuator Specifications																				
Inputs																				
Control Signal	<p>MF41-6043 and MF41-6083: Floating three-position control, 24 Vac.</p> <p>MS41-6043 and MS41-6083: Proportional, 0 to 10 Vdc; input resistance 100KΩ.</p> <p>Control signal adjustment available with MS41-6043-520 and MS41-6043-522: Start point (offset) — Between 0 and 5 Vdc (factory setting = 0 Vdc) Span — 2 to 30 Vdc</p>																			
Power Requirements	All 24 Vac circuits are Class 2.																			
	<table border="1"> <thead> <tr> <th rowspan="2">Part Number</th> <th colspan="4">Power Input @ 50/60 Hz</th> </tr> <tr> <th>Voltage^a</th> <th>Running VA</th> <th>Holding VA</th> <th>Watts</th> </tr> </thead> <tbody> <tr> <td>MF41-6043 and MF41-6083</td> <td>24 Vac +20/-15%</td> <td>2.3</td> <td>—</td> <td>2.0</td> </tr> <tr> <td>MS41-6043 and MS41-6083</td> <td>24 Vac +20/-15%</td> <td>3.3</td> <td>1.2</td> <td>3.0</td> </tr> </tbody> </table> <p>^a 24 Vac +20/-10% for ambient temperatures 90 to 130 °F (Mx41-6083 only).</p>	Part Number	Power Input @ 50/60 Hz				Voltage ^a	Running VA	Holding VA	Watts	MF41-6043 and MF41-6083	24 Vac +20/-15%	2.3	—	2.0	MS41-6043 and MS41-6083	24 Vac +20/-15%	3.3	1.2	3.0
Part Number	Power Input @ 50/60 Hz																			
	Voltage ^a	Running VA	Holding VA	Watts																
MF41-6043 and MF41-6083	24 Vac +20/-15%	2.3	—	2.0																
MS41-6043 and MS41-6083	24 Vac +20/-15%	3.3	1.2	3.0																
Connections	3 ft. (0.9 m) long, 18 AWG plenum-rated leads.																			
Motor Type	Synchronous																			
Outputs																				
Electrical	<p>Feedback potentiometer available for MF41-6043/6083-510: 0 to 1000 Ω < 10 mA</p> <p>Position feedback voltage for MS41-6043/6083: 0 to 10 Vdc, 1 mA</p> <p>Auxiliary Switches: Dual auxiliary switches available with MF41-6043/6083-502, MS41-6043/6083-502, MF41-6043/6083-522 and MS41-6043/6083-522 when these actuators are ordered as separate units. Auxiliary switches are not offered with factory ball valve assemblies.</p> <p>AC Rating: 24 Vac, 4 A resistive, 2 A inductive Switch hysteresis: 3° rotation</p> <p>DC Rating: 12 to 30 Vdc, DC 2 A</p> <p>Timing:</p> <table border="1"> <thead> <tr> <th rowspan="2">Part Number</th> <th colspan="2">90° Timing in Sec.</th> </tr> <tr> <th>At 60 Hz</th> <th>At 50 Hz</th> </tr> </thead> <tbody> <tr> <td>MF41-6043 MS41-6043</td> <td>90</td> <td>108</td> </tr> <tr> <td>MF41-6083 MS41-6083</td> <td>125</td> <td>150</td> </tr> </tbody> </table> <p>Switch Range: Switch A — 0 to 90° range in 5° intervals Recommended range usage — 0 to 45° Factory setting — 5° Switch B — 0 to 90° range in 5° intervals Recommended range usage — 45 to 90° Factory setting — 85°</p>	Part Number	90° Timing in Sec.		At 60 Hz	At 50 Hz	MF41-6043 MS41-6043	90	108	MF41-6083 MS41-6083	125	150								
Part Number	90° Timing in Sec.																			
	At 60 Hz	At 50 Hz																		
MF41-6043 MS41-6043	90	108																		
MF41-6083 MS41-6083	125	150																		
Mechanical	<p>Output torque rating: 35 lb-in. (4 N-m) for Mx41-6043; 70 lb-in. (8 N-m) for Mx41-6083</p> <p>Stroke: Normal angle of rotation is 90°, limited to a maximum of 95°. Field adjustable to limit travel on either end of stroke.</p> <p>Position indicator: Adjustable pointer is provided for position indication.</p> <p>Output shaft setscrew: Tightening torque 55 to 60 lb-in. (6.3 to 6.8 N-m).</p>																			
Environment																				
Temperature Limits	<p>Shipping and storage: -40 to 158 °F (-40 to 70 °C) ambient.</p> <p>Operating: -25 to 130 °F (-32 to 55 °C) ambient.</p>																			
Humidity	5 to 95% RH, non-condensing.																			
Locations	NEMA Type 2 (IEC IP54).																			
Agency Listings (Actuator)																				
UL	UL-873, Underwriters Laboratories.																			
cUL	Canadian Standards C22.2 No. 24-93.																			
European Community	EMC Directive (89/336/EEC). Emissions (EN50081-1). Immunity (EN50081-2).																			

2-Way Ball Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	P Code ^a	Valve Dimensions in inches (millimetres) (Refer to Figure-1)			
			A	B	C	D
2-Way VF-2213-505-9-P VF-2213-506-9-P VS-2213-505-9-P VS-2213-506-9-P	1	21, 23	3-1/16 (78)	6-3/4 (171)	8-1/2 (216)	3 (76)
		22, 25	3-3/4 (95)	7-1/16 (179)	8-3/16 (208)	2-7/8 (72)
		24, 26	4-5/16 (110)	7-7/16 (189)	9-1/8 (231)	3-1/4 (82)
		27	3-1/16 (78)	7-9/16 (192)	8-1/2 (216)	3 (76)
	1-1/4	41, 42, 43, 45	3 (76)	6-3/4 (171)	8-7/16 (215)	3-1/8 (79)
		44, 46	3-5/8 (92)	6-13/16 (173)	9-1/8 (231)	3-1/4 (82)
	1-1/2	51, 53	4-11/16 (119)	7-9/16 (192)	9-1/8 (231)	3-1/4 (82)
		52, 54	4-1/16 (103)	7-1/16 (179)	9-5/8 (244)	3-3/4 (95)
	2	61, 65	4-21/32 (118)	7-1/2 (191)	9-5/8 (244)	3-3/4 (95)
		63, 66, 67	4-15/16 (125)	7-7/16 (189)	10-3/8 (264)	4-1/16 (103)
	2-1/2	71, 72, 76, 73, 74, 75	4-3/4 (121)	7-9/16 (192)	10-3/8 (264)	4-1/16 (103)
	3	82, 85	5-1/16 (129)	7-3/4 (197)	10-9/16 (268)	4-1/16 (103)

^a To find the corresponding flow coefficients for these port codes, refer to "Port Codes for Schneider Electric DuraDrive Ball Valve Assemblies" on page 6.

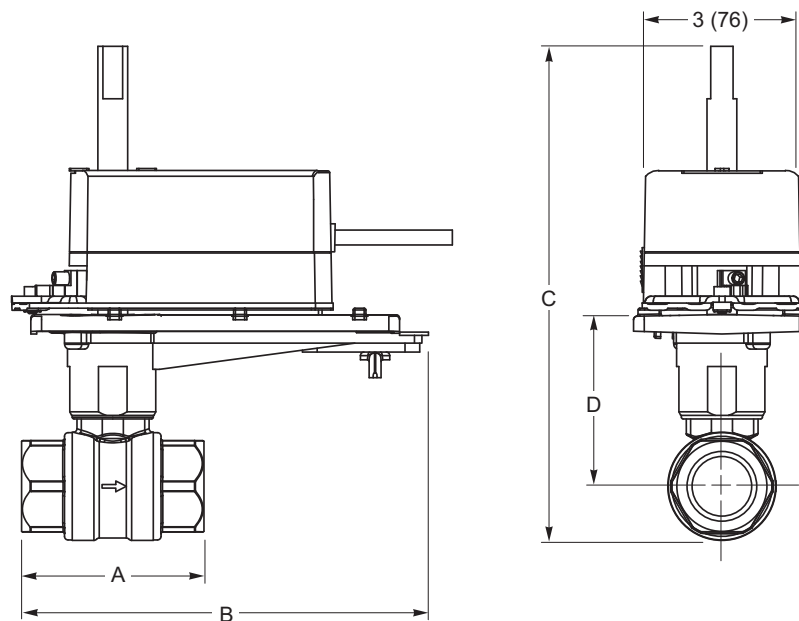


Figure-1 Mx41-6043 or Mx41-6083 with 2-Way Ball Valve.

3-Way Mixing Ball Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	P Code ^a	Valve Dimensions in inches (millimetres) (Refer to Figure-2)				
			A	B	C	D	E
3-Way VF-2313-505-9-P VF-2313-506-9-P VS-2313-505-9-P VS-2313-506-9-P	1	21, 22, 23, 24, 25, 28	3-3/4 (95)	7-1/4 (184)	9-1/2 (238)	2-7/8 (72)	2-1/16 (52)
		27, 30	3-1/16 (78)	6-3/4 (171)	9-7/8 (251)	3 (76)	2-7/16 (62)
		26, 29, 31	4-5/16 (110)	7-3/4 (197)	10-7/8 (275)	3-1/4 (82)	3-1/8 (80)
	1-1/4	45	3 (76)	6-3/4 (171)	9-7/8 (251)	3 (76)	2-7/16 (61)
		41, 43, 44, 46	3-5/8 (92)	7-3/16 (182)	10-1/2 (267)	3-1/4 (82)	2-13/16 (72)
	1-1/2	51, 52, 53, 55	4-1/2 (114)	7-3/4 (197)	10-3/8 (264)	3-1/4 (82)	2-3/4 (69)
		54	4-1/16 (103)	7-1/16 (179)	11-3/8 (288)	3-3/4 (95)	3-3/16 (81)
		56	4-1/16 (103)	7-3/4 (197)	11-3/8 (288)	3-3/4 (95)	3-3/16 (81)
	2	61, 63	3-15/16 (100)	7-1/8 (181)	11-1/4 (287)	3-3/4 (95)	3-1/8 (79)
		62, 64	5 (127)	7-3/4 (197)	12-1/4 (314)	4-1/16 (103)	3-7/8 (98)

^a To find the corresponding flow coefficients for these port codes, refer to "Port Codes for Schneider Electric DuraDrive Ball Valve Assemblies" on page 6.

