TECHNICAL INSTRUCTIONS
Iron Body Series 596 MI

Form TI596MI

UTILITY IRON BODY SERIES

DESCRIPTION

Powers Flowrite II Water Mix (MI) Valves combine hot and cold water proportionally to satisfy the demands of the controlling instrument. The valve's linear inherent characteristic produces equal changes in flow per unit of valve stroke regardless of plug position. The valve is air operated and can be used in a variety of mixing applications.

596 MI with 46 in² actuator shown

SPECIFICATIONS

VALVE	
Body Sizes:	2 1/2" – 6"
Body Material:	Cast Iron (per ASTM A126-93 Class B)
End Connectors:	125 # Flanged (per ASNI B16.1-1993)
Trim:	Bronze
Packing:	Spring loaded TFE packing
Seat Leakage:	ANSI Class III; <0.1 % leakage
Cv Range:	74-390
Rangeability:	100:1
Characteristics:	Linear/Mixing
Maximum Pressure:	200 psi @ Temp. <150°F
Max. Differential Press.:	50 psi
Temperature Range:	40 – 281° F
ACTUATOR	
Housing Construction:	Die cast aluminum
Diaphragm Construction:	Replaceable molded neoprene
Diaphragm Area:	46 in², 100 in²
Maximum Press. and Temp:	35 psi and 200°F
Ambient Shipping Limits:	- 40 to 220° F
Ambient Operating Limits:	- 20 to 220° F
Air Connection:	46 in² 1/4" NPT 100 in² 1/8" FNPT
Position Indication:	1/8" increments
Mounting:	In any upright position with actuator head above 45° of the center line of the valve body. Actuator head may be swiveled to any convenient position.

Sizes	Actuators Available
2 1/2"	46 in² or 100 in² Diaphragm
3"	46 in² or 100 in² Diaphragm
4"	46 in² or 100 in² Diaphragm
5"	100 in² Diaphragm
6"	100 in² Diaphragm

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CALIFORNIA PROPOSITION 65 WARNING

WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

(Installer: California law requires that this warning be given to the consumer.)

For more information: www.wattsind.com/prop65

APPLICATION INFORMATION

Flowrite II 596MI Valves are used for mixing hot and cold-water streams or bypassing flow with the valve in the return line. The controlling instrument positions the mixing valve to obtain the approximate mixture temperature.

Figure 1 shows an example of a mixing application, a typical boiler hot water control system. The cold inlet supply is fed to the upper inlet port (A port) of the valve as well as through the boiler for production of hot water to be fed into the bottom port (B port).

Figure 2 shows an example of a bypass application, piping for control of a heating or cooling coil, with the valve in the return line. The controlling instrument positions the valve so that the hot water will bypass the coil when the air is at the proper temperature. A pump is recommended in the coil loop to improve the heat transfer characteristics of the coil.

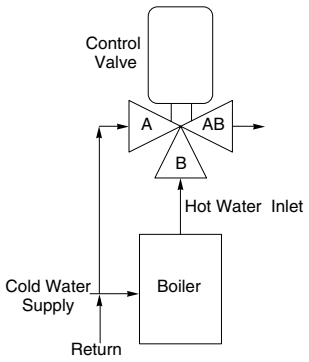


Figure 1 - Boiler Hot Water Control System

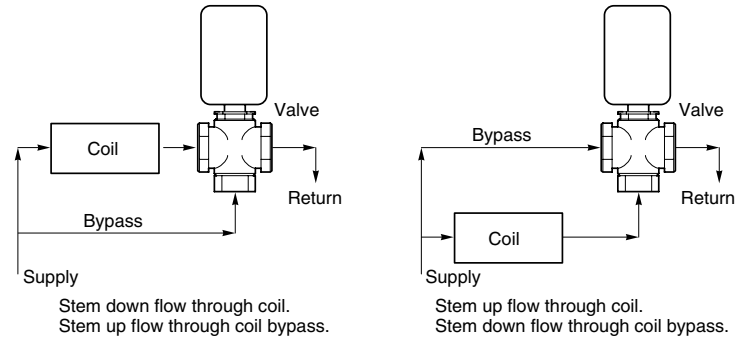


Figure 2 - Bypass Piping for Control of a Heating or Cooling Coil

THEORY OF OPERATION

Air pressure from the controlling instrument enters the pressure tight chamber of the actuator between the diaphragm and the upper housing. An increase in control air pressure causes the diaphragm to press down on the thrust plate, compressing the springs and moving the valve stem downward. In the valve, this reduces the flow through the "B" port and increases the flow through the "A" port.

