

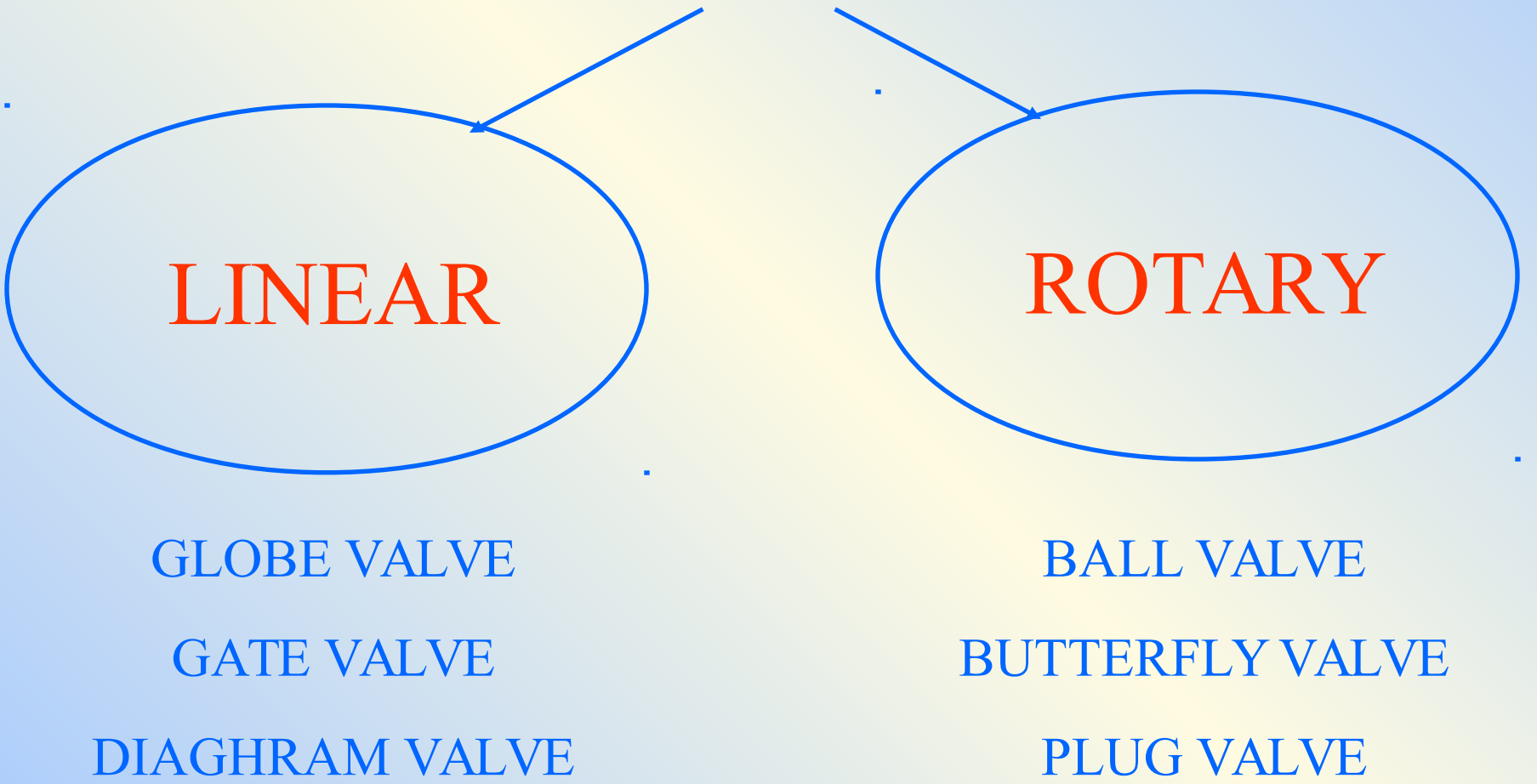
Control Valve Types

The control valve regulates the rate of fluid flow as the position of the valve plug or disk is changed by force from the actuator.

To do this, the valve must:

1. Contain the fluid without external leakage
2. Have adequate capacity for the intended service
3. Be capable of withstanding the erosive, corrosive, and temperature influences of the process
4. Incorporate appropriate end connections to mate with adjacent pipelines and actuator attachment means to permit transmission of actuator thrust to the valve plug stem or rotary shaft.