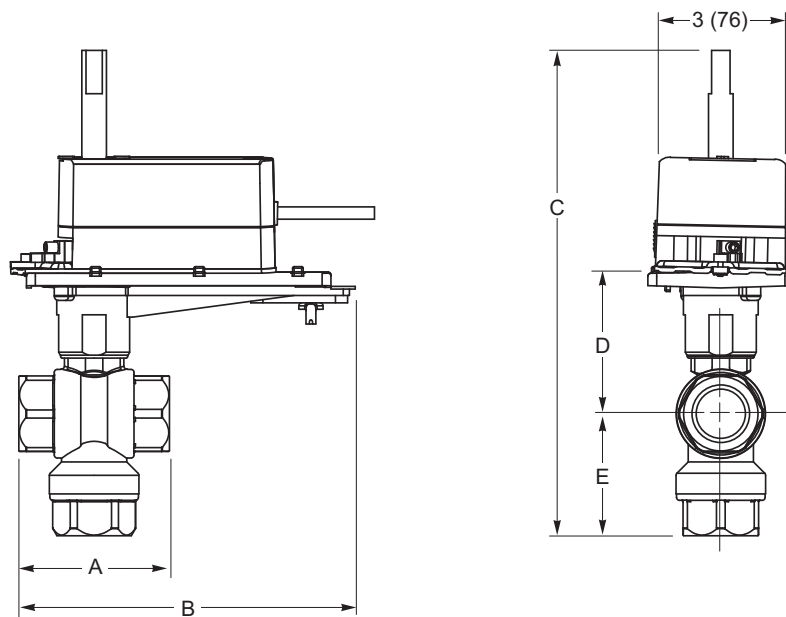


Figure-2 Mx41-6043 or Mx41-6083 with 3-Way Ball Valve.

Valve Assemblies with MF4D-608x and MS4D-608x Non-Spring Return Schneider Electric DuraDrive Actuators

Actuator Specifications							
Inputs							
Control Signal and Power Requirements	All 24 Vac circuits are Class 2						
	Part Number	Control Signal	Voltage	Actuator Power Input			
				Running		Holding	
			50/60 Hz		DC	50/60 Hz	
			VA	W	Amps	W	
	MF4D-6083-000	Floating	24 Vac ±20% or 20 to 30 Vdc	5.9	3.6	0.13	1.6
	MF4D-6083-100						
	MS4D-6083-000	2 to 10 Vdc ^a Proportional		5.2	2.7	0.10	1.4
	MS4D-6083-100						
	MS4D-6083-020	0 to 3 Vdc Proportional		5.2	2.7	0.10	1.4
	MS4D-6083-120						
	MS4D-6083-030	6 to 9 Vdc Proportional		5.2	2.7	0.10	1.4
	MS4D-6083-130						
MS4D-6083-050	2 to 10 Vdc Proportional	5.2		2.7	0.10	1.4	
MS4D-6083-150							
MS4D-6083-060	4 to 20 mAdc Proportional	5.2		2.7	0.10	1.4	
MS4D-6083-160							
^a 4 to 20 mAdc with field-installed 500 Ω resistor.							
Connections	<p>Mx4D-6083-0x0: 3 ft. (0.9 m) long, appliance cable, 1/2 in. (13 mm) conduit connector. For M20 Metric conduit, use AM-756 adaptor.</p> <p>Mx4D-6083-1x0: 10 ft. (3.05 m) long, plenum cable, 1/2 in. (13 mm) conduit connector. For M20 Metric conduit, use AM-756 adaptor.</p>						
Motor Type	Brush DC.						
Outputs							
Electrical	<p>Timing: Approx. 85 sec. at 70 °F (21 °C), measured with no load applied to actuator.</p> <p>Position Feedback Voltage: For 0 to 3 Vdc, 6 to 9 Vdc, and 2 to 10 Vdc proportional actuators, the feedback signal is the same voltage range as the input signal. The 4 to 20 mA proportional actuators and floating actuators have a 2 to 10 Vdc feedback signal. The feedback signal can supply up to 0.5 mA to operate up to four additional slave actuators.</p>						
Mechanical	<p>Stroke: 93° nominal.</p> <p>Manual Override: Allows positioning of valve shaft, using a manual crank.</p> <p>Output torque rating: 70 lb-in (6.6 N-m).</p> <p>RA/DA Jumper (Proportional Models): Permits selection of reverse acting or direct acting control.</p> <p>Position indicator: Visual indicator.</p>						
Environment							
Temperature Limits	<p>Shipping and storage: -40 to 160 °F (-40 to 71 °C) ambient.</p> <p>Operating: -22 to 140 °F (-30 to 60 °C) ambient.</p>						
Humidity	15 to 95% RH, non-condensing.						
Locations	NEMA 1. NEMA 2, UL Type 2 (IEC IP54) with customer-supplied watertight conduit connectors. Enclosure is air plenum rated.						
Agency Listings (Actuator)							
UL	UL 873, Underwriters Laboratories (File #9429 Category Temperature-Indicating and Regulating Equipment). Plenum rated.						
European Community	EMC Directive (89/336/EEC). Low Voltage Directive (72/23/EEC). This product fits into Installation Category (Overvoltage Category) II per EN 61010-1.						
cUL	Canadian Standards C22.2 No. 24-93.						
Australia	This product meets requirements to bear the C-Tick Mark according to the terms specified by the Communications Authority under the Radiocommunications Act 1992.						

2-Way Ball Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	P Code ^a	Valve Dimensions in inches (millimetres) (Refer to Figure-3)			
			A	B	C	D
2-Way VF-2213-841-9-P VS-2213-841-9-P thru VS-2213-849-9-P	1	21, 23	3-1/16 (78)	7 (178)	8-1/2 (216)	3 (76)
		22, 25	3-3/4 (95)	7-3/8 (188)	8-3/16 (208)	2-7/8 (72)
		24, 26	4-5/16 (110)	7-5/8 (194)	9-1/8 (231)	3-1/4 (82)
		27	3-1/16 (78)	7-13/16 (200)	8-1/2 (216)	3 (76)
	1-1/4	41, 42, 43, 45	3 (76)	5-13/32 (112)	8-7/16 (215)	3-1/8 (79)
		44, 46	3-5/8 (92)	7-3/32 (180)	9-1/8 (231)	3-1/4 (82)
	1-1/2	51, 53	4-11/16 (119)	7-13/16 (198)	9-1/8 (231)	3-1/4 (82)
		52, 54	4-1/16 (103)	7-11/32 (186)	9-5/8 (244)	3-3/4 (95)
	2	61, 65	4-21/32 (118)	7-3/4 (196)	9-5/8 (244)	3-3/4 (95)
		63, 66, 67	4-15/16 (125)	7-5/8 (195)	10-3/8 (264)	4-1/16 (103)
	2-1/2	71, 72, 76, 73, 74, 75	4-3/4 (121)	7-7/8 (200)	10-3/8 (264)	4-1/16 (103)
	3	82, 85	5-1/16 (129)	8 (203)	10-9/16 (268)	4-1/16 (103)

^a To find the corresponding flow coefficients for these port codes, refer to "Port Codes for Schneider Electric DuraDrive Ball Valve Assemblies" on page 6.

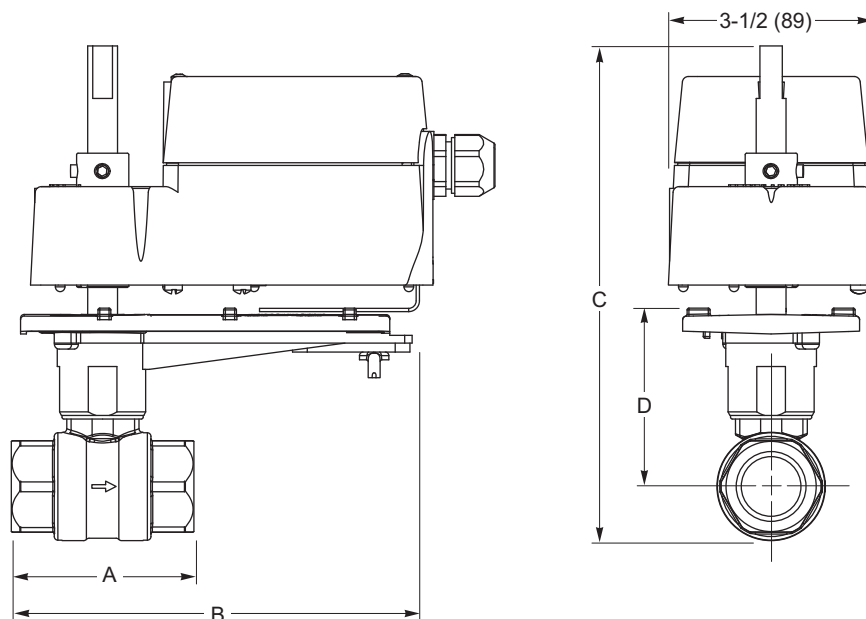


Figure-3 MF4D-608x, MS4D-608x with 2-Way Ball Valve.

