

VRP-B-CH Series Valve Regulation Pilot

VRP-B-CH Valve Regulator Pilot Provides Low-Bleed Pressure Control When Combined with Double-Acting Pneumatic Control Valve Actuators

Description

The Becker Model VRP-B-CH Valve Regulator Pilot provides pressure control when combined with double-acting piston actuated control valves. The VRP-B-CH measures the sensing pressure and positions the control valve to maintain setpoint pressure. The VRP-B-CH may be utilized for pressure setpoints ranging from 3.0 psig to 1300 psig (20.7 - 8964 kPa). The VRP-B-CH features low bleed characteristics and is typically utilized when bleed gas must be directed to atmosphere. The VRP-B-CH is compatible with the following Becker double-acting actuators: RPDA, LPDA, and SYDA. The VRP-B-CH is also compatible with other manufacturers' double-acting control valve actuators for easy retrofit.



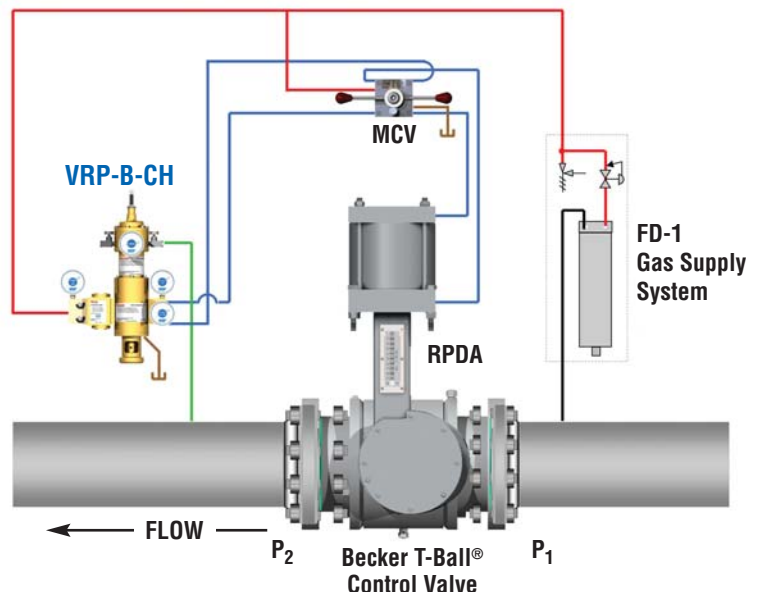
Figure 1 - Becker Model VRP-600-B-CH pressure control system shown with optional NBV-100 Non-Bleed Valve.

Figure 2 - VRP-B-CH Series Pilot configured for pressure control.

The VRP-B-CH may be utilized with any Becker double-acting series actuator and control valve combination to achieve downstream pressure control. The VRP-B-CH is shown here with optional NBV Non-Bleed Valve to shutoff bleed gas when the control valve is at full-open or full-closed position.

Schematic Legend

- Sensing Pressure
- Line Pressure
- Exhaust
- Power Supply
- Loading Pressure



VRP-B-CH Applications

- Pressure Control

Compatible Actuators

- RPDA Series (small volume models)
- SYDA Series (small volume models)
- LPDA Series (small volume models)

Application Guidelines

• Actuator Volume Restrictions:

The VRP-B-CH is compatible with all small volume double-acting control valve actuators with total volume displacement of >2000 in.³ (0.033 m³). Larger volume displacement actuators require Model VB-250 Volume Booster, which are not compatible with Model VRP-B-CH.

• High Gain Systems:

Power plant feeds and other similar systems require fast stroking speed in order to satisfy required system gain: Becker VRP-B-CH Series Pilots are not recommended for use in high gain applications that require fast stroking. Additionally, note that Becker VRP-B-CH is not compatible with Becker VB-250 Volume Boosters.

• Two-Stage Pressure Cuts:

Becker VRP-B-CH is not recommended for use in pressure control applications where two-stage (series) pressure cuts are incorporated. This includes working monitor regulators. For two-stage cut and working monitor applications, reference Becker's VRP-CH and VRP-SB-PID Series Pilots brochures.

