



VRG Controls, LLC
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VPC-1500 MAOP Sensing 1500 psig (10342 kPa)
VPC-700 MAOP Sensing 700 psig (4826 kPa)
VPC-225 MAOP Sensing 225 psig (1551 kPa)
All Other Ports MAOP 150 psig (1034 kPa)
Temperature -20 to +160 °F (-29 to +71 °C)



II 2 G Ex h IIA T5 Gb

PATENT NO:
US D919763S1
US 10876645
US 10234047B2
US 9400060B2

Applicable Models:

This Instruction Manual applies to the following VRG - Valve Pilot Controllers. To confirm suitability for additional models and/or components, please contact VRG Controls or view us online at www.vrgcontrols.com.

VPC-225-DA-SN

VPC-700-DA-SN

VPC-1500-DA-SN

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SCOPE OF MANUAL

This Instruction Manual provides instructions for installation, maintenance, adjustment and troubleshooting of VRG Controls VPC“SN” Series Valve Pilot Controllers. This product is typically utilized in conjunction with control valves, pneumatic actuators and a variety of other ancillary devices and accessories. For information on products other than those manufactured by VRG Controls, please consult the appropriate manufacturer.

WARNING

VPC - Valve Pilot Controllers utilize high pressure flammable natural gas or other pneumatic supply as part of their standard operation. Improper installation, operation, maintenance and adjustment of these devices can result in property damage, personal injury or death. Only those qualified through training should install, operate, maintain or adjust this product. Contact your local VRG Controls sales representative or VRG Controls direct for additional information or assistance.

TECHNICAL ASSISTANCE

For technical assistance with VRG products, please contact your local VRG Controls sales representative or VRG Controls direct. In order to facilitate technical assistance, we strongly recommend that obtain the MODEL NUMBER and SERIAL NUMBER of the product for which you require assistance prior to contact us. MODEL NUMBER and SERIAL NUMBER may be found on the PRODUCT ID LABEL located on the front of the VPC product on the center face of lower portion of the power assembly.

We recommend that you record the MODEL NUMBER and SERIAL NUMBER of all VRG Products installed at each application location in the table below for future reference.

Product ID Label



INSTALLED ITEM IDENTIFICATION LOG

| ITEM | TAG | MODEL NUMBER | SERIAL NUMBER |
|---------|-------------------------|---------------|---------------|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| Example | Run 1 Monitor Regulator | VPC-700-DA-SN | 08125V |

Applicable Models:

This Instruction Manual applies to the following VRG - Valve Pilot Controllers. To confirm suitability for additional models and/or components, please contact VRG Controls or view us online at www.vrgcontrols.com.

VPC-225-DA-SN

VPC-700-DA-SN

VPC-1500-DA-SN

DESCRIPTION

The VPC Valve Pilot Controller represents a breakthrough in Valve Control technology. The VPC provides a modular, plug & play pressure control system for use in conjunction with pneumatically actuated control valves. The VPC features a simplified 5-in-1 configuration that provides compatibility with double acting and single acting (spring return) control valves utilizing a single platform. The VPC may be easily reconfigured in the field to provide compatibility with almost any pneumatic control valve on the market. The highly accuracy performance and ZERO emissions capabilities of the VPC provide the desired features to meet natural gas industry needs. The VPC was designed by the inventor of the original "Valve Regulator Pilot" and features patent-pending technological advances that provide reliability, convenience, and performance above and beyond previous technologies. VPC - Valve Pilot Controllers represent the future of control valve pressure control technology and are backed up by the industries' most experienced team.

DEFINITIONS

WARNING:

If not observed, user incurs a high risk of severe damage to actuator and/or fatal injury to personnel.

CAUTION:

If not observed, user may incur damage to actuator and/or injury to personnel.

NOTE:

Advisory and information comments provided to assist maintenance personnel to carry out maintenance procedures.

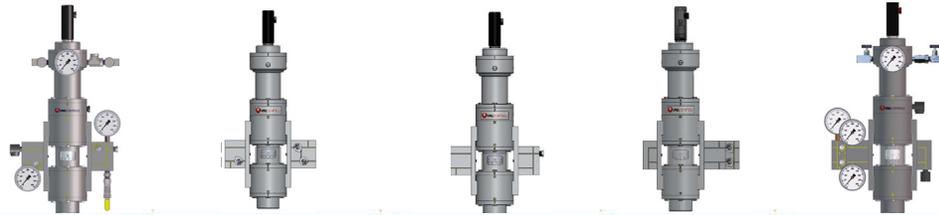
APPLICATIONS

The VPC Controller is designed to provide self-contained pressure control when incorporated with pneumatic control valves. The system utilizes pressurized natural gas or from the pipeline to operate and can address a number of common pipeline pressure control applications. Contact VRG Controls for assistance with your application.

- Primary Pressure Control (Active)
- Overpressure Protection (Monitor)
- Underpressure Protection (Standby)
- Backpressure Control
- Tandem Pressure Control
- Two-Stage Pressure Control
- Split Range Pressure Control
- Power Plant Fuel Gas Feed
- Compressor Suction Control

TABLE 1.0 VPC VALVE PILOT CONTROLLER TECHNICAL SPECIFICATIONS

PATENT NO.:
US 9,400,060 B2



| VPC Model | VPC-SA-BV | VPC-SA-BV-ID | VPC-SA-BV-GAP | VPC-DA-BV | VPC-DA-SN |
|--|--|----------------|-------------------|-----------------------|-------------------------------|
| ATTENTION | Please refer to VPC"BV" Series Valve Pilot Controller Instruction Manual for Above Models | | | | |
| Type | Variable | Variable | Discrete (On-Off) | Variable | Variable |
| Outputs | Single Acting (1) | | | Double Acting (2) | |
| Internal Valve Logic | NC Balanced Valve ¹ | | | | NO Seat & Nozzle ¹ |
| Setpoint Range | 3-1500 psig (21-10,341 kPa) | | | | |
| Temperature Range | -20°F to +160°F (-29°C to +71°C) | | | | |
| Consumption | | | | | |
| Steady State Control | ZERO ² | | | <10 scfh ³ | ≈30 scfh ³ |
| Full Open | ZERO | | | ZERO ⁴ | |
| Full Closed | ZERO | | | ZERO ⁴ | |
| ZERO Emissions | ZERO Atmospheric Emissions May Be Achieved When "Vent to Pressure System" Feature Utilized | | | | |
| EPA Specifications | Exceeds EPA Ruling, EPA-HQ-OAR-2010-0505, requiring <6 SCFH bleed rate by October 2013. | | | | |
| Pneumatic | | | | | |
| Supply Gas Quality | Dry, Filtered @ 10µ Natural Gas or Air | | | | |
| Max Supply Gas Pressure | 400 psig (2758 kPa) | | | | |
| Min Supply Gas Pressure | 20 psig | | | | |
| Max Discharge ΔP | 250 psig (1724 kPa) | | | | |
| Min Discharge ΔP | 50 psig (345 kPa) | | | | |
| Connections | All Ports ¼ FNPT | | | | |
| Construction | | | | | |
| External Parts | VRG Military Grade Aluminum Alloy with "Stealth System" Corrosion Protection 316 SS – Optional Construction | | | | |
| Internal Parts | 316 SS | | | | |
| Diaphragms | Nylon Reinforced Buna-N (Viton Optional) | | | | |
| O-Rings | Buna-N | | | | |
| Control Springs | Powder Coated Alloy Steel | | | | |
| Gauges | 2.5 in. Liquid-Filled SS Case & Body | | | | |
| Weight | 20 lbs. (9.0 kg) | | | | |
| Approx. Dimensions | 22 in 12 in X 7 in (559 mm X 305 mm X 178 mm) | | | | |
| Compatible Actuators & Control Valves | | | | | |
| SA Spring & Diaphragm Act. | ■ | ■ | ■ | | |
| SA Spring & Piston Act. | ■ | ■ | ■ | | |
| Double Acting Piston Act. | ■ ⁵ | ■ ⁵ | ■ ⁵ | ■ | ■ |
| "Jet" Regulator | ■ | ■ | ■ | | |
| Pneumatic Positioner | | ■ | | | |
| Volume Booster | ■ | ■ | | | ■ |

NOTES

1. NC Balanced Valves and NO Seat & Nozzle internal components may be exchange/converted to meet application requirements
2. ZERO Steady State emissions achieved when VPC properly adjusted to exhibit factory advised deadband setting
3. Consumption is approximate and based upon 100 psig Supply Gas with #2 Adjustable Orifice Settings and CLOSE and OPEN gages balanced at 80% Supply Gas

4. Double acting VPC's require addition of NVD No-Vent Device to achieve ZERO emissions at full open and full closed
5. Double Acting Piston Actuators Equipped with Single Acting VPC requires additional interface instrumentation such as pneumatic positioner or pilot-operated trigger valve (GAP).

TABLE 2.0 MODEL NUMBER EXPLANATION

| Base Model | | Pressure Series | | Output Type | | Internal Valve Logic | | Additional | |
|------------|------------------------|-----------------|-----------------------|-------------|---------------|----------------------|----------------|------------|-------------|
| VPC | Valve Pilot Controller | 225 | 225 psig Max Sensing | DA | Double Acting | BV | Balanced Valve | ID | I-D Control |
| | | 700 | 700 psig Max Sensing | SA | Single Acting | SN | Seat & Nozzle | GAP | Gap Control |
| | | 1500 | 1500 psig Max Sensing | | | | | | |

Example: Model VPC-700-DA-SN
Valve Pilot Controller, 700 psig Max Sensing, Double Acting Output, Seat & Nozzle Internals

VPC MODEL NUMBER IDENTIFICATION LABEL

VPC SPRING CONTROL RANGE LABEL



VPC Model Number - 225 Pressure Series

- VPC-225-SA-BV
- VPC-225-SA-BV-ID
- VPC-225-SA-BV-GAP
- VPC-225-DA-BV
- VPC-225-DA-SN

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225 Pressure Series - Spring Control Range

| Control Range | Color | Part No. |
|--|--------|----------|
| <input type="checkbox"/> 3 - 15 psig (21 - 103 kPa) | Black | CS-0100 |
| <input type="checkbox"/> 5 - 53 psig (55 - 365 kPa) | Brown | CS-0110 |
| <input type="checkbox"/> 16 - 100 psig (110 - 689 kPa) | Grey | CS-0120 |
| <input type="checkbox"/> 40 - 170 psig (276 - 1172 kPa) | Orange | CS-0130 |
| <input type="checkbox"/> 65 - 205 psig (448 - 1413 kPa) | White | CS-0135 |
| <input type="checkbox"/> 100 - 225 psig (689 - 1551 kPa) | Purple | CS-0140 |

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| MODEL | MAOP | SPIKE PRESSURE * | BURST PRESSURE |
|----------|-----------|------------------|----------------|
| VPC-225 | 225 psig | 450 psig | 675 psig |
| VPC-700 | 700 psig | 1050 psig | 2100 psig |
| VPC-1500 | 1500 psig | 2250 psig | 3500 psig |

* PRESSURE APPLIED CANNOT EXCEED 30 MINUTES

TABLE 3.0 VPC CONTROLLER SPRING RANGES AND PERFORMANCE SPECIFICATIONS

| VPC Pressure Series | Control Range | Spring Color | Setpoint Change Per Rev. | Setpoint Accuracy ¹ | Maximum "GAP" Setpoint Range ² | Control Spring Part No. |
|----------------------------|--------------------------------------|--------------|--------------------------|--------------------------------|---|-------------------------|
| VPC - 225 Pressure Series | 3 - 15 psig (21 - 103 kPa) | Black | 0.8 psig (5.5 kPa) | ±0.1 psig (±0.7 kPa) | 0.1 - 0.6 psig (0.7 - 4.0 kPa) | CS-0100 |
| | 5 - 53 psig (55 - 365 kPa) | Brown | 3.1 psig (21.4 kPa) | ±0.2 psig (±0.7 kPa) | 0.2 - 2.3 psig (1.4 - 15.9 kPa) | CS-0110 |
| | 16 - 100 psig (110 - 689 kPa) | Grey | 8 psig (55 kPa) | ±0.3 psig (±1.0 kPa) | 0.5 - 6 psig (3.4 - 41 kPa) | CS-0120 |
| | 40 - 170 psig (276 - 1172 kPa) | Orange | 20.2 psig (139 kPa) | ±0.4 psig (±2.6 kPa) | 1 - 15 psig (6.9 - 103 kPa) | CS-0130 |
| | 65 - 205 psig (448 - 1413 kPa) | White | 32.2 psig (222 kPa) | ±0.6 psig (±4.2 kPa) | 2-24 psig (14 - 165 kPa) | CS-0135 |
| | 100 - 225 psig (689 - 1551 kPa) | Purple | 44.2 psig (305 kPa) | ±0.8 psig (±5.6 kPa) | 3 - 34 psig (21 - 234 kPa) | CS-0140 |
| VPC - 700 Pressure Series | 9 - 45 psig (62 - 310 kPa) | Black | 2.4 psig (17 kPa) | ±0.4 psig (±2.4 kPa) | 0.5 - 1.9 psig (3.4 - 14 kPa) | CS-0100 |
| | 30 - 160 psig (241 - 1103 kPa) | Brown | 9.6 psig (73 kPa) | ±0.5 psig (±3.4 kPa) | 1.5 - 8 psig (10 - 55 kPa) | CS-0110 |
| | 75 - 310 psig (517 - 2137 kPa) | Grey | 24.5 psig (175 kPa) | ±1.1 psig (±7.7 kPa) | 3 - 20 psig (21 - 137 kPa) | CS-0120 |
| | 150 - 520 psig (1034 - 3585 kPa) | Orange | 62.1 psig (423 kPa) | ±2.7 psig (±18.6) | 5 - 49 psig (35 - 337 kPa) | CS-0130 |
| | 240 - 635 psig (1655 - 4378 kPa) | White | 98.9 psig (687 kPa) | ±4.4 psig (±30.3) | 6 - 80 psig (41 - 552 kPa) | CS-0135 |
| | 350 - 700 psig (2413 - 4826 kPa) | Purple | 135.9 psig (926 kPa) | ±5.8 psig (±40.0) | 8 - 107 psig (69 - 276 kPa) | CS-0140 |
| VPC - 1500 Pressure Series | 30 - 90 psig (207 - 620 kPa) | Black | 5.0 psig (34 kPa) | ±3.5 psig (±24 kPa) | N/A ³ | CS-0100 |
| | 50 - 335 psig (345 - 2309 kPa) | Brown | 19.7 psig (149 kPa) | ±3.5 psig (±24 kPa) | N/A ³ | CS-0110 |
| | 100 - 640 psig (689 - 4412 kPa) | Grey | 50.4 psig (361 kPa) | ±3.5 psig (±24 kPa) | 10 - 40 psig (69 - 276 kPa) | CS-0120 |
| | 265 - 1070 psig (1827 - 7377 kPa) | Orange | 127.6 psig (870 kPa) | ±5.5 psig (±38 kPa) | 10 - 100 psig (69 - 690 kPa) | CS-0130 |
| | 400 - 1300 psig (2758 - 8962 kPa) | White | 203.2 psig (1400 kPa) | ±9.1 psig (±63 kPa) | 15 - 163 psig (103 - 1125 kPa) | CS-0135 |
| | 625 - 1500 psig (4309 - 10341) | Purple | 279.3 psig (1904 kPa) | ±11.9 psig (±82 kPa) | 20 - 220 psig (138 - 1522 kPa) | CS-0140 |

NOTES

1. Setpoint Accuracy based upon proper maintenance of VPC Controller and adjustment to specification following VPC Controller Technical Manual. Setpoint Accuracy represents maximum control band over 24 hours when VPC utilized WITHOUT volume booster or pneumatic positioner. When VPC utilized WITH volume booster or pneumatic positioner accuracy increases and value should be multiplied by 0.5.

2. Maximum "GAP" Setpoint Range applicable only to VPC-GAP Controller Configurations. The "GAP" relates to bracketed high-low trigger points for discrete on-off control logic.

3. These Control Springs not recommended for this particular model of VPC GAP Controller.

TABLE 4.0 CRITICAL FLOW EQUATION

$$Q_c = 312.9 \times (P_1 + 14.7) \times C_v \times \sqrt{\frac{1}{G \times (T + 460)}}$$

Where:

| Variable | Description | Unit |
|----------------|------------------------------------|------|
| Q _c | Critical Flow Across Inlet Orifice | scfh |
| P ₁ | Supply Pressure | psig |
| C _v | Flow Factor | -- |
| G | Specific Gravity of Gas | -- |
| T | Gas Temperature | *F |

TABLE 5.0 FLOW COEFFICIENT TABLE (CV)

Adjustable Orifice Flow Coefficients

| Adjustable Orifice Setting | | | | | | | | |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Installed Orifice | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Standard | 0.006 | 0.009 | 0.018 | 0.044 | 0.069 | 0.096 | 0.111 | 0.126 |
| Medium (M) | 0.042 | 0.045 | 0.062 | 0.089 | 0.134 | 0.172 | 0.211 | 0.249 |
| Large (L) | 0.042 | 0.063 | 0.172 | 0.328 | 0.461 | 0.578 | 0.634 | 0.675 |

Notes:

- Equation above may be utilized to determine supply regulator consumption requirements and steady state bleed rates for control valves operated with a VGP Valve Gas Positioner.
- VGP Adjustable Orifices are typically utilized in double acting applications only and represents the limiting flow factor in determining flow rates and resultant stroking times.
- When applications do not utilize Adjustable Orifice, then the VGP internal Balanced Valve becomes the limiting factor to determine flow rates and resultant stroking times. VGP Internal Balanced Valve C_v=1.45.