3-Way Ball Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	P Code ^a	Valve Dimensions in inches (millimetres) (Refer to Figure-4)				
			A	B	C	D	E
3-Way VF-2313-841-9-P VS-2313-841-9-P thru VS-2313-849-9-P	1	21, 22, 23, 24, 25, 28	3-3/4 (95)	7-1/2 (191)	9-1/2 (238)	2-7/8 (72)	2-1/16 (52)
		27, 30	3-1/16 (78)	7 (178)	9-7/8 (251)	3 (76)	2-7/16 (62)
		26, 29, 31	4-5/16 (110)	7 (178)	10-7/8 (275)	3-1/4 (82)	3-1/8 (80)
	1-1/4	45	3 (76)	7 (178)	9-7/8 (251)	3 (76)	2-7/16 (61)
		41, 43, 44, 46	3-5/8 (92)	7-3/8 (188)	10-1/2 (267)	3-1/4 (82)	2-13/16 (72)
	1-1/2	51, 52, 53, 55	4-1/2 (114)	7-3/4 (197)	10-3/8 (264)	3-1/4 (82)	2-3/4 (69)
		54, 56	4-1/16 (103)	7-1/4 (184)	11-3/8 (288)	3-3/4 (95)	3-3/16 (81)
	2	61, 63	3-15/16 (100)	8-7/16 (214)	11-1/4 (287)	3-3/4 (95)	3-1/8 (79)
		62, 64	5 (127)	7-1/2 (191)	12-1/4 (314)	4-1/16 (103)	3-7/8 (98)

^a To find the corresponding flow coefficients for these port codes, refer to "Port Codes for Schneider Electric DuraDrive Ball Valve Assemblies" on page 6.

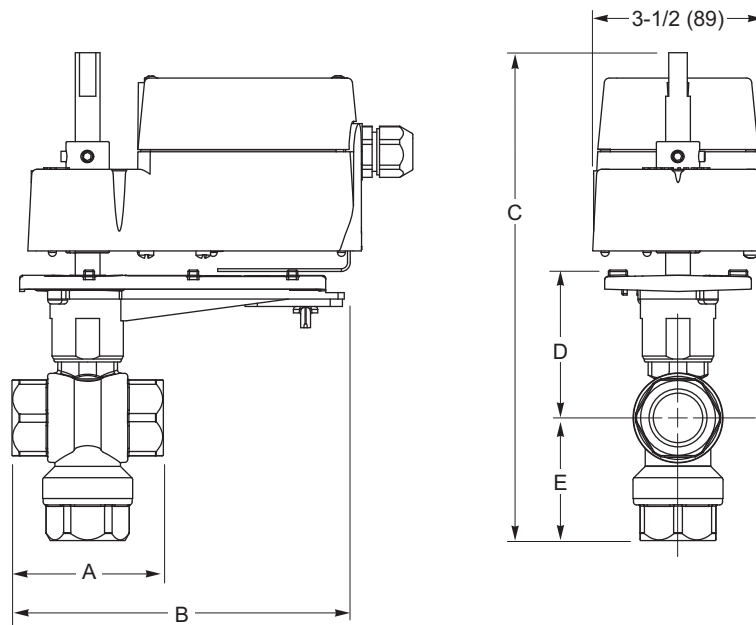


Figure-4 MF4D-608x, MS4D-608x with 3-Way Ball Valve.

Valve Assemblies with MF4E-60830-100 Non-Spring Return Schneider Electric DuraDrive Actuators

Note: The MF4E-60830-100 is the only MF4E series Schneider Electric DuraDrive model actuator used in the Schneider Electric Ball Valve Assemblies.

Actuator Specifications				
Inputs				
Control Signal	Floating point control, 24 Vac +20% / -15%.			
Power Requirements	All 24 Vac circuits are Class 2.			
	Part Number	Voltage 50/60 Hz	Running	
			VA	
			50 Hz	60 Hz
	MF4E-60830-100	24 Vac +20% / -15%	1.0	1.0
Watts				1.0
Connections	10 ft. (3.05 m) long, plenum cable.			
Motor Type	Synchronous.			
Outputs				
Electrical	Timing: Approx. 90 sec. at 60 Hz, 108 sec. at 50 Hz, for 90° stroke at 70 °F (21 °C).			
Mechanical	Stroke: 95°. Stroke limit is adjustable, 0° to 95°, in both clockwise (CW) and counterclockwise (CCW) directions.			
	Manual Override: Allows free shaft rotation to any position from 0° to 95°.			
	Output torque rating: 70 lb-in (6.6 N-m).			
	Position indicator: Visual indicator.			
Environment				
Temperature Limits	Shipping and storage: -40 to 160 °F (-40 to 71 °C) ambient.			
	Operating: -22 to 140 °F (-30 to 60 °C) ambient.			
Humidity	5 to 95% RH, non-condensing.			
Locations	NEMA Type 1 (IEC IP30).			
Agency Listings (Actuator)				
UL	UL 873, Underwriters Laboratories (File #9429 Category Temperature-Indicating and Regulating Equipment). Plenum rated.			
European Community	EMC Directive EN 61326.			
cUL	Canadian Standards C22.2 No. 24-93.			
Australia	This product meets requirements to bear the C-Tick Mark according to the terms specified by the Communications Authority under the Radiocommunications Act 1992.			

2-Way Ball Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	P Code ^a	Valve Dimensions in inches (millimetres) (Refer to Figure-5)			
			A	B	C	D
2-Way VF-2213-880-9-P	1	21, 23	3-1/16 (78)	7-1/4 (184)	8-1/2 (216)	3 (76)
		22, 25	3-3/4 (95)	7-9/16 (192)	8-3/16 (208)	2-7/8 (72)
		24, 26	4-5/16 (110)	7-7/8 (200)	9-1/8 (231)	3-1/4 (82)
		27	3-1/16 (78)	8 (203)	8-1/2 (216)	3 (76)
	1-1/4	41, 42, 43, 45	3 (76)	7-1/4 (184)	8-7/16 (215)	3-1/8 (79)
		44, 46	3-5/8 (92)	7-1/4 (184)	9-1/8 (231)	3-1/4 (82)
	1-1/2	51, 53	4-11/16 (119)	7-9/16 (192)	9-1/8 (231)	3-1/4 (82)
		52, 54	4-1/16 (103)	7-1/16 (179)	9-5/8 (244)	3-3/4 (95)
	2	61, 65	4-21/32 (118)	7-1/2 (191)	9-5/8 (244)	3-3/4 (95)
		63, 66, 67	4-15/16 (125)	7-7/16 (189)	10-3/8 (264)	4-1/16 (103)
	2-1/2	71, 72, 76, 73, 74, 75	4-3/4 (121)	7-9/16 (192)	10-3/8 (264)	4-1/16 (103)
	3	82, 85	5-1/16 (129)	7-3/4 (197)	10-9/16 (268)	4-1/16 (103)

^a To find the corresponding flow coefficients for these port codes, refer to "Port Codes for Schneider Electric DuraDrive Ball Valve Assemblies" on page 6.

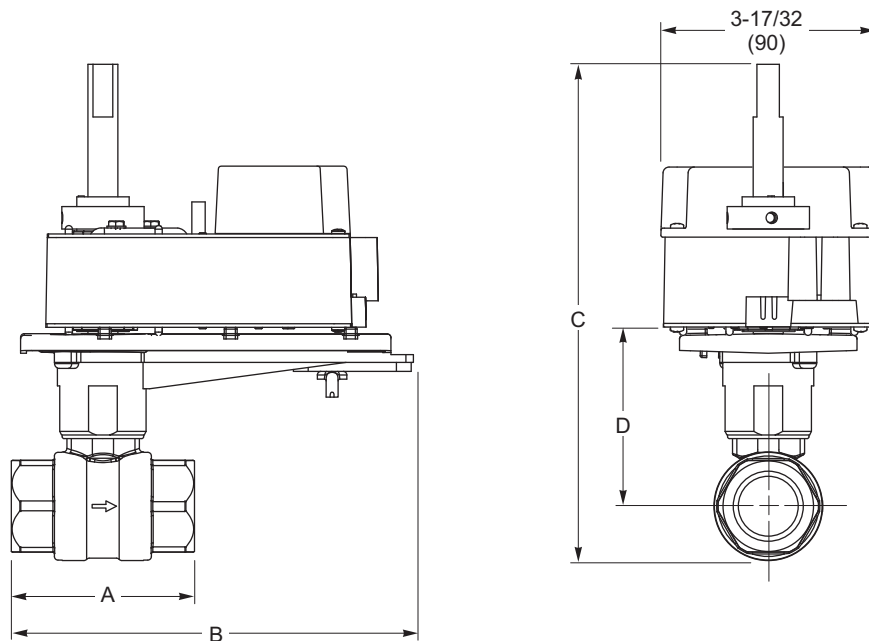


Figure-5 MF4E-60830-100 with 2-Way Ball Valve.