Conversely, A decrease in control air pressure reduces the downward force on the actuator diaphragm, moving the thrust plate and stem upward. The flow through the "B" port is increased, and the flow through the "A" port is decreased.

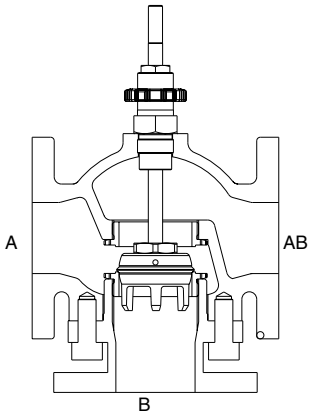


Figure 3 - Three-way valve

In temperature mixing applications the hot inlet is usually plumbed to the "A" side port, which will close on loss of signal. Otherwise, the "B" lower port is used for hot, "A" upper side port for cold, and the "AB" outlet for the mixed combination (see Figure 3).

Three-way mixing valves are designed so that the flow from either of the inlet ports to the outlet is approximately linear, which means the total flow from the outlet is almost constant over the stroke of the valve stem. See Figure-4 for typical flow characteristics of 596 MI.

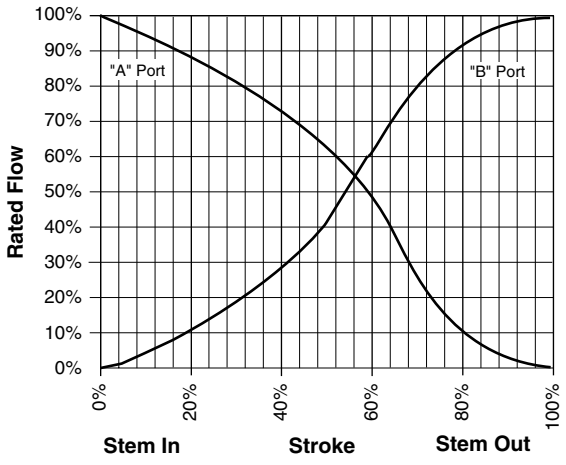


Figure 4 - Rated Flow vs Stroke Diagram

VALVE SIZING AND SELECTION

Note: Supply pressures (inlet) are affected by piping schedule, internal surface conditions, and vertical runs (back pressure) so the actual flowing pressure is best measured at the point of valve use.

Proportional to Mix Supply Flows

Proportional valves when used to blend two water flows control the output by varying the water temperature to the heat exchanger at constant flow.

These valves require high pressure drops for good control results. They can be sized for a pressure drop of 20% of the flowing pressure or equal to 25% of the pressure drop through the heat exchanger at full flow.

Table - 1 Water Capacity in Gallons Per Minute

Valve Size	Cv Rating	Differential Pressure (Δ in psi)									
		5	10	15	20	25	30	35	40	45	50
2.5	74	165	234	287	331	370	405	438	468	496	523
3	101	226	319	391	452	505	553	598	638	678	714
4	170	380	538	658	760	850	931	1006	1075	1140	1202
5	290	648	917	1123	1297	1450	1588	1716	1834	1945	2051
6	390	872	1233	1510	1744	1950	2136	2307	2467	2616	2758

Proportional to Bypass Flow

Proportional mixing valves when used to bypass flow are piped on the outlet side of the hot water source to throttle the water flow and thereby control heat output. These valves are usually selected to take a pressure drop up to 50% of the flowing pressure through the valve.

VALVE SIZING AND SELECTION (CONT.)

CAVITATION, FLASHING AND CHOKED FLOW: LIMITATIONS ON VALVE PRESSURE DROP

A concern in high temperature water systems is the potential for cavitation, which is caused by the downstream pressure being lower than that of the vapor pressure of the fluid. This basically causes the water to "boil" and can result in reduced flow/capacity, excessive noise, vibration, wear and should be avoided if possible. If the pressure downstream of the area restriction rises rapidly above the vapor pressure, the vapor bubbles will collapse violently (implode). The bubble collapse is an affirmation of cavitation. Use the following equation below to estimate the maximum allowable pressure drop across the valve.

Flashing is a phenomenon where the flowing high temperature water inlet experiences a significant pressure drop, with the outlet pressure below the vapor pressure of the water (as in cavitation) and is converted to a vapor within the control region of the valve.

This can also produce a choked flow condition where the rapidly expanding vapor prohibits any increase in flow, even though P1 (inlet) pressure is increased.