TABLE 6.0 ESTIMATED TRAVEL TIME

$$t = 0.148 \times \frac{H \times D^2}{C_v} \times \sqrt{\frac{G}{T + 460}}$$

Where:

| Variable | Description | Unit |
|----------------|---------------------------------|----------------------|
| t | Stroke Time | Sec. |
| H | Actuator Cylinder Stroke Length | in. |
| D | Actuator Cylinder Diameter | in. |
| C _v | Limiting Flow Coefficient | -- |
| G | Gas Specific Gravity | Typ. 0.6 Natural Gas |
| T | Gas Temperature | *F |

HOW IT WORKS DESCRIPTIONS:

DOUBLE ACTING VPC-DA-SN

When the SENSING pressure is equal to the VPC-DA-SN setpoint, the net force on the VPC-DA-SN power module is zero. This is the equilibrium or "balanced" condition where the sensing pressure that pushes down on the sensing diaphragm and the control spring force that pulls up on the sensing diaphragm are equal. When the VPC-DA-SN achieves equilibrium, the OPEN seat & nozzle assembly and CLOSE seat & nozzle assembly will be positioned at equal openings maintaining a constant OUTPUT pressure to the top and bottom chambers of the control valve actuator. The VPC-DA-SN will exhibit constant emissions at this state as referenced in Table 1.0. From this position two possible scenarios can occur, the sensing pressure can rise above or below the set point. If the sensing pressure rises above the VPC-DA-SN setpoint the net force on the VPC-DA-SN power module is downward. The CLOSE seat & nozzle assembly will move toward closed position and divert pressure to the CLOSE chamber of the double acting actuator. The OPEN seat & nozzle assembly will open more and pressure shall be reduced on the OPEN side of the double acting actuator. The combination of these actions creates a differential pressure to be applied to the double acting actuator that will move the valve toward the closed position.

If the sensing pressure falls below the VPC-DA-SN setpoint the net force on the VPC-DA-SN power module is upward. The OPEN seat & nozzle assembly will move toward closed position and divert pressure to the OPEN chamber of the double acting actuator. The CLOSE seat & nozzle assembly will open more and pressure shall be reduced on the CLOSE side of the double acting actuator. The combination of these

actions creates a differential pressure to be applied to the double acting actuator that will move the valve toward the open position.

An adjustment for sensitivity is achieved via a rotating drum at the center of the VPC-DA-SN. Rotation of the drum to the LEFT (Increasing Numbers) will increase the fixed distance of the internal assembly, requiring greater travel of VPC-DA-SN internals to affect a change in CLOSE PRESSURE and OPEN PRESSURE. Conversely, rotation of the drum to the RIGHT (Decreasing Numbers) will decrease the fixed distance of the internal assembly, requiring lesser travel of VPC-DA-SN internals to affect a change in CLOSE PRESSURE and OPEN PRESSURE.

Adjustable orifices are installed upstream of the SUPPLY PRESSURE that affect the maximum achievable flow rate to CLOSE PRESSURE and OPEN PRESSURE independently. These Adjustable Orifices may be utilized to adjust the CLOSING and OPENING speed of travel of the control valve actuator with both Adjustable Orifices being set equally. Alternatively, the Adjustable Orifices may be set at different levels to achieve a difference between CLOSING and OPENING speed necessary to optimize control performance for certain applications. Note that the VPC-DA-SN atmospheric emissions may be completely eliminated by discharging exhaust to a nearby or downstream pressure system. Additionally, addition of an NVD No-Vent Device will eliminate emissions when the control valve remains in the full-open or full-closed positions such as a standby, overpressure monitor or relief type application.

TABLE 7.0 VPC DA-SN (SEAT AND NOZZLE TYPE) INITIAL ADJUSTMENT PROCEDURE SUMMARY

| STEP | VPC COMPONENT | ADJUSTMENT ACTION OR OBSERVATION | NOTES |
|------|------------------------|--|---|
| 1 | SENSING PRESSURE | CLOSE + VENT | SENSING VALVES must be 100% bubble tight for successful adjustment |
| 2 | OUTPUT VALVES | CLOSE | OUTPUT VALVES must be 100% bubble tight for successful adjustment |
| 3 | SUPPLY REGULATOR | Adjust to Required Pressure | Refer to ACTUATOR Manufacturer Details for required SUPPLY PRESSURE |
| 4 | SETPPOINT ADJUST SCREW | → CCW to unload Control Spring Then Clockwise ← 2.0 Turns | When CONTROL SPRING unloaded torque will decrease noticeably |
| 5 | ADJUST DRUM | → RIGHT until STOP • then ← 1 Turns to ← LEFT | Do not apply excessive force |
| 6 | SENSING PRESSURE | Apply Required Setpoint Pressure (false Signal) | Recommended to utilize accurate calibrated gage |
| 7 | SETPPOINT ADJUST SCREW | Clockwise ← (CW) until CLOSE PRESSURE And OPEN PRESSURE are EQUAL regardless of value. | CLOSE and OPEN Pressures should be steady. |
| 8 | ADJUST DRUM | Turn to ← LEFT (Increasing Numbers) until either the CLOSE OR OPEN OUTPUT decreases to TARGET BALANCE PRESSURE Per Table 8.0. | CLOSE and OPEN OUTPUT pressures may not increase at the same rate. Rotate drum to raise or lower output pressure. |
| 9 | SETPPOINT ADJUST SCREW | Turn clockwise ← (CW) OR counterclockwise → (CCW) until CLOSE PRESSURE and OPEN PRESSURE are EQUAL regardless of value. | Rotate back & forth to achieve Equal pressures |
| 10 | OUTPUT PRESSURE | OUTPUT PRESSURE Should be steady at TARGET BALANCE PRESSURE Per Table 8.0. REPEAT Steps 9 and 10 Until this scenario is achieved. | |
| 11 | EXHAUST | EXHAUST port should vent gas continually at this stage when CLOSE PRESSURE and OPEN PRESSURE are equal. If the VPC is equipped with an NVD No-Vent Device the VPC will exhibit ZERO vent (exhaust) when control valve is FULL OPEN or FULL CLOSED and process operating pressure is within ±2.0% maximum spring range value from setpoint. | Initial Adjustment Achieved. Refer to Application Based Fine Tuning Setting Guidelines (Table 8.0) for Application Specific Secondary Tuning. |

NOTES

1. Adjustment and Installation of VRG Controls equipment should be only be performed by qualified personnel adequately trained and familiar with products.

2. For technical assistance, please contact your local VRG Controls Sales Representative or VRG Controls direct (www.vrgcontrols.com)

TABLE 8.0 VPC-DA-SN (SEAT AND NOZZLE TYPE) APPLICATION BASED FINE TUNING SETTING GUIDELINES

| Application | Recommended VPC Model | Ball Valve | Globe Valve | Moderate Volume DA Actuator | Large Volume DA Actuator | Volume Booster | Discharge to Pressure System | OPEN Orifice ¹⁰ | CLOSE Orifice ⁶ | Target Balance Pressure |
|--|---|------------|-------------|-----------------------------|--------------------------|----------------|------------------------------|----------------------------|----------------------------|--|
| Pipeline Interconnect ⁴ | VPC-DA-SN (Actuator Volume < 950 in ³) | ■ | | ■ | | N | Y | S3 | S3 | $(0.70 \times (P_{Supply} - P_{Discharge})) + P_{Discharge}$ |
| | VPC-DA-SN (Actuator Volume < 950 in ³) | ■ | | ■ | | Y | N | S2 | S2 | $0.80 \times P_{Supply}$ |
| | VPC-DA-SN (Actuator Volume > 950 in ³) | ■ | | | ■ | Y | N | S2 | S2 | $0.70 \times P_{Supply}$ |
| | VPC-DA-SN Actuator Volume Any | | ■ | ■ | | N | Y | S4 | S4 | $(0.70 \times (P_{Supply} - P_{Discharge})) + P_{Discharge}$ |
| Power Plant / Industrial Users ⁵ (Close-Coupled Systems) | VPC-DA-SN (Actuator Volume < 500 in ³) | ■ | | ■ | | N | Y | S4 | M5 | $(.80 \times (P_{Supply} - P_{Discharge})) + P_{Discharge}$ |
| | VPC-DA-SN (Actuator Volume < 500 in ³) | | ■ | ■ | | N | Y | S2 | M5 | $(.90 \times (P_{Supply} - P_{Discharge})) + P_{Discharge}$ |
| | VPC-DA-SN (Actuator Volume > 500 in ³) | | ■ | | ■ | N | N | S2 | M5 | $(.90 \times (P_{Supply} - P_{Discharge})) + P_{Discharge}$ |
| | VPC-DA-SN (Any Size Actuator) | ■ | | ■ | ■ | Y | N | S2 | S3 | $(.90g \times (P_{Supply} - P_{Discharge})) + P_{Discharge}$ |

NOTES

- Adjustment and Installation of VRG Controls equipment should be only be performed by qualified personnel adequately trained and familiar with products.
- For technical assistance, please contact your local VRG Controls Sales Representative or VRG Controls direct (www.vrgcontrols.com).
- All values represent a starting point. Dynamic tuning with VPC in "live control" will be necessary to optimize performance.
- In this table, Pipeline Interconnects are defined >1.0 mile downstream piping adjacent to control valve.
- In this table, Close-Coupled System Applications are defined <1.0 mile downstream piping adjacent to control valve.
- Increasing number on the CLOSE and OPEN Orifice will increase the speed of response independently in each direction (faster reset rate). Refer to VPC Application Schematic to determine which Adjustment Orifice controls OPEN and CLOSE speed.
- If system is unstable upon adjusting VPC per above guidelines, corrective adjustment to INCREASE CLOSING speed and REDUCE OPENING speed are suggested. Additionally, the sensitivity may be decreased by increasing the output pressure of CLOSE/OPEN gages from 50% of SUPPLY GAS PRESSURE up to 99% by rotating ADJUSTMENT DRUM to right in direction of decreasing numbers.
- All above settings are for ACTIVE control valves. For STANDBY Monitor Type control valves, it is recommended that the CLOSE ORIFICE that controls CLOSING SPEED by increasing to maximum setting of #6 in all cases. See application schematic for details.
- For Close-Coupled System Applications where "Discharge to Pressure System" is incorporated, P_{Discharge} must not exceed 150 psig.
- Typically P_{Differential} = P_{Supply} - P_{Discharge} must be minimum of 100 psid. Where P_{Differential} < 100 psig, please consult VRG Controls.

VOLUME BOOSTER

NOTES

1. Sensitivity adjustment screw allows to bypass the pilot output around the booster directly to the actuator.
2. Clockwise rotation of the screw reduces and eliminates bypass, the highest booster sensitivity.
3. For all applications we recommend to start the booster 45 degree away from full close position.
4. If the booster response is still to sensitive the adjusting screw can be turn additional amount CCW to reduce sensitivity.
5. As a general rule large downstream systems (over 1 mile) and or large size actuators (over 950 in3) can be used with booster at maximum sensitivity (the screw is turned CW all the way).
6. The jam nut must be tighten after adjustment is completed.

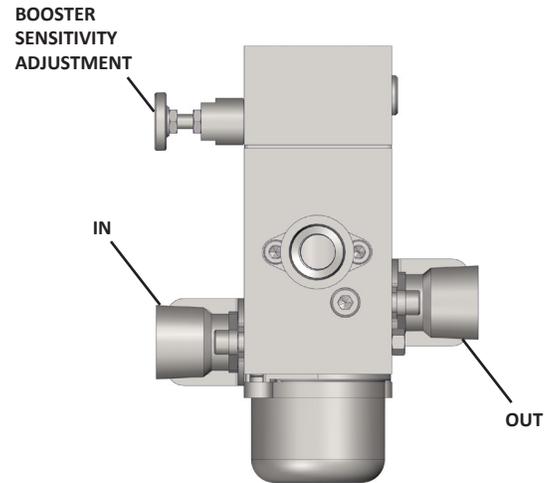


TABLE 9.0 VPC-DA-SN (SEAT AND NOZZLE TYPE) ASSEMBLY CONFIGURATION SUMMARY

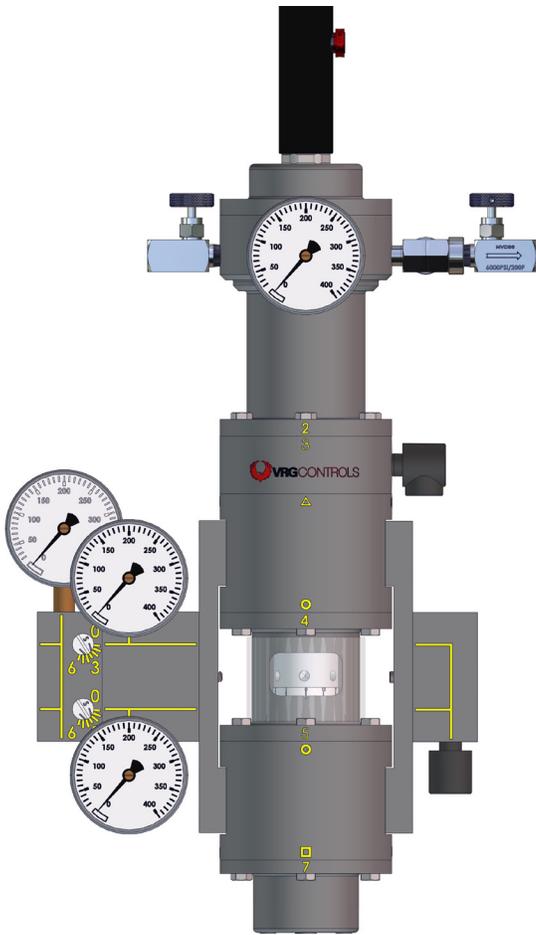
| Component | VPC-DA-SN |
|---------------------------------|-----------------|
| Output | DA |
| Internal Valve Logic | SN |
| Action | -- |
| Cartridge Top Flange | 1 |
| Spring Cartridge | 2 |
| 700 Sensing Spacer | 3 |
| 225/1500 Spacer Flange/ Adapter | 3A |
| 225/1500 Sensing Spacer | 3B |
| Pilot Block (TOP) | ▲ |
| Pilot Block (BOTTOM) | ● |
| Pilot Spacer (TOP) | 4 |
| Pilot Spacer (BOTTOM) | 5 |
| Pilot Block (TOP) | ● |
| Pilot Block (Bottom) | ■ |
| Pilot Bottom Flange | 7 |
| Left Hand Manifold | DA "S" |
| Right Hand Manifold | DA "EX" |
| DA Output Manifold | "OUT 1" "OUT 2" |

NOTES

1. When VPC-DA-SN discharges to a pressure system the EXHAUST "EX" manifold must be replaced with full capacity DOWNSTREAM DISCHARGE "DN" manifold.

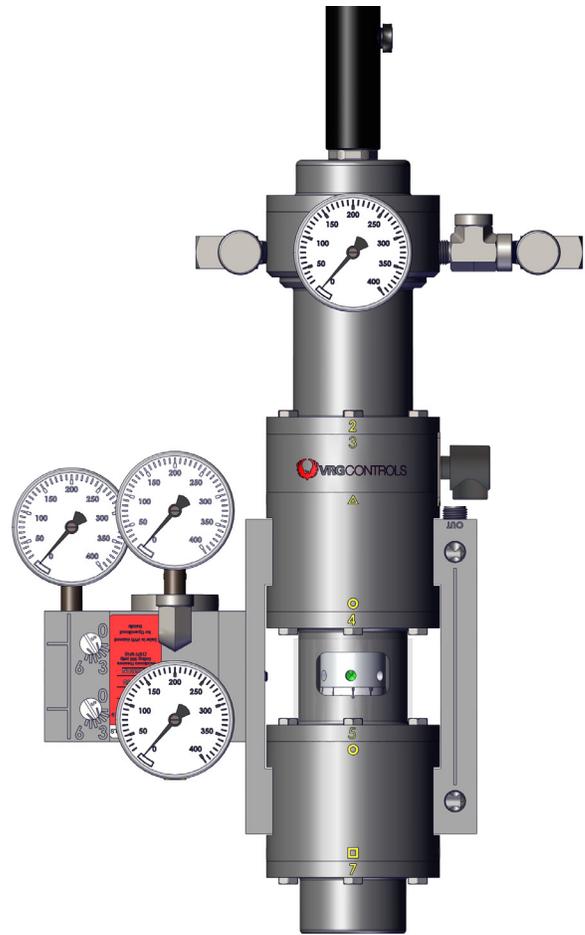
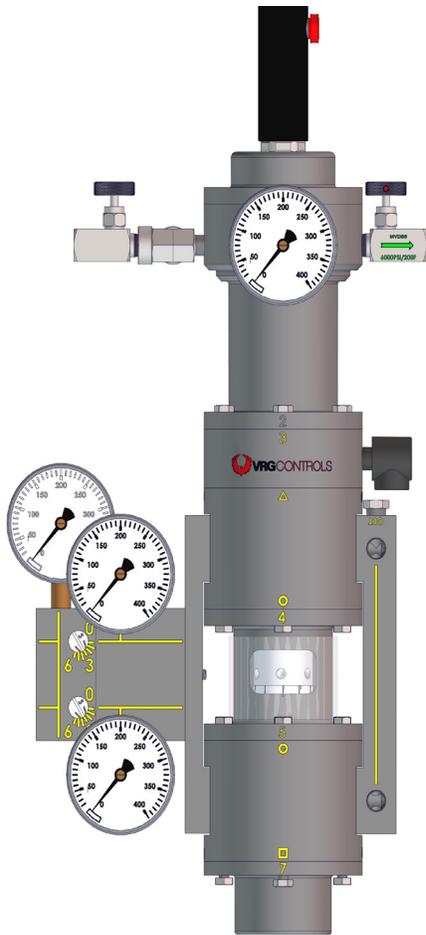
VPC-700-DA-SN (Double Acting) Assembly Guide
Part Number: PA-0020
Corresponds with Diagrams 1 and 1A

VPC-700-DA-SN-NVD(Double Acting) Assembly Guide
With NVD No-Vent Device
Part Number: PA-0025
Corresponds with Diagrams 2, 2A, 3, AND 3A



