PRESSURE INDEPENDENT CONTROL VALVE TECHNOLOGY

Typical Hydronic System Problems

- **Low Delta "T"s resulting in:**
  1. **Chillers operating at higher capacities** and/or **longer than necessary during low load conditions.**
  2. **Condensing boilers performing as conventional boilers because of higher temperature return water.**

- **Unbalanced Systems:** ***(Systems not getting balanced from the beginning / Systems not getting re-balanced as additions are made to existing buildings)***

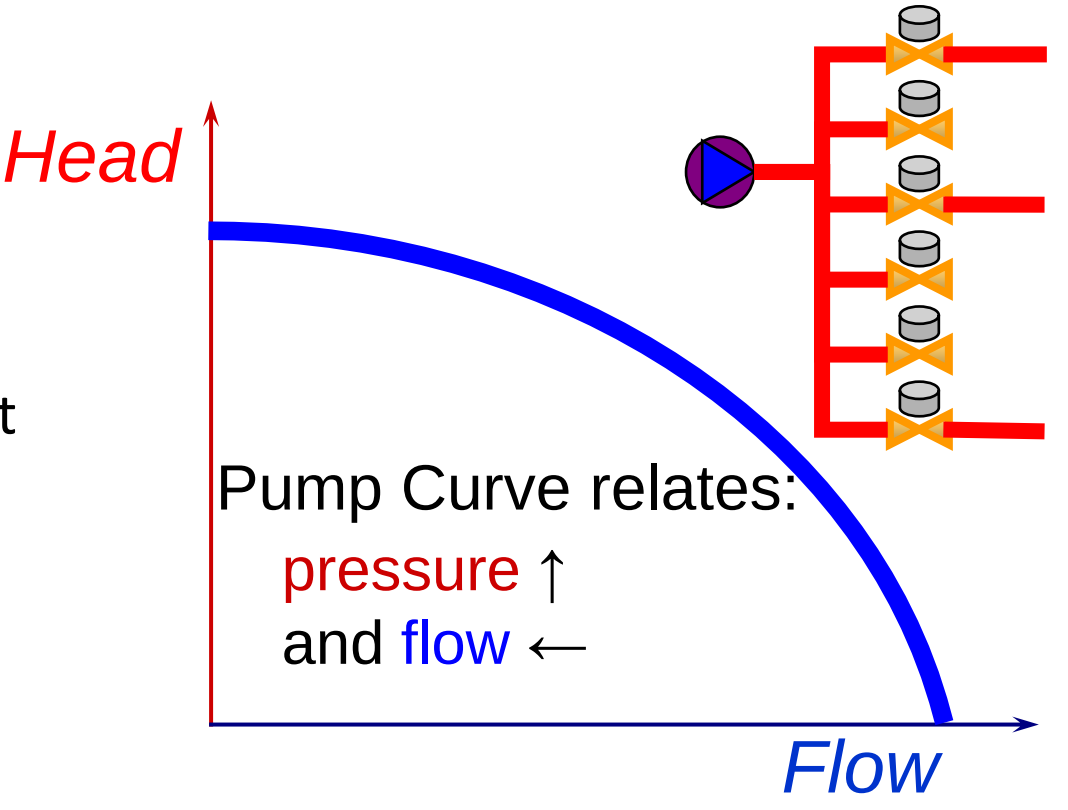
- **Uneven flows resulting in a lack of heating** and/or **cooling in some areas of a building.**

- **Unnecessary change of flows as a result of constant changing of system pressures.**

- **Constant changing of output control signals to control valves other than to compensate for temperature fluctuations.**