3-Way Ball Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	P Code ^a	Valve Dimensions in inches (millimetres) (Refer to Figure-6)				
			A	B	C	D	E
3-Way VF-2313-880-9-P	1	21, 22, 23, 24, 25, 28	3-3/4 (95)	7-11/16 (195)	9-1/2 (238)	2-7/8 (72)	2-1/16 (52)
		27, 30	3-1/16 (78)	7-1/4 (184)	9-7/8 (251)	3 (76)	2-7/16 (62)
		26, 29, 31	4-5/16 (110)	8-1/4 (210)	10-7/8 (275)	3-1/4 (82)	3-1/8 (80)
	1-1/4	45	3 (76)	6-3/4 (171)	9-7/8 (251)	3 (76)	2-7/16 (61)
		41, 43, 44, 46	3-5/8 (92)	7-5/8 (194)	10-1/2 (267)	3-1/4 (82)	2-13/16 (72)
	1-1/2	51, 52, 53, 55	4-1/2 (114)	7-3/4 (197)	10-3/8 (264)	3-1/4 (82)	2-3/4 (69)
		54, 56	4-1/16 (103)	7-1/4 (184)	11-3/8 (288)	3-3/4 (95)	3-3/16 (81)
	2	61, 63	3-15/16 (100)	7-1/8 (181)	11-1/4 (287)	3-3/4 (95)	3-1/8 (79)
		62, 64	5 (127)	7-3/4 (197)	12-1/4 (314)	4-1/16 (103)	3-7/8 (98)

^a To find the corresponding flow coefficients for these port codes, refer to "Port Codes for Schneider Electric DuraDrive Ball Valve Assemblies" on page 6.

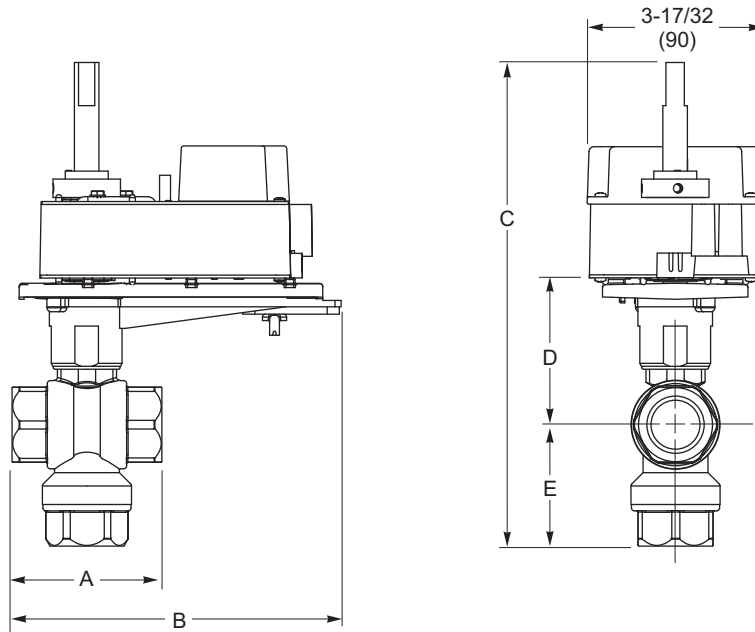


Figure-6 MF4E-60830-100 with 3-Way Ball Valve.

Valve Assemblies with Mx40-704x Spring Return Schneider Electric DuraDrive Actuators

Note: The Ball Valve Assemblies use the basic Mx41-6043, Mx41-6083, and Mx40-704x Schneider Electric DuraDrive actuators. Specifications for actuators containing auxiliary switches are also provided here. Ball valve assemblies using the switch-equipped actuators may be field-assembled using ball valve body/linkage assemblies (VB-2x13-500-9-xx).

Actuator Specifications

Inputs

Control Signal
MA40-704x: ON/OFF SPST control contacts or Triacs (500 mA rated)
MS40-7043: Proportional, 2 to 10Vdc or 4 to 20 mAdc with 500 Ohm resistor.
MS40-7043 MP/MP5: Proportional 6 to 9 Vdc.
MF40-7043: Floating point control, 24 Vac.

Power Requirements All 24 Vac circuits are Class 2.

Part Number	Voltage 50/60 Hz	Voltage Vdc	Running				Holding	
			50 Hz		60 Hz		50 Hz	60 Hz
			VA	W	VA	W	W	W
MA40-7043	24 Vac ± 20%	22 to 30	4.4	2.9	4.4	2.9	0.8	0.8
MS40-7043	24 Vac ± 20%	22 to 30	5.6	4.2	5.6	4.2	2.4	2.4
MF40-7043	24 Vac ± 20%	22 to 30	5.9	4.4	5.9	4.4	2.9	2.9
MS40-7043-MP	24 Vac ± 20%	22 to 30	6.9	5.0	6.6	5.0	3.2	3.2
MS40-7043-MP5	24 Vac ± 20%	22 to 30						
MA40-7040	120 Vac ± 10%	—	6.4	3.8	4.3	3.4	1.6	1.2

Connections
MA40-704x and MA40-704x-501: 3 ft. (0.9 m) long, appliance cable, 1/2 in. conduit connector. For M20 Metric conduit, use AM-756 adaptor.
MF40-7043 and MF40-7043-501, MS40-7043 and MS40-7043-501: 3 ft. (0.9 m) long, plenum rated cable, 1/2 in. conduit connector. For M20 Metric conduit, use AM-756 adaptor.

Motor Type
MA40-704x: Brush DC.
MF40-7043, MS40-7043: Brushless DC.

Outputs

Electrical
Auxiliary Switches: Available when actuators are ordered as separate units. Auxiliary switches are not offered with factory ball valve assemblies.
Mx40-7043-501 and MS40-7043-MP5 One auxiliary switch available. SPDT 6 A resistive @ 24 Vac, adjustable 0 to 95° (0 to 1 scale). Switch meets VDE requirements for 6 (1.5) A, 24 Vac.
MA40-7040-501 One auxiliary switch available. SPDT 6 A resistive @ 250 Vac, adjustable 0 to 95° (0 to 1 scale). Switch meets VDE requirements for 6 (1.5) A, 250 Vac.
Position Feedback Voltage: 2 to 10 Vdc (maximum 0.7 mA) output signal for position feedback or operation of up to four slave actuators.
Control Mode: Switch provided for selection of direct acting or reverse acting control mode on proportional models.
Timing: MA-704x — Approx. 50 sec.; MF- and MS-7043 — Approx. 130 sec.
Auxiliary Power Supply: MS40-7043-MP and MS40-7043-MP5 — +20 Vdc @ 25 mA (max.)

Mechanical
Stroke: Angle of rotation is limited to a maximum of 95°, with mechanical stop.
Output torque rating: Mx40-704x — 35 lb-in (4 N-m)
Position indicator: Visual scale numbered from 0 to 90°, provided for position indication.

Environment

Temperature Limits
Shipping and storage: -40 to 160 °F (-40 to 71 °C) ambient.
Operating: -22 to 140 °F (-30 to 60 °C) ambient.

Humidity 5 to 95% RH, non-condensing.

Locations NEMA Type 2 (IEC IP54)

Agency Listings (Actuator)

UL UL 873, Underwriters Laboratories (File #9429 Category Temperature-Indicating and Regulating Equipment).

European Community EMC Directive (89/336/EEC). Low Voltage Directive (72/23/EEC).

cUL Canadian Standards C22.2 No. 24.

Australia This product meets requirements to bear the C-Tick Mark according to the terms specified by the Communications Authority under the Radiocommunications Act 1992.

2-Way Ball Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	P Code ^a	Valve Dimensions in inches (millimetres) (Refer to Figure-7)			
			A	B	C	D
2-Way VA-2213-522-9-P VA-2213-526-9-P VA-2213-532-9-P VA-2213-536-9-P VF-2213-526-9-P VF-2213-536-9-P VS-2213-526-9-P VS-2213-536-9-P	1	21, 23	3-1/16 (78)	7-1/4 (184)	8-1/2 (216)	3 (76)
		22, 25	3-3/4 (95)	7-9/16 (192)	8-3/16 (208)	2-7/8 (72)
		24, 26	4-5/16 (110)	7-7/8 (200)	9-1/8 (231)	3-1/4 (82)
		27	3-1/16 (78)	8 (203)	8-1/2 (216)	3 (76)
	1-1/4	41, 42, 43, 45	3 (76)	7-1/4 (184)	8-7/16 (215)	3-1/8 (79)
		44, 46	3-5/8 (92)	7-1/4 (184)	9-1/8 (231)	3-1/4 (82)
	1-1/2	51, 53	4-11/16 (119)	8-1/16 (205)	9-1/8 (231)	3-1/4 (82)
		52, 54	4-1/16 (103)	7-1/2 (190)	9-5/8 (244)	3-3/4 (95)
	2	61, 65	4-21/32 (118)	8 (203)	9-5/8 (244)	3-3/4 (95)
		63, 66, 67	4-15/16 (125)	7-7/8 (200)	10-3/8 (264)	4-1/16 (103)
	2-1/2	71, 72, 76, 73, 74, 75	4-3/4 (121)	8 (203)	10-3/8 (264)	4-1/16 (103)
	3	82, 85	5-1/16 (129)	8-1/4 (210)	10-9/16 (268)	4-1/16 (103)

^a To find the corresponding flow coefficients for these port codes, refer to "Port Codes for Schneider Electric DuraDrive Ball Valve Assemblies" on page 6.

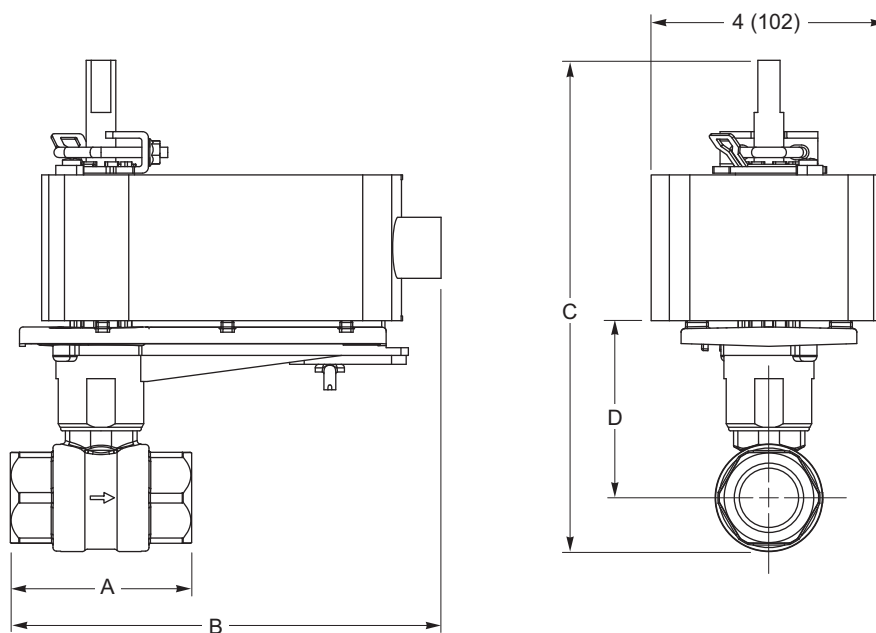


Figure-7 Mx40-704x with 2-Way Ball Valve.