VALVE MOTION



LINEAR

GLOBE VALVE

GATE VALVE

DIAPHRAM VALVE

ROTARY

BALL VALVE

BUTTERFLY VALVE

PLUG VALVE

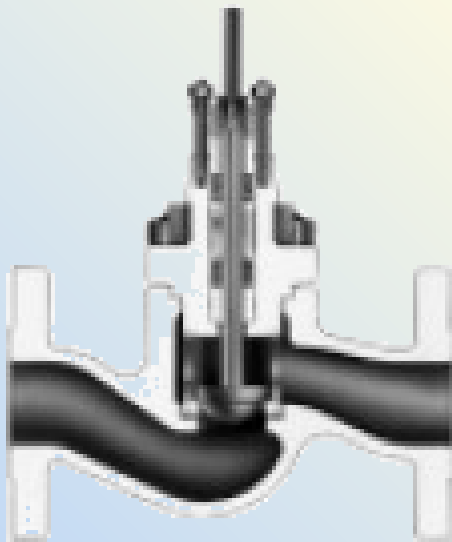
Globe Valves

Single-Port Valve Bodies

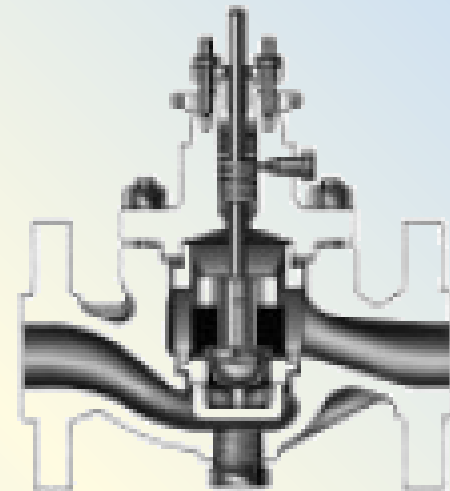
- Single port is the most common valve body style and is simple in construction.
- Single-port valves are available in various forms, such as globe, angle, bar stock, forged, and split constructions.
- Generally single-port valves are specified for applications with stringent shutoff requirements.
- They use metal-to-metal seating surfaces or soft-seating with PTFE or other composition materials forming the seal.
- Single-port valves can handle most service requirements.

- Because high-pressure fluid is normally loading the entire area of the port, the unbalance force created must be considered in selecting actuators for single-port control valve bodies.
- Although most popular in the smaller sizes, single-port valves can often be used in 4-inch to 8-inch sizes with high-thrust actuators.
- Many modern single-seated valve bodies use cage or retainer-style construction to retain the seat ring cage, provide valve-plug guiding, and provide a means for establishing particular valve flow characteristics.
- Retainer-style trim also offers ease of maintenance with flow characteristics altered by changing the plug.

➤ Cage or retainer-style single seated valve bodies can also be easily modified by change of trim parts to provide reduced-capacity flow, noise attenuation, or reduction or elimination of cavitations.



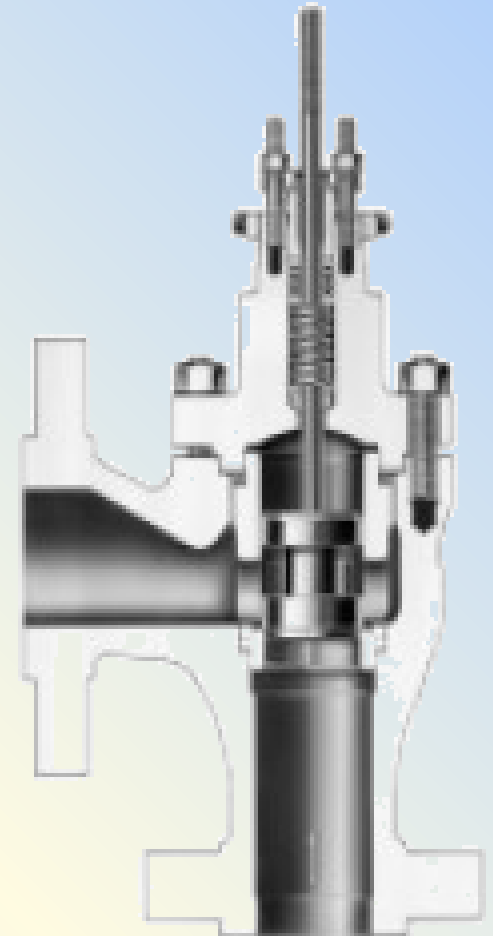
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Angle valves