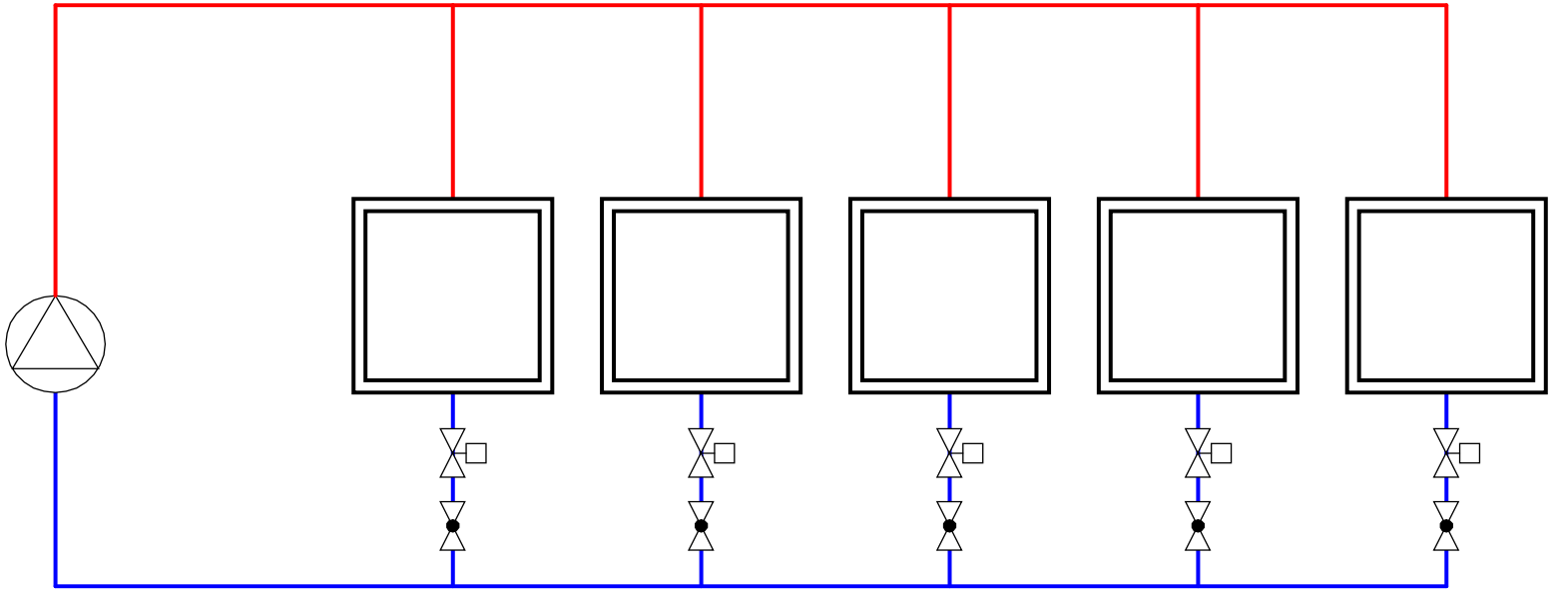
Pump/System Interaction Issues

- Characteristic curve of impeller correlates flow and pump head pressure
- As controls change flow, head pressure changes inversely
- Pressure changes travel in the system at the speed of sound
  - At low load, small pressure changes cause large changes in thermal output, causing hunting in the control system
- Affinity Laws for Centrifugal Pumps:
  - Pressure varies proportionally to speed
  - Flow varies with square of speed
  - Power varies with cube of speed



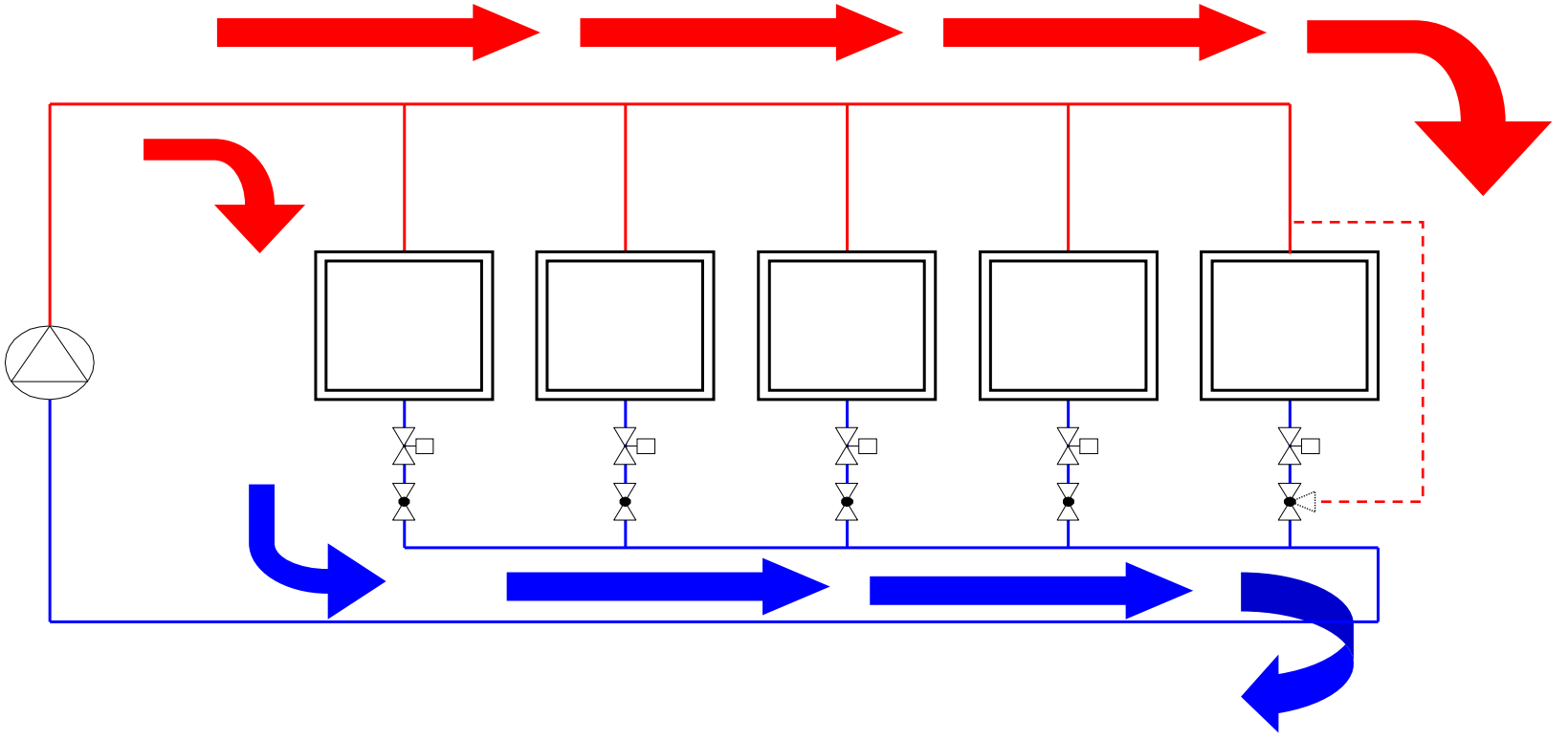
Variable Frequency Drives controlled from average system head are slow to respond to pressure changes = loop instability

