CALEFFI. NATURAL SOLUTIONS.
47 years of growth.

Website Technical Trainer

Caleffi North America Inc.
414-238-2360
www.caleffi.us
Zoning with Caleffi
Featuring Z-one Zone Valve

Webinar Outline

• INTRODUCE CALEFFI ZONE VALVE PRODUCTS
  Quick Review of each style
  Compare operating characteristics

• IN-DEPTH ANALYSIS
  Z-one Series

• MOST COMMON REASONS FOR TECH CALLS
• Q & A
Industry Trend – Returning to Zone Valves

Caleffi Zone Valve Products

Thermo-Electric Zone Valve: 676 series

Motorized Ball Valves: 644 Series
## Caleffi Zone Valve Products

### 24 VAC Supply

<table>
<thead>
<tr>
<th>Series</th>
<th>656 Series</th>
<th>Z-one</th>
<th>644 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inrush Current (mA)</td>
<td>100</td>
<td>100</td>
<td>75</td>
</tr>
<tr>
<td>Inrush VA</td>
<td>19</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Holding Current (mA)</td>
<td>640</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Holding Watts</td>
<td>3</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Holding VA</td>
<td>4</td>
<td>7</td>
<td>0</td>
</tr>
</tbody>
</table>

**Notes:**
- Time required to reach holding current is approx. 2 minutes.
- Spring return 120-180 sec full stroke.

### Size/Connection/Cv / Close off PSI

<table>
<thead>
<tr>
<th>Size/Connection/Cv</th>
<th>½&quot; Sweat 4 Cv / 20 psi</th>
<th>¾&quot; Sweat 4 Cv / 20 psi</th>
<th>1&quot; Sweat 4 Cv / 20 psi</th>
</tr>
</thead>
<tbody>
<tr>
<td>½&quot; &amp; ¾&quot; Inv Flare</td>
<td>1.0 Cv / 75 psi</td>
<td>2.5 Cv / 50 psi</td>
<td>3.5 Cv / 30 psi</td>
</tr>
<tr>
<td>½&quot; &amp; ¾&quot; SAE Flare</td>
<td>0.5 Cv / 50 psi</td>
<td>1.5 Cv / 30 psi</td>
<td>2.5 Cv / 20 psi</td>
</tr>
<tr>
<td>¾&quot; Inv Flare</td>
<td>5.0 Cv / 25 psi</td>
<td>7.5 Cv / 15 psi</td>
<td>10 Cv / 10 psi</td>
</tr>
<tr>
<td>¾&quot; &amp; 1&quot; Inv Flare</td>
<td>7.5 Cv / 20 psi</td>
<td>10 Cv / 15 psi</td>
<td>15 Cv / 10 psi</td>
</tr>
<tr>
<td>¾&quot; &amp; 1&quot; SAE Flare</td>
<td>3.5 Cv / 20 psi</td>
<td>5.0 Cv / 14 psi</td>
<td>7.5 Cv / 10 psi</td>
</tr>
</tbody>
</table>

### Max Water Temp

<table>
<thead>
<tr>
<th>Temp</th>
<th>2-way</th>
<th>3-way (divert or mix)</th>
<th>3-way (bypass)</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 F</td>
<td>220 F</td>
<td>240 F</td>
<td>220 F</td>
</tr>
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</table>

### Actuator

<table>
<thead>
<tr>
<th>Actuator</th>
<th>Thermo-Electric</th>
<th>Hysteresis Motor</th>
<th>Permanent Magnet Motor</th>
</tr>
</thead>
</table>

### Valve flow control member

<table>
<thead>
<tr>
<th>Member</th>
<th>Disk</th>
<th>Paddle</th>
<th>Ball</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size/Connection/Cv</td>
<td>½&quot;, ¾&quot;, 1&quot; 13 Cv for 2-way</td>
<td>½&quot;, ¾&quot;, 1&quot; 4.5 Cv for 3-way diverting</td>
<td>½&quot;, ¾&quot;, 1&quot; 12 Cv / 1.5 Cv for bypass port</td>
</tr>
<tr>
<td>All styles</td>
<td>150 psi close-off</td>
<td>All styles available with Sweat or NPT connections</td>
<td></td>
</tr>
</tbody>
</table>