Pmax = 0.5 (P1 – Pv)
Where:
Pmax = Maximum allowable pressure drop
P1 = Absolute inlet pressure (psia)
Pv = Absolute vapor pressure (refer to psia - Table 2)
Absolute pressure = gage pressure + 14.7

Table-2 Vapor Pressure of Water

Water Temp. (°F)	Vapor Pressure (psia)	Water Temp. (°F)	Vapor Pressure (psia)
40	0.12	140	2.89
50	0.18	150	3.72
60	0.26	160	4.74
70	0.36	170	5.99
80	0.51	180	7.51
90	0.70	190	9.34
100	0.95	200	11.53
110	1.28	210	14.12
120	1.69	220	17.19
130	2.22	230	20.78

CLOSE OFF DATA

Varying the preload is possible to adjust close off's between the upper and lower ports.

Table 3 - Close Off Data

Valve Size (in)	Actuator Size (in²)	Close Off (Δ P in psi) Signal-to-Actuator					
		3-15 PSI		1-17 PSI		(Positioner) 0-30 PSI	
		Upper Port	Lower Port	Upper Port	Lower Port	Upper Port	Lower Port
2.5	46	8	8	27	27	73	73
	100 (1M)	13	98	55	125	55	125
3	46	3	3	16	16	48	48
	100 (1M)	6	66	35	94	35	125
4	46	0	0	6	6	24	24
	100 (1M)	1	34	17	50	17	125
5	100 (1M)	0	21	9	31	9	97
6	100 (1M)	0	13	5	20	5	66

TEMPERATURE/PRESSURE RATINGS

Never exceed the temperature/pressure ratings of the valve (see figure 5). The shaded area shows the acceptable region.

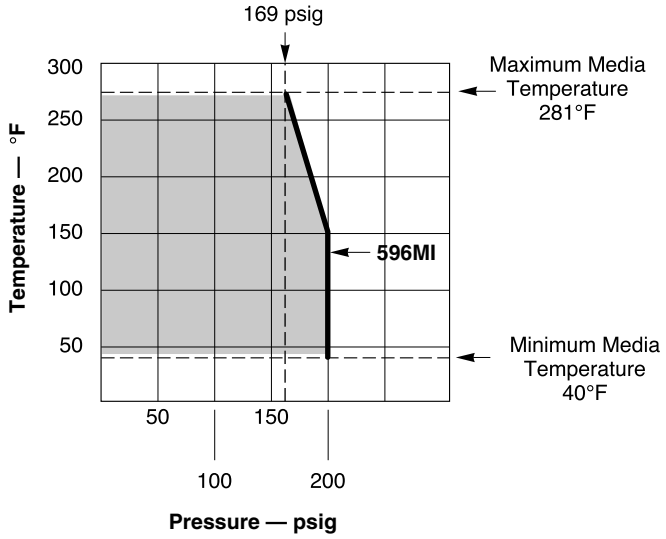


Figure 5 - Temperature and Pressure Ratings

DIMENSIONAL DATA

Table-4 Dimensions for 596MI Series Valves

Nominal Pipe Size	2-1/2"	3"	4"	5"	6"
A	8.500	9.500	11.500	13.000	14.000
STROKE	0.875	0.875	0.875	1.750	1.750
B	5.375	6.375	8.500	8.750	9.750
C	3.500	3.750	4.500	5.000	5.875
D	10.375	10.375	10.375	N/A	N/A
E	10.000	10.000	10.000	N/A	N/A
F	16.625	16.625	16.625	19.000	19.000
G	10.313	10.313	10.313	10.313	10.313
Valve Weight (lbs)	62.00	82.00	115.00	180.00	264.00
Weight w/46"	75.00	95.00	128.00	N/A	N/A
Weight w/100"	87.00	107.00	140.00	205.00	289.00

