# Pressure Regulating Valves

Selection and Installation

# Types of Pressure Regulation

- Sustaining
- Reducing
- Combination sustaining and reducing
- Relief

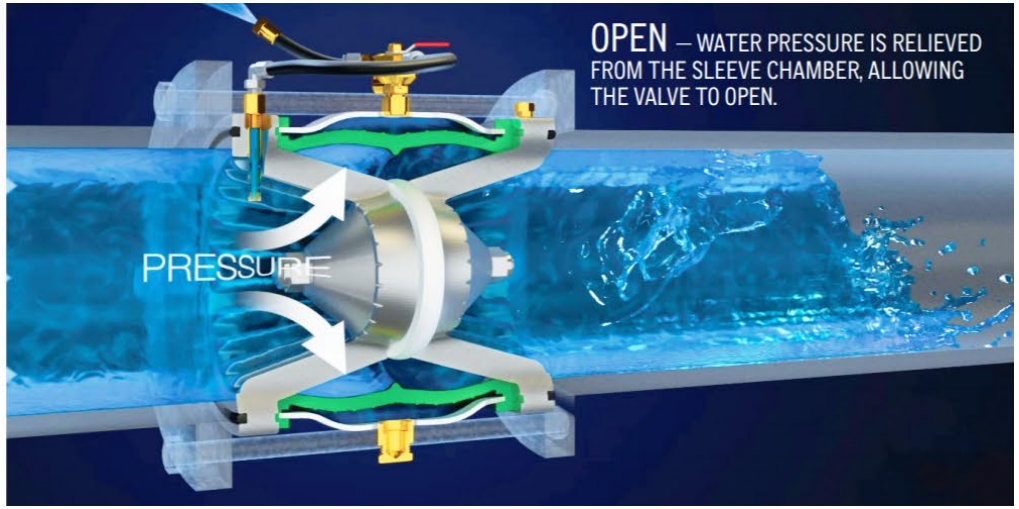
# Types of Pressure Regulation

- 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


Source: Nelson

Source: Rivulus

Source: Dorot

Source: Bermad

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

# Why is Pressure Reduction Needed?

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

Dual system – hand move and tape

# 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

BCID (Tracy, CA) PTO pump, media tanks on pistachios

# 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 **(or not)** maintain a target downstream pressure

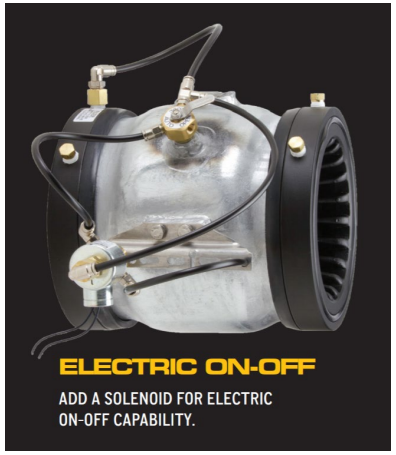
Wapato Irrigation Project – Farm turnout with butterfly valves