### Max Static Pressure

<table>
<thead>
<tr>
<th>Pressure</th>
<th>150 psi</th>
<th>300 psi</th>
<th>150 psi</th>
</tr>
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</table>

### Notes:
- Motor drives for 40 seconds then power is dropped by internal switch, requires power in both directions.
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Z-one
In-depth Analysis
Actuator

1. Aluminum Motor Plate

3. Poly Carbonate Cover and Base

2. Motor: 7 VA, 5 W


5. Large push button release

6. Terminal Block option

7. Same body for NO and NC actuators

8. Stainless Steel Torsion Spring

9a. Bronze Bushing
9b. Case hardened 12L14 Steel Pinion
9c. Extra Thick Sector Gear

10. 20:1 Reduction Gear Train

11. Lost Motion design

12. Sealed End Switch
Inside the Z-one Actuator

**Aluminum Casing** – No corrosion from chilled water condensation. Aids in heat dissipation. Others use plated steel.

**Reliable Motor** – Paired with the lost motion gear, twice the gear ratio is achieved versus competitive units. Result is high close off pressures and less stress on the motor for longer life.

**Polycarbonate Cover** – High temp rated and durable.

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Z-one
In-depth Analysis
Actuator

5. Large push button release
6. Terminal Block option
Z151000 Screw Terminal Connection

Z-one
In-depth Analysis
Actuator

7. Same body for NO and NC actuators

8. Stainless Steel Torsion Spring

9a. Bronze Bushing
9b. Case hardened 12L14 Steel Pinion
9c. Extra Thick Sector Gear

10. 20:1 Reduction Gear Train
Inside the Z-one Actuator

Return Spring - when power is removed, torque from return spring closes valve.

Pinion Gear—has a unique “lost motion” design.

12L14 case hardened steel pinion
Inside the Z-one Actuator

All parts inside the Z-one actuator are corrosion resistant.

**Bronze Bushing**

Inside the Z-one Actuator

Spring is wound until correct torque value is reached

Erie & HW’s spring position is fixed making them vulnerable to manufacturing tolerances
Inside the Z-one Actuator

Large gear face spreads load evenly across motor pinion
(twice the thickness of competitive zone valves)

Honeywell sector gear is thin and concentrates stress on motor pinion

(See HW thin gear video)

Z-one
In-depth Analysis
Actuator

11. Lost Motion design
Innovative motion - Unlike other brands where motor drives a sector gear directly, the Z-one motor drives an extra “lost motion” gear for more torque and smoother, higher close-off.

Durability – Caleffi’s exclusive “lost motion” gear protects the motor. How? As the valve seats during spring return, the lost motion gear “coasts” thus preventing an impact load which can heavily stress gear teeth and bearings – a common cause of failure in competitive units.

(See Lost Motion Videos)

Z-one
In-depth Analysis
Actuator

12. Sealed End Switch
OVERVIEW OF NEW END SWITCH DESIGN

The 24 Volt Z-one actuator end switches have been redesigned and are now standardized.

The change is not externally noticeable.

Internally, however, you’ll see that the previous switch is white in color.

The new design is black.

Old design 24 V models
Current for other Voltages

New design 24 V models:
Z111000
Z151000

OVERVIEW OF NEW END SWITCH DESIGN

Prior design

New design
OVERVIEW OF NEW END SWITCH DESIGN

Utilizing reed switch technology, Caleffi has developed an innovative sealed end switch design—PATENT PENDING— that will not be susceptible to the effect of environmental airborne contamination, and can significantly extend operating life.