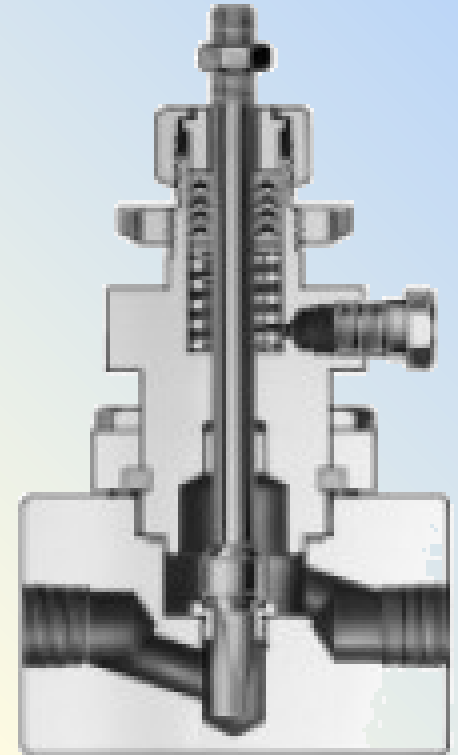
- Nearly always single Ported.
- They are commonly used in boiler feed water and heater drain service and in piping schemes where space is at a premium and the valve can also serve as an elbow.
- The valve shown has cage-style construction.
- Others might have screwed-in seat rings, expanded outlet connections, restricted trim, and outlet liners for reduction of erosion damage.



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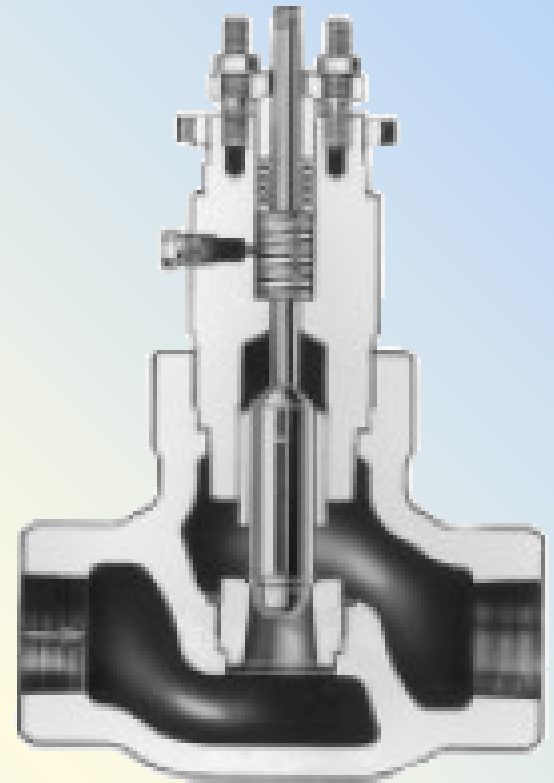
Bar-stock valve bodies

- Often specified for corrosive applications in the chemical industry.
- They can be machined from any metallic bar-stock material and from some plastics.
- When exotic metal alloys are required for corrosion resistance, a bar-stock valve body is normally less expensive than a valve body produced from a casting.