# 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




Nelson electric solenoid control


Netafim controller

# Key Functions For Today

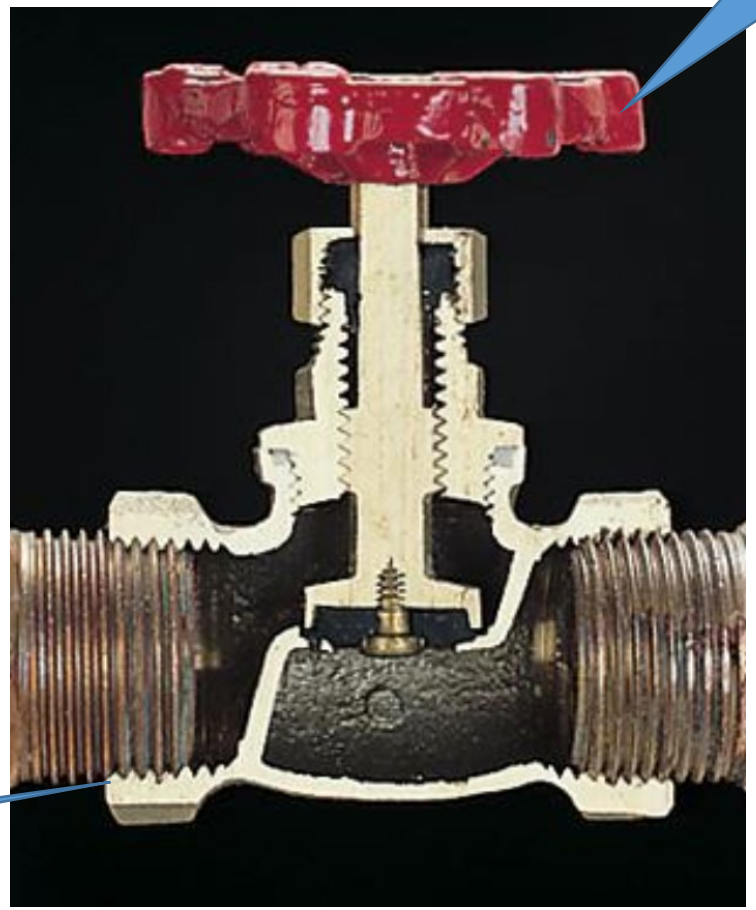
- On/Off
- Automatic pressure regulation