Commonly used for years in automotive applications, the reed switch features electrical contacts that are sealed from potential exposure to air-borne contaminants.

The hermetically-sealed reed switch contacts open and close by way of a magnet imbedded in the sector gear.

This switch has been specifically designed for switching 24 V relays, boiler contacts (TT) and DDC systems.

It has exceptionally long life, having been tested to over 1 million cycles without failure.

Magnetism attracts reeds, closing normally open contacts.

OVERVIEW OF NEW END SWITCH DESIGN

The reed switch is actuated by the field from a magnet coupled to the actuator sector gear.

There are no mechanical cams as with traditional designs, offering fewer parts susceptible to wearing out.
OVERVIEW OF NEW END SWITCH DESIGN

Extensive life testing has been completed and all 24 V actuators are now shipping with this feature.

The instruction sheet and recently released technical brochure (01115-09 NA) have been revised accordingly.

OVERVIEW OF THE PRIOR END SWITCH DESIGN

Zone Valve manufacturers typically use micro switches for their end switch design.

Micro switches incorporate silver contacts that are susceptible to residue build up due to air borne contaminants such as sulfur.
What’s wrong with a micro switch in low voltage applications?

Zone Valve Manufacturers typically use commercially-available micro switches for their end switch design.

Micro switches incorporate silver contacts, are typically open to the atmosphere, and therefore require sufficient current to wipe the contacts clean during normal operation.

This is especially true with the low 24 VAC powered actuators. If the system does not have enough current draw the switch contacts are susceptible to residue buildup due to airborne contaminants such as sulfur from boiler combustion. This increases the resistance disabling the switch to close.

Because of this, typically the operating life for these switches can be shorter than expected for most contractors and end users, and this depends on their location and operating frequency.
Current Draw

Minimum current draw for each switch is to ensure enough power to clean off accumulating residue from the environmental surroundings. An example of this is sulfur from boiler combustion attracting to and coating the silver contacts in the switch. Added sources of sulfur are floor wax, other household products, and Chinese manufactured Drywall.

Current Draw

Zone valve manufacturers now specify and require a minimum current draw for each switch:

- Erie - 101mA
Additional Benefit of the Reed Switch Design

In addition to the contacts being sealed from outside and effects of airborne contaminants:

The reed switch design offers no required minimum current load for more cost effective system designing.

Most zoning panels source an end switch signal in the range of 40 – 70 mA per zone, allowing only one zone valve end switch. Caleffi zone valves now offer the ability to install multiple end switches connected in parallel into the zoning panel.

Following Erie's spec, with 100 mA limit only 1 should be installed. The wiping current reduces with each additional zone valve.

5 zone system: Piping and Typical Wiring
Additional Benefit of the Reed Switch Design

For Caleffi’s Reed Switch -
No limit to # of zone valves to install in parallel as there is no issue with wiring in parallel

100 mA (Boiler current draw)

NEW END SWITCH DESIGN

Summary:
24V actuators use a patent pending sealed reed switch for the end switch:
- Hermetically sealed from potential exposure to air-born contaminants extending operating life
- Requires no minimum current load allowing an unlimited number of 24V actuator end switches in parallel to one zoning panel or thermostat.
**Z-one**

**In-depth Analysis**

**Actuator**

1. **Aluminum Motor Plate**
2. **Motor: 7 VA, 5 W**
3. **Poly Carbonate Cover and Base**
4. **Manual Opening Lever**
5. **Large push button release**
6. **Terminal Block option**
7. **Same body for NO and NC actuators**
8. **Stainless Steel Torsion Spring**
9a. **Bronze Bushing**
9b. **Case hardened 12L14 Steel Pinion**
9c. **Extra Thick Sector Gear**
10. **20:1 Reduction Gear Train**
11. **Lost Motion design**
12. **Sealed End Switch**

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### Z-one Advantage!