High-pressure single-ported globe valves

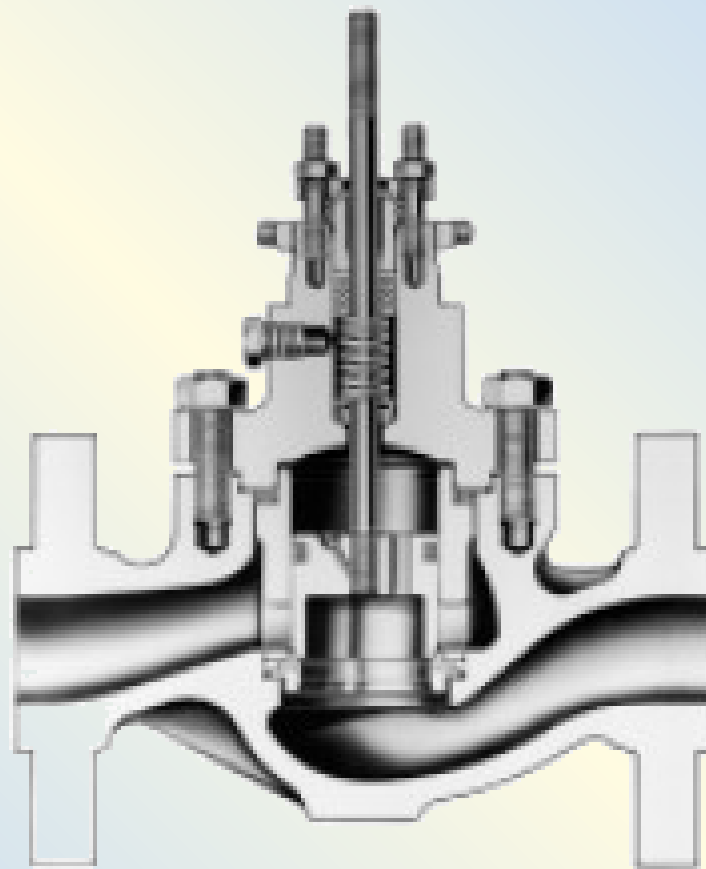
- Often used in production of gas and oil.
- Variations available include cage-guided trim, bolted body-to-bonnet connection, and self-draining angle versions.
- Flanged versions are available with ratings to Class 2500.



Balanced-Plug Cage-Style Valve Bodies

- This popular valve body style, single ported in the sense that only one seat ring is used, provides the advantages of a balanced valve plug often associated only with double-ported valve bodies.
- Cage-style trim provides valve plug guiding, seat ring retention, and flow characterization.
- In addition a sliding piston ring-type seal between the upper portion of the valve plug and the wall of the cage cylinder virtually eliminates leakage of the upstream high pressure fluid into the lower pressure downstream system.
- Downstream pressure acts on both the top and bottom sides of the valve plug, thereby nullifying most of the static unbalance force.

- Reduced unbalance permits operation of the valve with smaller actuators than those necessary for conventional single-ported valve bodies.
- Interchangeability of trim permits choice of several flow characteristics or of noise attenuation or anticavitation components.
- For most available trim designs, the standard direction of flow is in through the cage openings and down through the seat ring.
- These are available in various material combinations, sizes through 20-inch, and pressure ratings to Class 2500.

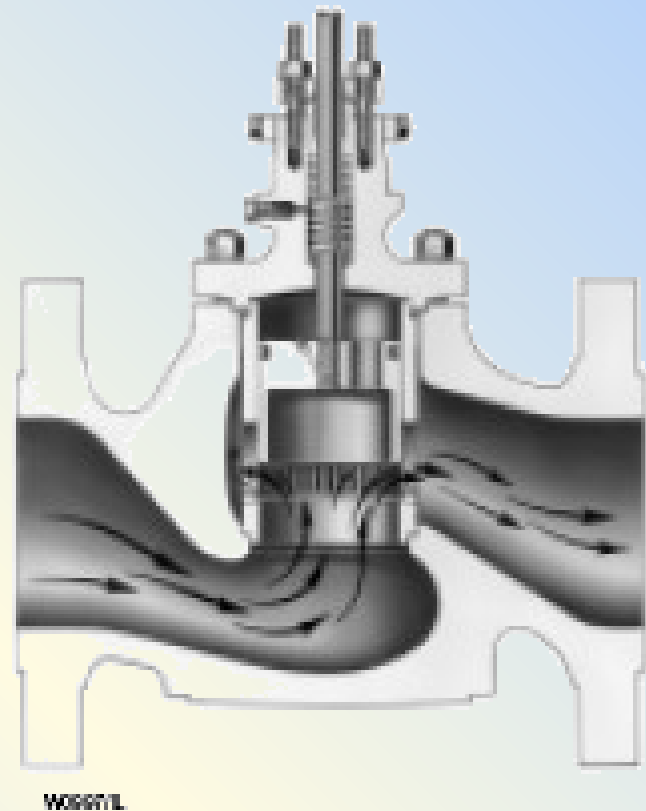


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High Capacity, Cage-Guided Valve Bodies