VPC-700-DA-SN-DN (Double Acting) Assembly Guide
Part Number: PA-0020-DN
Corresponds with Diagrams 3, 3A, 4 and 4A

VPC-700-DA-SN-DN-NVD (Double Acting) Assembly Guide With NVD No-Vent Device
Part Number: PA-0025-DN
Corresponds with Diagrams 5 and 5A



VPC-1500-DA-SN(Double Acting) Assembly Guide
Part Number: PA-0022-NO
Corresponds with Diagrams 6 and 6A

VPC-1500-DA-SN-NC (Double Acting) Assembly Guide
With NVD No-Vent Device
Part Number: PA-0022-NC
Corresponds with Diagrams 7 and 7A

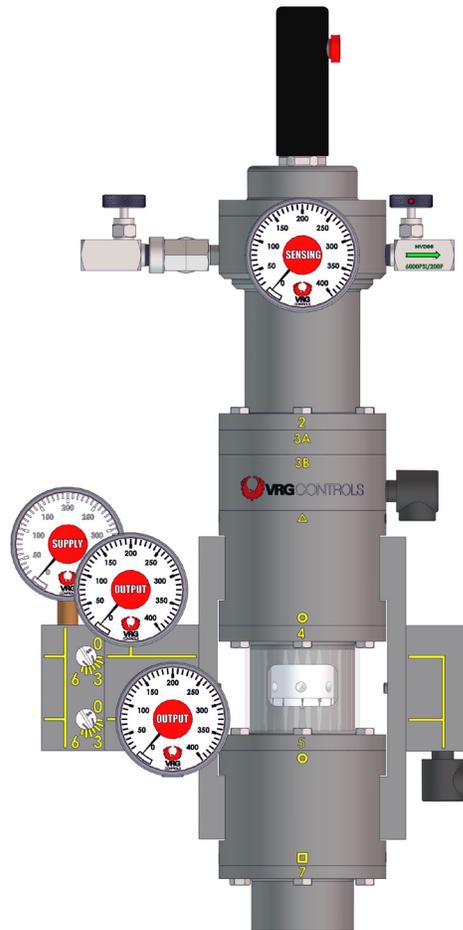
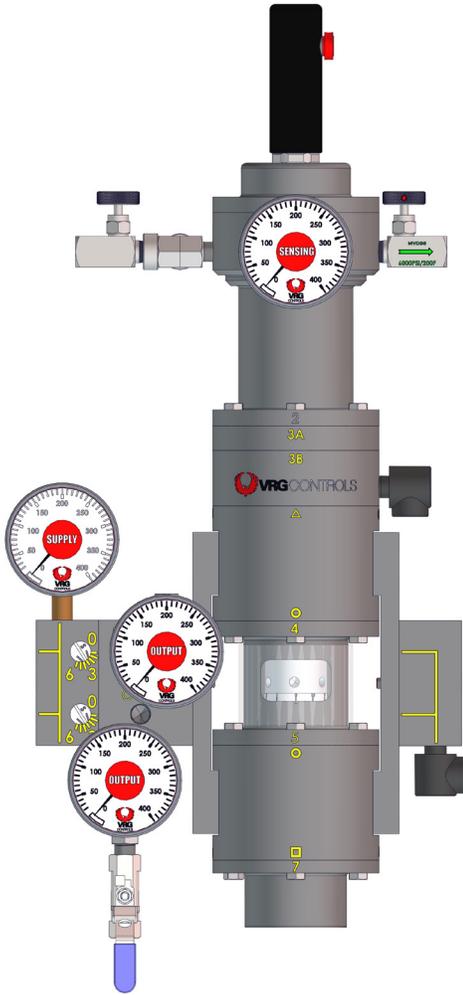


TABLE 10.0 FACTORY QUALITY CHECKLIST VPC VALVE PILOT CONTROLLER

| | | |
|--|---------------------------------|--|
| Date: | | |
| VRG Invoice Number: | | |
| Technician Name: | Technician Signature: | |
| QC Name: | QC Signature: | |
| Model Number: | | |
| Serial Number: | | |
| Customer: | | |
| Customer Tag: | | |
| Supply Pressure | | |
| Discharge Pressure | | |
| Orifice Setting _____ | <input type="checkbox"/> Output | <input type="checkbox"/> Open <input type="checkbox"/> Close <input type="checkbox"/> Supply |
| Orifice Setting _____ | <input type="checkbox"/> Output | <input type="checkbox"/> Open <input type="checkbox"/> Close <input type="checkbox"/> Supply |
| Procedure | Verified | Notes |
| Apply Maximum Sensing Pressure 30 min. | <input type="checkbox"/> VERIFY | |
| Adjust VPC to Setpoint | <input type="checkbox"/> VERIFY | |
| Friction Test | <input type="checkbox"/> VERIFY | |
| Gage Check | <input type="checkbox"/> VERIFY | |
| Valve Leak Check | <input type="checkbox"/> VERIFY | |
| Assembly Leak Check | <input type="checkbox"/> VERIFY | |
| Seat Check | <input type="checkbox"/> VERIFY | |
| Sensitivity/Deadband Adjustment (Initial) | <input type="checkbox"/> VERIFY | |
| Sensitivity/Deadband Adjustment (Adjusted) | <input type="checkbox"/> VERIFY | |
| Sensitivity Check | <input type="checkbox"/> VERIFY | |
| Label Check | <input type="checkbox"/> VERIFY | |
| Notes: | | |

TABLE 11.0 VPC-SN SERIES REPAIR KIT BILL OF MATERIALS (BOM) PACKING LIST

| PACKED DATE | PACKED BY | QC CHECK |
|-------------|-----------|----------|
|-------------|-----------|----------|

| REPAIR KIT | PART NO. | NOTES: |
|-------------------|----------|--------|
| VPC-SN REPAIR KIT | RK-0200 | |

THIS REPAIR KIT FITS THE FOLLOWING VRG MODELS:

VPC-225-DA-SN

VPC-700-DA-SN

VPC-1500-DA-SN

| ITEM | PART NUMBER | DESCRIPTION | TYPE | QTY | CHK |
|------|-------------|---|------------|-----|--------------------------|
| 1 | EL-0010 | Diaphragm w/Hole-700 psig, Buna | Diaphragms | 5 | <input type="checkbox"/> |
| 2 | EL-0020 | Diaphragm w/Hole-1500 psi, Buna | Diaphragms | 1 | <input type="checkbox"/> |
| 3 | EL-0030 | Diaphragm w/Hole-225 psig, Buna | Diaphragms | 1 | <input type="checkbox"/> |
| 4 | EL-0200 | O-Ring,-010, Buna, 3/8 x 1/4 x 1/16 | O-Rings | 8 | <input type="checkbox"/> |
| 5 | EL-0210 | O-Ring,-012, Buna, 1/2 x 3/8 x 1/16 | O-Rings | 11 | <input type="checkbox"/> |
| 6 | EL-0220 | O-Ring,-014, Buna, 5/8 x 1/2 x 1/16 | O-Rings | 4 | <input type="checkbox"/> |
| 7 | EL-0230 | O-Ring,-109, Buna, 1/2 x 5/16 x 3/32 | O-Rings | 1 | <input type="checkbox"/> |
| 8 | EL-0235 | O-Ring,-112, Buna, 11/16 x 1/2 x 3/32 | O-Rings | 4 | <input type="checkbox"/> |
| 9 | EL-0237 | O-Ring,-116, Buna, 15/16 x 3/4 x 3/32 | O-Rings | 1 | <input type="checkbox"/> |
| 10 | EL-0240 | O-Ring,-147, Buna, 2-7/8 x 2-11/16 x 3/32 | O-Rings | 2 | <input type="checkbox"/> |
| 11 | EL-0100 | Buna-N Seat | Seals | 2 | <input type="checkbox"/> |
| 12 | N/A | Mobilith SHC 220 Standard VRG Lubricant | Lubricant | 1 | <input type="checkbox"/> |

VPC-SN Double Acting Pilot Annual Maintenance Checklist

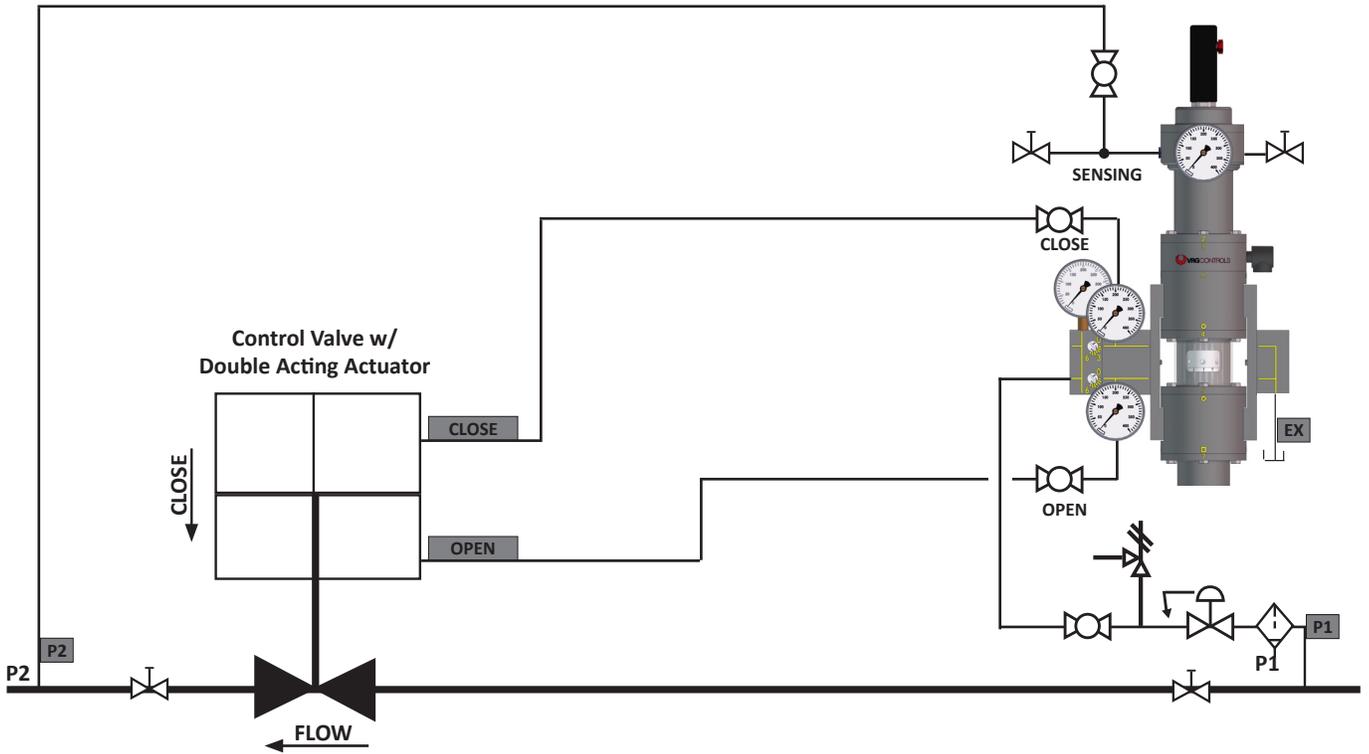
1. _____ VRG Controls recommends functional inspection of VPC-DA-SN Valve Pilot Controllers on an annual basis.
2. _____ For operating regulators, VRG Controls recommends complete replacement of elastomers of VPC-DA-SN Valve Pilot Controllers on a 5 year basis using VRG Controls repair kit.
3. _____ For monitor or standby regulators, VRG Controls recommends complete replacement of elastomers of VPC-DA-SN Valve Pilot Controllers on a 10 year basis using VRG Controls repair kit.
4. _____ Isolate and remove pressure from all VPC-DA-SN components. Clean and inspect Adjustable Orifice Assemblies. Repressurize as appropriate
5. _____ Check Integrity of VPC-DA-SN Pilot Seats by increasing/decreasing measured variable (SENSING) at least 2.0% of CONTROL SPRING RANGE above/below the setpoint such that full differential pressure is achieved on CLOSE/OPEN gages. The EX port must be bubble tight. (The pilot must have NVD in order to perform this test)
6. _____ Soap Test All Diaphragm Mating Surfaces And Adjustable Orifice Assembly to Check for Leaks.
7. _____ Replace Elastomers Utilizing VRG Controls VPC-DA-SN Series Repair Kit if leaks are found. See the AssemblyManual for the VPC-DA-SN Series Valve Pilot Controller.
8. _____ Confirm Supply Pressure Is Correct. Refer To Original VRG Controls Packing Slip or Invoice for Details. Also reference Table 6.0 - Application Based Fine Tuning Setting Guidelines – VPC "SN" Series Double Acting (VPC-DA-SN). If you cannot locate original packing slip or invoice to obtain original application, information, please contact VRG Controls or your local VRG Controls sales representative for assistance. PLEASE PROVIDE VPC SERIAL NUMBER TO FACILITATE ASSISTANCE.
9. _____ Check sensitivity of VPC-DA-SN. Confirm proper cylinder balance pressures (OPEN / CLOSE Gages)
(Refer to Table 8.0)
10. _____ Observe Operation Of All Gages And Replace If Defective.
11. _____ Perform Internal Friction Test by slightly tapping the VPC assembly when unit is adjusted to setpoint and measured variable (SENSING) is loaded to setpoint pressure. CLOSE and OPEN gages should be equal and steady when VPC is adjusted to setpoint. CLOSE and OPEN gages should remain stable and not move when VPC assembly is tapped. Any change in CLOSE and/or OPEN gage values indicates internal friction in the VPC.
12. _____ Inspect And Verify Proper Operation Of All VPC-DA-SN Accessories.

Note: It is not necessary to replace any elastomers in VRG Controls instrumentation or instrumentation accessories on a regular basis. Industry best practices promote rebuild using a VRG Controls spare parts kit on a 5-year frequency. VRG Controls suggested maintenance frequency should never supersede any mandated regulatory requirements or company mandated maintenance.

TABLE 12.0 VPC APPLICATION SCHEMATICS TABLE OF CONTENTS

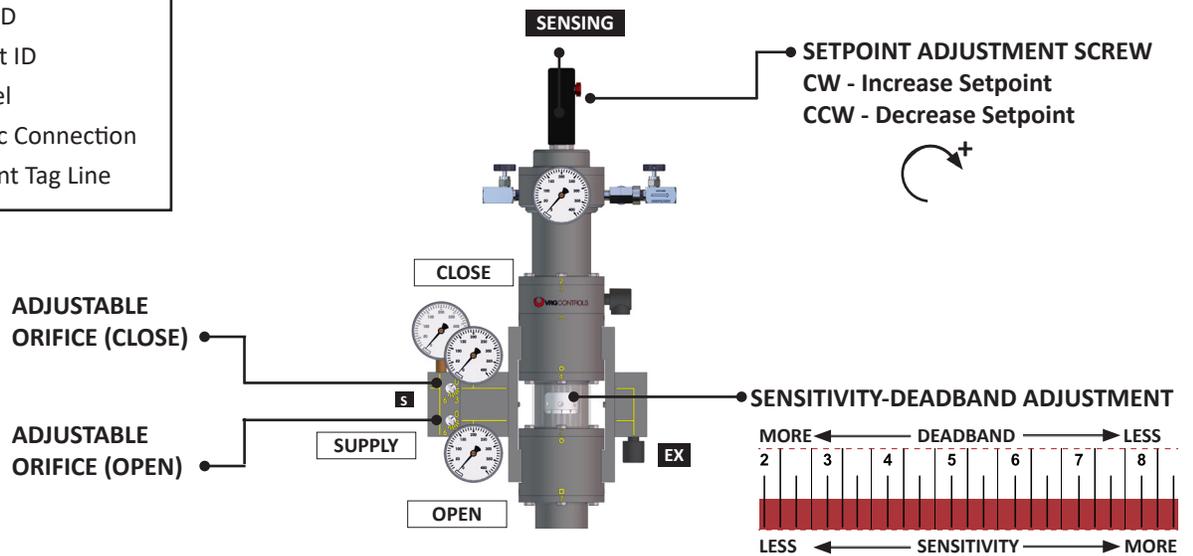
| No. | VPC | Application | Actuator Mode | Booster | Accessory | Discharge | Pg. |
|-----|-----------|--------------------------|-----------------|------------|-------------------------|-----------------|-----|
| 1 | VPC-DA-SN | PIPELINE | DOUBLE ACTING | - | - | ATM | 20 |
| 1A | VPC-DA-SN | PIPELINE | DOUBLE ACTING | - | VMO | ATM | 21 |
| 2 | VPC-DA-SN | PIPELINE | DOUBLE ACTING | 2 BOOSTERS | NVD | ATM | 22 |
| 2A | VPC-DA-SN | PIPELINE | DOUBLE ACTING | 2 BOOSTERS | NVD AND VMO | ATM | 23 |
| 3 | VPC-DA-SN | POWER PLANT | DOUBLE ACTING | 2 BOOSTERS | NVD | ATM | 24 |
| 3A | VPC-DA-SN | POWER PLANT | DOUBLE ACTING | 2 BOOSTERS | NVD AND VMO | ATM | 25 |
| 4 | VPC-DA-SN | PIPELINE AND POWER PLANT | DOUBLE ACTING | - | - | PRESSURE SYSTEM | 26 |
| 4A | VPC-DA-SN | PIPELINE AND POWER PLANT | DOUBLE ACTING | - | VMO | PRESSURE SYSTEM | 27 |
| 5 | VPC-DA-SN | PIPELINE AND POWER PLANT | DOUBLE ACTING | - | NVD | PRESSURE SYSTEM | 28 |
| 5A | VPC-DA-SN | PIPELINE AND POWER PLANT | DOUBLE ACTING | - | NVD AND VMO | PRESSURE SYSTEM | 29 |
| 6 | VPC-DA-SN | PIPELINE AND POWER PLANT | DOUBLE ACTING | - | NVD AND BP SENSOR | PRESSURE SYSTEM | 30 |
| 6A | VPC-DA-SN | PIPELINE AND POWER PLANT | DOUBLE ACTING | - | NVD, BP SENSOR, AND VMO | PRESSURE SYSTEM | 31 |
| 7 | VPC-DA-SN | PIPELINE | NORMALLY OPEN | 2 BOOSTERS | DP SENSOR | ATM | 32 |
| 7A | VPC-DA-SN | PIPELINE | NORMALLY OPEN | 2 BOOSTERS | DP SENSOR AND VMO | ATM | 33 |
| 8 | VPC-DA-SN | PIPELINE | NORMALLY CLOSED | 2 BOOSTERS | DP SENSOR | ATM | 34 |
| 8A | VPC-DA-SN | PIPELINE | NORMALLY CLOSED | 2 BOOSTERS | DP SENSOR AND VMO | ATM | 35 |

| No. VPC | Application | Actuator Mode | Booster | Accessory | Discharge |
|-------------|-------------|---------------|---------|-----------|-----------|
| 1 VPC-DA-SN | Pipeline | Double Acting | - | - | ATM |