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**Z-one**

**In-depth Analysis**

**Actuator**

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Z-one
In-depth Analysis
Valve Body

13. EPDM paddle and o-rings vs. BUNA-N
14. Paddle design vs. competitors ball
15. Large Valve Cavity
16. Hex Nut
17. One body for 32 – 240°F water and 15 PSI steam
18. Forged brass body 300 PSI, 32 – 240°F, 15 PSI steam
19. Stainless Valve Stem and rubber insert

Z-one
In-depth Analysis
Valve Body

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<tr>
<td>12. Peroxide cured EPDM Paddle and o-rings vs. competitors Buna N</td>
<td>For high temperature and oxygen resistant resistance from high boiler feed and open system applications</td>
</tr>
<tr>
<td>13. Paddle design vs. Ball</td>
<td>Same sealing surface over the life of the product. Rubber balls rotate and must seal over previous seat impressions.</td>
</tr>
<tr>
<td>15. Large Valve Cavity and Longer Stroke (45° versus Erie’s 22° stroke)</td>
<td>Quieter flow and prevention of water hammer. Slows the flow of water down earlier and for a longer distance.</td>
</tr>
<tr>
<td>16. Hex Nut</td>
<td>Easy clean out and easy replacement of stem/plug assembly.</td>
</tr>
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<td>17. One body for water (32 - 240°F) and 15 psi steam</td>
<td>Easy stocking with fewer items, less chance for error when selecting.</td>
</tr>
<tr>
<td>18. Forged brass body, 300 psi static pressure rating</td>
<td>For superior strength and durability</td>
</tr>
<tr>
<td>19. Stainless Steel Valve Stem and Rubber Insert</td>
<td>Better corrosion protection versus nickel plated brass used by competitors. Beryllium Copper rail helps paddle to slide.</td>
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</table>
Some Common Technical Calls

Q: So, just how does the "Lost Motion" feature work in the Z-one?
A: In order to achieve high close off pressures and longer life in a zone valve, Caleffi has developed a new drive mechanism in their zone valve compared to tradition zone valve designs. Traditional designs typically use a synchronous motor which drives a gear. That gear is spring loaded and it typically drives a stem and some sort of sealing member. When power is supplied to the motor, the motor drives the gear which opens the valve. When power is dropped from the motor, the spring (either torsion or extension) is used to close the valve. One of the major disadvantages with this type of system occurs during the spring closing. Because the return spring is located on the sector gear, the gear is "back driving" the pinion. Whenever a gear is driving a pinion the efficiency is very low, especially when large ratios are used like most zone valves. In the Caleffi Z-one valve, a different approach has been taken. An additional gear cluster has been added to the drive. This additional gear cluster does two things, it allows for a higher gear reduction and it allows the torsion spring to be located on the pinion which is driving the final sector gear. This means that during opening or closing of the valve, the pinion is always driving the sector gear allowing for a more efficient transfer of torque to the stem.

Another problem associated with traditional zone valve designs is the impact that occurs on the sector gear and motor when the sealing member hits the seat. When power is dropped to the motor, the return spring puts a force on the sector gear to "back drive" the motor. The motor gearbox contains many small gears and when they start to spin they build up inertia. All of this momentum comes to an abrupt stop when the sealing member hits the seat. The sector gear and motor then see a large impact force from this which causes the sector gear or the motor gears to fail. The Caleffi Z-one valve uses a unique approach to eliminate or reduce this impact considerably. The pinion which is driven by the sector gear has a tab protruding upward.

Answer Continued:

Another problem associated with traditional zone valve designs is the impact that occurs on the sector gear and motor when the sealing member hits the seat. When power is dropped to the motor, the return spring puts a force on the sector gear to "back drive" the motor. The motor gearbox contains many small gears and when they start to spin they build up inertia. All of this momentum comes to an abrupt stop when the sealing member hits the seat. The sector gear and motor then see a large impact force from this which causes the sector gear or the motor gears to fail. The Caleffi Z-one valve uses a unique approach to eliminate or reduce this impact considerably. The pinion which is driven by the sector gear has a tab protruding upward.

