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**AC/YC Series Ball Valves**
DZR brass body with seven accessory port locations; ball valve has Teflon packing, blowout proof stem, handle with vinyl grip. Flow cartridge (AC) or strainer (YC) easily removable for maintenance without breaking piping. Dual P/T ports standard on AC.

Sizes: ½” - 2”  
PSID ranges: 2-32, 5-60  
Flow ranges: 0.33-70 gpm  
Rating: 400 psig @ 250° F

**MC/TC Series Ball Valves**
Compact, DZR brass T-shape body with four accessory port locations; ball valve has Teflon packing, blowout proof stem, handle with vinyl grip. Flow cartridge (MC) or strainer (TC) easily removable for maintenance without breaking piping. Dual P/T ports standard on MC.

Sizes: ½”, ¾”  
PSID ranges: 2-32, 5-60  
Flow ranges: 0.33-5.0 gpm  
Rating: 400 psig @ 250° F

**YR/YW Series Regulators/Strainers**
DZR brass body with two accessory port locations. Flow regulator (YR) or strainer (YW) easily removable for maintenance without breaking piping. Dual P/T ports standard on YR.

Sizes: ½” - 2½”  
PSID ranges: 2-32, 5-60  
Flow ranges: 0.33-120 gpm  
Rating: 400 psig @ 250° F

**UA/UB Series Shut-off Valves**
DZR brass body with three accessory port locations; ball valve has Teflon packing, blowout proof stem, standard adjustable memory stop and dual P/T ports standard on UA.

Sizes: ½” – 2”  
CV: 0.28-68.0  
Flow ranges: 0.2-103.3 gpm  
Rating: 600 psig @ 250° F

**KTM Series Pressure Independent Flow Control Valves**
Ductile iron body contains throttle for flow adjustment, valve for temperature regulation, and inline differential pressure controller in one housing. Flow remains constant (±5%) regardless of pressure variations.

Sizes: ½” – 5”  
Max Differential Pressure: 230 psi  
Flow ranges: 0.10-300 gpm  
Rating: 360 psig @ 284° F

**UP Series Unions**
DZR brass body with two accessory port locations.

Sizes: ½” – 2 ½”  
Rating: 400 psig @ 250° F
DA516 Series Adjustable Differential Pressure Controllers
Inline differential pressure controller is used to stabilize differential pressure across multiple circuits within a branch, depending on the flow rates and the piping layout. The differential pressure can be adjusted between 1 to 15 psi.

Sizes: ½” – 5”  
Max Differential Pressure: 230 psi  
Rating: 360 psig @ 284°F

WS Series Regulators
AutoFlow regulator with ductile iron wafer style body compatible with ANSI class 150 or 300 flanges. Automatically limits to the specified flow within ± 5% over 95% of the control range.

Sizes: 2 ½” – 30”
Max. flow ranges: 80 - 21000 gpm  
PSID ranges: 2-32, 5-60, 3-20, 5-40, 7-45  
Rating: 600 psig @ 250 °F (2 ½” – 14”) and 225 psig @ 250 °F(16” – 30”)

TBV-C Series Terminal Balancing and Control Valves with Shut-off
TBV-C valve combines control, balancing, ports for pressure and temperature measurement, stepless adjustment of Cv and shut-off valve in one dezincification resistant alloy body. TBV-C is available with a factory mounted on-off actuator.

Sizes: ½” – ¾”  
Rating: 14 psi max differential pressure, 250 psig @ 250 °F

CW Series Cast Iron Y-Strainer Flanged
Cast iron Y-body flanged strainer features a machine tapered seat which ensures a perfect fit for the removable stainless steel screen, flanged blow-off cover, gasket and plug. HB male ended ball valves can be used for blow-off valves.

Sizes: 2 ½” – 8”  
Rating: 125 psi @ 350 °F

BF Series Butterfly Valves
Ductile iron lug type resilient seated butterfly valve is bi-directionally designed for dead-end service. The rounded and polished disc provides minimum flow restriction and lower torque. The valve has infinite position handle for memory stops.

Sizes: 2” – 8”  
Rating: 240 psi @ 250 °F

Refer to [www.flowdesign.com](http://www.flowdesign.com) for the most current submittals, installation guides, specification guides and brochures for all of these Flow Design products.
Hydronic balancing - a necessity for good building control. In theory, new control technologies can satisfy the most demanding requirements for indoor climate and operating costs. In practice, however, not even the most sophisticated controllers always perform as promised. As a result, comfort is compromised and operational costs are higher than expected.