3-Way Ball Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	P Code ^a	Valve Dimensions in inches (millimetres) (Refer to Figure-8)				
			A	B	C	D	E
3-Way VA-2313-526-9-P VA-2313-536-9-P VF-2313-526-9-P VF-2313-536-9-P VS-2313-526-9-P VS-2313-536-9-P	1	21, 22, 23, 24, 25, 28	3-3/4 (95)	7-11/16 (195)	9-1/2 (238)	2-7/8 (72)	2-1/16 (52)
		27, 30	3-1/16 (78)	7-1/4 (184)	9-7/8 (251)	3 (76)	2-7/16 (62)
		26, 29, 31	4-5/16 (110)	8-1/4 (210)	10-7/8 (275)	3-1/4 (82)	3-1/8 (80)
	1-1/4	45	3 (76)	7-1/4 (184)	9-7/8 (251)	3 (76)	2-7/16 (61)
		41, 43, 44, 46	3-5/8 (92)	7-5/8 (194)	10-1/2 (267)	3-1/4 (82)	2-13/16 (72)
	1-1/2	51, 52, 53, 55	4-1/2 (114)	8-1/4 (210)	10-3/8 (264)	3-1/4 (82)	2-3/4 (69)
		54, 56	4-1/16 (103)	7-1/16 (179)	11-3/8 (288)	3-3/4 (95)	3-3/16 (81)
	2	61, 63	3-15/16 (100)	7-9/16 (192)	11-1/4 (287)	3-3/4 (95)	3-1/8 (79)
		62, 64	5 (127)	8-1/4 (210)	12-1/4 (314)	4-1/16 (103)	3-7/8 (98)

^a To find the corresponding flow coefficients for these port codes, refer to "Port Codes for Schneider Electric DuraDrive Ball Valve Assemblies" on page 6.

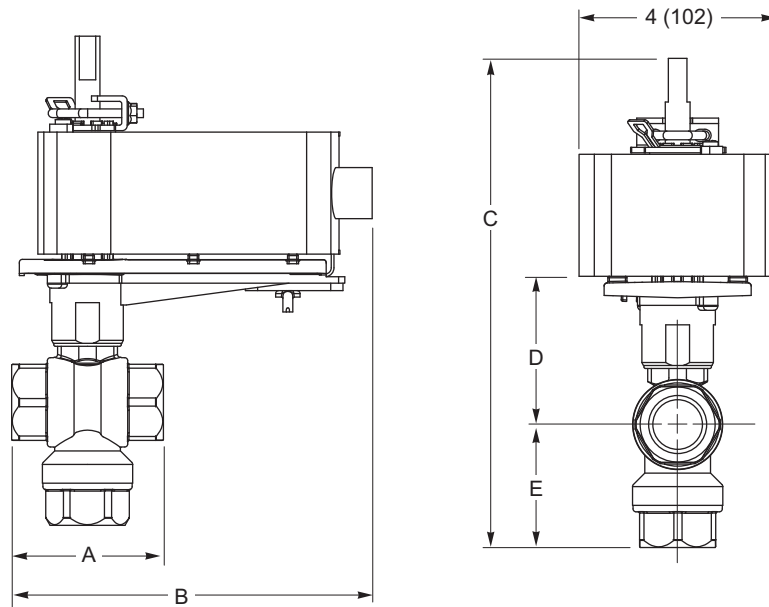


Figure-8 Mx40-704x with 3-Way Ball Valve.

Valve Assemblies with Mx4D-703x and Mx4D-803x Spring Return Schneider Electric DuraDrive Actuators

Actuator Specifications													
Inputs													
Control Signal and Power Requirements	All 24 Vac circuits are Class 2. All circuits 30 Vac and above are Class 1.												
	Part Number for Mx4D-703x-xxx Mx4D-803x-xxx	Control Signal	Voltage	Actuator Power Input									
				Running			Holding						
				50/60 Hz		DC Amps	50/60 Hz						
				VA	W		W						
	MA4D-x033-000	2 Position SPST	24 Vac \pm 20% or 20 to 30 Vdc	5.1	3.6	0.14	1.3						
	MA4D-x033-100												
	MA4D-x030-000			120 Vac \pm 10% 50/60 Hz	7.8	5.0	—	2.5					
	MA4D-x031-000		230 Vac \pm 10% 50/60 Hz	7.2	5.2	—	2.4						
	MF4D-x033-000	Floating	24 Vac \pm 20% or 20 to 30 Vdc	6.8	4.2	0.15	1.9						
	MF4D-x033-100												
	MS4D-x033-000	2 to 10 Vdc ^a		24 Vac \pm 20% or 20 to 30 Vdc	6.1	3.4	0.12	1.4					
	MS4D-x033-100	Proportional											
	MS4D-x033-020	0 to 3 Vdc											
	MS4D-x033-120	Proportional											
MS4D-x033-030	6 to 9 Vdc												
MS4D-x033-130	Proportional												
MS4D-x033-050	0 to 10 Vdc												
MS4D-x033-150	Proportional												
MS4D-x033-060	4 to 20 mAdc												
MS4D-x033-160	Proportional												
^a 4 to 20 mAdc with field-installed 500 Ω resistor.													
Connections	Mx4D-703x-0x0 and Mx4D-803x-0x0: 3 ft. (0.9 m) long, appliance cable, 1/2 in. (13 mm) conduit connector. For M20 Metric conduit, use AM-756 adaptor. Mx4D-703x-1x0 and Mx4D-803x-1x0: 10 ft. (3.05 m) long, plenum cable, 1/2 in. (13 mm) conduit connector. For M20 Metric conduit, use AM-756 adaptor.												
Motor Type	Brush DC.												
Outputs													
Electrical	Timing:	Part Number	Approx. Timing in Sec. @ 70 °F (21 °C)^a										
			Powered	Spring Return									
				CCW^b	CW^b								
		MA4D-703x	56	26	—								
		MF4D-703x MS4D-703x	85	21	—								
		MA4D-803x	56	—	26								
		MF4D-803x MS4D-803x	85	—	21								
^a Timing was measured with no load applied to actuator.													
^b CCW or CW as viewed from cover side of actuator.													
Position Feedback Voltage: For 0 to 3 Vdc, 0 to 9 Vdc, and 0 to 10 Vdc proportional actuators, the feedback signal is the same voltage range as the input signal. The 4 to 20 mA proportional actuators and floating actuators have a 2 to 10 Vdc feedback signal. The feedback signal can supply up to 0.5 mA to operate up to four additional slave actuators.													
Mechanical	Stroke: 93° nominal. Manual Override: Allows positioning of valve shaft, using a manual crank. Output torque rating: 30 lb-in (3.4 N-m). RA/DA Jumper (Proportional Models): Permits selection of reverse acting or direct acting control. Position indicator: Visual indicator.												

Actuator Specifications (Continued)

Environment

Temperature Limits	Shipping and storage: -40 to 160 °F (-40 to 71 °C) ambient. Operating: -22 to 140 °F (-30 to 60 °C) ambient.
Humidity	15 to 95% RH, non-condensing.
Locations	NEMA 1, NEMA 2, UL Type 2 (IEC IP54) with customer-supplied watertight conduit connectors. Enclosure is air plenum rated.

Agency Listings (Actuator)

UL	UL 873, Underwriters Laboratories (File #9429 Category Temperature-Indicating and Regulating Equipment). Plenum rated.
European Community	EMC Directive (89/336/EEC). Low Voltage Directive (72/23/EEC). This product fits into Installation Category (Overvoltage Category) II per EN 61010-1.
cUL	Canadian Standards C22.2 No. 24-93.
Australia	This product meets requirements to bear the C-Tick Mark according to the terms specified by the Communications Authority under the Radiocommunications Act 1992.

2-Way Ball Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	P Code ^a	Valve Dimensions in inches (millimetres) (Refer to Figure-9)			
			A	B	C	D
2-Way VA-2213-815-9-P thru VA-2213-818-9-P VA-2213-821-9-P VA-2213-831-9-P	1	21, 23	3-1/16 (78)	7 (178)	8-1/2 (216)	3 (76)
		22, 25	3-3/4 (95)	7-3/8 (188)	8-3/16 (208)	2-7/8 (72)
		24, 26	4-5/16 (110)	7-5/8 (194)	9-1/8 (231)	3-1/4 (82)
VF-2213-821-9-P VF-2213-831-9-P VS-2213-821-9-P thru VS-2213-839-9-P		27	3-1/16 (78)	7-13/16 (200)	8-1/2 (216)	3 (76)

^a To find the corresponding flow coefficients for these port codes, refer to "Port Codes for Schneider Electric DuraDrive Ball Valve Assemblies" on page 6.