This tab engages with another tab on the bottom side of the mating gear that the motor drives. This allows the gear to have "lost motion" travel. In other words, the synchronous motor is allowed to disengage from the rest of the gearing when the paddle strikes the seat allowing the motor to coast to a stop. This prevents the impact loading and extends the life of the actuator.
Some Common Technical Calls

Q: Is the brass used in the Z-one valve bodies and wetted rubber parts also compatible for potable water?
A: Caleffi does not have NSF 61 approval but we do have customers that use the valve in potable water situations. Just state that we do not have NSF 61 approval and let them decide.

Q: Does any other manufacturer have NSF 61 approval?
A: Not that Caleffi is aware of as of August 2009.

Q: Do you have sizing charts to size a zone valve for steam?
A: No. These zone valves, however, can control up to a maximum 15 psi saturated steam. The maximum steam flow can be roughly calculated knowing the Cv of the valve with the formula:
Steam flow in lb/hr = Cv x 2.1 x Sq Root (max press drop x (P1 + P2)).
And, then you can get the EDR (Equivalent Direct Radiation) value = lb/hr / 1.24.

Q: Do you have a repair kit for the inner valve and stem?
A: Yes, PN 69293A. It is not published but is available for that rare special request.

Q: Will a Caleffi Z-one actuator work on an Erie valve?
A: No.

Some Common Technical Calls

Q: What is Cv?
A: Cv is a valve sizing coefficient determined experimentally for each style and size of valve, using water at standard conditions as the test fluid. Cv is numerically equal to the number of US gallons of water at 60°F that will flow through the valve in one minute when the pressure differential across the valve is 1 psi. Cv varies with both size and style of valve, but provides an index for comparing liquid capacities of different valves under a standard set of conditions.

Flow (gpm) = Cv x SQRT(ΔP / G)

where G = specific gravity of fluid (water at 60°F = 1.0)

or,

Cv = Q x SQRT(G / ΔP) where Q = Flow rate in gpm
Some Common Technical Calls

Q: Do you have a Caleffi Cross Reference to Competitors?
A: YES, here's page 1 of 5. It is included in Resource materials included with this presentation or by calling Caleffi.

<table>
<thead>
<tr>
<th>Caleffi</th>
<th>Cross Reference for Competitors</th>
</tr>
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<tbody>
<tr>
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</table>

Some Common Technical Calls

Q: I expect the Z-one must be 'idiot proof' when installing the actuator on a valve body. That is, there's no chance that it could be 'backwards' in that when it's called to drive open that the valve paddle is already at the end stop and the actuator is over torque-ing thinking it's driving open?
A: The actuators are pretty much idiot proof. They can only be installed one way and they self limit the stroke. The only thing that can be done incorrectly is to install a normally open actuator on a 3-way valve body, that's a no-no due to the lower torque output of the NO actuator during spring opening.

In addition, the motor in the Z-one valve can't "over torque" itself or draw more current when loaded. If 24 VAC is applied, it can never deliver more torque, even when it is stalled. The motor is unique in that it is designed to be stalled indefinitely.

Q: What is current draw of the Z-one Zone valves?
A: The current draw for the Z-one by actuator voltage:
- 24 VAC = 300 mA
- 120 VAC = 55 mA
- 208 VAC = 30 mA
- 230 VAC = 25 mA
- 277 VAC = 20 mA
Zoning with Caleffi
Part 2

Webinar Outline

- INTRODUCE CALEFFI ZONE VALVE PRODUCTS
  Quick Review of each style
  Compare operating characteristics

- IN-DEPTH ANALYSIS
  644 High Flow High Close-off Motorized Ball Valves
  656 Thermo-electric Actuators
  -for Radiant Manifold circuit control
  -676 Zone Valve
  519 Differential Pressure Bypass Valves