# How Do Valves Work?

Start with the basics

# How Do Valves Work?

Start with the basics

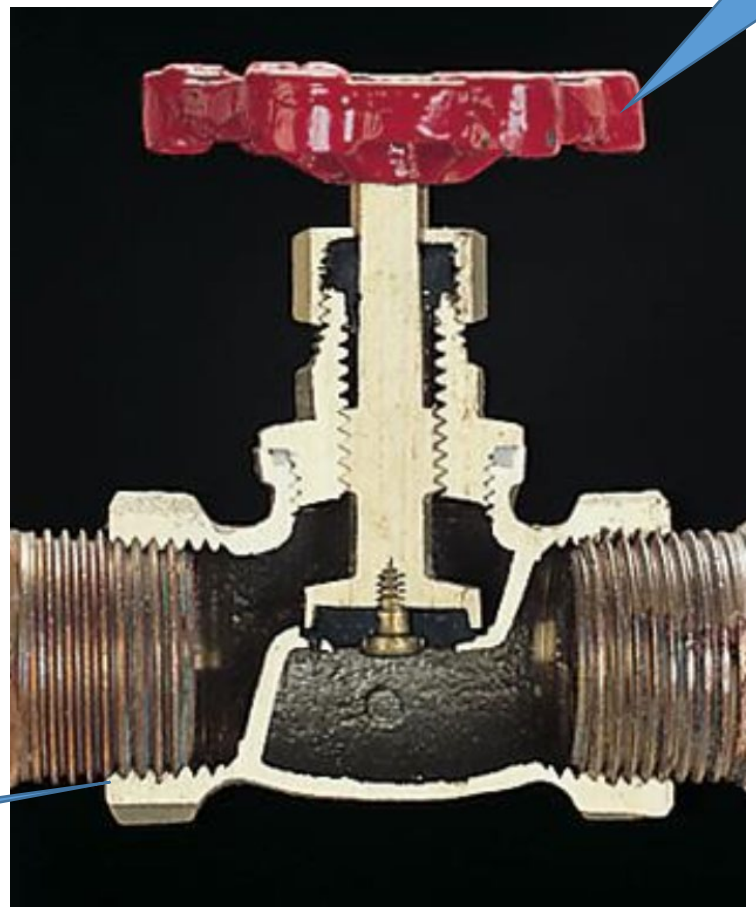



Source: Google images

# How Do Direct Control Valves Work?

On is “slightly” to fully open

Off is fully closed



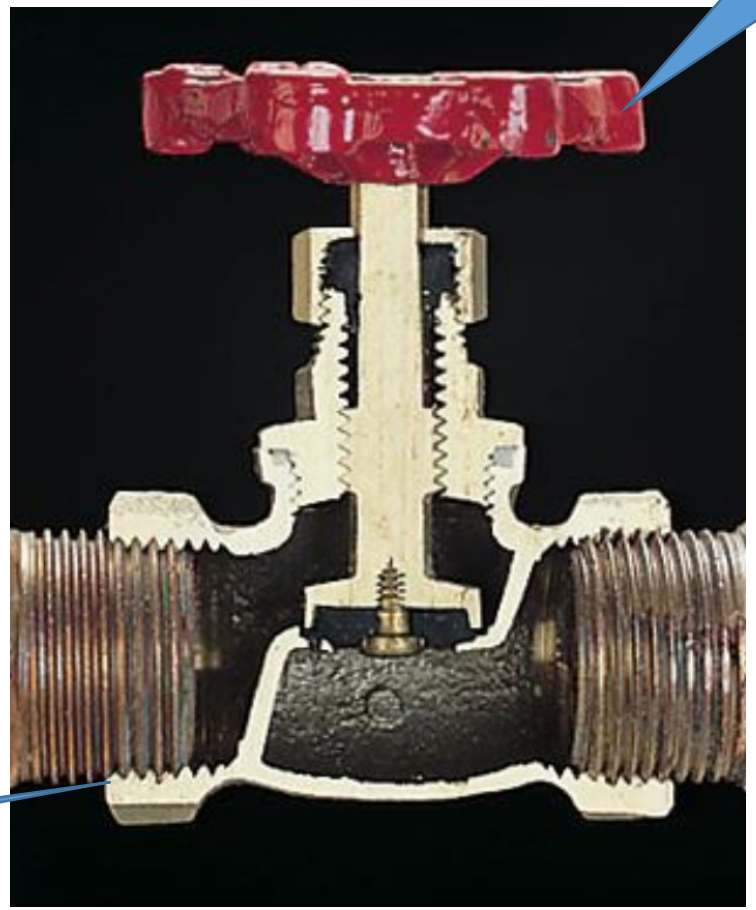

Source: Google images

# What Else?

On is “slightly” to fully open

Off is fully closed

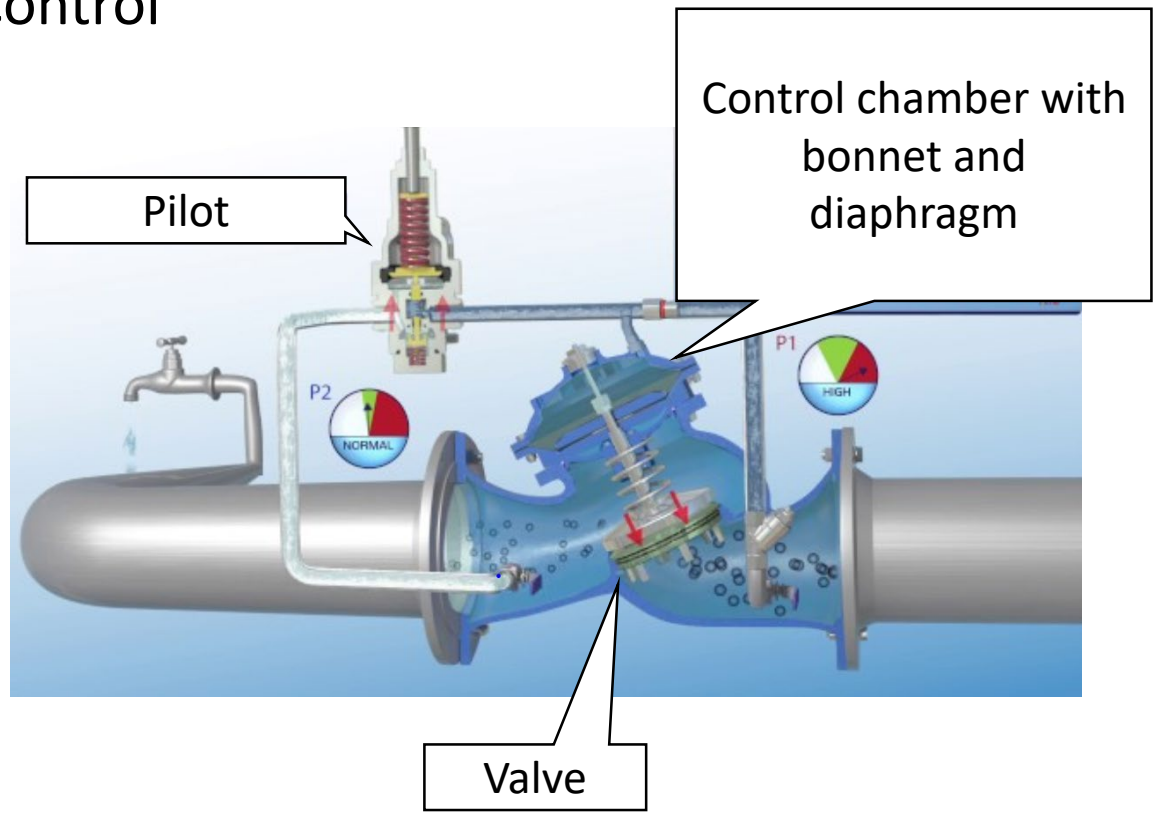
**Pressure drop occurs across the valve**