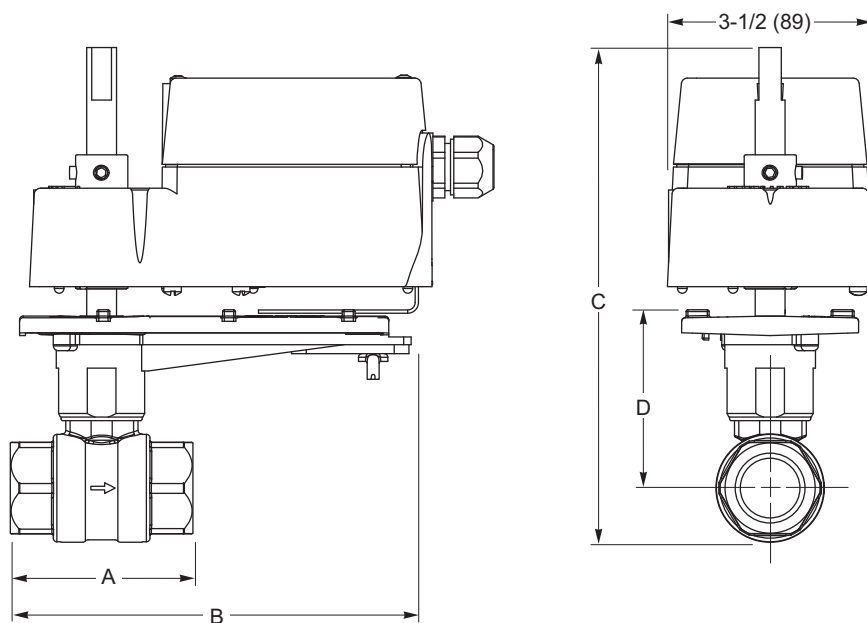


Figure-9 MA4D-703x, MF4D-703x, MS4D-703x, MA4D-803x, MF4D-803x, or MS4D-803x with 2-Way Ball Valve.

3-Way Ball Valve Assembly Dimensions

Valve Assembly Part Number	Valve Size in.	P Code ^a	Valve Dimensions in inches (millimetres) (Refer to Figure-10)				
			A	B	C	D	E
3-Way VA-2313-815-9-P thru VA-2313-818-9-P VA-2313-821-9-P VA-2313-831-9-P	1	21, 22, 23, 24, 25, 28	3-3/4 (95)	7-1/2 (191)	9-1/2 (238)	2-7/8 (72)	2-1/16 (52)
		27, 30	3-1/16 (78)	7 (178)	9-7/8 (251)	3 (76)	2-7/16 (62)
		26, 29, 31	4-5/16 (110)	7 (178)	10-7/8 (275)	3-1/4 (82)	3-1/8 (80)
VF-2313-821-9-P VF-2313-831-9-P							
VS-2313-821-9-P thru VS-2313-839-9-P							

^a To find the corresponding flow coefficients for these port codes, refer to "Port Codes for Schneider Electric DuraDrive Ball Valve Assemblies" on page 6.

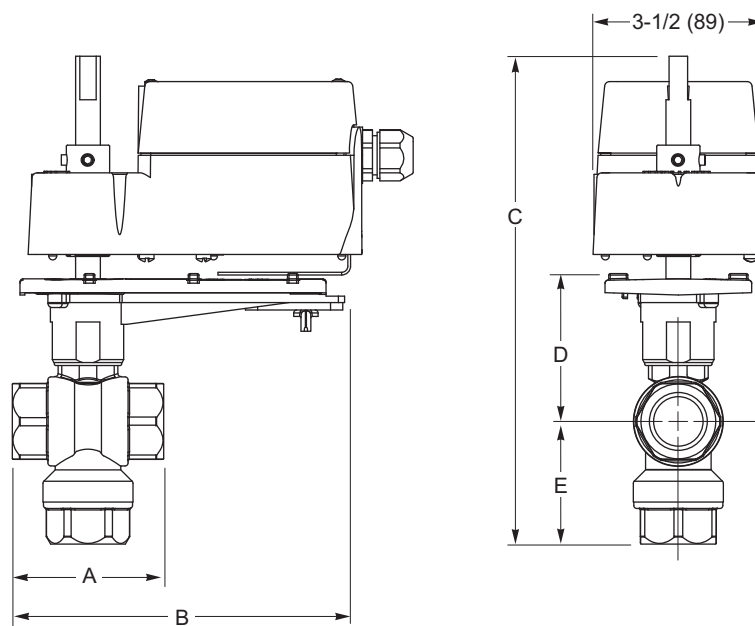


Figure-10 MA4D-703x, MF4D-703x, MS4D-703x, MA4D-803x, MF4D-803x, or MS4D-803x with 3-Way Ball Valve.

Installation Considerations

Mounting Angle of Valve Assembly

Be sure to allow the necessary clearance around the valve assembly. The valve assembly must be mounted so that the actuator is horizontally even with, or above, the valve. This ensures that any condensate that forms on the valve body will not travel into the actuator, where it may cause corrosion or electrical malfunction. See *Vx-2x13-5xx-9-xx Series Ball Valve Assembly Installation Instructions, F-27087* or *Mx4D-xxxxSeries Schneider Electric DuraDrive Rotary Overshaft Actuators General Instructions, F-27170*.

Piping

Figure-11 and Figure-12 illustrate 2-way and 3-way ball valve assembly piping.

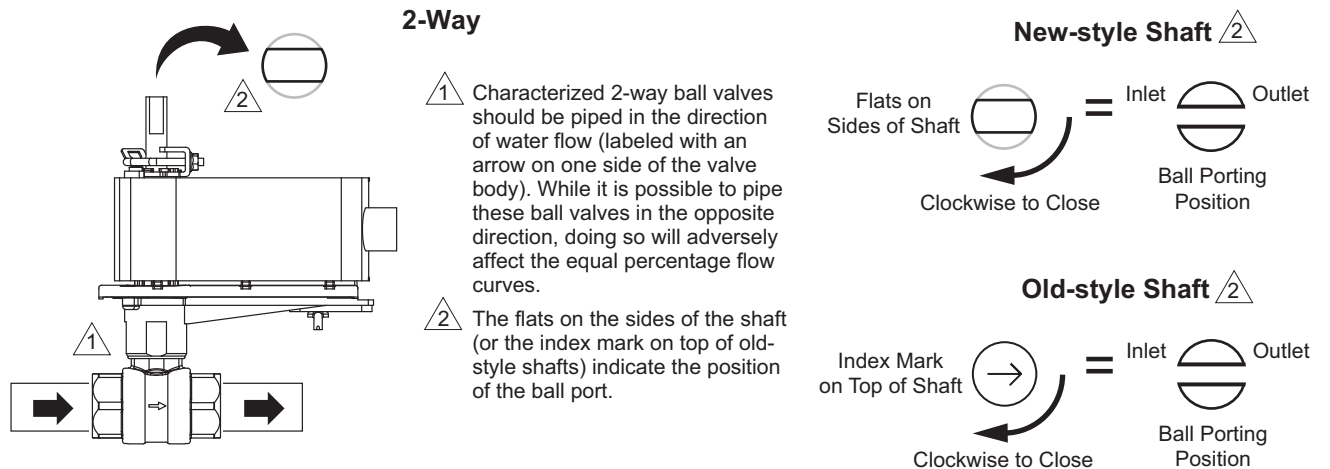


Figure-11 2-Way Valve Assemblies Piping Diagram.

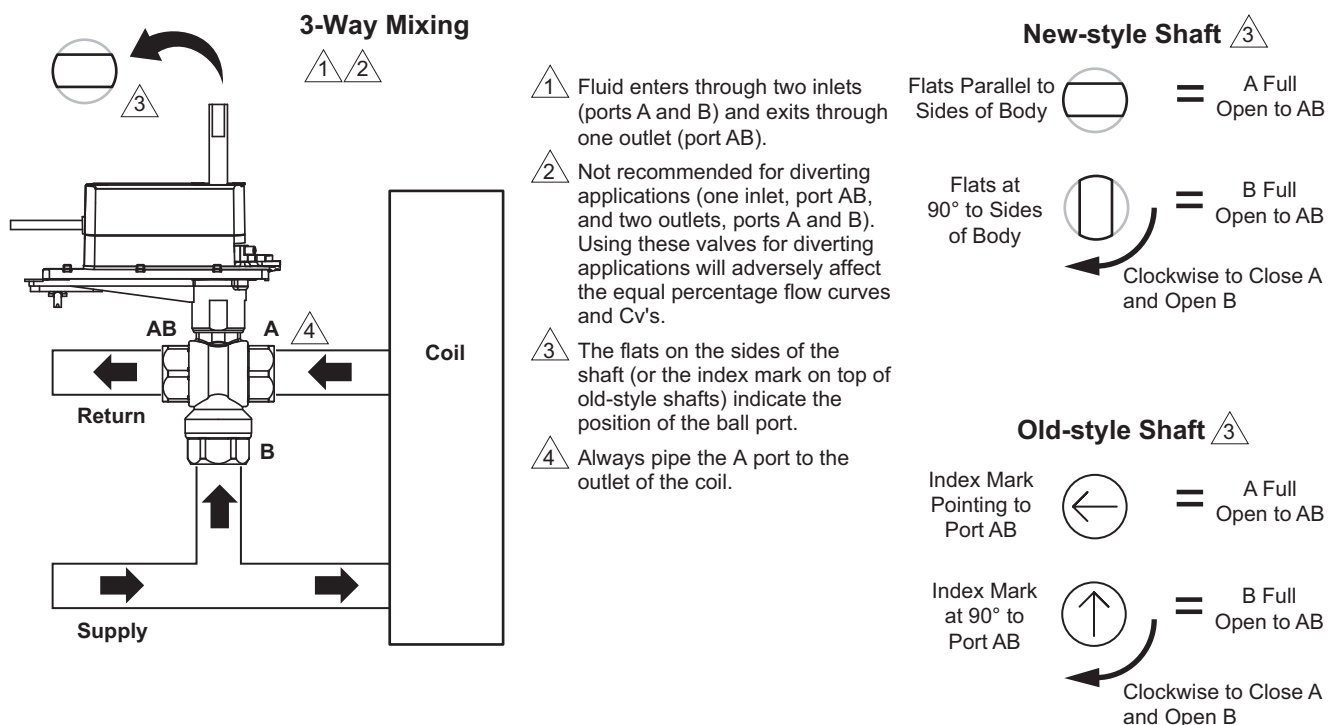


Figure-12 3-Way Mixing Valve Assemblies Piping Diagram.

