Pressure Regulating Valves

Selection and Installation
Types of Pressure Regulation

• Sustaining
• Reducing
• Combination sustaining and reducing
• Relief
Types of Pressure Regulation

• Sustaining (upstream)
• Reducing (downstream)
• Combination sustaining and reducing
• Relief
Types of Pressure Regulation

- Sustaining (upstream)
- **Reducing (downstream)**
- Combination sustaining and reducing
- Relief
Automatic, Hydraulic Pressure Reducing Valves

Closed – upstream water is applied to the outer sleeve chamber, the sleeve becomes hydraulically balanced and the flow passage is closed off by the sleeve pressing against the center seat.

Source: Nelson

Castroville, CA – Tape on butternut lettuce
Why is Pressure Reduction Needed?

• Reduce excess pressures, to:
  • Achieve a target emitter flow rate
  • To avoid over-pressuring pipe/hose/emitter/fitting
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• To automatically maintain a target downstream pressure

BCID (Tracy, CA) PTO pump, media tanks on pistachios
Why is Pressure Reduction Needed?

• Reduce excess pressures, to:
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  • To avoid over-pressuring pipe/hose/emitter/fitting

• To automatically (or not) maintain a target downstream pressure
Why is Pressure Reduction Needed?

• Reduce excess pressures, to:
  • Achieve a target emitter flow rate
  • To avoid over-pressuring pipe/hose/emitter/fitting

• To automatically maintain a target downstream pressure

• To automatically (without human intervention) open (and regulate) or close via electronic signals from a controller
Key Functions For Today

• On/Off
• Automatic pressure regulation
How Do Valves Work?

Start with the basics
How Do Valves Work?

Start with the basics

Connection

Manual control

Source: Google images
How Do Direct Control Valves Work?

On is “slightly” to fully open

Off is fully closed
What Else?

On is “slightly” to fully open

Off is fully closed

Pressure drop occurs across the valve
How Does It Work?

Pilot Control

Control chamber with bonnet and diaphragm

Source: Bermad Valves
Pilot Control

• Indirectly controlling the position of a control valve diaphragm

Spring force > water force = DOWN
Spring force = water force = No Movement
Spring force < water force = UP Movement
Pilot Control

• Indirectly controlling the position of a control valve diaphragm
Types of Pilot Control

• 2-way (two positions)
  • Open
  • Close

• 3-way (three positions)
  • Open
  • Close
  • Hold
Key Design Parameters

• Providing enough pressure drop for hydraulic pilot control to work
• Keeping things clean
• Low/High pipe pressures
• Low/High pressure differential
ITRC Research

• Key questions:
  • Variability in outlet pressures with varying pressure?
    • Test 1: Inlet Pressures?
    • Test 2: Flow rates?
  • Test 3: What is the minimum pressure loss across the valve required for it to function automatically?
<table>
<thead>
<tr>
<th>Valve ID</th>
<th>Manufacturer</th>
<th>Distributor</th>
<th>Model</th>
<th>Size</th>
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<th>Spring Model</th>
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*Two valves tested did not perform well during Test 1; therefore, these valves were not tested further.
ITRC Research - Key Findings

• Key findings
  • There is a HUGE difference in the minimum required pressure differential across the valve for good downstream pressure regulation
  • The absolute minimum found was ~2 psi
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  • Sometimes more pressure loss is required across the valve than published

![Graph showing minimum valve pressure loss](image)
ITRC Research Findings

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  • There is a HUGE difference in the minimum required pressure differential across the valve for good downstream pressure regulation
  • The absolute minimum found was ~2 psi
  • Sometimes more pressure loss than published is required across the valve
  • Some valves are better than others at maintaining downstream pressures with varying:
    • Inlet pressure
    • Flow rates
Example: Varying Inlet Pressures

**Figure 22. Test 1 - 4-inch Nelson Series 800 (3-way pilot)**

- **Nelson Series 800 4”**
  - Standard Pilot
  - C1 Spring (10 - 50 psi)
  - Standard Diaphragm

- **Start Input:** 30.0 psi
- **Start Output:** 13.0 psi
- **Flow:** 512 GPM

**Figure 24. Test 1 - 4-inch Ooval ZA04RDA001L (3-way pilot)**

- **Ooval ZA04RDA001L 4”**
  - P-31 Pilot
  - Blue Spring
  - Standard Diaphragm

- **Start Inlet:** 25 psi
- **Start Outlet:** 13.03 psi
- **Flow:** 200 GPM
ITRC Research Findings

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  • The absolute minimum found was ~2 psi
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  • Some valves are better than others at maintaining downstream pressures with varying:
    • Inlet pressure
    • Flow rates

• 2-way pilots are best suited for:
  • Pressure relief applications
  • Pressure reducing applications where there will always be over 15 psi of pressure loss required across the valve

• 3-way pilots are best suited for:
  • Applications where the pressure...