This is often because the mechanical design of the HVAC plant does not meet some conditions necessary for stable and accurate control. Three important conditions are:

1. The design flow must be available at all terminals.
2. The differential pressure across the control valves must not vary too much.
3. Flows must be compatible at system interfaces.

This application guide shows typical HVAC applications, and how they can be designed for the perfect indoor climate with optimum energy savings.

Common Problems

These problems are typical indications that the HVAC design for flow requirements are not met:

- Higher than expected energy costs
- Installed power is not deliverable at intermediate and/or high load
- Too hot in some parts of the building, too cold in other parts
- Long delay before the desired room temperatures are obtained in all rooms when starting up after night setback
- Abnormal pump energy consumption

Common but incorrect countermeasures:

- Increase pump head of main or secondary pump
- Increase supply temperature in a heating system
- Reduce supply temperature in a cooling system
- Cancel night and weekend setback function
- Modify control software although it is a hydronic problem
- Replace correctly sized but hunting control valves with smaller ones
- Install additional production units

Correct solutions:

- Design production, distribution and terminal system with the opportunity for professional hydronic balancing
- Balance the plant to ensure flow compatibility throughout the plant using balancing and differential pressure control valves

- Supply air temperature or room temperature fluctuates
- Noise from control valves
- Maximum installed power is not deliverable when required
One important measure of hydronic design quality is the circuit characteristic. Figure 1 represents a typical hydronic circuit for an air heating/cooling coil. The circuit characteristic is the relationship between the control signal and the resulting thermal power from the coil. It determines the controllability of the system. The circuit characteristic is a result of the combined characteristics of the control valve (actuator/valve), terminal (thermal emission characteristics) and hydronic conditions (valve authority $\beta$).

Normally the control valve characteristics (EQM) are chosen opposite to the terminal characteristics in order to linearize the circuit characteristics. The hydronic conditions in the system cause the pressure to change and distort the circuit characteristics. See Figure 1 below.

Fig 1.
The degree to which the resulting curve resembles the intended curve is a direct result of the valve authority. See Figure 2 below.

Valve authority is a measure of the change in differential pressure across a control valve during operation. The flow through a control valve depends on the differential pressure across the valve and its Cv value. The Cv value is given by the inherent valve characteristic for any valve opening. If the differential pressure is constant during operation, the relationship between Cv and water flow would be completely linear. However, in a variable flow system, the differential pressure varies during operation, which means that the relationship becomes more or less nonlinear. The “magnitude” of the nonlinearity is expressed by the valve authority:

\[
\beta = \frac{\Delta p_{\text{design}}}{\Delta p_{\text{shut}}}
\]

A high value of valve authority (close to 1) means that the differential pressure is close to constant and the relationship between Cv value and water flow becomes quite linear. A low value (significantly less than 1) means that the differential pressure will increase substantially when the valve closes, resulting in large nonlinearity between Cv value and flow. The lower the valve authority is, the more nonlinear the curve becomes. Simply by looking at the compound of the circuit characteristic, it is quite clear that a low valve authority will make the circuit characteristic curve unfavorable.
The available differential pressure across the hydronic circuit is transferred to the control valve once it shuts, which means that size, design and control of the system determine the differential pressure across the control valve when fully shut.

$$\beta_{\text{design}} = \frac{\Delta p \cdot V_{\text{design}}}{\Delta H_{\text{design}}}$$

- $\beta_{\text{design}}$ = Valve authority at design condition [-]
- $\Delta H_{\text{design}}$ = Available differential pressure across circuit at design condition [psi]

$$\beta_{\text{min}} = \frac{\Delta p \cdot V_{\text{design}}}{\Delta H_{\text{max}}}$$

- $\beta_{\text{min}}$ = Minimum valve authority [-]
- $\Delta H_{\text{max}}$ = Maximum differential pressure across circuit during operation [psi]

In order to prevent the valve authority from distorting the circuit characteristic too much, the lowest values of design and minimum authority are:

- $\beta_{\text{design}} \geq 0.5$
- $\beta_{\text{min}} \geq 0.25$

To achieve this design and minimum authority, all control valves should have differential pressure stabilization if the pump head is bigger than four (4) times the pressure drop in the control valve (if $H \geq 4 \times \Delta p_{\text{ATC}}$).