• CVE Globe Pattern Control Valves:

The Model VRP-B-CH is compatible with LPDA (small volume) Series Actuators when utilized with globe pattern control valves for pipeline pressure control.

Improve Performance and Minimize Bleed Gas Emissions!

Optimum performance is achieved by pairing the VRP-B-CH with genuine Becker control valve actuators. If control valve actuators are already in service, the addition of a VRP-B-CH can improve performance and minimize bleed gas emissions. Becker VRP-B-CH pilots are compatible for retrofit with most manufacturers' double-acting piston style actuators. Consult Becker Precision Equipment for more information.



Figure 3 - Model VRP-B-CH with SP Series Setpoint Pump and NBV No-Bleed Valve

A Model VRP-600-B-CH is installed with NBV-100 No-Bleed Valve and SP Series Setpoint Pump. This particular application is configured with a Below Ground Ball Valve Regulator for monitor (overpressure) service. Note that the actuator cylinder pressures indicate that the control valve is at full-open position. The NBV-100 eliminates atmospheric bleed gas when control valve is at full-open and full-closed positions. The SP provides easy ability to calibrate VRP-600-B-CH setpoint without the need for auxiliary nitrogen or other high pressure source.

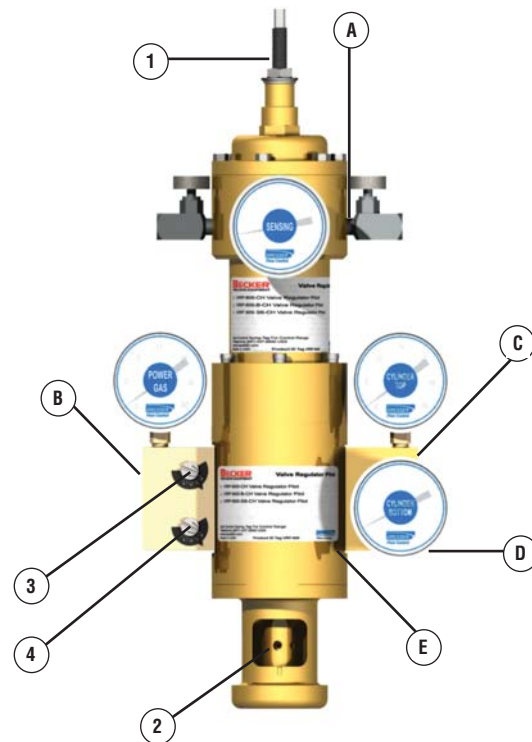


Figure 4 - Becker Model VRP-600-B-CH pressure control system.

The VRP-B-CH is specifically designed for use in natural gas pressure regulation and provides a simple, economical alternative to the controller/positioner combination.

Table 1 - VRP-B-CH Port Definitions

VRP-B-CH Port Definitions	Port Size	Item
Sensing (input)	1/4" FNPT	A
Power Gas Supply (input)	1/4" FNPT	B
Cylinder Top (output)	1/4" FNPT	C
Cylinder Bottom (output)	1/4" FNPT	D
Exhaust (discharge)	1/4" FNPT	E
Breather Vents	1/4" FNPT	F

Reference Figure 4

Table 2 - VRP-B-CH Adjustments

VRP-B-CH Adjustments	Item
Setpoint Elevation Adjustment	1
Deadband (sensitivity)	2
Cylinder Top Adjustable Orifice	3
Cylinder Bottom Adjustable Orifice	4

Reference Figure 4

How it Works (Downstream Pressure Control)

The energy to operate the control valve is obtained from the differential between supply gas pressure and discharge gas pressure. When the measured variable is at setpoint the pilot output pressures to cylinder top and bottom are equal (Figure 5.1). The control valve remains stationary. As the measured variable rises above setpoint, the pilot pistons move downward. This causes an decrease in cylinder top pressure creating a force to close the valve and lessen the flow (Figure 5.2). The measured variable returns to setpoint, and the pilot output pressures will automatically return to equilibrium at the new valve position. If the measured variable falls below setpoint, the opposite reaction occurs (Figure 5.3).