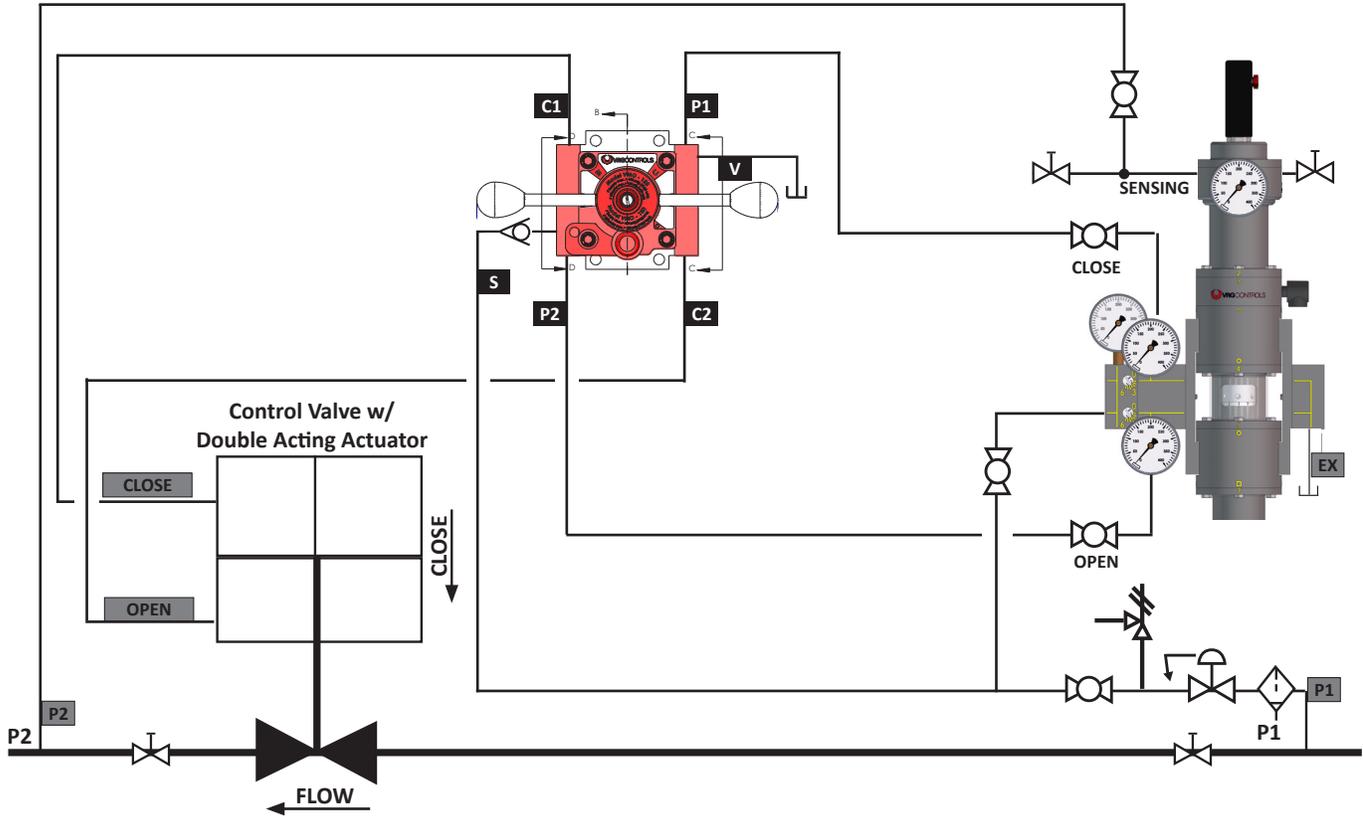


SCHEMATIC LEGEND

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- TEXT** Other Port ID
- TEXT** Gage Label
- Pneumatic Connection
- Adjustment Tag Line

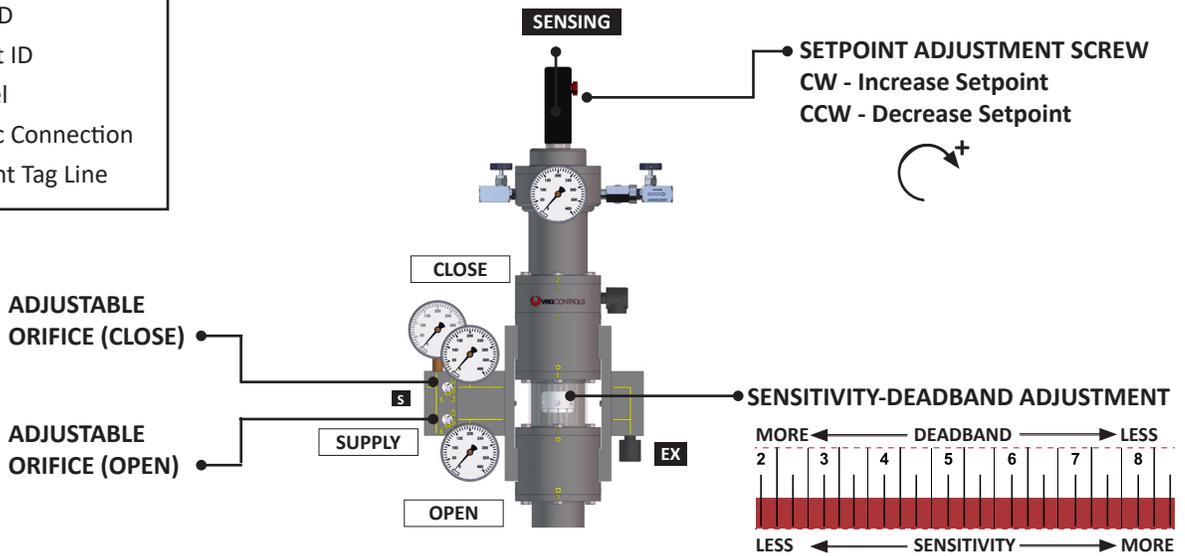


| No. VPC | Application | Actuator Mode | Booster | Accessory | Discharge |
|--------------|-------------|---------------|---------|-----------|-----------|
| 1A VPC-DA-SN | Pipeline | Double Acting | - | VMO | ATM |

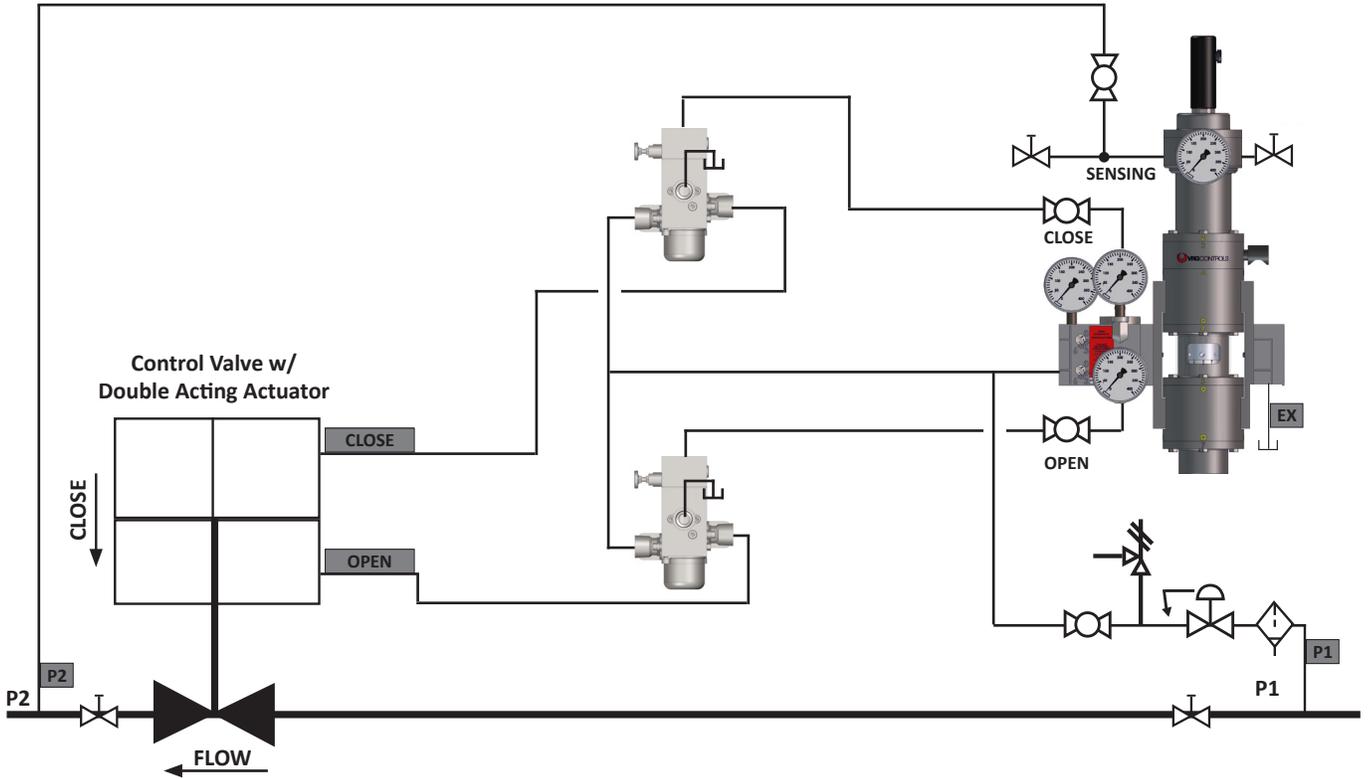


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- Adjustment Tag Line

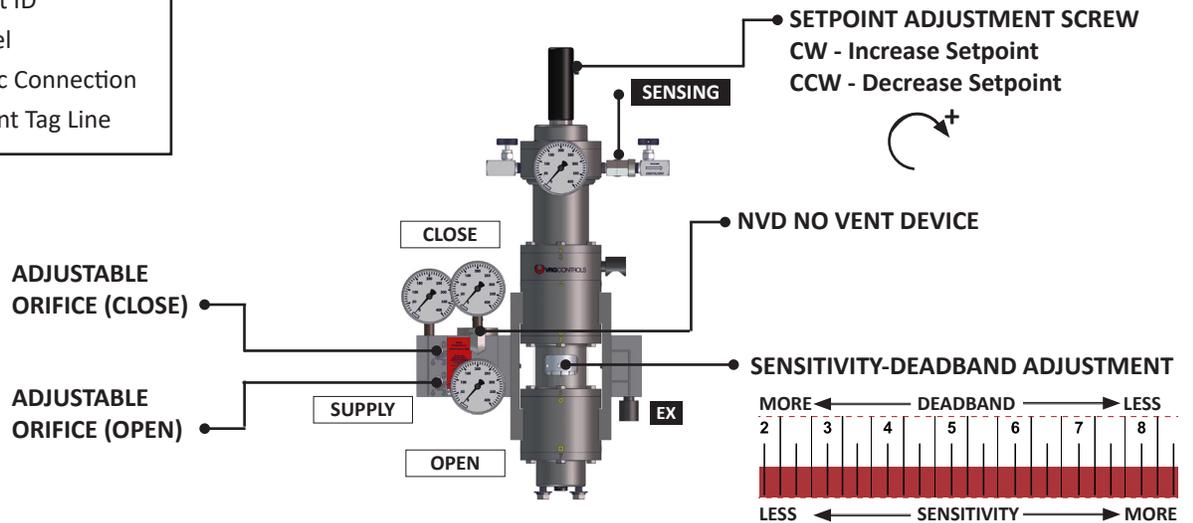


| No. VPC | Application | Actuator Mode | Booster | Accessory | Discharge |
|-------------|-------------|---------------|------------|-----------|-----------|
| 2 VPC-DA-SN | Pipeline | Double Acting | 2 BOOSTERS | NVD | ATM |

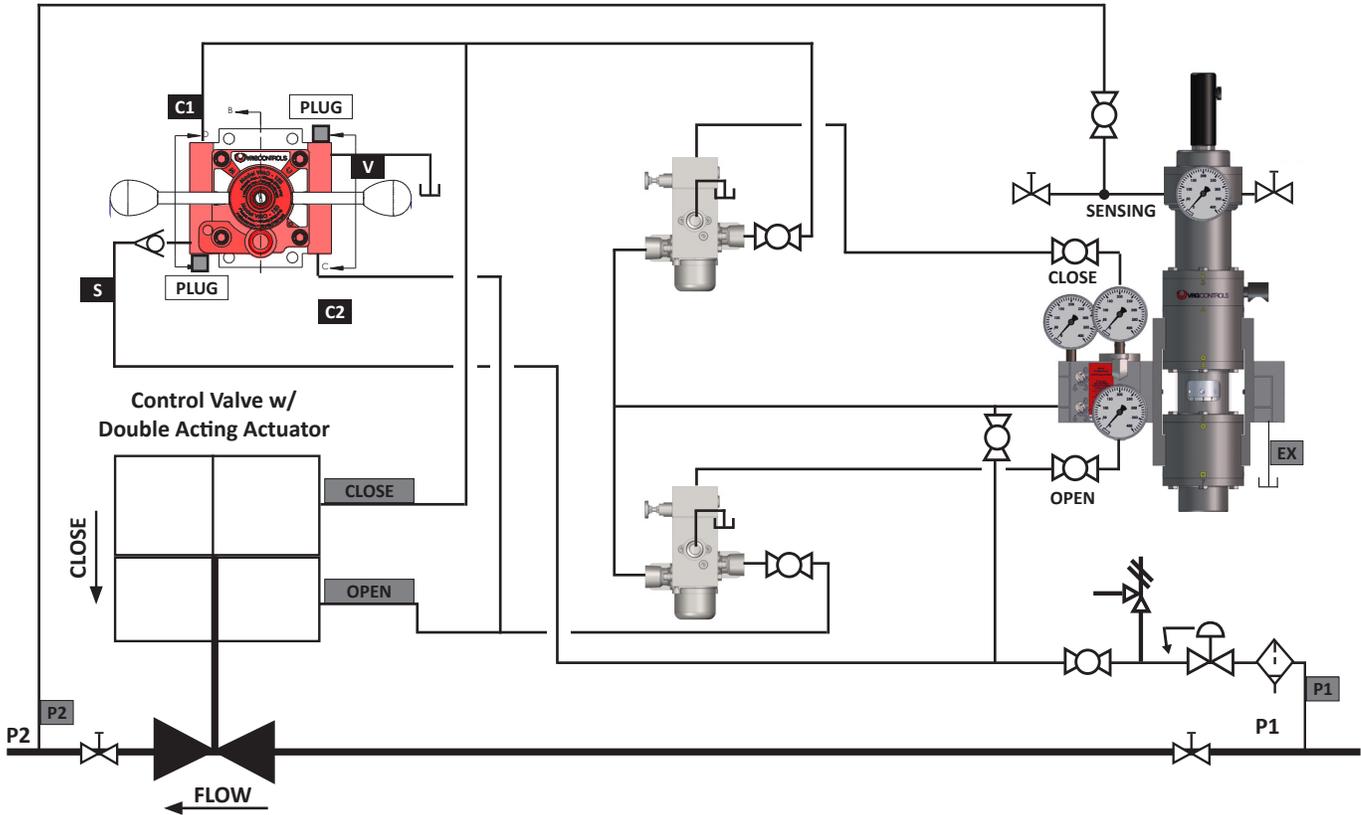


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- TEXT** Gage Label
- Pneumatic Connection
- Adjustment Tag Line

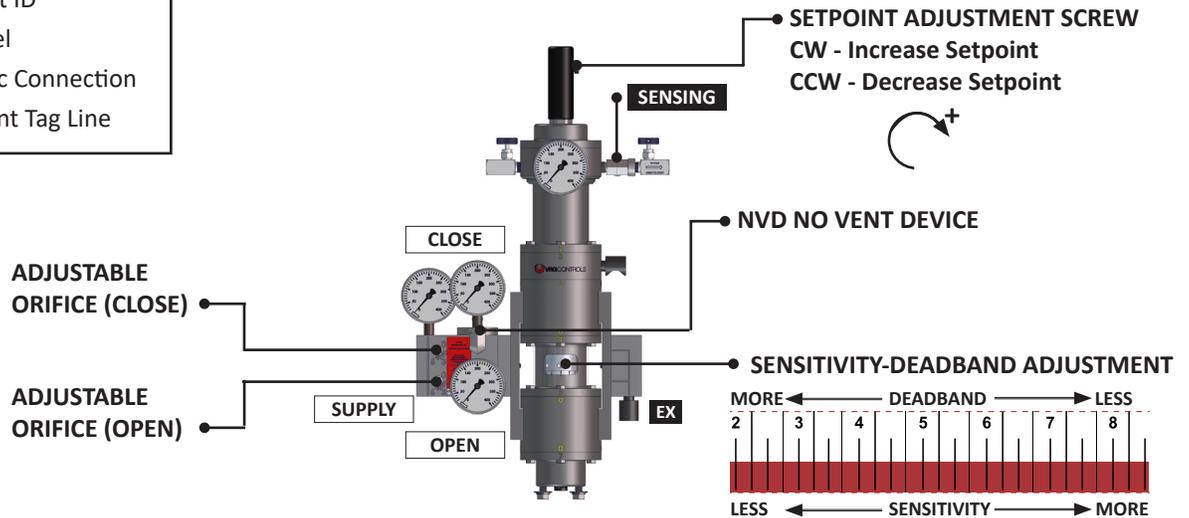


| No. VPC | Application | Actuator Mode | Booster | Accessory | Discharge |
|--------------|-------------|---------------|------------|-------------|-----------|
| 2A VPC-DA-SN | Pipeline | Double Acting | 2 BOOSTERS | NVD AND VMO | ATM |