Source: Google images

# How Does It Work?

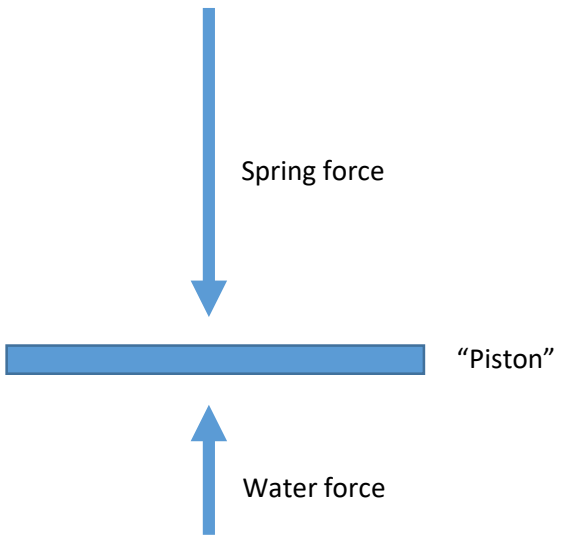
## Pilot Control



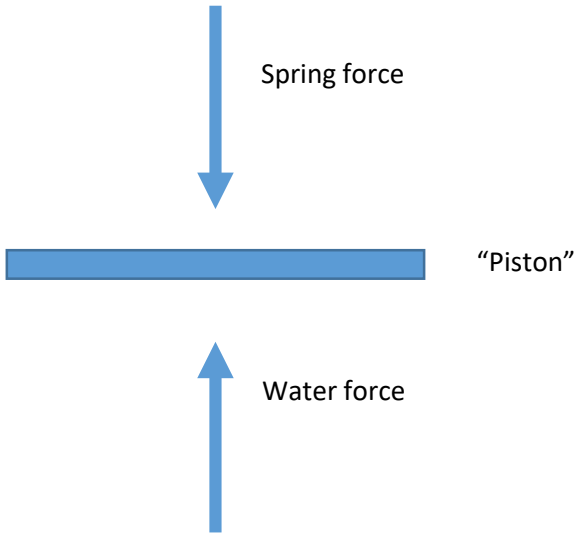

Source: Bermad Valves

# Pilot Control

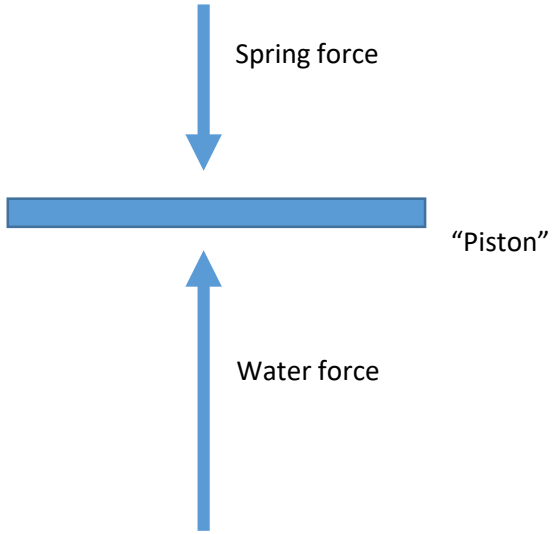
- Indirectly controlling the position of a control valve diaphragm