Schematic Legend

- Atmospheric Pressure
- High Pressure Gas
- Cylinder Loading Pressure
- Measured Variable (Downstream Pressure)

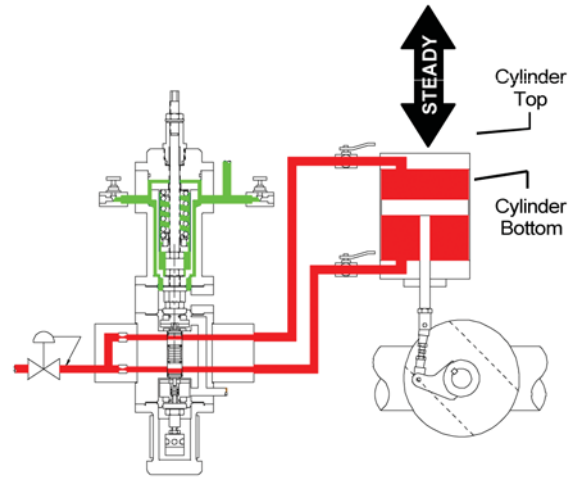


Figure 5.1 - Setpoint satisfied

When the measured variable is at setpoint the pilot output pressures to cylinder top and bottom are equal and the control valve remains stationary.

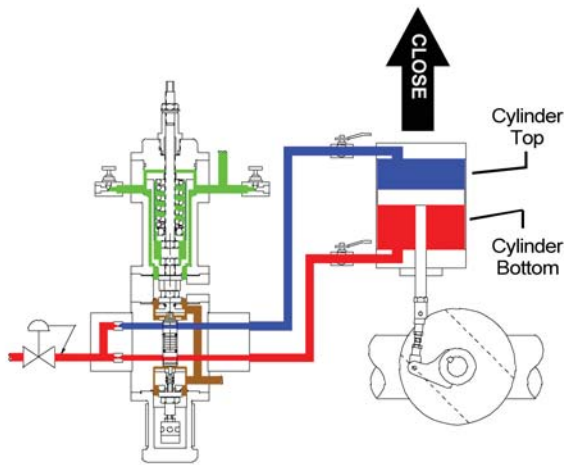


Figure 5.2 - Downstream pressure climbs above setpoint

When the measured variable rises above setpoint the pilot pistons move downward causing a decrease in cylinder top pressure. The control valve moves toward the closed position.

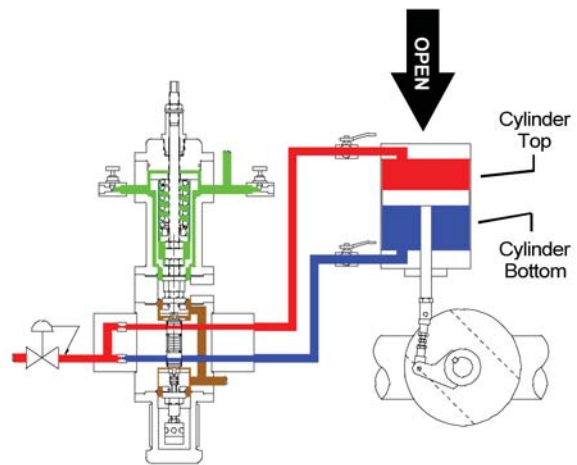


Figure 5.3 - Downstream pressure falls below setpoint

When the measured variable falls below setpoint the pilot pistons move upward causing a decrease in cylinder bottom pressure. The control valve moves toward the open position.