Basic Direct Return Piping Layout



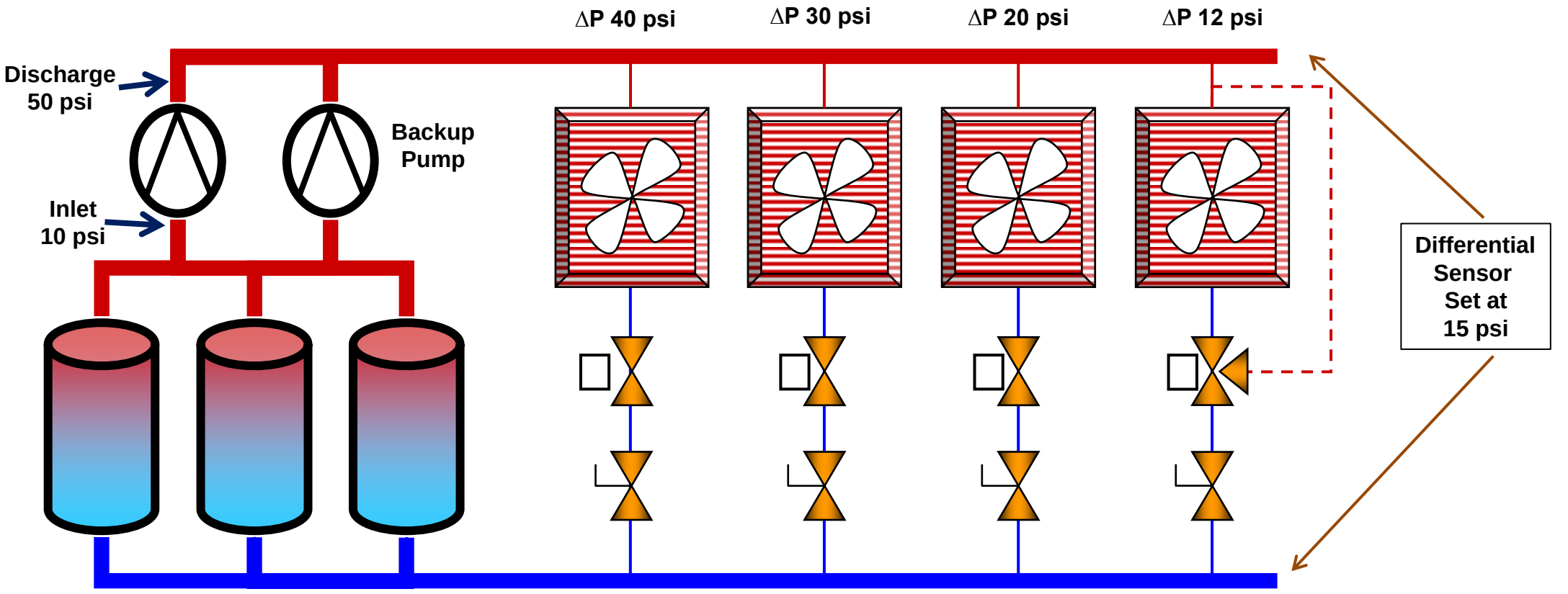
Balancing valves are required, as well as initial balancing of the system. Flows are constantly changing as a result of the fluctuation of the ΔP due to control valves constantly opening and closing and pump speeds ramping up and down.