The following pages show seven different applications. Our recommendations to reach optimum balancing for good control is rated with stars (★) based on performance vs. cost ratio.

★★★ = Best Solution
Best opportunities for enhanced controllability and energy savings

★★ = Better Solution
Offers good controllability with some first cost reduction

★ = Good Solution
Air Handling Units

An air handling unit (AHU) is used to condition and circulate air as part of a heating, ventilating, and air-conditioning (HVAC) system. Usually, an air handler is a large metal box containing a blower, heating and/or cooling elements, filter racks or chambers, sound attenuators, and dampers. Air handlers usually connect to ductwork that distributes the conditioned air through the building, and returns it to the AHU. Sometimes AHUs discharge (supply) and admit (return) air directly to and from the space served, without ductwork.

Because the AHU is providing conditioned air to a large number of rooms, the water side is routinely controlled by a modulating control valve. The pipe friction loss between the AHUs and the limited number of Cv values in the ATC valves demand that balancing and verification of flow must be performed at each unit.

### Balancing options:

1. Pressure stabilization if \( H \geq 4 \times \Delta p_{\text{ATC}} \)
   - a. KTM ★★★
   - b. ATC valve with DA and venturi ★★★

2. Flow limiting if \( H < 4 \times \Delta p_{\text{ATC}} \)
   - a. AutoFlow™ ★★
Heat

Outdoor air

Heat

Cool

Cool

Supply air

UP - UNION WITH MANUAL AIR VENT

UB - UNIBODY SHUT-OFF VALVE WITH HOSE END ADAPTER

KTM - PRESSURE INDEPENDENT CONTROL VALVE WITH P/T PORT AND FDI ACTUATOR

UB - UNIBODY SHUT-OFF VALVE WITH UNION AND P/T PORT

FA - ACCESSORY FLANGE

KTM - FLANGED PRESSURE INDEPENDENT CONTROL VALVE WITH P/T PORT AND FDI ACTUATOR

UB - UNIBODY SHUT-OFF VALVE WITH UNION AND P/T PORT

CW - STRAINER WITH P/T PORT

BF - BUTTERFLY VALVE

CBW - STRAINER WITH P/T PORT

FF - ACCESSORY FLANGED X FLANGED WITH P/T PORT

BF - BUTTERFLY VALVE

YC - COMBINATION BALL VALVE Y/STRAINER WITH UNION, P/T PORT, HOSE END DRAIN, CAP AND RETAINER STRAP

FA - ACCESSORY FLANGE

UB - UNIBODY SHUT-OFF VALVE WITH HOSE END ADAPTER

Y - UNIBODY SHUT-OFF VALVE WITH HOSE END DRAIN, CAP AND RETAINER STRAP

UP - UNION WITH MANUAL AIR VENT

UB - UNIBODY SHUT-OFF VALVE WITH HOSE END ADAPTER
Outdoor air -> Heat outdoor air -> Heat

UP - UNION WITH 1/4" TEE, BUSHING, MANUAL AIR VENT AND P/T PORT

FA - ACCESSORY FLANGE

UB - UNIBODY SHUT-OFF VALVE WITH HOSE END ADAPTER

CW - STRAINER WITH P/T PORT

BF - BUTTERFLY VALVE

DA - DIFFERENTIAL PRESSURE CONTROLLER WITH P/T PORT

CA - DIFFERENTIAL PRESSURE CONTROLLER

UA - UNIBODY MANUAL VENTURI BALANCING VALVE WITH P/T PORTS, MANUAL AIR VENT AND MEMORY STOP

YV - COMBINATION BALL VALVE STRAINER WITH UNION, P/T PORT, HOSE END DRAIN, CAP AND RETAINER STRAP

VF - FLANGED STEEL VENTURI WITH 1/4" TEE, BUSHING, MANUAL AIR VENT AND EXT. P/T PORTS

DA - FLANGED DIFFERENTIAL PRESSURE CONTROLLER

BF - BUTTERFLY VALVE

FF - ACCESSORY WITH P/T PORT (FLG'D X FLG'D)

CW - STRAINER WITH P/T PORT

BF - BUTTERFLY VALVE

DA - DIFFERENTIAL PRESSURE CONTROLLER

VF - FLANGED STEEL VENTURI WITH 1/4" TEE, BUSHING, MANUAL AIR VENT AND EXT. P/T PORTS

Outdoor air -> Cool outdoor air -> Cool

Heat air -> Heat air

Cool air -> Cool air

Supply air
**Fan Coil Units**

A **fan coil unit** (FCU) is a small ventilator unit containing cooling and/or heating coils, a fan, and possibly some dampers. It typically serves a single room or a few small rooms. Airflow is often from outdoors, which will be heated or cooled to desired temperature.

