Tech Sheet #CVR 406

Control Valve Trim Descriptions

Control valves can be used with a variety of fluids, pressures, and capacities. The variations of these conditions will have an effect on the trim you select in your control valve. Following is a list of characteristics, types, materials and sizes to help you determine the appropriate trim for your application.

- **Basic Trim Characteristics**
  - **Equal Percentage:** For equal increments of valve plug travel, the change in flow rate with respect to travel may be expressed as a constant percent of the flow rate at the time of the change. The change in flow rate observed with respect to travel will be relatively small when the valve plug is near its seat and relatively high when the valve plug is nearly wide open. This is the preferred valve characteristic when pressure differential across the valve decreases with increases in flow rate, such as steam flowing through a control valve to a heat exchanger.
  - **Linear:** Flow capacity or (C_v) increases linearly with valve travel. Flow is directly proportional to valve travel. This is the preferred valve characteristic for a control valve that is being used with a distributive control system (DCS) or programmable logic controller (PLC).
  - **Quick Opening:** Provides maximum change in flow rate at low travels. The curve is basically linear through the first 40% of travel. It then flattens out indicating little increase in flow rate as travel approaches the wide-open position. This decrease occurs when the valve plug travel equals the flow area of the port. This normally happens when the valve characteristic is used for on/off control.
- **Plug Guiding**
  - **Cage Guided:** A hollow cylindrical trim element that is sometimes used as a guide to align the movement of a valve plug with a seat ring. C_v and flow characteristic are most often determined by openings machined into the wall of the cage. It can be modified for some valve types to characterize the flow through the valve. The cage may also act as a noise attenuation or anti-cavitation device.
    - Profiled sleeve and/or a profiled plug
    - Sleeve guides the plug
  - **Top Guided (stem guided):** A guide bushing closely fitted to the valve stem and aligned with the seat.
    - Profiled plug
    - Bushing guides the stem which guides the plug
- **Pressure Balanced / Pressure Unbalanced**
  - **Pressure Balanced:** A trim arrangement that tends to equalize the pressure above and below the valve plug to minimize the net static and dynamic fluid flow forces

acting along the axis of the stem of a globe valve. Some regulators also use this design, particularly in high pressure service. Cage guided trims may be balanced or unbalanced.

- **Pressure Unbalanced:** A trim arrangement in which the pressure above and below the plug is not equalized. In operation, more axial force is needed to maintain trim position than would be required in a pressure balanced valve. Top guided trims are generally unbalanced.

- **Trim Types**
  - **"Standard"** (parabolic)
    - In a standard trim, there is generally only one pressure drop across the valve.
  - **Tortuous Flow Path**
    - This type of trim (perforated by holes or slots as an example) is used to reduce noise, fight cavitation, etc.
    - **Anti-Cavitation:** A special trim used in control valves to stage the pressure drop through the valve, which will either prevent the cavitation from occurring or direct the bubbles that are formed to the center of the flow stream away from the valve body and trim. This is usually accomplished by causing the fluid to travel along a torturous path or through successively smaller orifices, slots, or a combination of both.
      - Perforated: A trim design where flow passes through a series of holes in the plug and/or sleeve. As the plug is lifted, more holes are exposed, increasing flow. Single stage means flow passes through one set of holes; multi-stage means flow passes through two or more sets of holes.
      - Slotted to Perforated, but uses slots instead of circular holes.
    - **Noise Reduction:** A special caged trim that utilizes multiple orifices of a special shape, size, and spacing to minimize noise generated by the flow of vapor, gas, or steam through a control valve.
      - Perforated: A trim design where flow passes through a series of holes in the plug and/or sleeve. As the plug is lifted, more holes are exposed, increasing flow. Single stage means flow passes through one set of holes; multi-stage means flow passes through two or more sets of holes.

- **Trim Materials**
  - **"Standard":** A material that is in its normal state, or reference to the base material offering of a specific manufacturer. Common materials are 304 and 316 SS.
  - **Hard Facing:** A material that is harder than the surface to which it is applied. It is normally used to resist fluid erosion or to reduce the chance of galling between

moving parts. Hard facing may be applied by fusion welding, diffusion, inductive heating, or spray coating the material. Alloy #6 or Stellite is a common material used for this purpose.

- **Soft Seat:** Valve trim with an elastomeric or polymeric material used either in the valve plug or seat ring to provide tight shutoff with a minimal amount of actuator force. A soft seated valve will usually provide CLASS VI seat leakage capability.

- **Trim Size**
  - **"Standard" Trim (Full Port):** Valve trim that indicates that the internal diameter of the valve opening is the same as the pipe it is connected to, or reference to largest port offered by a specific manufacturer.
  - **Reduced Trim:** This trim is an undersized orifice. A reduced or restricted capacity trim is used for several reasons to include adjusting a large valve to handle smaller flow requirements, reducing inlet and outlet fluid velocities and correcting errors in over sizing.
    - **Micro Trim** – Most often for flow capacities less than 0.2, consisting of matched orifice and plug set.

The preceding is an explanation of various trim characteristics, types, materials, and sizes for control valves to help you determine the best trim for your application; however, we recommended that you consult with the control valve manufacturer before making your final selection.

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