Reverse Return Piping Layout

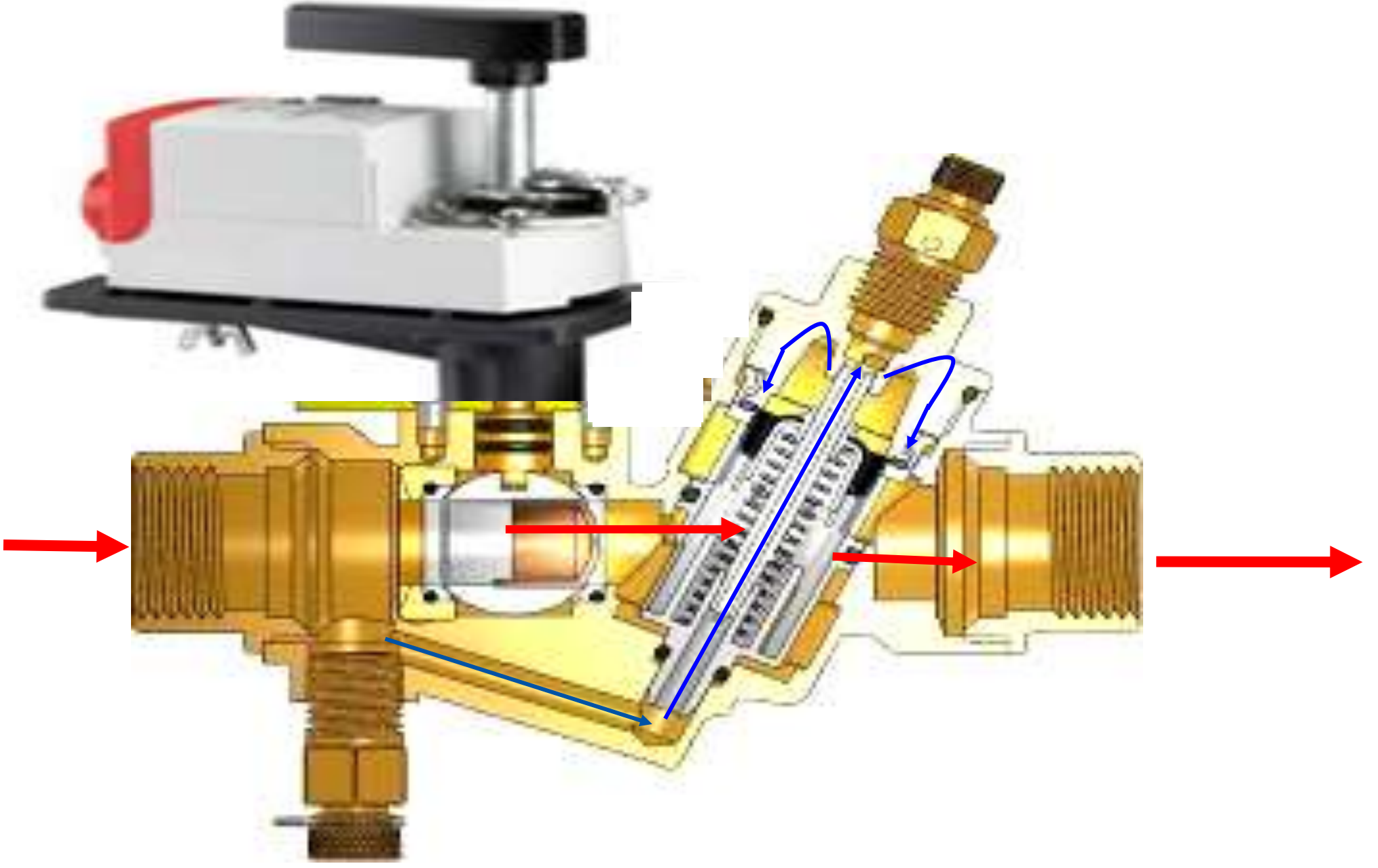


Will provide even flows without the use of balancing valves and having to balance the system, but it involves more engineering time plus more material and more upfront installation costs than direct return piping. Valves are still constantly opening and closing unnecessarily as a result of fluctuating system dynamics, which still results in unstable flows and lower ΔTs, especially at low loads.

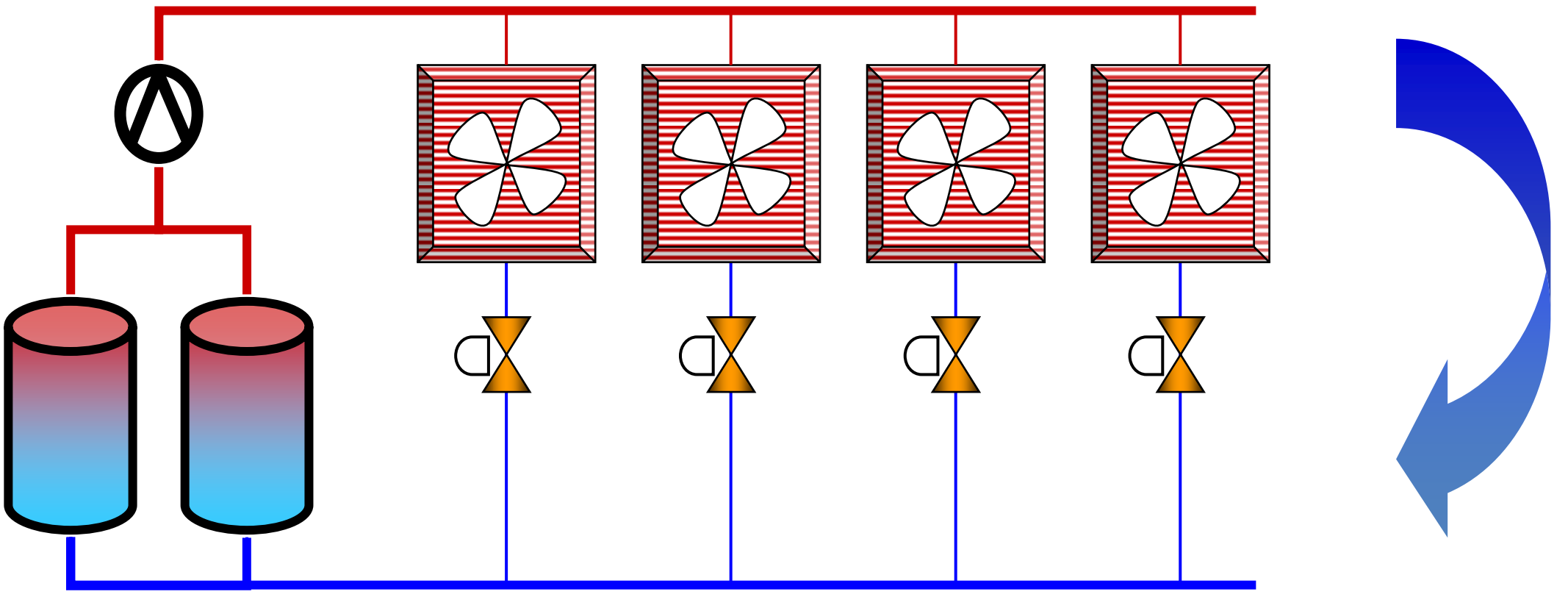
Direct Return Piping with Conventional Valves