Because of the small load that these units typically serve, water flow to the coils is normally controlled with an ON/OFF ATC, which works extremely well with a flow limiting valve such as AutoFlow™ at each terminal. Alternatively, FCUs are often close enough together to allow a single pressure controller (Ref. DA) to serve several units with manual balancing between individual terminals.

**Balancing options:**

1. Flow limiting on each terminal
   a. ATC + AutoFlow™ ★★★
2. Combination terminal unit valve + shared Dp controller
   a. TBV-C + DA ★★
   b. ATC + Manual valve + DA ★
3. Pressure stabilization – (modulating ATC)
   a. KTM ★
AC - AUTOFLOW VALVE WITH UNION AND P/T PORTS

UP - UNION WITH MANUAL AIR VENT AND P/T PORTS

YC - COMBINATION BALL VALVE, Y-STRAINER WITH UNION, P/T PORT, HOSE END DRAIN, CAP AND RETAINER STRAP

FCU
YC - COMBINATION BALL VALVE, Y-STRAINER WITH UNION, P/T PORT, HOSE END DRAIN, CAP AND RETAINER STRAP

S2 - STAINLESS STEEL BRAIDED HOSE

TBV-C - COMBINATION TERMINAL VALVE, ON/OFF CONTROL, MANUAL BALANCING, P/T PORTS, SHUT-OFF AND WITH FDI ACTUATOR

UP - UNION WITH MANUAL AIR VENT

S2 - STAINLESS STEEL BRAIDED HOSE

UB - UNIBODY SHUT-OFF VALVE WITH UNION

DA - Differential Pressure Controller WITH P/T PORT

FCU
FCU

ATC

UB - UNIBODY SHUT-OFF VALVE WITH UNION

DA - DIFFERENTIAL PRESSURE CONTROLLER WITH P/T PORT

YC - COMBINATION BALL VALVE, Y-STRAINER WITH UNION, P/T PORT, HOSE END DRAIN, CAP AND RETAINER STRAP

UA - UNIBODY MANUAL VENTURI BALANCING VALVE WITH P/T PORTS AND MEMORY STOP

UP - UNION WITH MANUAL AIR VENT AND P/T PORT

S2 - STAINLESS STEEL BRAIDED HOSE

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Introducing The KTM Pressure Independent Control Valve

The KTM from FDI is a pressure independent flow and temperature control valve built in one efficient and compact body design. Available in sizes from ½” to 5”, with flow capacities up to 300 gpm, the KTM is ideal for applications ranging from radiant panels, fan coils and VAV terminals, to large air handlers and process control applications.

The KTM provides flow control accuracy within ±5%, regardless of differential pressure variations in the system up to 230 psi. Like all Flow Design valves, it is 100% leak tested at the factory.

- System pressure changes will not affect flow
- Delivers maximum control, ±5%
- Control valve authority close to 1, regardless of load
- Low pressure drop for reduced pump head
- Compact design fits tight spaces

Contact your local Flow Design Representative today, and ask about the KTM!

Flow Design, Inc.
1-800-ASK-FLOW (1-800-275-3569)
Fax: 214-631-0735

www.flowdesign.com
Radiant Panels

Radiant panels transfer energy mostly by radiation, although partly by convection.

Radiant panels are almost always in the occupied space, and typically close to the occupants. This calls for a quiet solution, implying a small pressure drop. Because of the small load that these units typically serve, water flow to the coils is normally controlled with an ON/OFF ATC. These considerations together make a combination balancing / control valve such as the TBV-C the best choice. In larger systems where the pump head is greater than 10 psi, a pressure control valve such as DA should be used to maintain the quiet operation that radiant systems provide. Alternatively, radiant panels can be balanced with a flow limiting valve such as AutoFlow™ at each terminal.