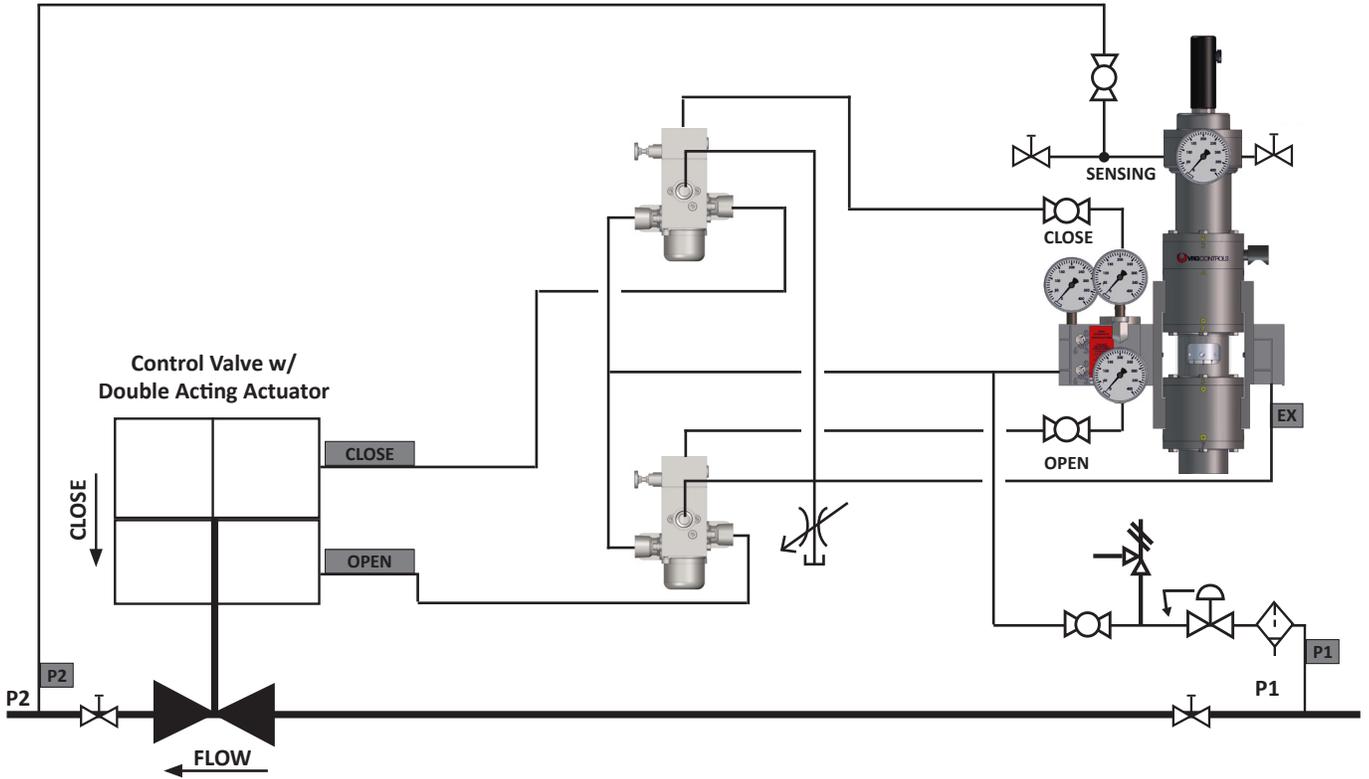


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- TEXT** Gage Label
- Pneumatic Connection
- Adjustment Tag Line

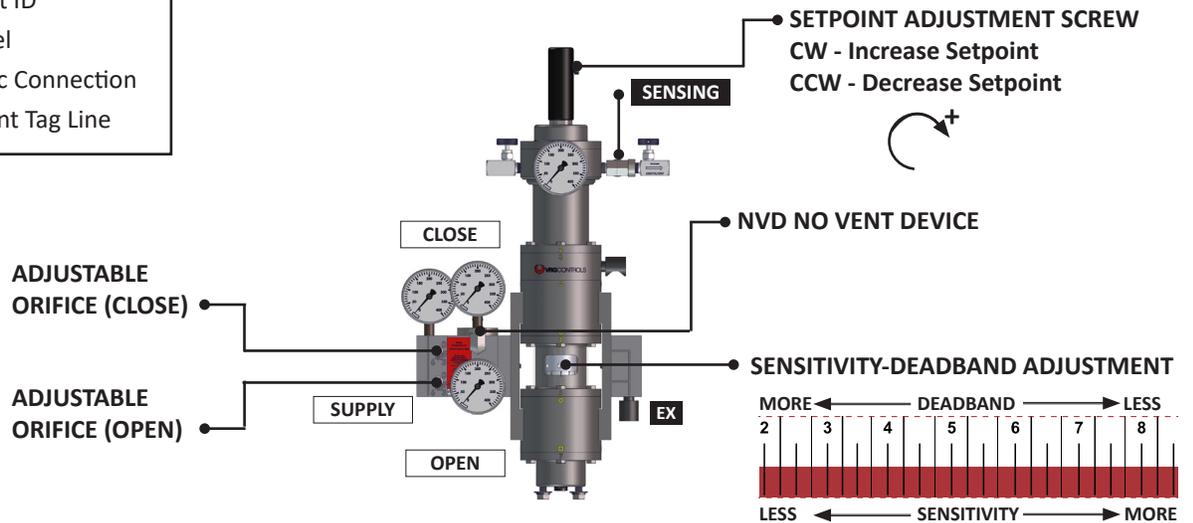


| No. VPC | Application | Actuator Mode | Booster | Accessory | Discharge |
|-------------|-------------|---------------|------------|-----------|-----------|
| 3 VPC-DA-SN | Power Plant | Double Acting | 2 BOOSTERS | NVD | ATM |

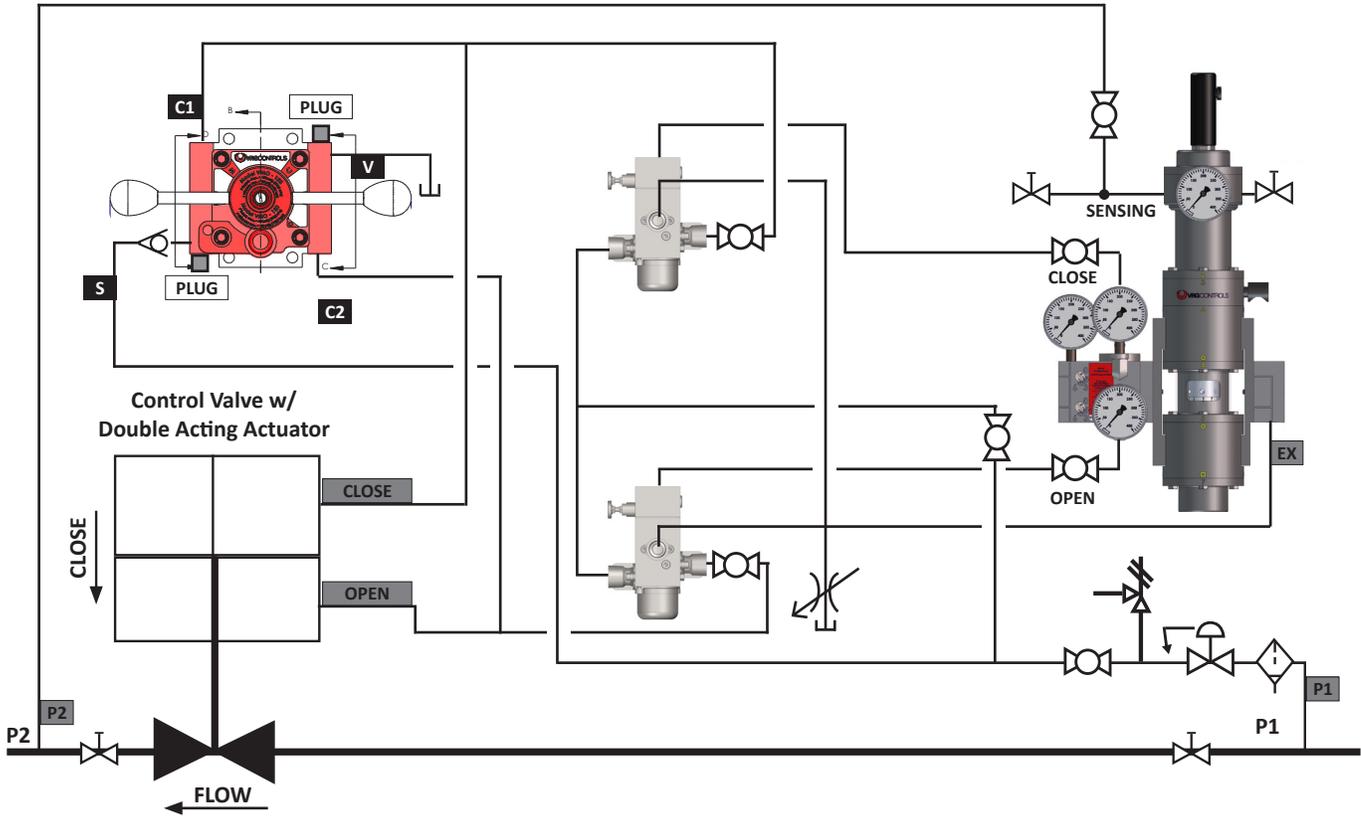


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- TEXT** Gage Label
- Pneumatic Connection
- Adjustment Tag Line

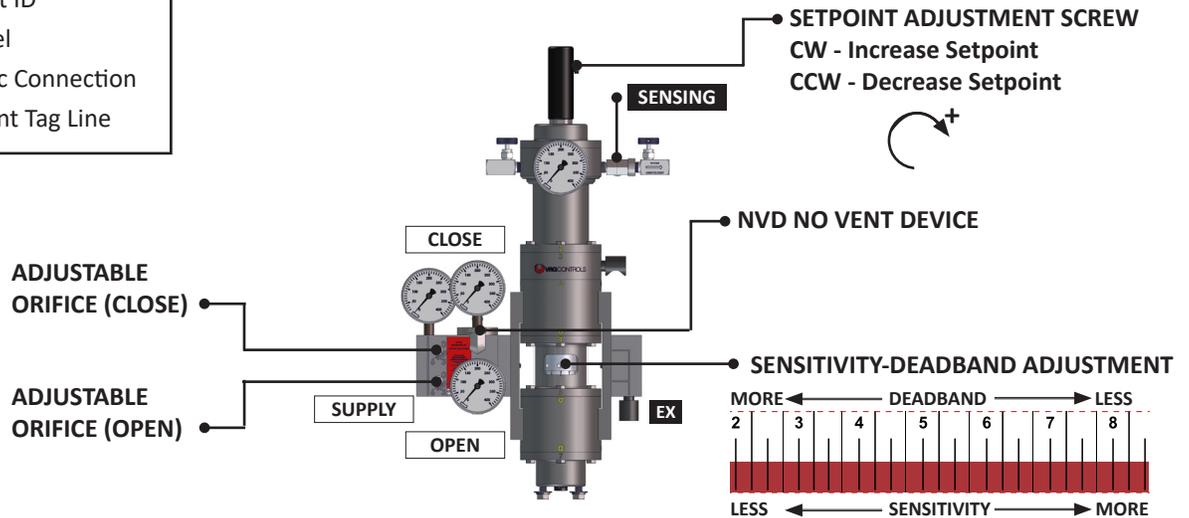


| No. VPC | Application | Actuator Mode | Booster | Accessory | Discharge |
|--------------|-------------|---------------|------------|-------------|-----------|
| 3A VPC-DA-SN | Power Plant | Double Acting | 2 BOOSTERS | NVD AND VMO | ATM |

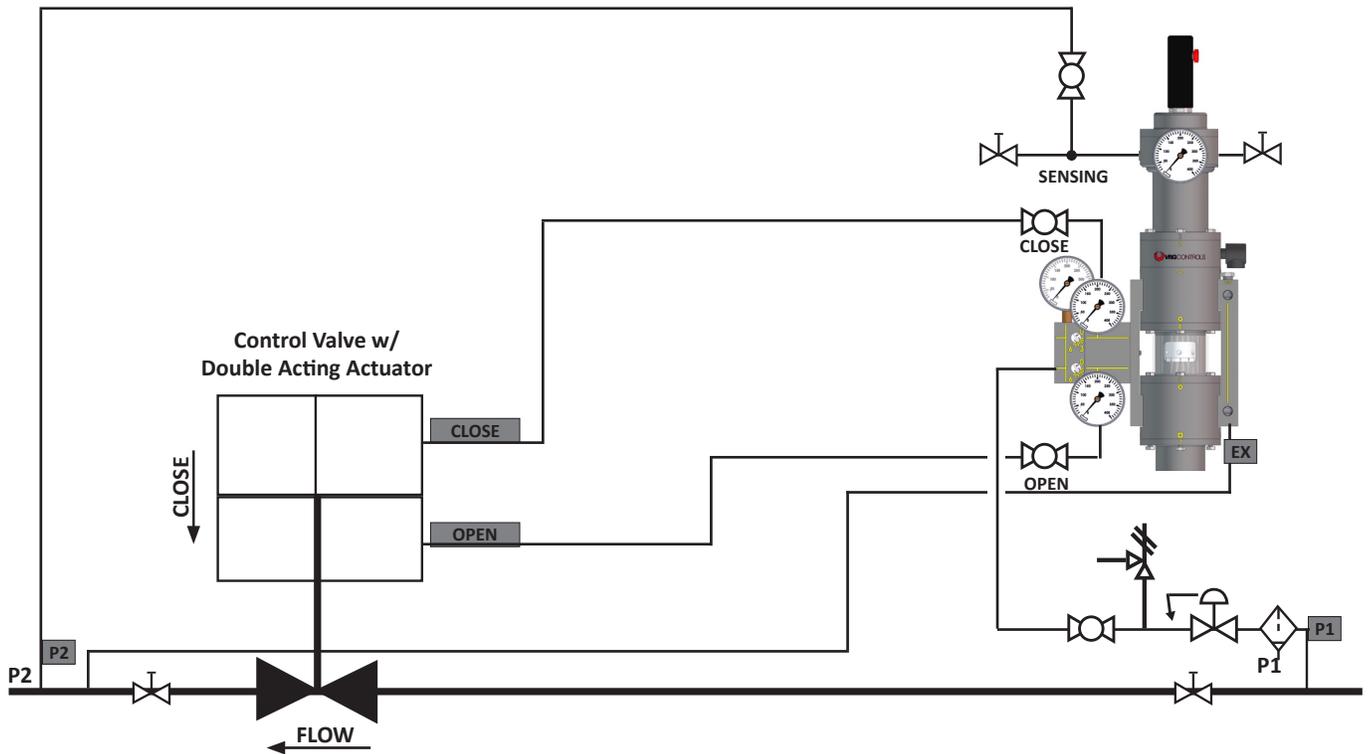


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- Adjustment Tag Line

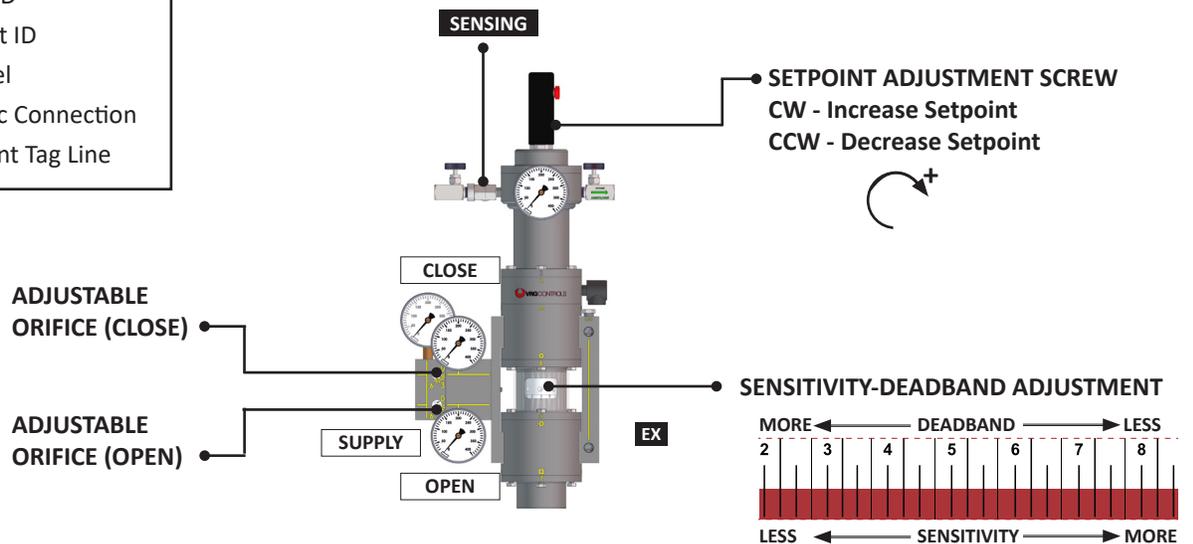


| No. VPC | Application | Actuator Mode | Booster | Accessory | Discharge |
|-------------|--------------------------|---------------|---------|-----------|-----------------|
| 4 VPC-DA-SN | Pipeline and Power Plant | Double Acting | - | - | Pressure System |