Table 3 - Technical Specifications for Model VRP-B-CH Pilot

Technical Specifications	
Steady State Gas Consumption	<10 scfh (see Table 4)
Supply Gas	dry, filtered (100μ) gas
Maximum Flow Capacity	500 scfh (14.2 scmh)
Maximum Supply Pressure	400 psig (2758 kPa)
Maximum Supply-Discharge Differential	250 psig (1723 kPa)
Minimum Supply-Discharge Differential	50 psig (345 kPa)
Operative Ambient Temperature Range	-20°F to +160°F (-29°C to +71°C)
Approximate Weight	12 pounds (5.4 kg)
Control Accuracy	±0.75% of setpoint
Maximum Sensing Pressure	VRP-175 225 psig (1551 kPa) VRP-600 600 psig (4136 kPa) VRP-1000/1300 1500 psig (10342 kPa)
Setpoint Range	3.0 psig - 1300 psig (21 kPa - 8966 kPa)
Housing	Meets NEMA 3 Classification
Installation Orientation	Vertical position recommended. Custom bracket supplied with Becker Actuators. 2" pipe mount provided for retrofit to other manufacturers' actuators.
Materials of Construction	
External Parts	Anodized AL 2024 316 SS available (for marine environments)
Internal Parts	316 SS and anodized AL 2024
Springs	Alloy steel
Diaphragms	Buna-n reinforced by nylon fabric
Seats and O-rings	Buna-n
Tubing and Tubing Fittings	316 SS
Gauges	2 1/2" dial liquid filled brass connection with stainless steel case (standard issue with units of psig dual units of psig/kPa available)

Table 4 - Bleed Rates (consumption) for Becker Control Instrumentation

Becker control instrumentation features low bleed and ZERO bleed technologies to minimize fugitive natural gas emissions and any environmental impact.

	VRP-CH Pilot	VRP-B-CH Pilot	VRP-SB-CH Pilot	VRP-SB-GAP	VRP-SB-PID Pilot	HPP-4 Positioner	HPP-5 Positioner	HPP-SB Positioner	DNGP Positioner
Bleed Rates (Consumption)									
Steady State Bleed ³	100	<10	zero	zero	zero	~100	<10	zero	zero
Non-Bleed	~	<	zero	zero	zero	~	<	zero	zero
Full-Open/Full-Closed Bleed to Pressure	Y ₁	N	Y	Y	N	Y ₁	Y ₂	Y	Y
Bleed to Pressure System (BPS™) ⁴	Y	N	Y	Y	N	Y	Y	Y	Y

Notes

1. Requires Model PS-2 or NBV Non-Bleed Device to eliminate bleed
2. Requires Model DPS-2 or NBV Non-Bleed Device to eliminate bleed
3. Bleed rates are estimated utilizing supply gas pressure = 100 psig
4. Bleed to Pressure System (BPS™) eliminates all atmospheric bleed