Balancing options:

1. Combination terminal unit valve + shared Dp controller
   a. TBV-C if $H < 10$ psi ★★★
   b. TBV-C + DA if $H \geq 10$ psi ★★★

2. Control valve + manual balancing on each panel
   a. ATC + FlowSet if $H < 10$ psi ★
   b. ATC + FlowSet + DA if $H \geq 10$ psi ★

3. Flow limiting on each panel
   a. ATC + AutoFlow™ if $H < 10$ psi ★★★
   b. ATC + AutoFlow™ + DA if $H \geq 10$ psi ★★★
Radiant Panel Solution 1A/1B

- **Radiant Panel**
- **S2 - Stainless Steel Braided Hose**
- **YC - Combination Ball Valve, Y-Strainer with Union, P/T Port, Hose End Drain, Cap and Retainer Strap**
- **UP - Union with Manual Air Vent**
- **UB - Unibody Shut-Off Valve with Union**
- **TBV-C - Combination Terminal Valve, On/Off Control, Manual Balancing, P/T Ports, Shut-Off and FDI Actuator**
- **DA - Differential Pressure Controller with P/T Port**
- **NOTE: USE DA IF H ≥ 10 PSI**

Differential Pressure Controller with P/T Port

Diagram shows a radiant panel solution with various components and connections. The text provides specific details about each component and their functions, ensuring a comprehensive understanding of the setup.
DA - DIFFERENTIAL PRESSURE CONTROLLER WITH P/T PORT

NOTE: USE DA IF H ≥ 10 PSI

S2 - STAINLESS STEEL BRAIDED HOSE

S2 - STAINLESS STEEL BRAIDED HOSE

YC - COMBINATION BALL VALVE, Y-STRAINER WITH UNION, P/T PORT, HOSE END DRAIN, CAP AND RETAINER STRAP

UA - UNIBODY MANUAL VENTURI BALANCING VALVE WITH P/T PORTS AND MEMORY STOP

ATC

UP - UNION WITH MANUAL AIR VENT AND P/T PORT

UB - UNIBODY SHUT-OFF VALVE WITH UNION

Radiant Panel
DA - DIFFERENTIAL PRESSURE CONTROLLER WITH P/T PORT

NOTE: USE DA IF H ≥ 10 PSI

UB - UNIBODY SHUT-OFF VALVE WITH UNION

AC - AUTOFLOW VALVE WITH UNION AND P/T PORTS

YC - COMBINATION BALL VALVE, Y-STRAINER WITH UNION, P/T PORT, HOSE END DRAIN, CAP AND RETAINER STRAP

S2 - STAINLESS STEEL BRAIDED HOSE

ATC

UP - UNION WITH MANUAL AIR VENT AND P/T PORT

Radiant Panel

NOTE: USE DA IF H ≥ 10 PSI
**VAV Terminals**

**VAV terminals** are used in a variable air volume system and heat (fan powered) or reheat (single duct) the air to the local needs of temperature. This heat can be provided by a hot water coil. The water flow in this coil is controlled with either modulating or ON/OFF control valve.

In modulating systems with a relatively low pump head, the balancing can be performed with a manual or AutoFlow™ balancing valve. If the pump head is relatively high, then the pressure should be stabilized with differential pressure controller, shared between several hot water coils.

ON/OFF systems work extremely well with a flow limiting valve such as AutoFlow™ or manual terminal valves. If the pump head is relatively high, the pressure should be stabilized with a differential pressure controller on each module.

---

## VAV Terminals (single duct shown)

**Balancing options modulating control:**

1. Flow limiting on each panel
   - a. ATC + AutoFlow™ if \( H < 4 \times \Delta p_{ATC} \) ★★★
   - b. ATC + AutoFlow™ + DA if \( H \geq 4 \times \Delta p_{ATC} \) ★★★

2. Pressure stabilization
   - a. KTM ★★

**Balancing options ON/OFF control:**

3. Flow limiting on each panel
   - a. ATC + AutoFlow™ ★★★

4. Combination terminal unit valve + shared Dp controller
   - a. TBV-C if \( H < 15 \text{ psi} \) ★★
   - b. TBV-C + DA if \( H \geq 15 \text{ psi} \) ★★