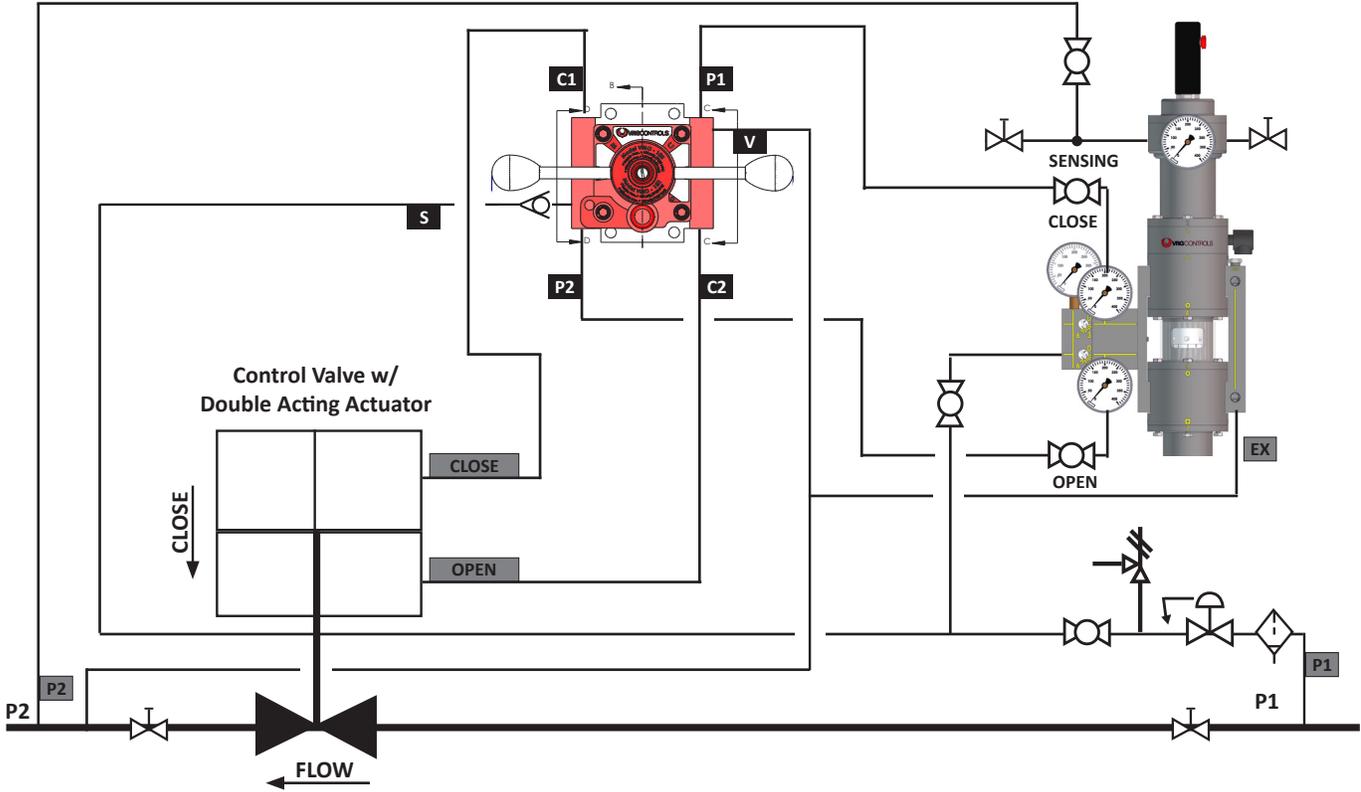


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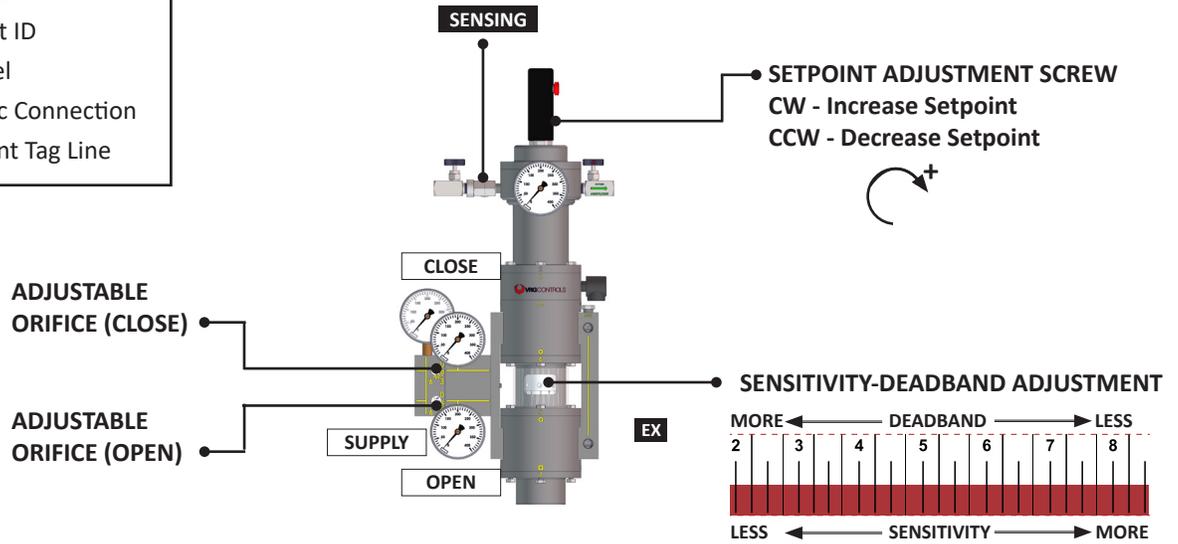
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- TEXT** Gage Label
- Pneumatic Connection
- Adjustment Tag Line



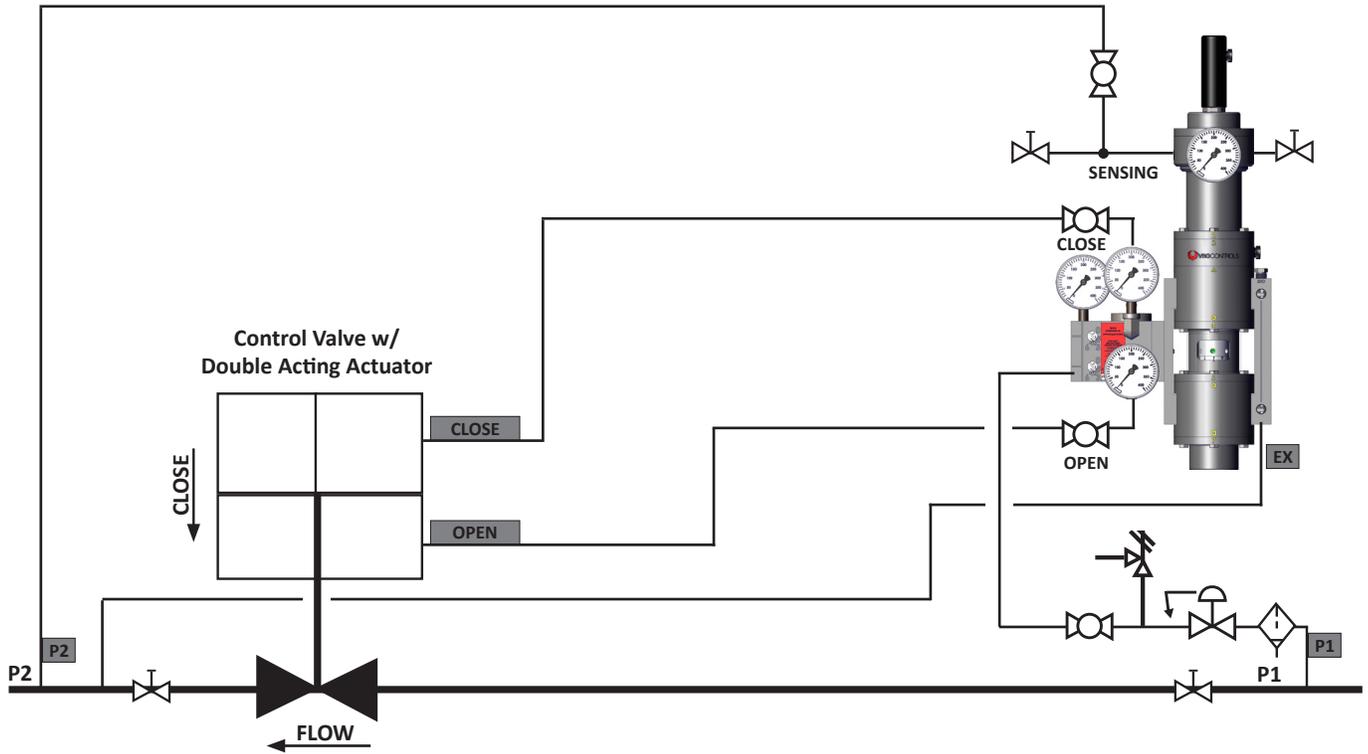
| No. VPC | Application | Actuator Mode | Booster | Accessory | Discharge |
|--------------|--------------------------|---------------|---------|-----------|-----------------|
| 4A VPC-DA-SN | Pipeline and Power Plant | Double Acting | - | VMO | Pressure System |



| SCHEMATIC LEGEND | |
|------------------|----------------------|
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| TEXT | Other Port ID |
| TEXT | Gage Label |
| — | Pneumatic Connection |
| ● | Adjustment Tag Line |

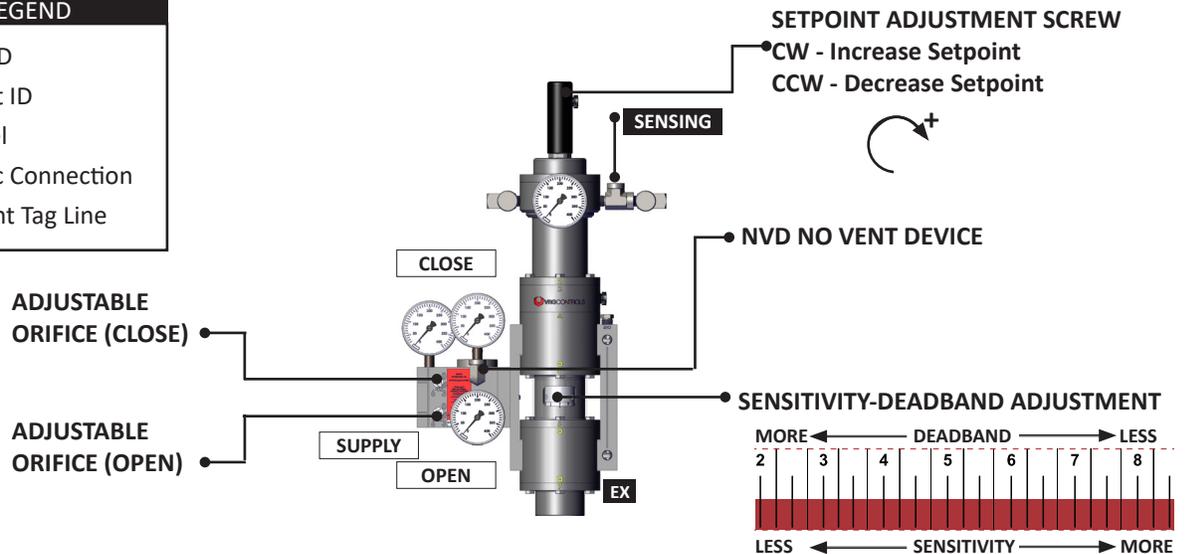


| No. VPC | Application | Actuator Mode | Booster | Accessory | Discharge |
|-------------|--------------------------|---------------|---------|-----------|-----------------|
| 5 VPC-DA-SN | Pipeline and Power Plant | Double Acting | - | NVD | Pressure System |

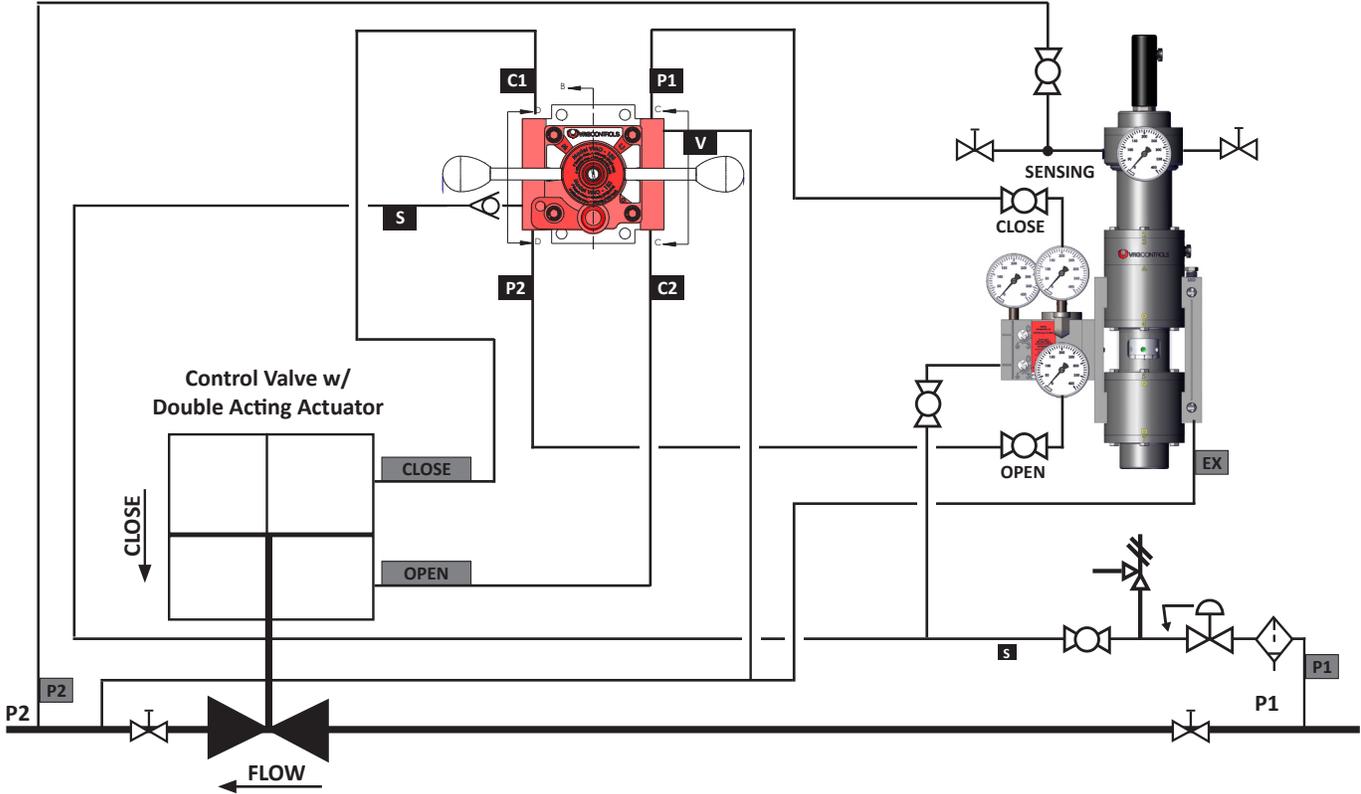


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- TEXT Gage Label
- Pneumatic Connection
- Adjustment Tag Line

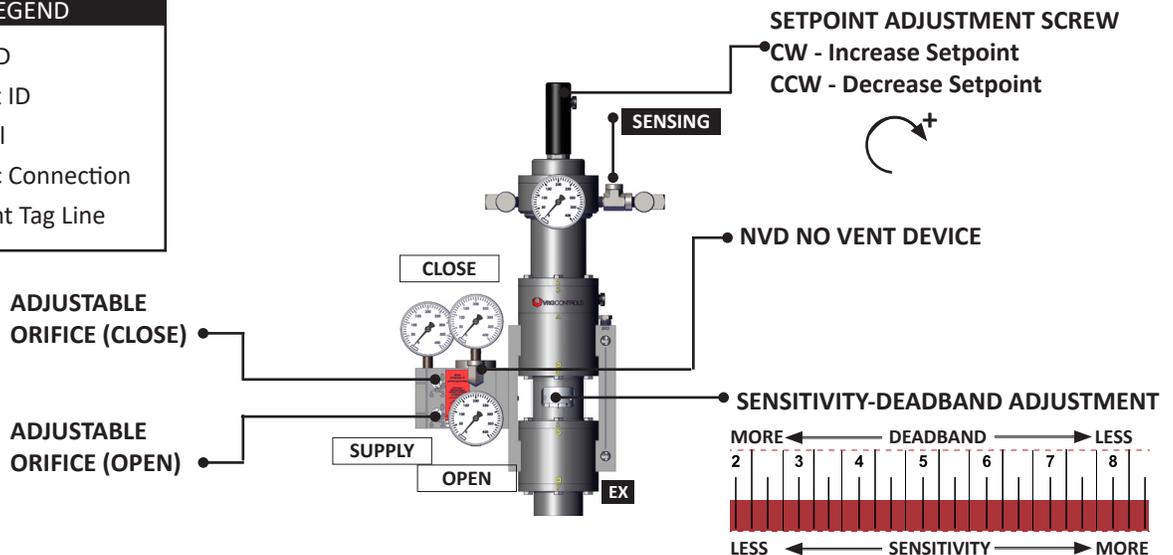


| No. VPC | Application | Actuator Mode | Booster | Accessory | Discharge |
|-------------------|--------------------------|---------------|---------|-------------|-----------------|
| 5A VPC-DA-BV (DA) | Pipeline and Power Plant | Double Acting | - | NVD AND VMO | Pressure System |