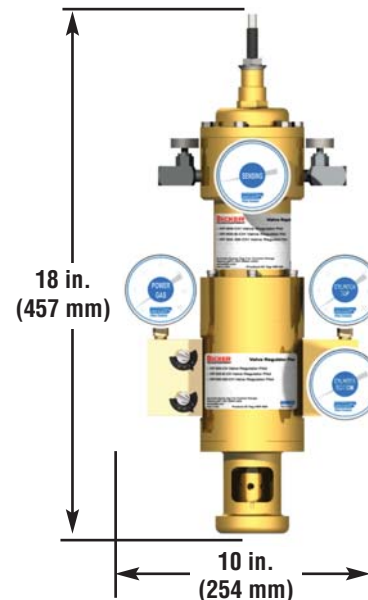


Figure 6 - Overall dimensions of Becker Model VRP-600-B-CH Pilot Control System

Table 5 - Selection Chart for VRP-B-CH Series Pilots

VRP-SB-CH Model Number	Control Range (psig/kPa)	Spring Color	Part Number	Setpoint change/ revolution of setpoint screw ²	Maximum Remote Setpoint Range ³	Repair Kit Part Number
VRP-175-B-CH¹	3.0 – 10 psig (21 – 69 kPa)	Gold	25-8236	0.57 psig/rev (3.9 kPa/rev)	(3.1 psig (21 kPa)	39-9102
	7.0 – 30 psig (48 – 207 kPa)	Beige	25-8238	2.0 psig/rev (14 kPa/rev)	(11 psig (76 kPa)	39-9102
	15 – 50 psig (103 – 345 kPa)	Burgundy	25-8239	3.0 psig/rev (21 kPa/rev)	(17 psig (114 kPa)	39-9102
	20 – 85 psig (138 – 596 kPa)	Pink	25-8240	6.4 psig/rev (44 kPa/rev)	(35 psig (241 kPa)	39-9102
	50 – 175 psig (345 – 1207 kPa)	Yellow	25-1306	23 psig/rev (159 kPa/rev)	(125 psig (862 kPa)	39-9102
VRP-600-B-CH	5.0 - 40 psig (34 - 276 kPa)	Gold	25-8236	2.1 psig/rev (14.06 kPa/rev)	11 psig (79 kPa)	30-9104
	25 - 140 psig (172 - 965 kPa)	Beige	25-8238	7.4 psig/rev (51 kPa/rev)	41 psig (283 kPa)	31-9104
	50 – 175 psig (345 – 1207 kPa)	Burgundy	25-8239	11 psig/rev (76 kPa/rev)	62 psig (427 kPa)	30-9104
	135 – 300 psig (931 – 2069 kPa)	Pink	25-8240	24 psig/rev (166 kPa/rev)	132 psig (910 kPa)	30-9104
	275 – 600 psig (1896 – 4137 kPa)	Yellow	25-1306	85 psig/rev (586 kPa/rev)	325 psig (2241 kPa)	30-9104
VRP-1000-B-CH	550 – 1000 psig (3792 – 6895 kPa)	Yellow	25-1306	144 psig/rev (993 kPa/rev)	700 psig (4826 kPa)	30-9105
VRP-1300-B-CH	800 – 1300 psig (5516 – 8964 kPa)	Gray	25-1562	227 psig/rev (1565 kPa/rev)	900 psig (6205 kPa)	30-9105

Notes

1. These models should only be used for applications that require high gain. Consult Becker prior to specifying these models.
2. Maximum remote setpoint range is based upon Model SM-1140 Remote Setpoint Module with maximum motor range of 5.8 revolutions. See Becker brochure RSM for additional information.
3. Maximum remote setpoint range reported is applicable to units with discrete (pulse) signal. Remote Setpoint Modules with analog (4-20 mA) signal have a maximum remote setpoint range equal to the full Control Range of the VRP-B-CH.



Figure 7.1 - Model VRP-175-B-CH



Figure 7.2 - Model VRP-600-B-CH

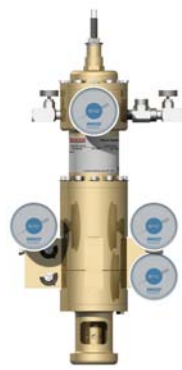


Figure 7.3 - Model VRP-1000-B-CH

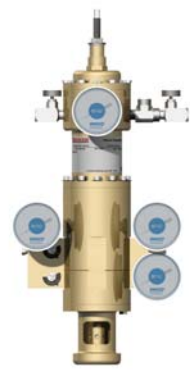


Figure 7.4 - Model VRP-1300-B-CH

VRP-B-CH Series Pilot Accessories

Realize Optimum Performance of your VRP-B-CH Series Pilot with These Popular Instrumentation Accessories!



NBV Series No-Bleed Valve

The NBV Series No-Bleed Valve eliminates bleed gas from Becker double-acting control instrumentation when corresponding control valve is at full-open and full-closed positions. This is ideal for monitor regulators and standby regulators that typically remain in the full-open or full-closed positions for extended periods of time. The NBV features bleed shutoff at both ends of valve travel without adjustment. The NBV is the primary choice for Non-Bleed technology on Becker double-acting control instrumentation. The NBV is compatible with all Becker double-acting Valve Regulator Pilots (VRPs) and double-acting High Pressure Positioners (HPPs).

Reference Becker NBV No-Bleed Valve Sales Literature for additional information.