- MOST COMMON REASONS FOR TECH CALLS
- Q & A
## Caleffi Zone Valve Products

### 519 Series
Differential Pressure Bypass Valves

### Z-one
519 Series Differential Pressure Bypass Valves

### Thermo-Electric Zone Valve: 676 series

### 644 Series Motorized Ball Valves

### Table 1: 24 VAC Supply

<table>
<thead>
<tr>
<th></th>
<th>656 Series</th>
<th>Z-one</th>
<th>644 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inrush Current Draw (mA)</td>
<td>&lt;1000</td>
<td>300</td>
<td>170</td>
</tr>
<tr>
<td>Inrush VA</td>
<td>19</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Holding Current (mA)</td>
<td>140</td>
<td>300</td>
<td>0</td>
</tr>
<tr>
<td>Holding Watts</td>
<td>3</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Holding VA</td>
<td>3</td>
<td>7</td>
<td>0</td>
</tr>
</tbody>
</table>

**Notes:**
- Time required to reach holding current is approx. 2 minutes, spring return 120-180 sec full stroke
- Steady current draw, spring return < 60 sec full stroke OPEN
- < 10sec full stroke CLOSED
- Motor drives for 40 seconds then power is dropped by internal switch, requires power in both directions (relay)

### Table 2: Size/Connection/ Cv / Close off PSI

<table>
<thead>
<tr>
<th></th>
<th>½&quot; Sweat 4 Cv / 20 psi</th>
<th>½&quot; &amp; ⅜&quot; 2.5 Cv / 50 psi</th>
<th>½&quot; &amp; ⅜&quot; 3.5 Cv / 30 psi</th>
<th>½&quot; &amp; ⅜&quot; 5.0 Cv / 25 psi</th>
<th>⅜&quot;, ⅛&quot; 1.1/4&quot; 7.5 Cv / 20 lpm Flare (1.0, 2.5, 3.5 Cv) SAE Flare (⅜&quot;, 3.5 Cv NPT (⅜&quot;, ⅜&quot;, ⅛&quot; 1.1/4&quot;) Sweat (⅜&quot;, ⅛&quot;, ⅛&quot;) 3.5 Cv)</th>
<th>½&quot;, ⅞&quot;, ⅛&quot; 13 Cv for 2-way ½&quot;, ⅞&quot;, ⅛&quot; 4.5 Cv for 3-way diverting ½&quot;, ⅞&quot;, ⅛&quot; 12 Cv / 2.1 Cv for bypass port All styles 150 psi close-off All styles available with Sweat or NPT connections</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>¾&quot; Sweat 4 Cv / 20 psi</td>
<td>½&quot; &amp; ⅜&quot; 2.5 Cv / 50 psi</td>
<td>½&quot; &amp; ⅜&quot; 3.5 Cv / 30 psi</td>
<td>½&quot; &amp; ⅜&quot; 5.0 Cv / 25 psi</td>
<td>⅜&quot;, ⅛&quot; 1.1/4&quot; 7.5 Cv / 20 lpm Flare (1.0, 2.5, 3.5 Cv) SAE Flare (⅜&quot;, 3.5 Cv NPT (⅜&quot;, ⅜&quot;, ⅛&quot; 1.1/4&quot;) Sweat (⅜&quot;, ⅛&quot;, ⅛&quot;) 3.5 Cv)</td>
<td>½&quot;, ⅞&quot;, ⅛&quot; 13 Cv for 2-way ½&quot;, ⅞&quot;, ⅛&quot; 4.5 Cv for 3-way diverting ½&quot;, ⅞&quot;, ⅛&quot; 12 Cv / 2.1 Cv for bypass port All styles 150 psi close-off All styles available with Sweat or NPT connections</td>
</tr>
<tr>
<td>Max Water Temp.</td>
<td>200 F</td>
<td>240 F</td>
<td>230 F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actuator</td>
<td>Thermo-Electric/ Wax Motor</td>
<td>Hysteresis Motor</td>
<td>Permanent Magnet Motor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valve flow control member</td>
<td>Disk</td>
<td>Paddle</td>
<td>Ball</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max Static Pressure</td>
<td>150 psi</td>
<td>300 psi</td>
<td>150 psi</td>
<td></td>
<td></td>
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</tbody>
</table>
Mike: didn’t you find out this was 5 and not 6.5?