Figure 6 - 2-1/2" to 6" Valve Bodies

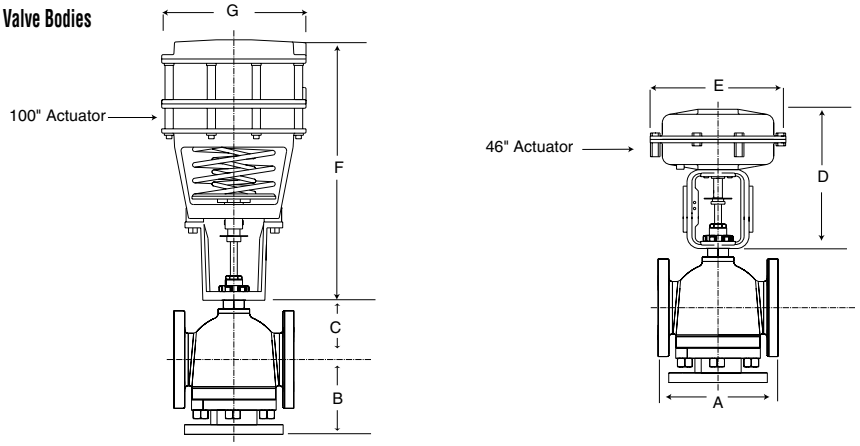
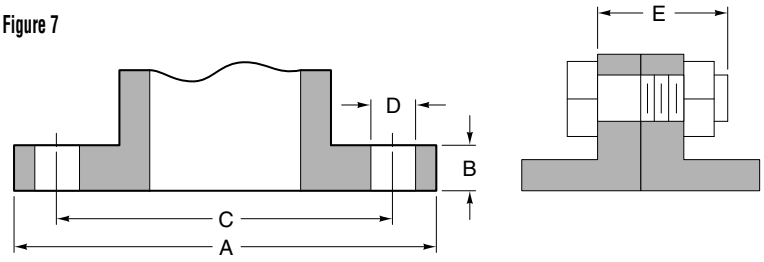


Table - 5 Flange Detail for American Standard 125 lb. Cast Iron Pipe Flanges

Valve Size	Flanges		Drilling		Bolting		Length of Machine Bolts
	Flange Diameter A	Flange Thickness B	Diameter of Bolt Circle C	Diameter of Bolt Holes D	Number of Bolts	Diameter of Bolts	E
2-1/2"	7"	11/16"	5-1/2"	3/4"	4	5/8"	2-1/2"
3"	7-1/2"	3/4"	6"	3/4"	4	5/8"	2-1/2"
4"	9"	15/16"	7-1/2"	3/4"	8	5/8"	3"
5"	10"	15/16"	8-1/2"	7/8"	8	3/4"	3"
6"	11"	1"	9-1/2"	7/8"	8	3/4"	3-1/4"

Figure 7



INSTALLATION

Inspection

Inspect the package and contents for damage. If damaged, notify the appropriate carrier immediately.
If consultation is necessary, please contact Powers Customer Service for assistance.

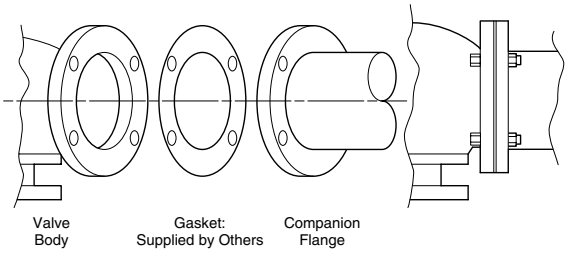
Requirements

- Pipe wrenches
- Flange gaskets, bolts / nuts
- Installer must be a qualified, experienced technician

CAUTION!

- Install the valve with the flow in the direction of the flow arrows ("A" and "B" ports are inlets and "AB" port is the outlet).
- Do not exceed the ratings of the device.
- Avoid locations where excessive moisture, corrosive fumes, or vibration are present.

Figure 8 - Installation of Flanged End Valves



Mounting / Orientation

1. The valve should be mounted in a location that is within the ambient limits of the actuator. When selecting a location, allow sufficient room for valve linkage, actuator, and other accessories and for service of the product.
2. The preferred mounting position for the valve is with the valve stem vertical above the valve body. Avoid mounting the valve so that the valve stem is below horizontal.
3. The valves must be piped with two inlets ("A" and "B" ports) and one outlet ("AB" port).

Flanged Connection

The 596 series flanged valve bodies conform to ANSI Standard 125 Lb. Cast Iron Pipe Flanges. The companion flanges (not provided) should be the same specification as the valve. The 125 Lb. Flanges have plain flat faces and should not be bolted to a raised faced flange.

1. All parts should be clean to assure the best results.
2. The pipe with the companion flanges installed should be properly supported and aligned. Be sure the companion flange is flush with the face of the valve body flange and lined up squarely.
3. Use a gasket material (not provided) that is recommended for the medium being handled. CAUTION! Do not apply pipe dope to the valve flange, gasket, or companion flange.
4. See Figure-7 for flange and flange bolt details. Figure-8 shows the proper way a flanged valve should be mounted.

MAINTENANCE

Regular maintenance of the total system is recommended to assure sustained performance. See Table-6 for maintenance kit part numbers.