Spring force > water force = DOWN



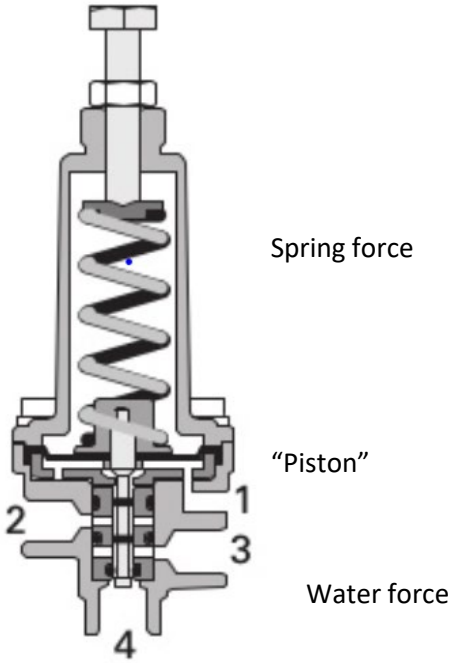

Spring force = water force = No Movement




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 varyingL
    - 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?

# ITRC Research

| Valve ID | Manufacturer | Distributor | Model | Size | Pilot Type | Pilot Model | Spring Model | Spring P Range (psi) | Diaphragm Type |
|---|---|---|---|---|---|---|---|---|---|
| 5-A | Bermad | Bermad | IR-120 | 6 | 3-way | PC-X | K | 7 to 45 | Standard |
| 4-A | Bermad | Bermad | IR-120 | 4 | 3-way | PC-X-A-P | K | 7 to 45 | Standard |
| 4-B | Dorot | Netafim | Series 96 | 4 | 3-way | 29-100 | Yellow | 7 to 30 | 095 (HP) |
| 4-C* | Dorot | Netafim | Series 96 | 4 | 3-way | 31-310 | Yellow | 7 to 30 | 095 (HP) |
| 4-D | Dorot | Netafim | Series 96 | 4 | 3-way | 31-310 | Yellow | 7 to 30 | 179 (LP) |
| 4-E | Dorot | Netafim | 100 | 4 | 3-way | 29-100 | Yellow | 7 to 30 | 005 (LP) |
| 4-F | Nelson | Nelson | 800 | 4 | 3-way | Standard | Standard | 5 to 50 | Standard |
| 4-G | Ooval | Eurodrip | PH0400G001 | 4 | 3-way | P-31 | Blue | 5 to 36 | Standard |
| 4-H | Ooval | Eurodrip | ZA04RDA001L | 4 | 3-way | P-31 | Blue | 5 to 36 | Standard |
| 4-I | Rafael | Jain | RAF-P | 4 | 3-way | PC | Blue | 7 to 22 | Standard |
| 3-A | Bermad | Bermad | DN80 | 3 | 3-way | PC-X-A-P | K | 7 to 45 | Standard |
| 3-B | Dorot | Netafim | Super Gal | 3 | 3-way | 29-100 | Yellow | 7 to 30 | Standard |
| 3-C | Ooval | EuroDrip | ZH3NRDG001 | 3 | 3-way | P-31 | Blue | 5 to 36 | Standard |
| 3-D | Rafael | Jain | RAF-P | 3 | 3-way | PC | Blue | 7 to 22 | Standard |

*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

# 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

# ITRC Research 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
  - Sometimes more pressure loss is required across the valve than published