Operation of the VRN Series Valves



Direct Return Piping with Pressure Independent Valves



HONEYWELL VRN & VRW VALVES

VRN Series – ½" ~ 3"

1 GPM to 95 GPM

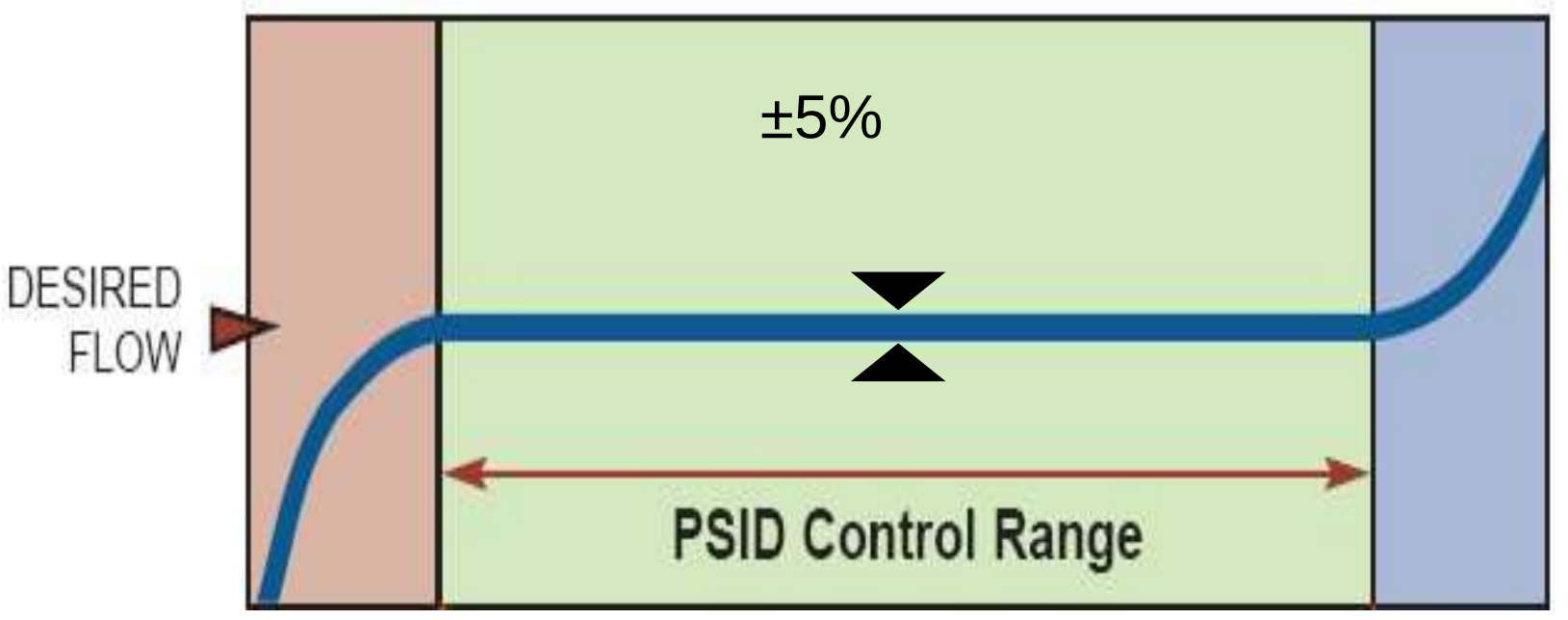
VRW Series
2½" ~ 6"

