PUMP CONTROL VALVES

The Brains of The Operation

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3 Main Components:
- Valve Body
- Valve Internals
- External Controls
Introduction to Control Valves

Valve Body:
- Globe (inline) / Angle (90°)
- Full ported / High capacity
- Expanded top (1-way / 2-way flow)
- Flange size / class
- Laying length
Introduction to Control Valves

Valve Internals:

- Operating chamber
- Seat profile
- Differential cylinder
- Throttling / Non-Throttling
Introduction to Control Valves

External Controls:

- **Pilot**
  - Hydraulic (internal/separate sensing)
  - Electric (2-way, 3-way solenoid)
  - Manual (3-way valve, float operated)

- **Strainer**
- **Needle Valve**
- **Isolation Valves**
- **Piping / Fittings**
- **Indicator Rod**
Basic hydraulic principles:
Valve wants to open when line pressure is applied
Seals & external controls determine when it is kept closed

Animation Link
What is a pump control valve?

1. Controls pump in the system
   a. Normally Open
   b. Normally Closed
   c. Emergency Fast Close
   d. Check Feature

2. Acts as a check in the system isolating the pump

3. Prevents backspin of pump

4. Promotes proper pump startup and shutdown

5. Regulates pressure in the system during normal operation
What does a pump control valve do?

On System Startup:
- Creates backpressure as pump spins up
- Valve begins to open when pressure switch is tripped

Normal Operating Conditions:
- Valve is fully open to allow flow of fluid from pump to the system

On System Shutdown:
- Pump continues to spin as valve closes
- When valve is almost closed, a switch triggers a pump shutdown

Emergency Fast Close:
- Sudden loss of pump (power outage)
What happens inside a pump control valve?

Pump Startup, Solenoid Actuated:
What happens inside a pump control valve?

Backwave, Solenoid Operated:
Key features of a pump control valve:

1. Valve actuator and pump are interlocked, assuring a safe, smooth and efficient operation.

2. Throttling stem.

3. Independent adjustable speed controls for both opening and closing.

4. Available in various body styles and designs.
What happens inside a pump control valve?

Pump Startup, Electric Actuator:
What happens inside a pump control valve?

On System Startup:

1. Valve remains closed as pump startup is initiated.
2. Pump begins to spin up and create a backpressure.
3. When specified pressure is met, valve begins to open.
4. Flow begins to enter the system
   a. No surge or major pressure ramping
5. Valve reaches full open and system runs at normal operating pressures.
What happens inside a pump control valve?

Operation, Rotary Cone Valve:
Types of pump control valves:

- Booster or Deep Well type
- In combination with:
  - Pressure Reducing
  - Back Pressure Sustaining
- Integrated Control Panels that interlock pump and valve operations.
Types of pump control valves:
Types of pump control valves:

Ball Valve:
- Quarter turn
- Rubber or Metal Seated
- Trunnion or Shaft mounted
- No more headloss than a equivalent length of pipe
- Pipeline stresses are transferred to the valve
- Can be used as a throttling valve as well
- Precise flow control over entire rotation
- High initial cost
- For Water and Wastewater Applications
- Estimated service life is 35 years
BALL VALVE
**Types of pump control valves:**

**Butterfly Valve:**
- Small lay length
- Wafer or Flange Mounted
- Valve requires less structural support
- **Crude flow control** over a majority of rotation (Limited Control Rangeability)
- Require maintenance due to
- A portion of the disc is always directly in the flow resulting in a pressure drop across the valve
- Low initial cost
- **Limited for water applications only**
- Estimated Service Life depends of severity of operating conditions
Types of pump control valves:

**Swing Check Valve:**
- Simple design
- Few moving parts
- Available with counterweight and/or oil dashpot.
- Check valve ONLY
- Prevents back flow
- Doesn’t control opening and closing speed and momentum for normal pump starts and stops.
- Position indicator is not a standard feature
- No feedback for SCADA
- Water and Wastewater applications
- Estimated Service Life depends on severity of operating conditions
SWING CHECK VALVE
Types of pump control valves:

**Globe Pump Control – Solenoid Operated:**
- Piston or Diaphragm style
- Used for Booster and also Deep Well applications
- Various control piping configurations
- Enhanced Features (Opening and Closing Speed Control, Emergency Solenoid, Lift Check, Back Pressure Pilot, Position indicator, Limit switch, Pressure Switch … etc.)
- Water Applications (No wastewater)
- Estimated Service Life 50 years with proper maintenance
Pump Startup, Solenoid Actuated:
Types of pump control valves:

**Globe Pump Control - Direct Acting Electric Actuated:**
- Direct Acting Piston Design
- Used for Booster and also Deep Well applications
- Electric Actuated
- Enhanced Features (Opening and Closing Speed Control, Lift Check, Position indicator, Limit switch, Pressure Switch … etc.)
- Water and Wastewater Applications
- Estimated Service Life 60 years
Pump Startup, Electric Actuator:
Types of pump control valves:

**Rotary Cone Valve:**
- Precision flow control over full stroke
- No more headloss than an equivalent length of pipe
- Drop tight seal
- Metal to metal seats for longer life
- High initial cost but low cost of ownership
- Can be used in various water applications
- Water and Wastewater Applications
- Estimated Service Life 60 years prior to factory rebuilds
What happens inside a pump control valve?

Operation, Rotary Cone Valve:
What are the advantages of using a pump control valve?

1. Opens fully to minimize headloss
2. Works with the
3. Energy savings
4. Excellent surge control
5. Prevents critical failures
6. Longer life of system
7. Various applications
   a. Raw water
   b. Greywater
   c. Wastewater
   d. Sewage
   e. Slurry
COMPARISON OF Cv vs. % OPEN
BASED ON 24” VALVE SIZE

RCV  --- Rotary Cone Valve
GV   --- Globe Valve
BFV  --- Butterfly Valve
SCV  --- Swing Check Valve
TDCV --- Tilting Disc Check Valve

Ideally Suited for Pump Control/Check Applications:
- Slow opening for first 80% where introduction of pump flow is critical
- After pumping system is balanced, valve opens remaining 20% at accelerated pace without the possibility of a surge
- 100% open results in no more head loss than an equivalent length of pipe

Pump Shutdown/Power Failure:
- Quickly shutoff majority of flow in the first 20% of closing
- Remaining flow is slowly and gently shutoff without impacting the pumping system (surge/water hammer)

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Questions?

Thank You For Coming