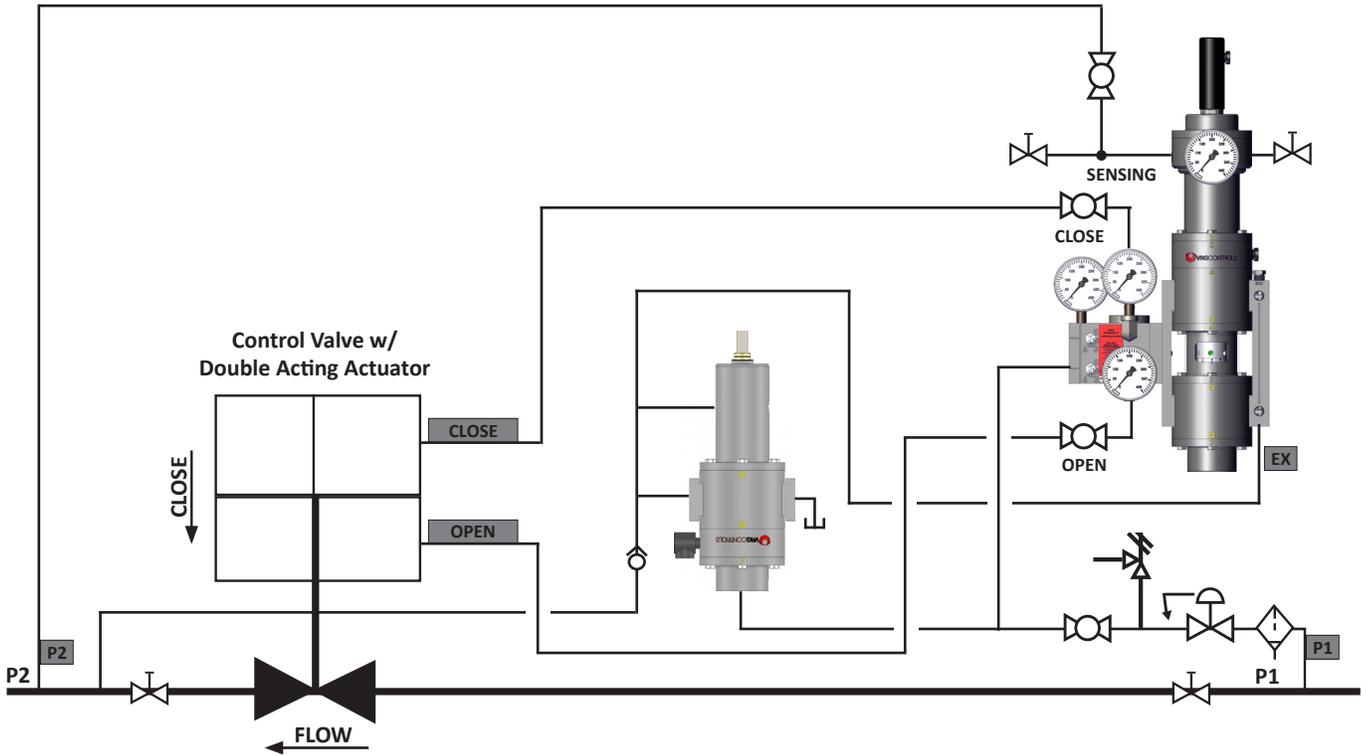


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- TEXT** Gage Label
- Pneumatic Connection
- Adjustment Tag Line

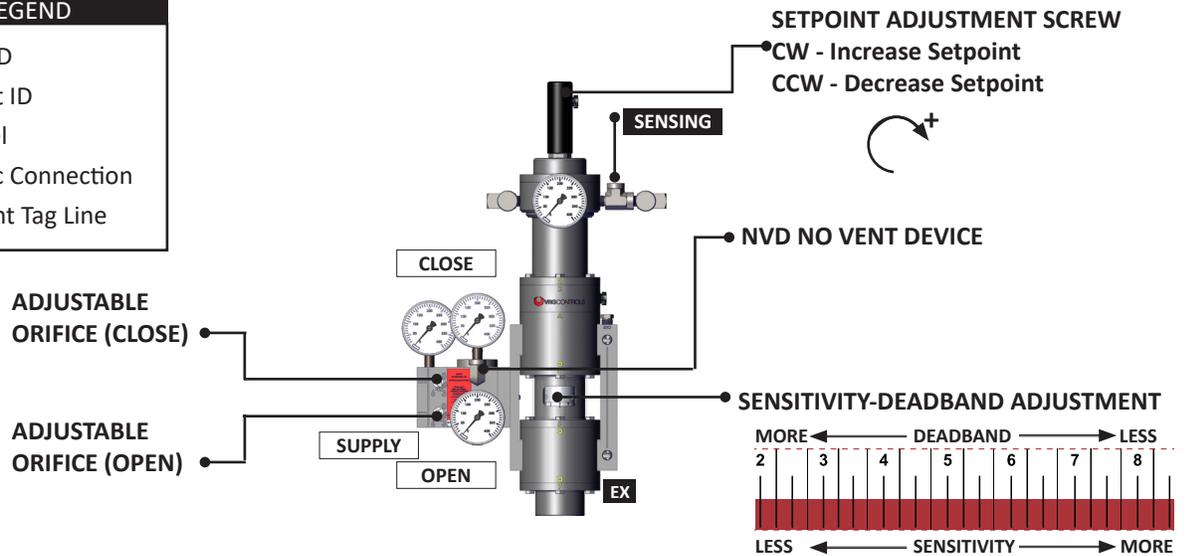


| No. VPC | Application | Actuator Mode | Booster | Accessory | Discharge |
|-------------|--------------------------|---------------|---------|-------------------|-----------------|
| 6 VPC-DA-SN | Pipeline and Power Plant | Double Acting | - | NVD AND BP SENSOR | Pressure System |

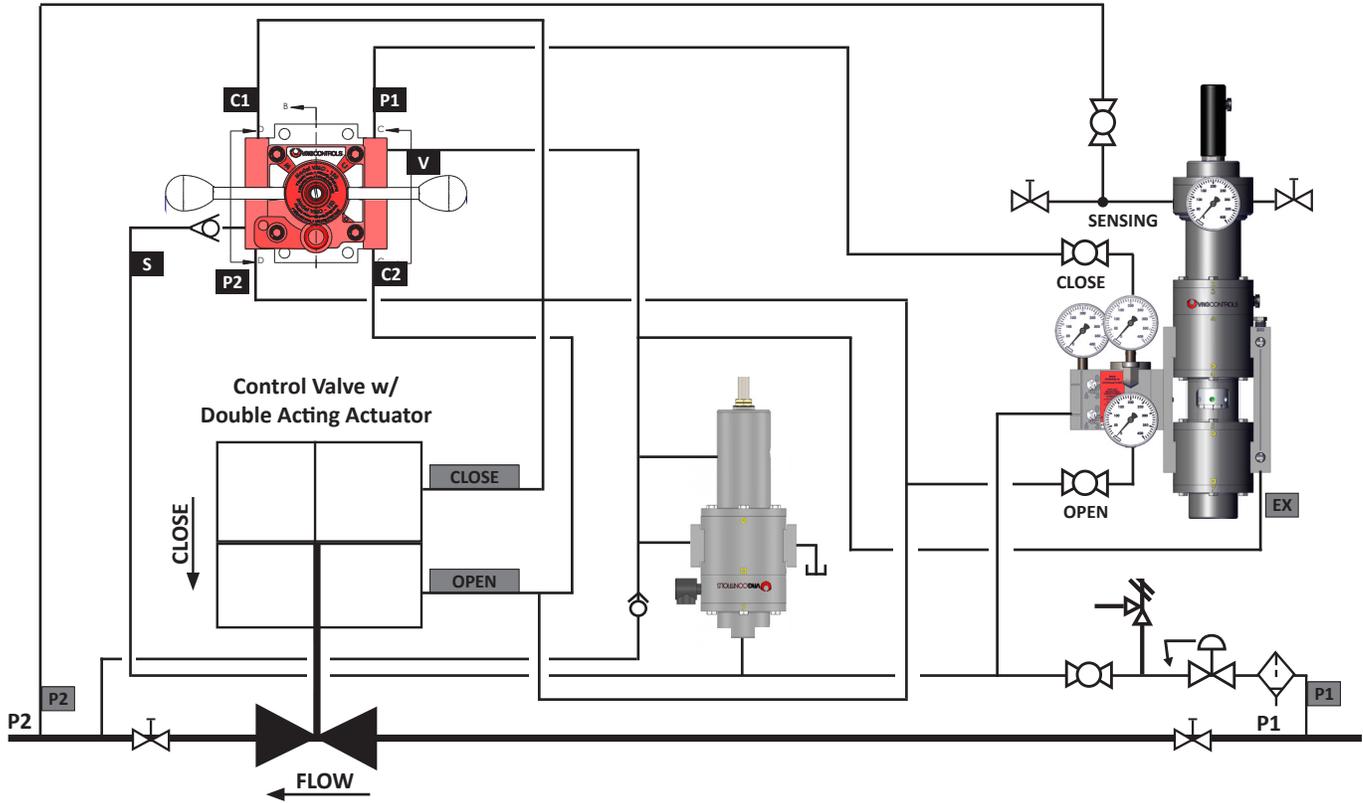


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- Adjustment Tag Line

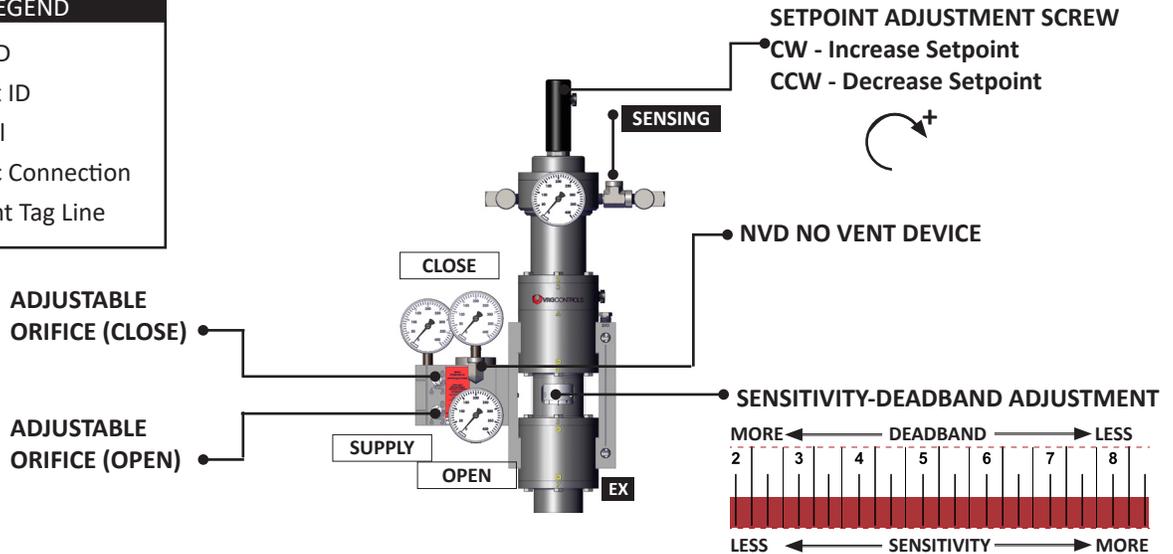


| No. VPC | Application | Actuator Mode | Booster | Accessory | Discharge |
|-------------------|--------------------------|---------------|---------|------------------------|-----------------|
| 6A VPC-DA-BV (DA) | Pipeline and Power Plant | Double Acting | - | NVD, BP SENSOR AND VMO | Pressure System |

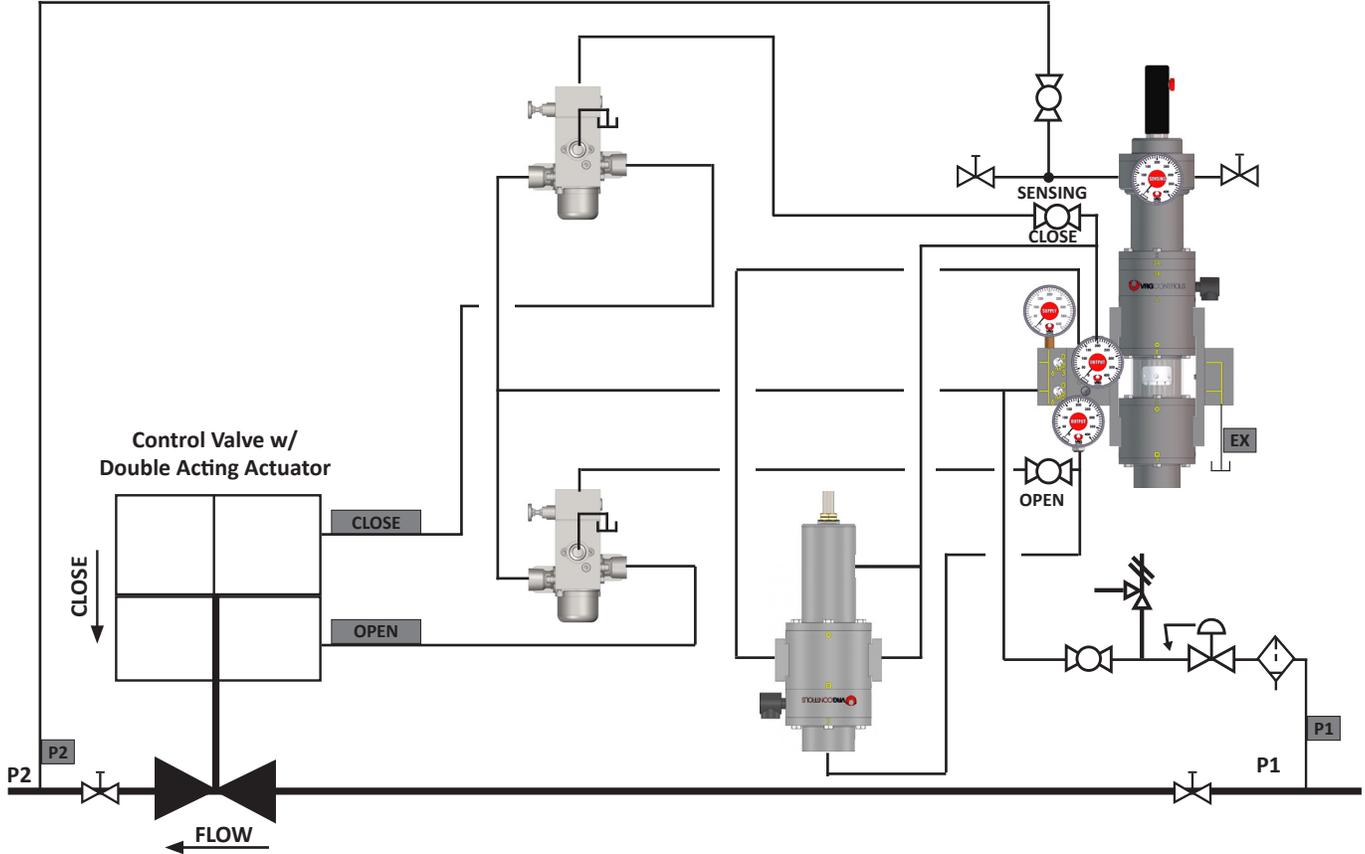


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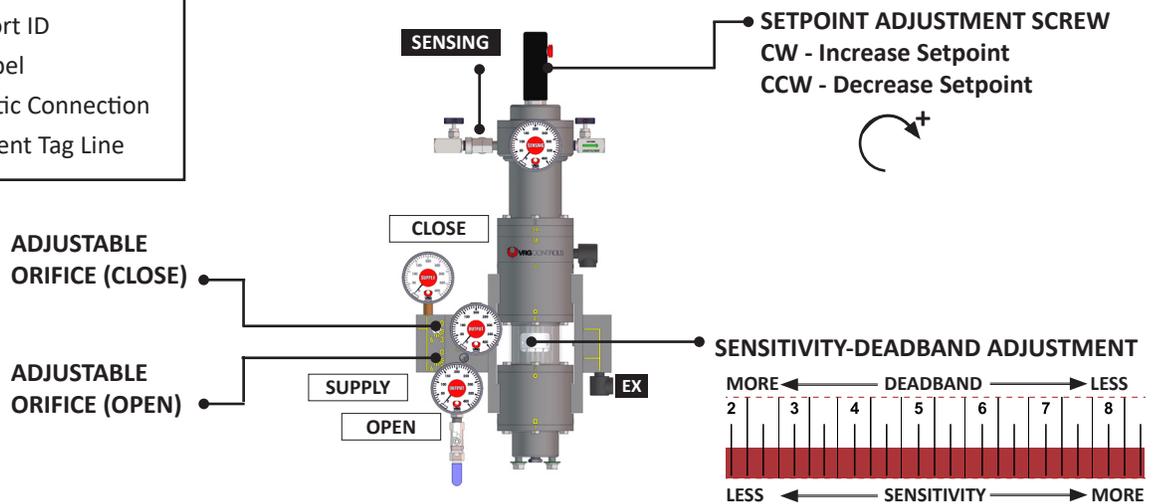


| No. VPC | Application | Actuator Mode | Booster | Accessory | Discharge |
|-------------|-------------|---------------|------------|-----------|-----------|
| 7 VPC-DA-SN | Pipeline | Normally open | 2 BOOSTERS | DP SENSOR | ATM |