- This adaptation of the cage-guided bodies mentioned above was designed for noise applications such as high pressure gas reducing stations where sonic gas velocities are often encountered at the outlet of conventional valve bodies.
- The design incorporates oversize end connections with a streamlined flow path and the ease of trim maintenance inherent with cage-style constructions.
- Use of noise abatement trim reduces overall noise levels by as much as 35 decibels. Also available in cageless versions with bolted seat ring, end connection sizes through 20-inch, Class 600, and versions for liquid service.

➤ Flow direction depends on the intended service and trim selection, with unbalanced constructions normally flowing up and balanced constructions normally flowing down.



Port-Guided Single-Port Valve Bodies

- These bodies are usually limited to 150 psi (10 bar) maximum pressure drop.
- They are susceptible to velocity induced vibration.
- Port-guided single-port valve bodies are typically provided with screwed in seat rings which might be difficult to remove after use.

Double-Ported Valve Bodies

- Dynamic force on plug tends to be balanced as flow tends to open one port and close the other.
- Reduced dynamic forces acting on plug might permit choosing a smaller actuator than would be necessary for a single-ported valve body with similar capacity.
- Bodies are usually furnished only in the larger sizes—4-inch or larger.
- Bodies normally have higher capacity than single-ported valves of the same line size.
- Many double-ported bodies reverse, so the valve plug can be installed as either push-down-to-open or push-down-to-close

- Metal-to-metal seating usually provides only Class II shutoff capability, although Class III capability is also possible.
- Port-guided valve plugs are often used for on-off or low-pressure throttling service.
- Top-and-bottom guided valve plugs furnish stable operation for severe service conditions. The control valve body shown in figure is assembled for push-down to- open valve plug action.
- The valve plug is essentially balanced and a relatively small amount of actuator force is required to operate the valve.
- Double ported designs are typically used in refineries on highly viscous fluids or where there is a concern about dirt, contaminants, or process deposits on the trim.

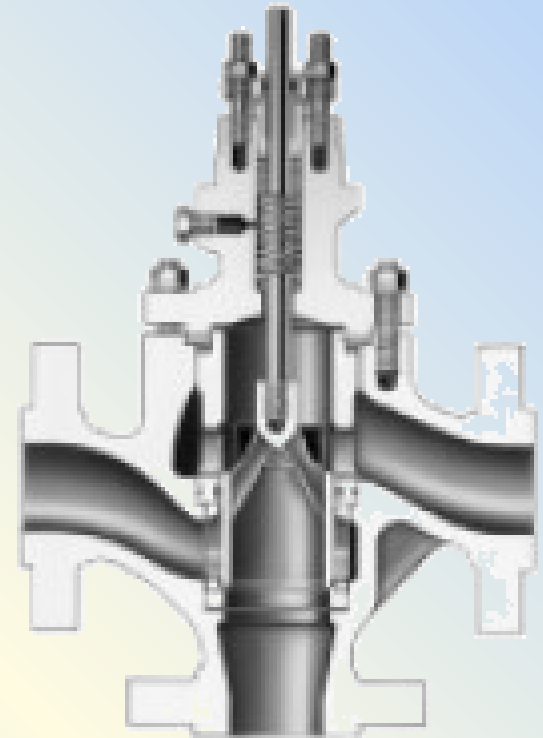


Three-Way Valve Bodies

Three pipeline connections provide general converging (flow-mixing) or diverging (flow-splitting) service.

Best designs use cage-style trim for positive valve plug guiding and ease of maintenance. Variations include trim materials selected for high temperature service.

Standard end connections (flanged, screwed, butt weld, etc.) can be specified to mate with most any piping scheme.



Actuator selection demands careful consideration, particularly for constructions with unbalanced valve plug.

Balanced valve plug style three-way valve body is shown with cylindrical valve plug in the down position.