39 GPM to 469 GPM

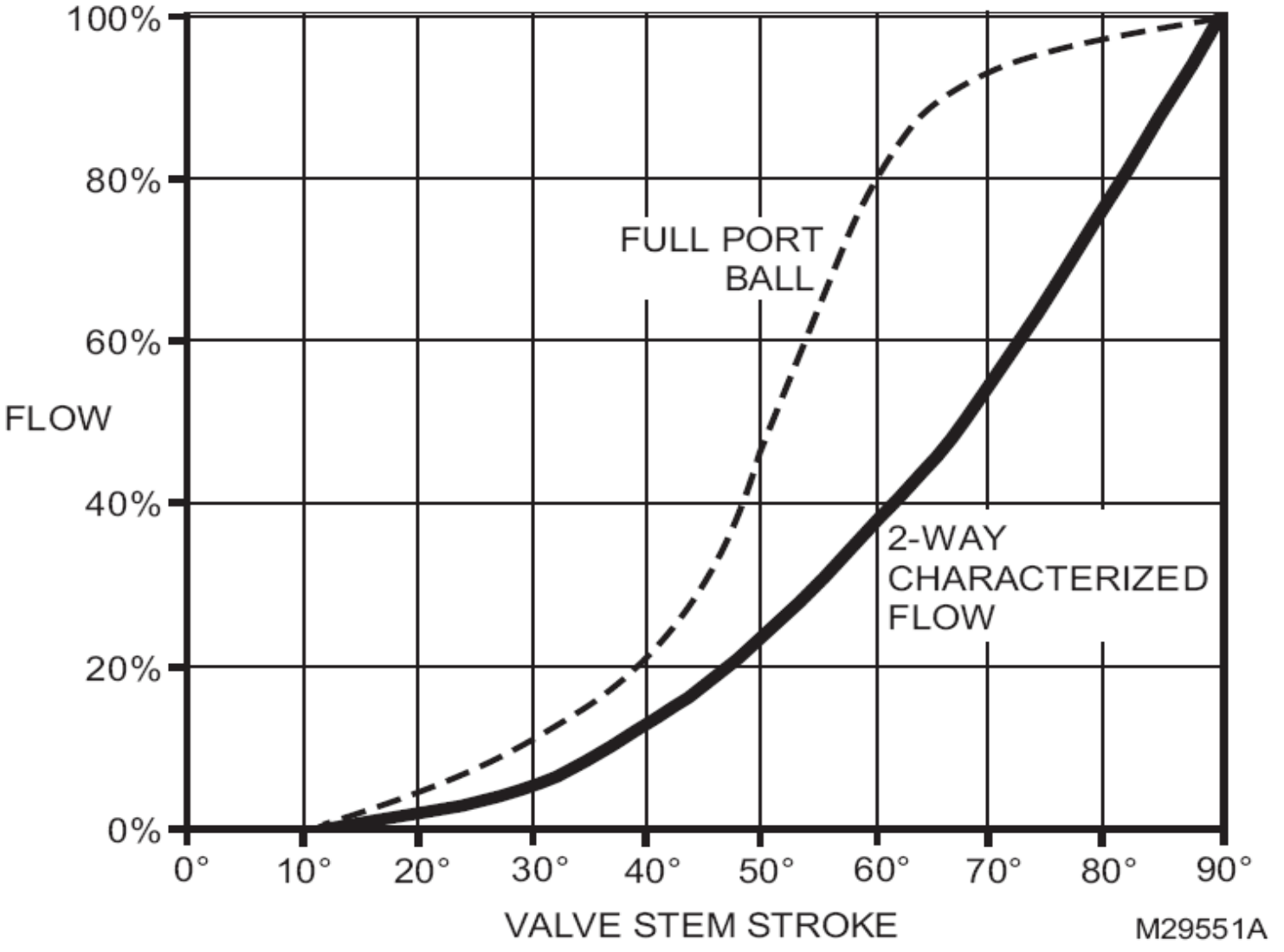
- ✓ *Flow accuracy ± 5%*
- ✓ No Field Calibration required
- ✓ Field-serviceable
- ✓ ½" to 6" pipe sizes
- ✓ 1.0 to 469 gpm

Minimum & Maximum ΔP

The Honeywell VRN & VRW Series valves, *(like any other manufacturer's pressure independent control valves),* require the a minimum and maximum pressure differential pressure across each valve in order to operate effectively.



Flow Adjustments



(The Modulating MN & MS series actuators will re-scale based on any angle of rotation).

Estimated Installation Cost Savings

(Means Mechanical 15100 Building Services Piping)

	½"	¾"	1"
Balancing valve per coil.	$ 64.98	$ 70.64	$ 90.45
Labor to install balancing valve per coil.	$ 55.15	$ 58.50	$ 60.10
Set up & calibration cost from balancing contractor per coil.	$ 88.81	$ 88.81	$ 88.81
Total Balancing Cost per Coil	$ 208.94	$ 217.95	$ 239.36
Conventional Honeywell VBN Modulating Ball Valve	$ 93.16	$ 101.66	$129.45
Total Balancing Cost plus VBN Ball Valve per Coil	$302.10	$319.61	$368.81
VRN Modulating Pressure Independent Control Valve	$232.10	$261.38	$302.88
Flow verification by balancing contractor per coil.	$40.00	$40.00	$40.00
Total of flow verification plus VRN Valve	$272.10	$301.38	342.88
Savings on Investment	[$30.00]	[$18.23]	[$25.93]