High Flow, High Close-off Zone Valves
644 Series Motorized Ball Valves with 3-wire Control

- 6442 series 2-way
- 6443 series 3-way
  - 3BY (Bypass)
  - (Diverting)
- 644004 replacement actuator
High Flow, High Close-off Zone Valves
644 Series Motorized Ball Valves with 3-wire Control

Easy to Install or Remove Actuator

Simply push actuator on
(no button or lever)

Squeeze the release lever and lift actuator off valve body
(no screws or linkage)

644 Series Zone Valves
Designed for High Flow & High Close-off

More Valves per Transformer - High electrical efficiency 24V allows for 9 valves on standard 40 VA transformer

Internal Switch - Shuts of motor at end of travel

EPDM O-rings - For high temperature and oxygen electrolysis resistance from high boiler feed and open system applications

Large 13 Cv full port ball - Higher flow with little pressure drop and high 150 psi close-off

Extra Thick Sector Gear - For better motor drive engagement and no stripped gears

Squeeze release lever - Makes assembly to valve body and removal easy

Forged brass body - For superior strength and durability, 23 – 230°F temperature rating.

Integral O-rings - No gasket to lose or hold onto during installation
### 644 Series Zone Valves
**High Close-off per Cv**

<table>
<thead>
<tr>
<th>Connections</th>
<th>Flow Coefficient</th>
<th>Max. Close-off $\Delta P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-way NPT and Sweat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/2”</td>
<td>13 Cv</td>
<td></td>
</tr>
<tr>
<td>3/4”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-way NPT and Sweat Bypass</td>
<td>12 Cv-Straight Thru 2.1 Cv-Bypass port</td>
<td>150 PSI</td>
</tr>
<tr>
<td>1/2”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/4”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-way NPT and Sweat Diverting/Mixing</td>
<td>4.5 Cv Both Ports</td>
<td></td>
</tr>
<tr>
<td>1/2”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3/4”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1”</td>
<td></td>
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</tbody>
</table>

### 644 Series Zone Valves
**Selling Features**

- Zero leakage across the valve
- 40 second stroke time both directions
- Operates at very high differential pressures
- Low pressure drop through the valve
- Union connections for simple installs and removals
**644 Series Zone Valves**

*644004 Actuator*

**ON/OFF (2 Position) Operating Mode:**

Can be used this way with a single electrical signal for opening or closing from 3-wire thermostat/timer-thermostat or an ordinary switch.

**MODULATING MODE**

This actuator can be combined with any type of three-wire floating controller for outdoor reset on radiant systems. Not recommended for 2-way valves because the ball is not characterized.

**AUXILIARY MICROSWITCH**

Equipped standard with a micro switch. Turns on for an average valve opening of 80%.

---

**644 Series Zone Valves**

**Bypass vs Diverting?**

---
644 Series Zone Valves
Bypass vs Diverting?

The bypass valve has one inlet and two outlets
Cv for the bypass operation much lower than in “open” or normal operation.
When there is a call for heat, the valve is in normal flow position, straight through with a 12 Cv
When no heat is called for, it closes off the port to the fan coil and ‘bypasses’ flow, at a much lower flow rate, 2.1 Cv, to keep the constant speed pump from dead heading

The diverting valve also has one inlet and two outlets
The diverter has the same flow characteristics on the two outlet ports
This valve can also be used for mixing with two inlet ports
No compromise on flow rate through either port
The key difference is the much lower Cv on the bypassing port to accommodate a special need for fan coil installations