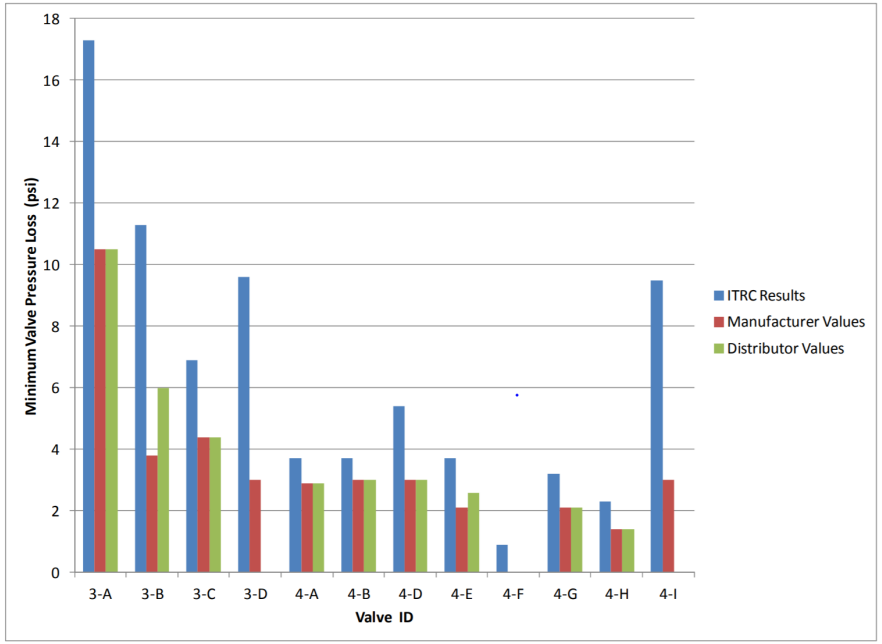



**Figure 40. Minimum valve pressure loss (during operation by pilot control) at 13 psi outlet pressure at 400 GPM**

# ITRC Research 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
  - 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