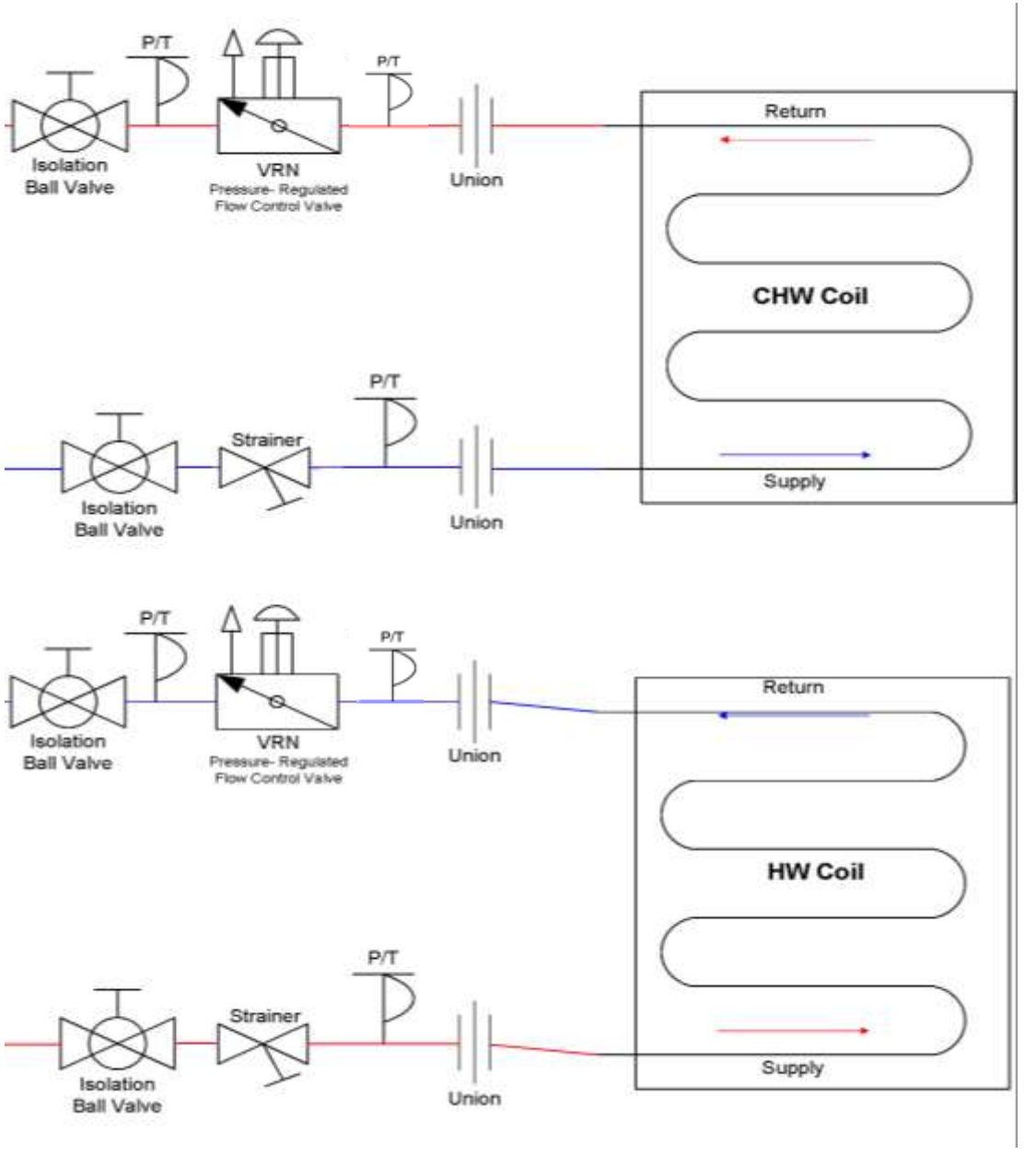
PRESSURE INDEPENDENT CONTROL VALVE SPECIFICATIONS

- Control valves shall be pressure independent.
  - The flow through the valve shall not vary more than +/- 5% due to system pressure fluctuations across the valve in the selected operating range.
  - The control valves shall accurately control the flow from 0 to 100% full rated flow. The valve shall have an equal percentage characteristic, through use of a characterized ball.
  - For valve sizes of ½" to 6", a minimum of 5.8 PSI differential shall be required across the valve, to operate independent of pressure changes.
  - Valve regulator cartridges shall be accessible and field serviceable.
  - Valve stems shall be removable and valve packing shall be field-replaceable.
  - All pressure independent control valves shall be sized by the maximum coil capacity in GPM, and not by the conventional CV method.
  - Pressure Independent Control valves shall be by Honeywell.
- The actuator shall be directly coupled to the valve at the factory.
  - The actuator for valves shall modulate the control valve for 0 to 100% design flow.
  - If information is required from the field regarding the actual flow to the coil, the actuator shall have a separate feedback wire which will be capable of sending a signal back to the controller. This signal will translate to the actual GPM of the associated coil.