Thermoelectric Zone Valve
676 Series

Compact – for baseboards or in cabinets
Spring Return – Normally Closed

Union connections in ½”, ¾” and 1” sweat and NPT

Optional Manual TwistTop (656314).
Quiet – 24V thermoelectric with end switch (656114).
The max ambient temp is 120F for this thermoelectric actuator.
Forged brass body for superior strength and durability, 32 – 200°F temperature rating, 150 psi max working pressure
Standard & TwisTop™ Actuators

656314
Manual TwisTop 24V with position indicator and end switch. Fits many competitive manifolds (check with factory)

656114
Standard 24V with end switch. Fits many competitive manifolds (check with factory)

Manual TwisTop engages end switch and auto-returns when energized. Green open indicator ring for easy viewing from any direction

• Heat Motor
• 24VAC power warms wax, expanding and forcing piston assembly upward allowing the spring-loaded shaft in either the manifold or in the 676 valve body to open the valve (1)
• Very slow 1/8” movement: 2-3 minutes
• Remains open as long as power is applied, 140 mA holding current, 2 to 4 watts.
• When power is removed, the wax cools and contracts
• The internal return spring assists in closing the valve
• Both models have 36” wire lead connections

656
Standard

676

656 TwisTop (optional)

• The TwisTop opens with a twist when power is off and returns to Auto position automatically when power returns
• Green ring indicates open actuator and can be seen from all sides
• It is available for the 676 series zone valves, with and without microswitch
Differential Pressure Bypass Valves
519 Series

Lockable adjustment always visible on neck
Adjustable from 2 to 10 psi (1 to 6 bar) differential pressure

Fitting Sizes:

- ¾” MNPT inlet with ¾” MNPT outlet - flow up to 9 GPM
- NEW: ¾” Sweat inlet AND outlet – flow up to 9 GPM
- 1” FNPT inlet with 1” Sweat or NPT outlet - flow up to 40 GPM
- 1 ¼” FNPT inlet with 1 ¼” Sweat or NPT outlet - flow up to 45 GPM
Differential Pressure Bypass Valves

To limit differential pressure increase in systems using fixed-speed circulators

Adjustment:
2 – 10 psi

Flow rates:
¾” up to 9 gpm
1” to 40 gpm
1-1/4” to 45 gpm

Ensures Consistent Secondary Flow, Prevents “Dead-Heading” Pump & Minimizes Water Hammer
Differential Pressure Bypass Valves

Setting Procedure:

a) With the hydronic system operating and all zone valves fully open (electrical, not manual), close the bypass valve by turning the control knob clockwise to stop at the maximum value (10 psi position).

b) Gradually open the valve with the control knob and use a thermometer or your hand to check on hot water flow.

c) As soon as you note a rise in temperature, turn the control knob closed one-half turn (clockwise) to stop flow.

d) Lock the knob in position with the locking screw.

Some Common Technical Calls

Q: What is the difference between the 3 way bypass and the 3 way diverting? Could you give me an application example for both.

A: Please refer to Tech Brochure 1131. The bypass valve has one inlet and two outlets and is designed specifically for the application on the 6th page lower diagram. And, notice, too that on the 4th page the flow characteristics show the Cv for the bypass operation much lower than in "open" or normal operation. This valve is installed, say, just before the fan coil. When there is a call for heat, the valve is in normal flow position, straight through with a 12 Cv. When no heat is called for, it closes off the port to the fan coil and 'bypasses' flow, at a much lower flow rate, 2.1 Cv, to keep the constant speed pump from dead heading. This is a standard, typical application. The valve's piping orientation accommodates the piping scheme into the fan coil typically. The diverter has the same flow characteristics on the two outlet ports (or this valve can also be used for mixing with two inlet ports). The 7th page shows a typical application in solar systems where the flow is diverted for various purposes. There is no compromise on flow rate through either port. It can be confusing as one could attempt to use one for the other. The key really is the much lower Cv on the bypassing port to accommodate a special need for fan coil installations (or others like it).