Insulation of Ball Valve Assembly

The ball valve should be completely insulated to minimize the effect of heat transfer and condensation at the actuator.

Caution: The actuator itself must not be insulated. Doing so can result in excess heat or condensation within the actuator.

Temperature Limits for Ball Valve Assembly

When installing the ball valve assembly, observe the minimum and maximum temperature limits. Refer to the valve and actuator specifications on pages 7, 12, 15, 18, 21, and 24.

Water System Maintenance

All heating and cooling systems are susceptible to valve and system problems caused by improper water treatment and system storage procedures. Durability of valve stems and packings is dependent on maintaining non-damaging water conditions. Inadequate water treatment or filtration, not in accordance with chemical supplier or ASHRAE handbook recommendations, can result in corrosion, scale, and abrasive particle formation. Scale and particulates can cause scratches in the stem and packing, and can adversely affect packing life and other parts of the hydronic system. Consult *EN-205, Water System Guidelines Engineering Information*, F-26080, for further details.

Sizing and Selection

Flow Coefficient (Cv)

When sizing a valve, you must select a flow coefficient (Cv), which is defined as the flow rate in gallons per minute (GPM) of 60 °F water that will pass through the fully open valve with a 1 psi pressure drop (ΔP). It is calculated according to this formula:

$$C_v = \frac{\text{gpm}}{\sqrt{\Delta P}}, \text{ where } \Delta P \text{ is measured in psi.}$$

Since the flow rate through the heat exchanger is usually specified, the only variable normally available in sizing a valve is the pressure drop. The following information in this section can be used to determine what pressure drop to use in calculating a valve Cv. Once you have calculated the Cv, consult Table-2 to select the valve body having the nearest available Cv.

Note: Metric equivalent.

- The metric measure of flow coefficient is k_{vs} , which is calculated according to the formula: $k_{vs} = \frac{\text{m}^3/\text{h}}{\sqrt{\Delta P}}$ (where ΔP is measured in bar; 1 bar = 100 kPa).
 - If the C_v is already known, it may be converted directly to its k_{vs} equivalent: $k_{vs} = \frac{C_v}{1.156}$.
-

Two-position Control

Two-position control valves are normally selected “line size” to keep pressure drop at a minimum. If it is desirable to reduce the valve below line size, then 10% of “available pressure” (that is, the pump pressure differential available between supply and return mains, with design flow at the valve location) is normally used to select the valve.

Flow Characterization for Proportional and Floating Control

The Vx-2x13-xxx-9-xx series ball valve assemblies provide equal percentage flow, which is achieved with a flow characterizing insert (Figure-13). The parabolic shape of the orifice allows a gradual change in flow, so that equal movements of the valve stem, at any point of the flow range, change the existing flow an equal percentage, regardless of the flow rate. As shown in the graph in Figure-14, a ball valve equipped with the flow insert mirrors the flow characteristic of the coil, resulting in linear heat transfer.

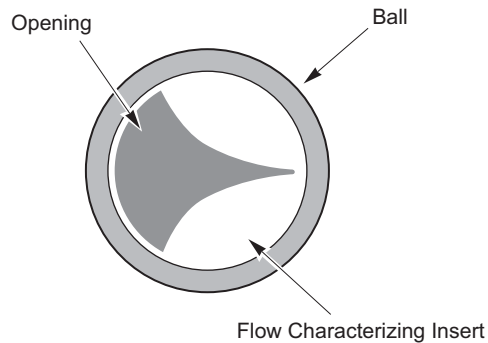


Figure-13 Flow Characterizing Insert

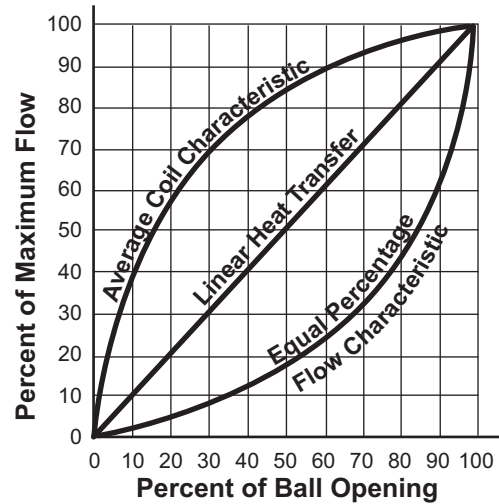


Figure-14 Equal Percentage Flow Control

Proportional control valves are usually selected to take a pressure drop equal to at least 50% of the “available pressure.” As “available pressure” is often difficult to calculate, the normal procedure is to select the valve using a pressure drop at least equal to the drop in the coil or other load being controlled (except where small booster pumps are used) with a minimum recommended pressure drop of 5 psi (34 kPa). When the design temperature drop is less than 60 °F (33 °C) for conventional heating systems, higher pressure drops across the valve are needed for good results (Table-8).

Table-8 Conventional Heating System.

Design Temperature Load Drop °F (°C)	Recommended Pressure Drop (% of Available Pressure)	Multiplier on Load Drop
60 (33) or More	50%	1 x Load Drop
40 (22)	66%	2 x Load Drop
20 (11)	75%	3 x Load Drop

Secondary Circuits with Small Booster Pumps: 50% of available pressure difference (equal to the drop through load, or 50% of the booster pump head).

3-Way Mixing Valves

3-way mixing valves used in variable flow applications (Figure-12) should be sized using the preceding guidelines. 3-way mixing valves used in constant flow applications (e.g. boiler bypass) should be sized to use 20% of “available pressure,” or equal to 25% of the pressure drop through the load at full flow.

Cavitation Limitations on Valve Pressure Drop

A valve selected with too high a pressure drop can cause erosion and/or wire drawing of the flow characterizing insert. In addition, cavitation can cause noise, damage to the valve trim (and possibly the body), and choke the flow through the valve.

Do not exceed the maximum differential pressure (pressure drop) for the valve selected. Refer to the chart in Figure-15.

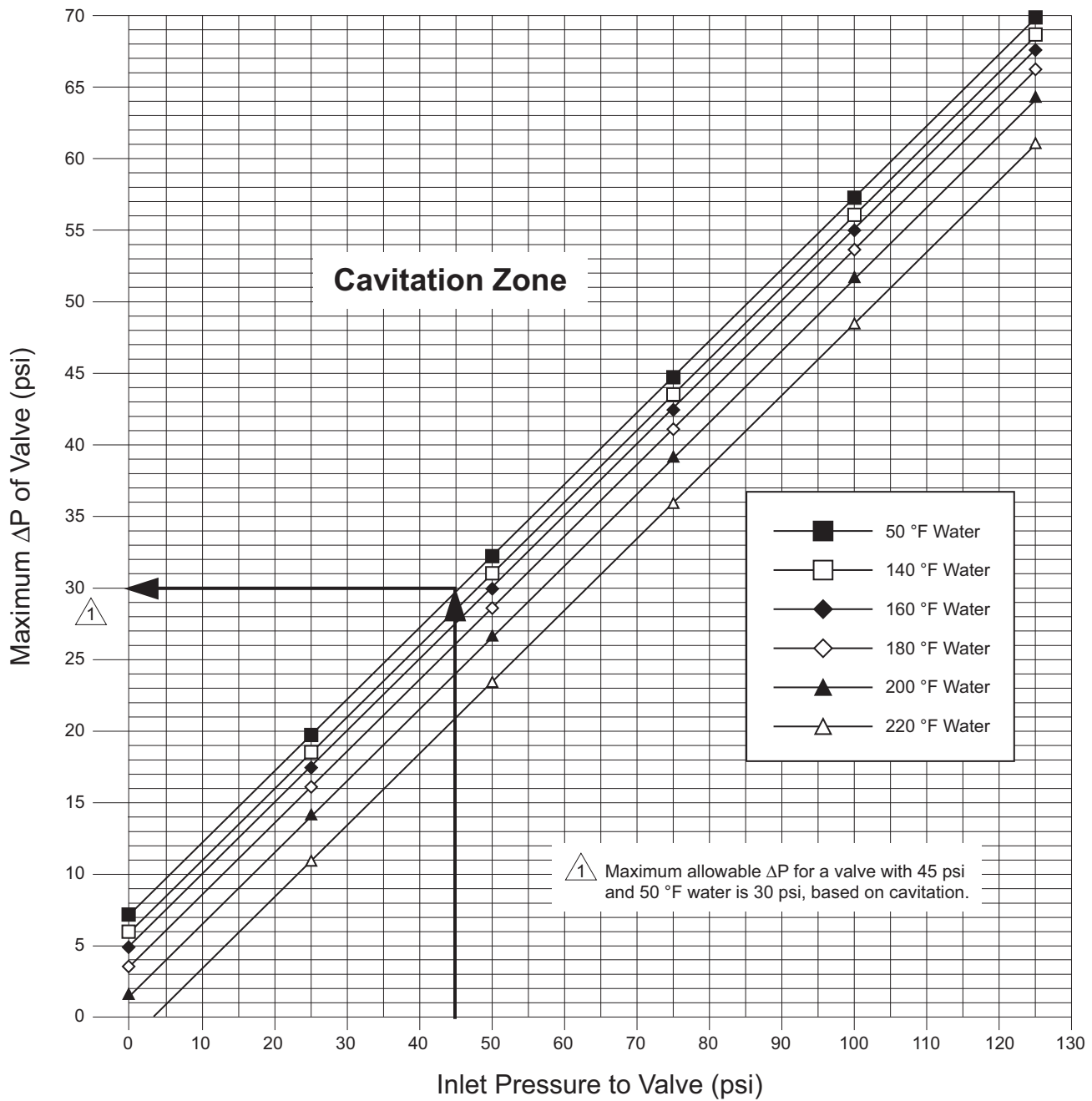


Figure-15 Maximum Allowable Differential Pressure (ΔP) for Water Valves.