This position opens the bottom common port to the right-hand port and shuts off the left-hand port. The construction can be used for throttling mid- travel position control of either converging or diverging fluids.

Rotary Valves

Butterfly Valve Bodies

Bodies require minimum space for installation. They provide high capacity with low pressure loss through the valves.

Butterfly valve bodies offer economy, particularly in larger sizes and in terms of flow capacity per investment dollar.

Conventional contoured disks provide throttling control for up to 60-degree disk rotation. Patented, dynamically streamlined disks suit applications requiring 90-degree disk rotation.

Bodies mate with standard raised-face pipeline flanges. Butterfly valve bodies might require high-output or large actuators if the valve is big or the pressure drop is high, because operating torques might be quite large.

Units are available for service in nuclear power plant applications with very stringent leakage requirements.

Standard liner can provide good shutoff and corrosion protection with nitrile or PTFE liner.

Standard butterfly valves are available in sizes through 72-inch for miscellaneous control valve applications.

Smaller sizes can use versions of traditional diaphragm or piston pneumatic actuators, including the modern rotary actuator styles.

Larger sizes might require high-output electric or long-stroke pneumatic cylinder actuators.

Butterfly valves exhibit an approximately equal percentage flow characteristic.

They can be used for throttling service or for on-off control.

Soft-seat construction can be obtained by using a liner or by including an adjustable soft ring in the body or on the face of the disk.

A dynamically contoured disk, such as the **Fishtail** disk shown, permits control through full 90 degrees of disk rotation, although conventional disks are usually limited to rotation of 60 degrees.

V-Notch Ball Control Valve Bodies

- This construction is similar to a conventional ball valve, but with patented, contoured V-notch in the ball.
- The V-notch produces an equal-percentage flow characteristic. These control valves have good rangeability, control, and shutoff capability.
- The paper industry, chemical plants, sewage treatment plants, the power industry, and petroleum refineries use such valve bodies. Straight-through flow design produces little pressure drop.
- V-notch ball control valve bodies are suited to control of erosive or viscous fluids, paper stock, or other slurries containing entrained solids or fibers.

- They use standard diaphragm or piston rotary actuators.
- Ball remains in contact with seal during rotation, which produces a shearing effect as the ball closes and minimizes clogging.
- Bodies are available with either heavy-duty or PTFE-filled composition ball seal ring to provide excellent rangeability in excess of 300:1. V-notch ball control valve bodies are available in flangeless or flanged body end connections.
- Both flanged and flangeless valves mate with Class 150, 300, or 600 flanges or DIN flanges.

Eccentric-Disk Control Valve Bodies

Bodies offer effective throttling control. Eccentric-disk control valve bodies provide linear flow characteristic through 90 degrees of disk rotation.

Eccentric mounting of disk pulls it away from seal after it begins to open, minimizing seal wear.

Eccentric disk control valve bodies are available in sizes

Standard flow direction is dependent on seal design; reverse flow results in reduced capacity.

Eccentric disk rotary shaft control valves are intended for general service applications not requiring precision throttling control.

They are frequently applied in applications requiring large sizes and high temperatures due to their lower cost relative to other styles of control valves.

The control range for this style of valve is approximately one third as large as a ball or globe style valves.

Consequently, additional care is required in sizing and applying this style of valve to eliminate control problems associated with process load changes.

They work quite well for constant process load applications.

Eccentric-Plug Control Valve Bodies

Valve assembly combats erosion. The rugged body and trim design handle temperatures to 800_F (427_C) and shutoff pressure drops to 1500 psi (103 bar).

Path of eccentric plug minimizes contact with the seat ring when opening, reducing seat wear and friction, prolonging seat life, and improving throttling performance

Plug, seat ring and retainer are available in hardened materials, including ceramics, for selection of erosion resistance.

Designs offering a segmented V-notch ball in place of the plug for higher capacity requirements are available.

This style of rotary control valve suits erosive, coking and other hard-to-handle fluids, providing either throttling or on-off operation.

The flanged or flangeless valves feature streamlined flow passages and rugged metal-trim components for dependable service in slurry applications.

Mining, petroleum refining, power, and pulp and paper industries use these valves.