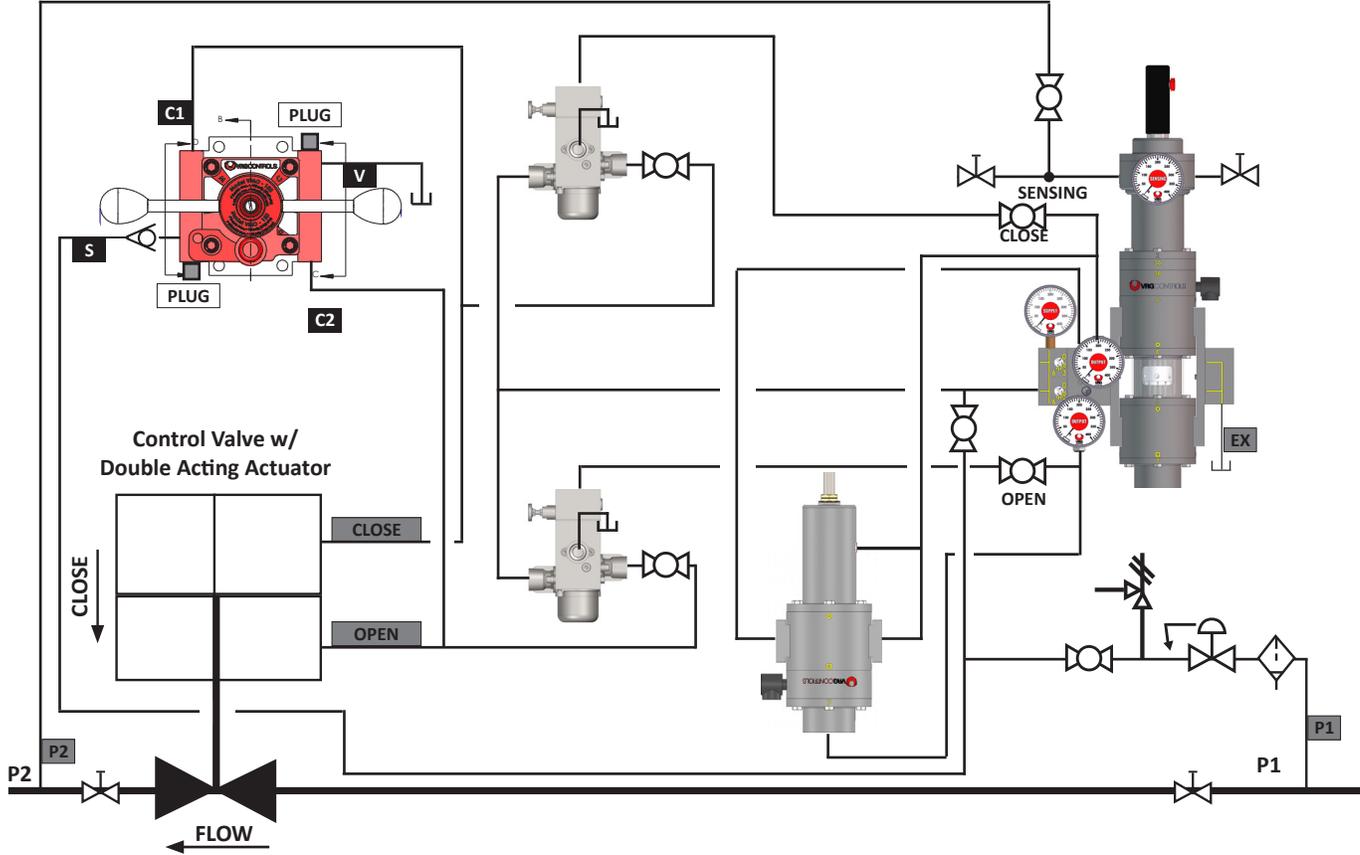


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- Pneumatic Connection
- Adjustment Tag Line

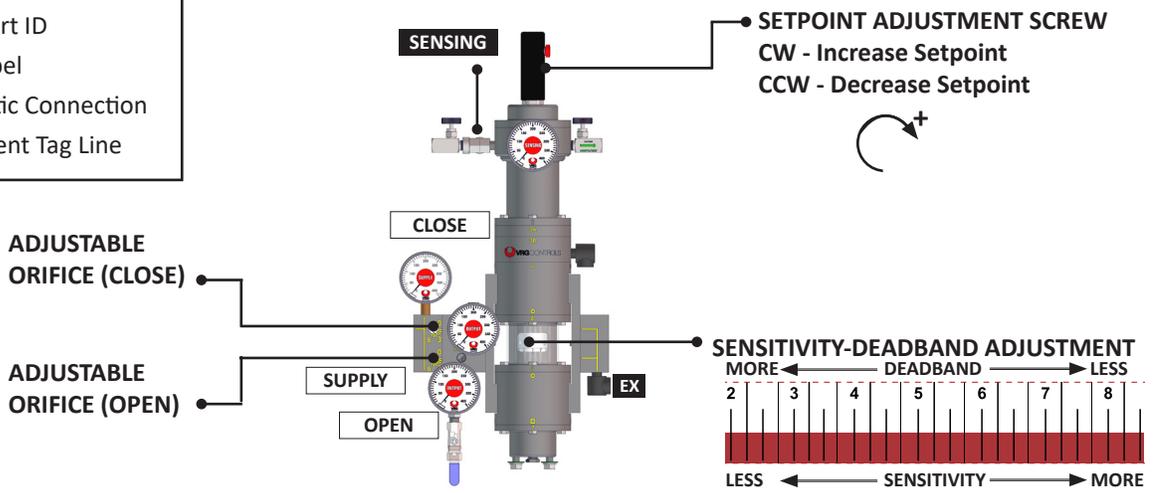


| No. VPC | Application | Actuator Mode | Booster | Accessory | Discharge |
|--------------|-------------|---------------|------------|-------------------|-----------|
| 7A VPC-DA-SN | Pipeline | Normally open | 2 BOOSTERS | DP SENSOR AND VMO | ATM |

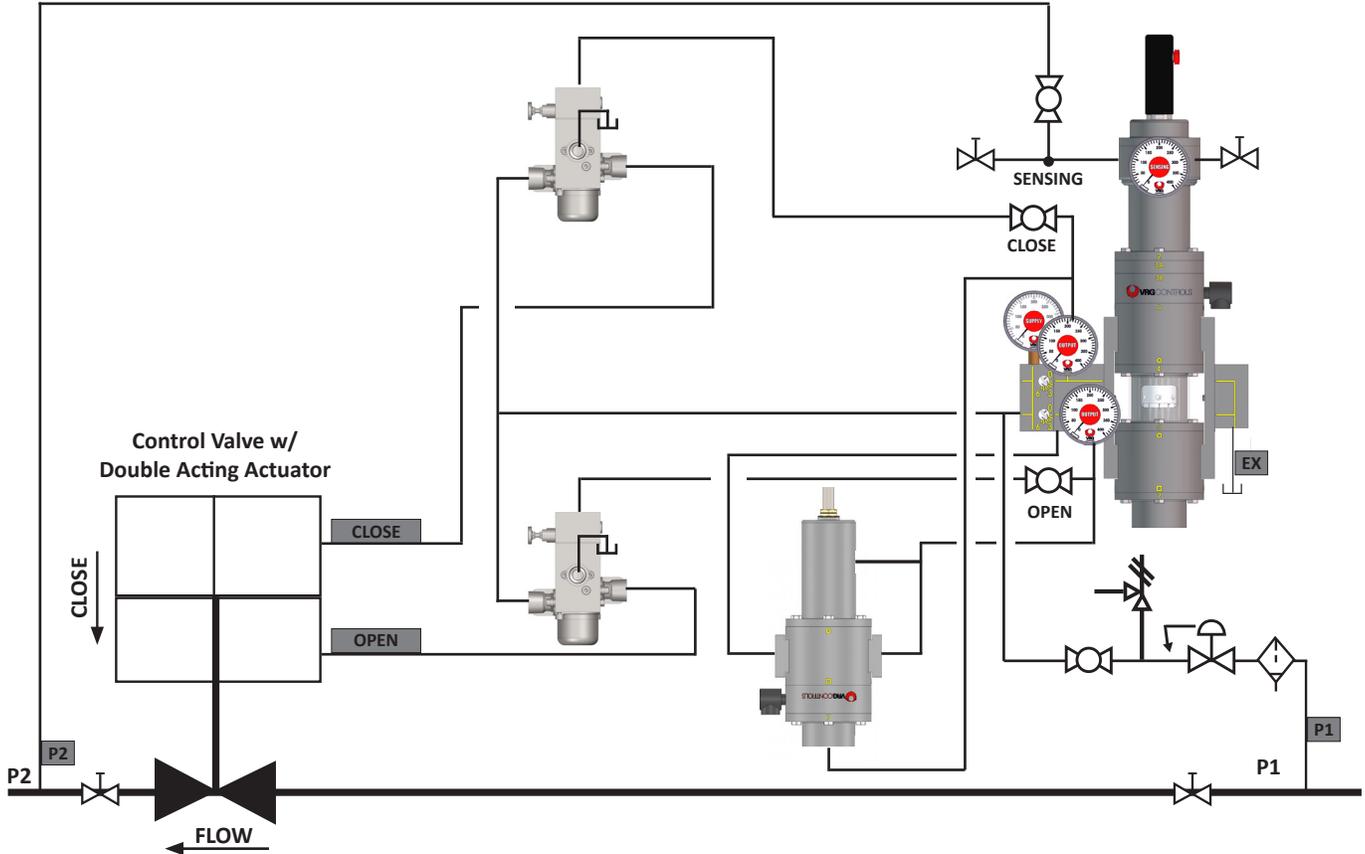


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- TEXT** Gage Label
- Pneumatic Connection
- Adjustment Tag Line

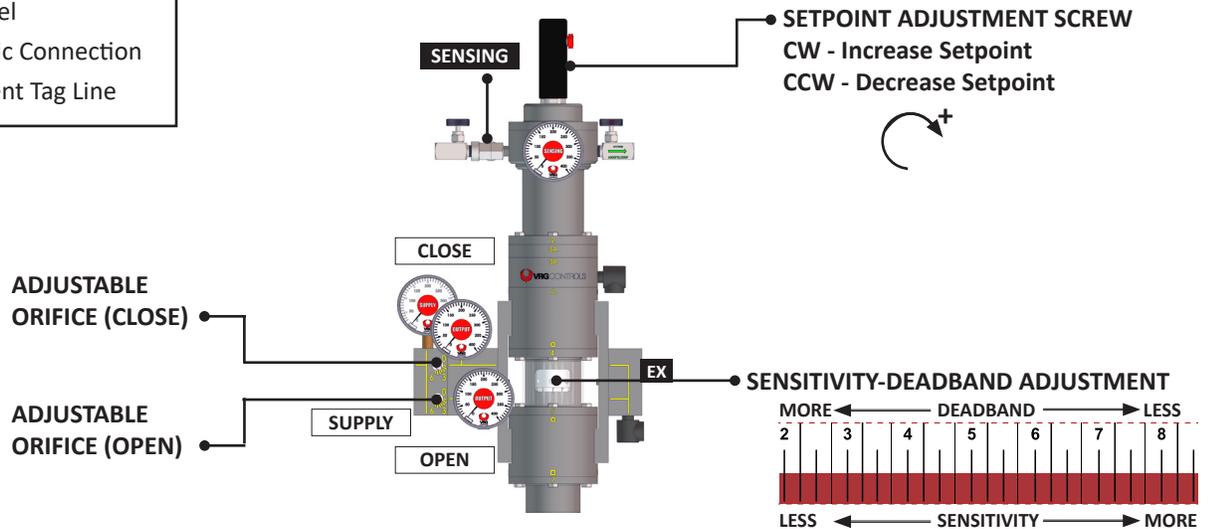


| No. VPC | Application | Actuator Mode | Booster | Accessory | Discharge |
|-------------|-------------|-----------------|---------|-----------|-----------|
| 8 VPC-DA-SN | Pipeline | Normally closed | Booster | DP SENSOR | ATM |

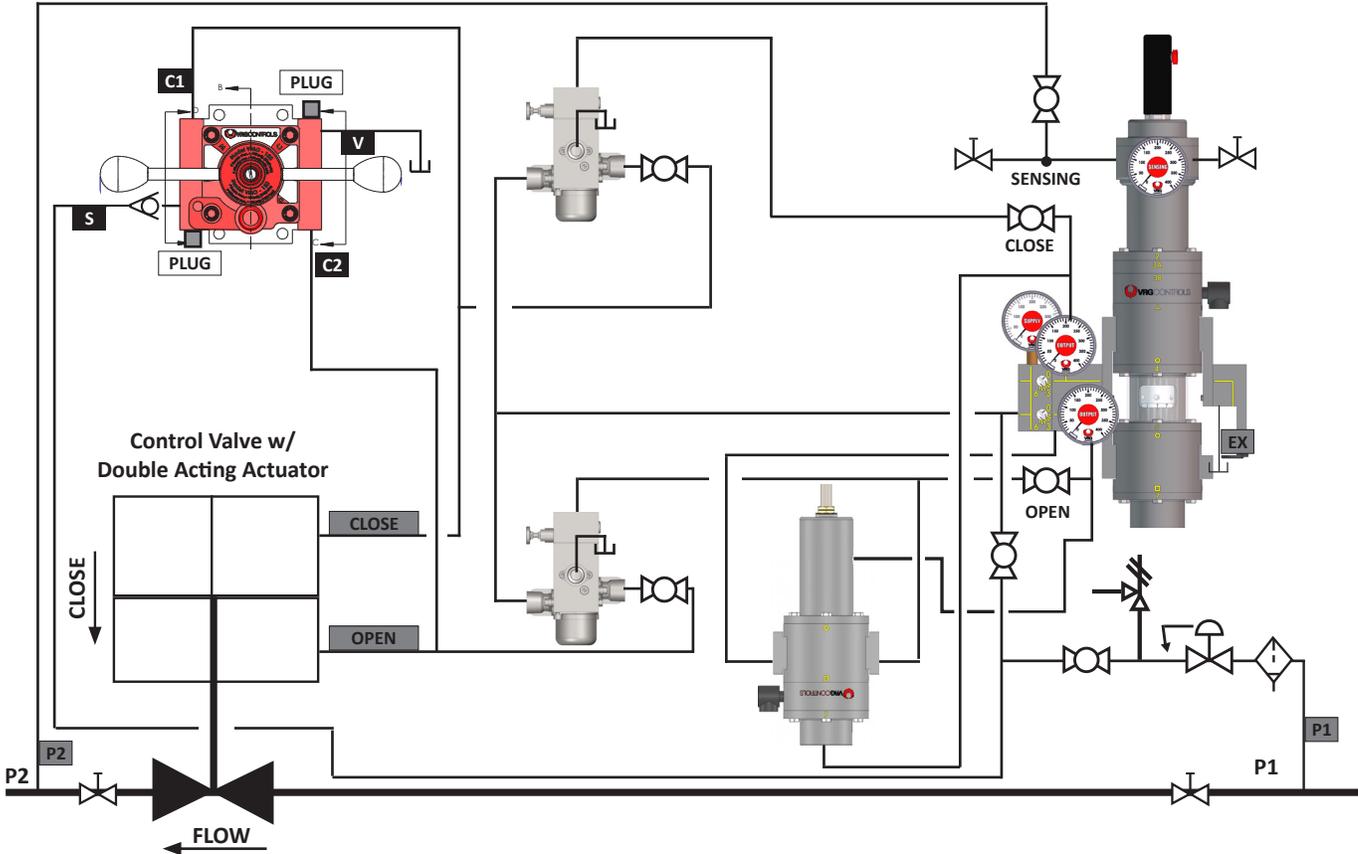


SCHEMATIC LEGEND

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- TEXT** Other Port ID
- TEXT** Gage Label
- Pneumatic Connection
- Adjustment Tag Line

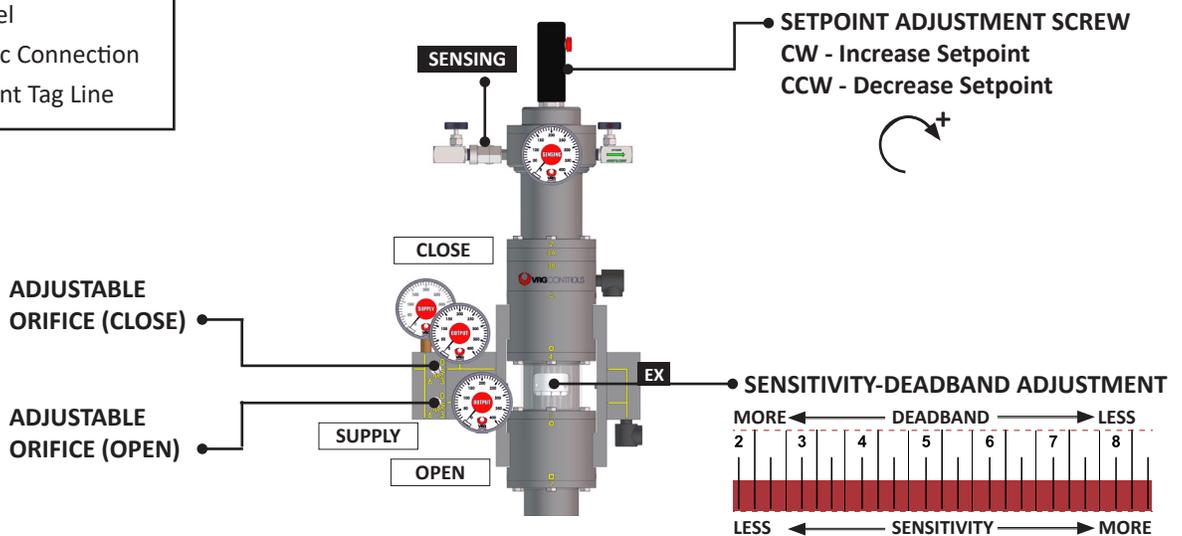


| No. VPC | Application | Actuator Mode | Booster | Accessory | Discharge |
|--------------|-------------|-----------------|---------|-------------------|-----------|
| 8A VPC-DA-SN | Pipeline | Normally closed | BOOSTER | DP SENSOR AND VMO | ATM |



SCHEMATIC LEGEND

- TEXT VPC Port ID
- TEXT Other Port ID
- TEXT Gage Label
- Pneumatic Connection
- Adjustment Tag Line



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