5. Control valve + manual balancing on each panel
   - a. ATC + FlowSet if \( H < 25 \text{ psi} \) ★
   - b. ATC + FlowSet + DA if \( H \geq 25 \text{ psi} \) ★

---

VAV TERMINAL OVERVIEW

VAV TERMINALS
Reheat Coil

Supply Air

AC - AUTOFLOW VALVE WITH UNION AND P/T PORTS

DA - DIFFERENTIAL PRESSURE CONTROLLER WITH P/T PORT

UB - UNIBODY SHUT-OFF VALVE WITH UNION

UB - UNIBODY SHUT-OFF VALVE WITH UNION

YC - COMBINATION BALL VALVE, Y-STRAINER WITH UNION, P/T PORT, HOSE END DRAIN, CAP AND RETAINER STRAP

S2 - STAINLESS STEEL BRAIDED HOSE

UP - UNION WITH MANUAL AIR VENT AND P/T PORT

S2 - STAINLESS STEEL BRAIDED HOSE

NOTE: USE DA IF H ≥ Δp ATC

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VAV TERMINALS
UB - UNIBODY SHUT-OFF VALVE WITH UNION AND P/T PORT

YC - COMBINATION BALL VALVE, Y-STRAINER WITH UNION, P/T PORT, HOSE END DRAIN, CAP AND RETAINER STRAP

S2 - STAINLESS STEEL BRAIDED HOSE

KTM - PRESSURE INDEPENDENT CONTROL VALVE WITH P/T PORTS AND FDI ACTUATOR

UP - UNION WITH MANUAL AIR VENT

Reheat Coil

Supply Air

VAV TERMINAL SOLUTION 2A
Reheat Coil

Supply Air

YC - COMBINATION BALL VALVE, Y-STRAINER WITH UNION, P/T PORT, HOSE END DRAIN, CAP AND RETAINER STRAP

S2 - STAINLESS STEEL BRAIDED HOSE

S2 - STAINLESS STEEL BRAIDED HOSE

AC - AUTOFLOW VALVE WITH UNION AND P/T PORTS

UP - UNION WITH MANUAL AIR VENT AND P/T PORT

ATC
DA - DIFFERENTIAL PRESSURE CONTROLLER WITH P/T PORT

YC - COMBINATION BALL VALVE, Y-STRAINER WITH UNION, P/T PORT, HOSE END DRAIN, CAP AND RETAINER STRAP

TBV-C - COMBINATION TERMINAL VALVE, ON/OF CONTROL, MANUAL BALANCING, P/T PORTS, SHUT-OFF AND FDI ACTUATOR

UP - UNION WITH MANUAL AIR VENT

S2 - STAINLESS STEEL BRAIDED HOSE

UC - UNIBODY SHUT-OFF VALVE WITH UNION

NOTE: USE DA IF P ≥ 15 PSI

Supply Air

Reheat Coil

S2 - STAINLESS STEEL BRAIDED HOSE
Reheat
Coil
Supply
Air

YC - COMBINATION BALL VALVE, Y-STRAINER WITH UNION, P/T PORT, HOSE END DRAIN, CAP AND RETAINER STRAP

UA - UNIBODY MANUAL VENTURI BALANCING VALVE WITH P/T PORTS AND MEMORY STOP

DA - DIFFERENTIAL PRESSURE CONTROLLER WITH P/T PORT

UB - UNIBODY SHUT-OFF VALVE WITH UNION

UP - UNION WITH MANUAL AIR VENT AND P/T PORT

NOTE: USE DA IF H ≥ 25 PSI
Process Cooling

Process cooling is used in many different applications such as computer room air conditioning (CRAC), breweries, paint shops, automotive industry and molding applications, etc.

Depending on the exact application it can be either modulating or ON/OFF water flow control. Reliability is typically the highest priority in these systems.

Balancing options:

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>★★★</td>
<td>IF ON/OFF</td>
</tr>
</tbody>
</table>
| ★★★★  | 1. Flow limiting on each panel
| ★★★★  | a. ATC + AutoFlow™  |
| ★★★   | IF Modulating |
| ★★★★  | 2. Pressure stabilization – (modulating ATC)
| ★★★★  | a. ATC + DA + Venturi |
| ★★★   | b. KTM |

Process Cooling Overview
Water Source Heat Pumps

Water source heat pumps (WSHP) provide hot or cool air to individual zones using water at a neutral temperature to transport heat. A reversible refrigeration cycle moves heat from the room into the water to cool the room or vice versa.