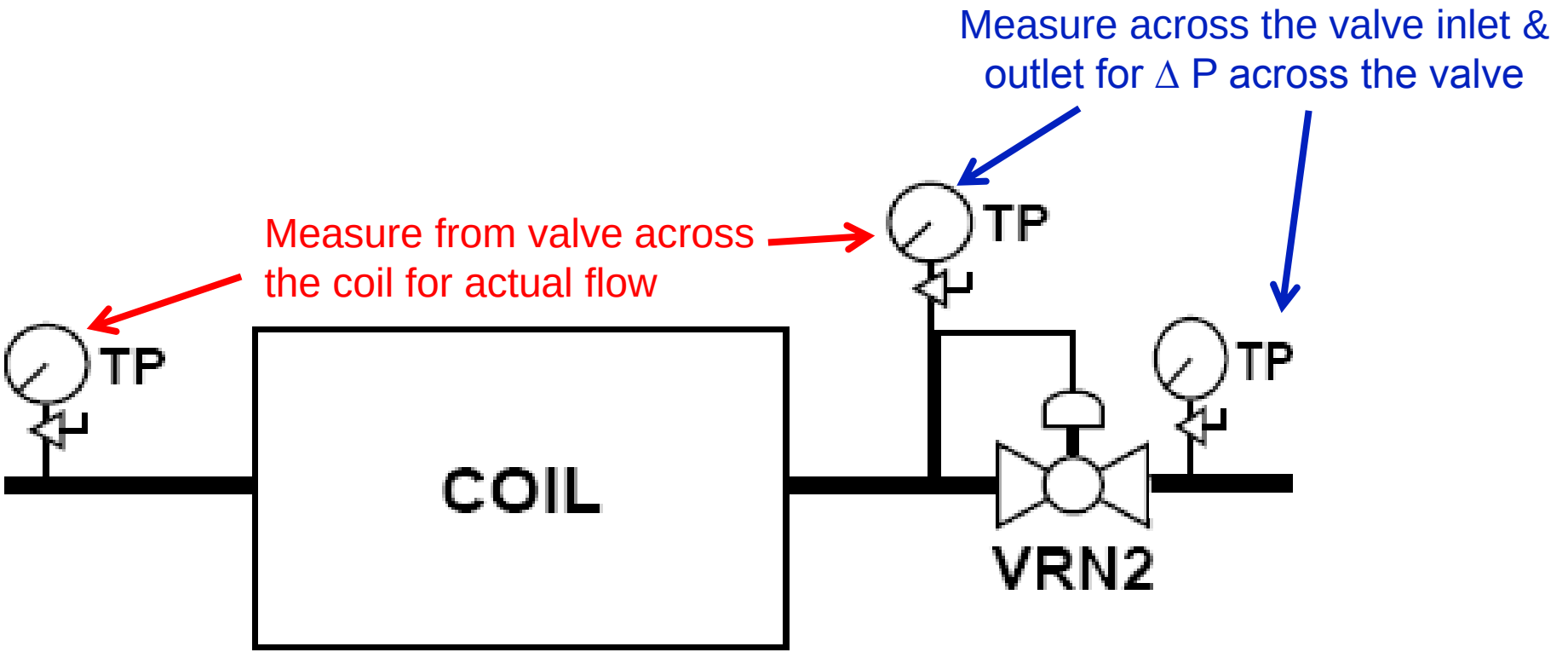
The following portion should be included in both the balancing specification, the mechanical specification and temperature control specification, to provide detail for the deletion of the balancing valves and balancing, where pressure independent valves are installed.

- Balancing valves and associated balancing shall not be required wherever a pressure independent control valve is installed. Flow performance curves shall be provided with each valve.

Coil Piping Details



Flow Verification



Overall Advantages

1. Actuator travel is consistently and significantly less in comparison to the typical globe or ball valves.
2. Less components to Install, installation is simplified, therefore lower total installation cost.
3. No Set up time, just verification of flow.
4. Increases the accuracy of room temperature control or other control parameters.
5. Maintains higher ΔTs for higher efficiency of chillers and condensing boilers. ***(Chilled water systems can be designed using a ΔT of 16°F to 18°F instead of the typical 12°F ΔT: This shrinks the pipe size due to lower calculated flows. Reduced flows render lower pump energy consumption. In Addition, chiller efficiency varies by 2~3% per every 1°F ΔT change).***
6. Prevents overflow or underflow for fast start-up during morning warm up or morning cool down.
7. Reduced to no liability on the consultant *and/or* the design team because of unbalanced systems *and / or* uneven temperatures in various zones.

Savings Potential

- **Decreased pump energy usage (secondary loop)**
- **Decreased pump energy usage (primary loop) dependent on chiller control strategy**
- **Additional chillers will not be required at part load due to higher efficiency and lower flows, reducing chiller energy consumption.**
- **Based on industry studies & findings from Honeywell and other pressure independent control valve manufacturers, the average annual operational savings is approximately 16% higher when using VFDS on pumps combined with pressure independent control valves *versus* using VFDs on pumps combined with conventional valves and balancing valves.**

Resources

The Honeywell Web Site:

www.customer.honeywell.com

Specifications for Consulting Engineers:

www.specifyhoneywell.com