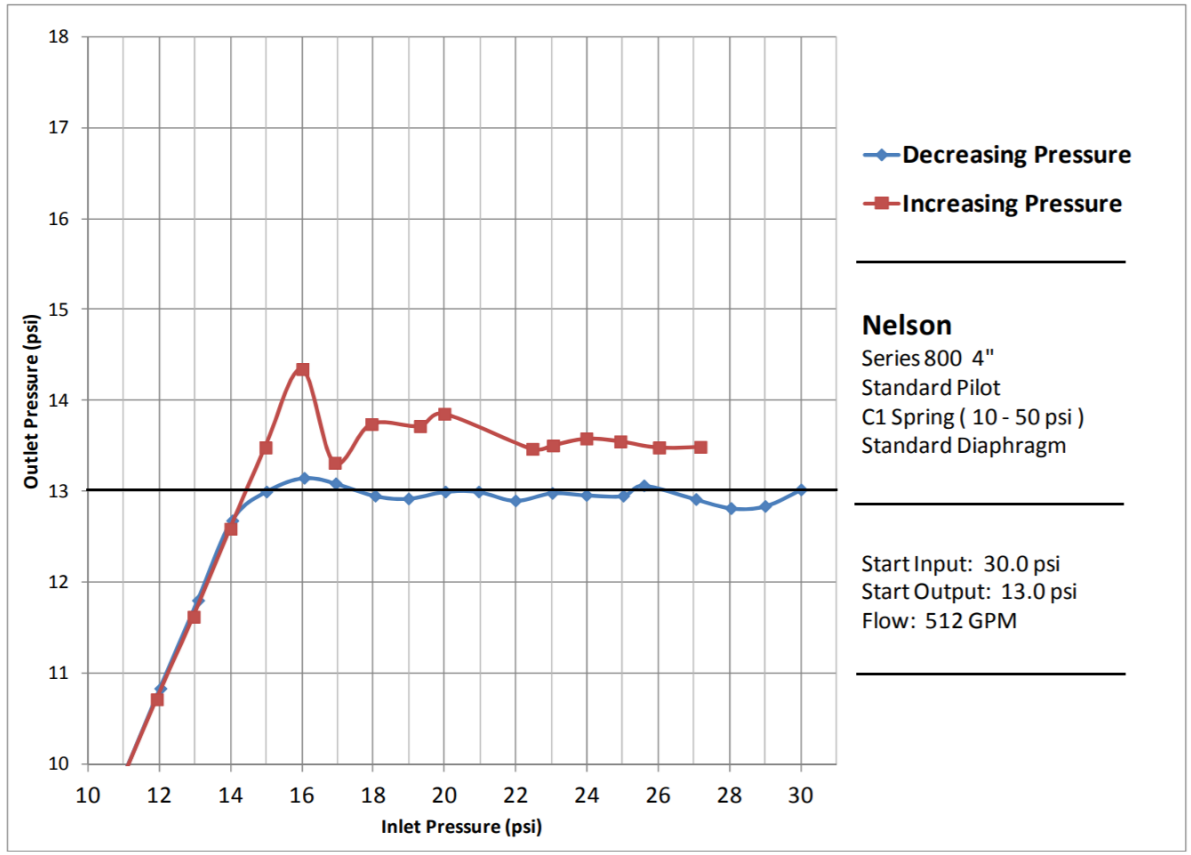



**Figure 22. Test 1 - 4-inch Nelson Series 800 (3-way pilot)**

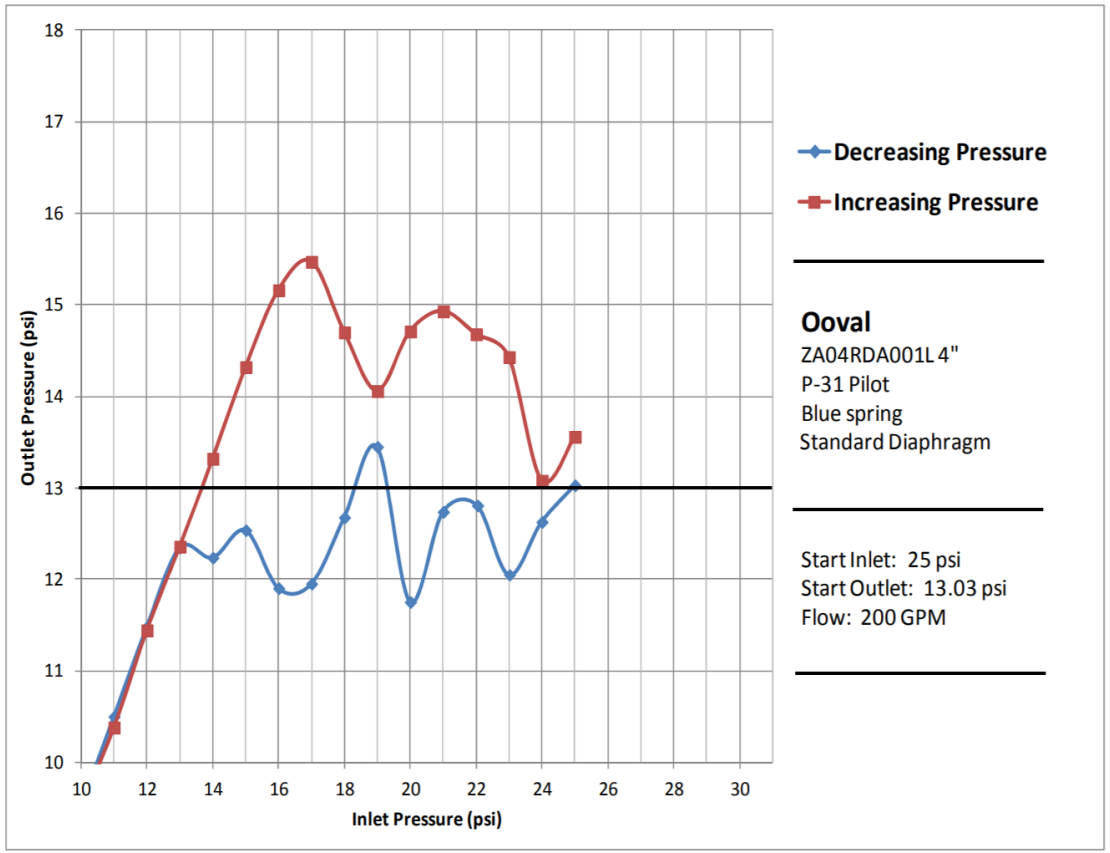



**Figure 24. Test 1 - 4-inch Ooval ZA04RDA001L (3-way pilot)**

# ITRC Research 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
  - 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
  - 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