In many installations the water runs continuously, but the addition of an ON/OFF control valve reduces pumping cost. Water flow is normally maintained at a constant level as long as the unit is operating. It is critically important that the heat pump receives enough water to avoid freeze-up or refrigerant overpressure conditions. Insufficient water flow would also cause a low coefficient of performance (COP). Hence balancing works extremely well with flow limiting AutoFlow™.

Balancing options:

1. Flow limiting on each panel
   a. ATC + AutoFlow™ ★★★
Central Plants / Production Units

*Chillers* are commonly staged ON/OFF depending on required capacity. Water flow through each chiller is normally constant during operation. Each chiller has an evaporator side through which water flows and, for water cooled chillers, there is also water flow through the condenser side. In many cases there are multiple cooling towers. Each of these areas requires balancing.

*Boilers* are, like the chillers, usually staged ON/OFF, depending on the required capacity. On very large boiler plants the exhaust may also be equipped with a condenser side.

As the flow through each evaporator, condenser, boiler or cooling tower is constant, the balancing is most easily accomplished with AutoFlow™. The balancing can also be done with manual balancing such as FlowSet™.

**Balancing options:**

1. Flow limiting on each section
   
   a. ATC + AutoFlow™  ★★★

2. Manual balancing on each section
   
   a. ATC + FlowSet™  ★★
AF VALVE - FLANGED VENTURI WITH EXT. P/T, MEMORY STOP AND BUTTERFLY VALVE

AF VALVE

AF VALVE - FLANGED VENTURI WITH EXT. P/T, MEMORY STOP AND BUTTERFLY VALVE

AF VALVE

AF VALVE

AF VALVE - FLANGED VENTURI WITH EXT. P/T, MEMORY STOP AND BUTTERFLY VALVE

AF VALVE

BF - BUTTERFLY VALVE

UB - SHUT-OFF VALVE WITH HOSE END ADAPTER

CW - STRAINER

Condenser

Evaporator

Condenser

Evaporator
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
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<tbody>
<tr>
<td>Manual Calibrated Balancing Valve</td>
<td></td>
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<tr>
<td>Venturi flowmeter</td>
<td></td>
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<tr>
<td>Automatic flow control valve</td>
<td></td>
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<tr>
<td>Ball valve</td>
<td></td>
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<tr>
<td>Ball valve with memory stop</td>
<td></td>
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<tr>
<td>Butterfly valve</td>
<td></td>
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<tr>
<td>Butterfly valve with memory stop</td>
<td></td>
</tr>
<tr>
<td>Hose end drain valve with cap &amp; chain</td>
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<tr>
<td>P/T plug</td>
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<tr>
<td>Manual air vent</td>
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</tr>
<tr>
<td>Drain</td>
<td></td>
</tr>
<tr>
<td>Automatic air vent</td>
<td></td>
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<tr>
<td>Union</td>
<td></td>
</tr>
<tr>
<td>Flange</td>
<td></td>
</tr>
<tr>
<td>Y-strainer</td>
<td></td>
</tr>
<tr>
<td>Two-way ATC valve</td>
<td></td>
</tr>
<tr>
<td>Three-way ATC valve</td>
<td></td>
</tr>
</tbody>
</table>

**Symbol Legend**

- Fire and smoke-rated hose
- Check valve
- Shut-off valve
- Place for balancing option
- Pump
- Supply lines
- Return lines
**Hydronic Training**

Flow Design offers a variety of knowledge-based seminars and training:

**For design engineers:**
- Why balance HVAC systems with modulating control?
- Mastering variable flow distribution systems
- Balancing with flow limitation AutoFlow™
- Balancing with manual balancing FlowSet™
- Differential pressure stabilization

**For contractors and commissioning technicians:**
- How to perform optimum balancing during the construction process
- Optimization of differential pressure controller and pump head based on professional balancing

For further information about our training curriculum or scheduled schools, please contact us directly at:

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1-800-ASK-FLOW (1-800-275-3569)
Fax: 214-631-0735
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Flow Design provides a total hydronic solution to the HVAC industry, with one of the broadest product lines, and technical training programs based upon your specific needs. Our world-wide experience base and in-depth knowledge of hydronic systems applications in HVAC is something you can build on!