Table - 6 Maintenance Kits for 596MI Valves

Valve Description	Replacement Packing Assembly	Replacement Gaskets	Valve Repair Kit*
2.5	596 Pack	596250G	MIGOBMTK
3	↓	596300G	MIHOBMTK
4	↓	596400G	MIJOBMTK
5	↓	596500G	MIKOBMTK
6	↓	596600G	MILOBMTK

** Kit includes replacement packing and stem & plug assembly.*

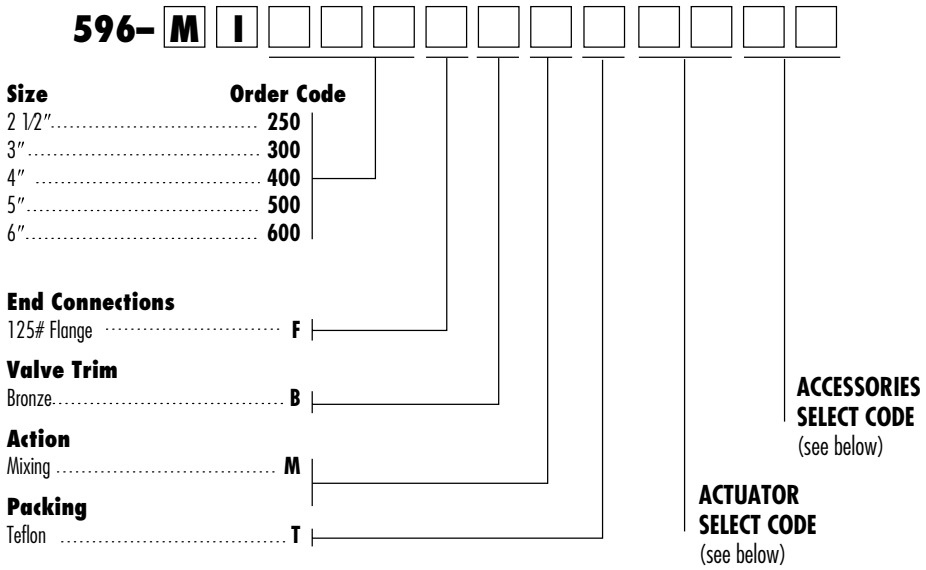
Water System Maintenance

All systems are susceptible to valve and system problems caused by improper water treatment and system storage procedures. These guidelines are provided to help avoid valve and water system problems resulting from improperly treated water or storage procedures and to obtain maximum life from the valves.

Durability of valve stems and packings is dependent on maintaining non-damaging water conditions. Inadequate water treatment or filtration can result in corrosion, scale, and abrasive particle formation. Scale and particulates can result in stem and packing scratches and can adversely affect packing life and other parts of the hydronic system.
To maintain non-damaging conditions, follow these guidelines:

- Clean the system prior to start up.
- Use filtration equipment where needed.
- Properly store off-line systems and monitor water treatment results.
- Follow the advice of a water treatment professional.

ORDERING INFORMATION



ACTUATOR SELECT CODE

CODE	PNEUMATIC DIAPHRAGM ACTUATORS
46	46 Sq. in, 1" Max Valve Stroke with Stainless Steel Springs, adjustable start w/ 7 ~ 12 lb. Fixed span.
4X	46 Sq. in, 1" Max Valve Stroke with Extended Springs (requires positioner), adjustable start w/22 lb. span.
1M	100 Sq. in, 5-10 psi Spring Range (Mixing Valves)

ACCESSORIES SELECT CODE

CODE	DESCRIPTION
	Bellofram 1000 I/P'S
IS	3–15 psi
TS	1–17 psi
US	3–27 psi
	CONTROL/AIR TYPE 900X I/P
ES	0–30 psi
	UTILITY POSITIONER AND I/P
BS	4–20 mA
	UTILITY POSITIONER
PS	3-15 psi
RS	3-9 psi
SS	9-15 ps
	NO ACCESSORIES
OS	No Accessories

I/P TRANSDUCERS

The "standard" 3-15 psi signal was originally designed as a transmission signal, not a valve actuation signal. The Fluid Controls Institute (in Standard 87-2) has recommended that a 1–17 psi air signal range be used when directly actuating a control valve without a positioner. Powers concurs with this recommendation, and therefore, offers a 1–17 psi I/P transducer and a 0–30 psi I/P transducer and the Accritem pneumatic controller for maximum close-off. 3-15 psi I/P transducers should be used in conjunction with positioners.

POSITIONERS

Positioners are used for one or more of the following reasons:

1) To split range valves.
2) To eliminate unwanted valve movement caused by line pressure variations
3) To minimize the effects of "stick-slip"
4) To speed response time and/or
5) To increase close-off rating when I/Ps are used.

POWERS
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