Using Pipe Reducers with 2-Way Ball Valve Assemblies

The following table provides estimated effective C_v 's when using pipe reducers with 2-way ball valve assemblies. Use these estimated effective C_v 's in place of the rated C_v 's when reducers or increasers are located within 6 pipe diameters upstream and 3 pipe diameters downstream of the valve.



Warning: Do not reduce the valve size to less than one-half the line size, as this may weaken the pipe reduction area. Physical injury can result if the weakened piping fails.

Table-9 Estimated Effective C_v when Using Pipe Reducers with 2-Way Ball Valve Assemblies.

Valve Size (in.)	P Code	C_v	Estimated Effective C_v (k_{vs})							
			Pipe Size - inches (NPT)							
			1	1-1/4	1-1/2	2	2-1/2	3	4	5
1	21	4.4	4.4 (3.8)	4.4 (3.8)	4.4 (3.8)	4.4 (3.8)	—	—	—	—
	22	9.0	9.0 (7.8)	8.9 (7.4)	8.8 (7.6)	8.7 (7.5)	—	—	—	—
	23	15.3	15.3 (13.2)	14.9 (12.9)	14.4 (12.5)	13.8 (11.9)	—	—	—	—
	24	26.1	26.1 (22.5)	24.4 (21.1)	22.4 (19.4)	20.3 (17.5)	—	—	—	—
	25	28.4 ^a	28.4 (24.6)	26.2 (22.7)	23.8 (20.6)	21.4 (18.5)	—	—	—	—
	26	43.9 ^a	43.9 (38.0)	36.8 (31.8)	31.0 (26.8)	26.1 (22.6)	—	—	—	—
	27	54.2 ^a	54.2 (46.8)	42.3 (36.6)	34.1 (29.5)	27.9 (24.1)	—	—	—	—
1-1/4	41	4.4	—	4.4 (3.8)	4.4 (3.8)	4.4 (3.8)	4.4 (3.8)	—	—	—
	42	8.3	—	8.3 (7.2)	8.3 (7.2)	8.2 (7.1)	8.2 (7.1)	—	—	—
	43	14.9	—	14.9 (12.9)	14.8 (12.8)	14.5 (12.5)	14.3 (12.3)	—	—	—
	44	36.5	—	36.5 (31.6)	35.0 (30.3)	31.5 (27.2)	29.6 (25.6)	—	—	—
	45	41.1 ^a	—	41.1 (35.5)	39.0 (33.7)	34.3 (29.7)	31.9 (27.5)	—	—	—
	46	102.3 ^a	—	102.3 (88.1)	79.1 (68.4)	53.3 (46.1)	45.5 (39.3)	—	—	—
1-1/2	51	22.8	—	—	22.8 (19.7)	22.4 (19.4)	22.0 (19.0)	21.8 (18.9)	—	—
	52	41.3	—	—	41.3 (35.7)	39.3 (33.9)	37.2 (32.1)	36.0 (31.1)	—	—
	53	73.9 ^a	—	—	73.9 (63.9)	63.7 (55.1)	55.9 (48.4)	52.0 (45.0)	—	—
	54	171.7 ^a	—	—	171.7 (148.5)	101.2 (87.5)	76.6 (66.3)	67.2 (58.0)	—	—
2	61	41.7	—	—	—	41.7 (36.1)	41.2 (35.6)	40.6 (35.1)	39.7 (34.3)	—
	63	71.1	—	—	—	71.1 (61.4)	68.8 (59.5)	65.9 (57.0)	62.4 (53.9)	—
	65	108.0 ^a	—	—	—	108.0 (93.4)	100.3 (86.8)	92.0 (79.6)	83.0 (71.8)	—
	66	210.0	—	—	—	210.0 (181.7)	165.9 (143.5)	134.6 (116.4)	110.5 (95.6)	—
	67	266.0 ^a	—	—	—	266.0 (229.7)	189.7 (164.1)	146.4 (126.6)	116.7 (100.8)	—
2-1/2	71	45.0	—	—	—	—	45.0 (38.9)	43.6 (37.7)	42.5 (36.8)	42.0 (36.3)
	72	55.0	—	—	—	—	55.0 (47.5)	52.5 (45.3)	50.6 (43.7)	49.7 (42.9)
	73	72.3	—	—	—	—	72.3 (62.5)	66.6 (57.6)	63.0 (54.5)	61.2 (52.9)
	74	101.0	—	—	—	—	101.0 (87.4)	87.5 (75.7)	79.7 (68.9)	76.2 (65.9)
	75	162.0	—	—	—	—	162.0 (140.0)	119.0 (102.9)	101.3 (87.6)	94.3 (81.6)
	76	202.0 ^a	—	—	—	—	202.0 (174.4)	132.4 (114.5)	109.3 (94.5)	100.6 (87.0)
3	82	63.0	—	—	—	—	—	63.0 (54.4)	56.7 (49.0)	55.5 (47.9)
	85	145.0 ^a	—	—	—	—	—	145.0 (125.2)	96.8 (83.7)	90.6 (78.4)

^a Denotes a full port valve, without the characterized insert.

Using Pipe Reducers with 3-Way Ball Valve Assemblies

The following table provides estimated effective C_v 's when using pipe reducers with 3-way ball valve assemblies. Use these estimated effective C_v 's in place of the rated C_v 's when reducers or increasers are located within 6 pipe diameters upstream and 3 pipe diameters downstream of the valve.



Warning: Do not reduce the valve size to less than one-half the line size, as this may weaken the pipe reduction area. Physical injury can result if the weakened piping fails.

Table-10 Estimated Effective Cv when Using Pipe Reducers with 3-Way Ball Valve Assemblies.

Valve Size (in.)	P Code	C _v (A Port)	Estimated Effective C _v (k _{vs})				
			Pipe Size - inches (NPT)				
			1	1-1/4	1-1/2	2	2-1/2
1	21	0.40	0.40 (0.35)	0.40 (0.35)	0.40 (0.35)	0.40 (0.35)	—
	22	0.65	0.65 (0.56)	0.60 (0.52)	0.60 (0.52)	0.60 (0.52)	—
	23	1.3	1.3 (1.1)	1.3 (1.1)	1.3 (1.1)	1.3 (1.1)	—
	24	2.3	2.3 (2.0)	2.3 (2.0)	2.3 (2.0)	2.3 (2.0)	—
	25	3.5	3.5 (3.0)	3.5 (3.0)	3.5 (3.0)	3.5 (3.0)	—
	26	4.5	4.5 (3.9)	4.5 (3.9)	4.5 (3.9)	4.5 (3.9)	—
	27	8.6	8.6 (7.4)	8.5 (7.3)	8.4 (7.2)	8.3 (7.2)	—
	28	10.0 ^a	10.0 (8.6)	9.9 (8.6)	9.7 (8.4)	9.6 (8.3)	—
	29	14.9	14.9 (12.9)	14.6 (12.6)	14.1 (12.2)	13.5 (11.7)	—
	30	22.3 ^a	22.3 (19.2)	21.2 (18.3)	19.9 (17.2)	18.4 (15.9)	—
31	30.8 ^a	30.8 (26.6)	28.0 (24.2)	25.2 (21.8)	22.3 (19.3)	—	
1-1/4	41	4.1	—	4.1 (3.5)	4.0 (3.5)	4.0 (3.5)	4.0 (3.5)
	43	8.7	—	8.7 (7.5)	8.6 (7.4)	8.6 (7.4)	8.5 (7.4)
	44	12.7	—	12.7 (11.0)	12.6 (10.9)	12.4 (10.7)	12.3 (10.6)
	45	19.4 ^a	—	19.4 (16.8)	19.2 (16.6)	18.5 (16.0)	18.1 (15.7)
	46	34.1 ^a	—	34.1 (29.4)	32.9 (28.4)	29.9 (25.9)	28.3 (24.4)
1-1/2	51	4.0	—	—	4.0 (3.5)	4.0 (3.5)	4.0 (3.5)
	52	8.3	—	—	8.3 (7.2)	8.2 (7.1)	8.2 (7.1)
	53	13.4	—	—	13.4 (11.6)	13.3 (11.5)	13.2 (11.4)
	54	23.5	—	—	23.5 (20.3)	23.1 (19.9)	22.7 (19.6)
	55	32.0 ^a	—	—	32.0 (27.7)	31.0 (26.8)	30.0 (25.9)
	56	61.1 ^a	—	—	61.1 (52.8)	54.9 (47.5)	49.7 (43.0)
2	61	23.9	—	—	—	23.9 (20.7)	23.5 (20.3)
	62	38.2	—	—	—	38.2 (33.0)	37.8 (32.7)
	63	56.7 ^a	—	—	—	56.7 (49.0)	55.5 (47.9)
	64	108.5 ^a	—	—	—	108.5 (93.9)	100.7 (87.1)

^a Denotes a full port valve, without the characterized insert.

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