DPS Series Non-Bleed Sensor

The DPS Series Non-Bleed Sensor is ideal for monitor regulators and standby regulators that typically remain in the full-open or full-closed positions for extended periods of time. The DPS-2 features bleed shutoff at one end of valve travel. If bleed shutoff is required at both ends of valve travel, two DPS-2 Non-Bleed Sensors are necessary. The DPS-2 is typically utilized for high pressure power supply gas (>150 psig) or when Bleed to Pressure System (BPS™) discharge pressure exceeds 60 psig. The DPS-2 is compatible with the following VRP-B-CH and HPP-5.

Reference Becker DPS-2 sales literature for additional information.



SP Series Setpoint Pump

Provides a simple and accurate method of applying false signal pressure during initial adjustment of the VRP-B-CH pilot. The pump can provide a false signal pressure of 20%-40% in excess of working pipeline pressure which eliminates the need for nitrogen bottles or electronic calibration devices. The SP Series Setpoint Pump is compatible with all models and series of Becker VRP.

Reference Becker SP Setpoint Pump sales literature for additional information.

VRP-B-CH Series Pilot Accessories

Realize Optimum Performance of your VRP-B-CH Series Pilot with These Popular Instrumentation Accessories!



RSM Series Remote Setpoint Module

The Remote Set Point Module RSM provides remote adjustment of VRP-B-CH set point via an electrical input signal. All RSMs are equipped with internal limit switches to prevent over-travel of setpoint. A 4-20 mA feedback of RSM motor is standard. All Becker RSM are rated Explosion Proof Class 1, Division 1 for use in hazardous locations. The standard RSM input signals are:

Digital Pulse Input

- 24 V D.C.
- 120 V A.C.

Analog Current Input

- 4-20 mA command signal at 24 V D.C.
- 4-20 mA command signal at 120 V A.C.

Reference Becker RSM Remote Setpoint Module Sales Literature for additional information.



Panel Mounting

Custom panel mounting is available to suit specific application needs. All panels come assembled, tested, and adjusted per requirements. Panel mounting simplifies retrofit of Becker instrumentation to existing equipment and ensures satisfactory performance and fit. A variety of configurations and options are available.



Stainless Steel Option

All Becker Precision Control instrumentation is manufactured from high-strength anodized aircraft aluminum alloy (AL2024). The standard aluminum construction provides adequate durability in most installation environments. In applications where the environment is harsh, the instrumentation may be specially ordered in a stainless steel option. The stainless steel option is typically utilized in the following areas:

- Marine environments
- Chemical plants
- Offshore platforms
- Coastal regions

Table 6 - Selection table for Becker Control Valves and Actuators

	VRP-CH Pilot	VRP-B-CH Pilot	VRP-SB-CH Pilot	VRP-SB-GAP	VRP-SB-PID Pilot	HPP-4 Positioner	HPP-5 Positioner	HPP-SB Positioner	DNGP Positioner	Notes
Applications										
Pressure Control	•	•	•		•	•	•	•	•	1,2
Flow Control						•	•	•	•	2
Power Plant Type Pressure Control	•				•	•		•	•	3
Power Plant Type Flow Control						•		•	•	3
Surge Control						•		•		
On / Off				•						
Compatible Actuators										
RPDA Series (Small Models)	•	•		•		•	•		•	4
RPDA Series (Large Models)	•			•		•			•	5
RPSR Series			•	•	•				•	
LPDA Series (Small Models)	•	•		•		•			•	4
LPDA Series (Large Models)	•			•		•			•	5
LPSR Series			•	•	•				•	
LD Series			•	•	•				•	6
Instrumentation Options										
Bleed to Pressure System BPS™	•	•	•	•		•	•	•	•	7
AB Series Atmospheric Bleed Control	•		•	•		•	•	•	•	
NBV Series No-Bleed Valve	•	•				•	•			8
DPS-2 Series Non-Bleed Sensor	•	•				•				9
PS-2 Series Non-Bleed Sensor	•					•				9
SP Series Setpoint Pump	•	•	•	•	•					
RSM Series Remote Setpoint Module	•	•	•	•	•					
Panel Mounting	•	•	•	•	•				•	
Stainless Steel Option	•	•	•	•	•	•	•	•	•	
VB Series Volume Booster	•	•		•	•	•	•	•		10
QEV Series Quick Exhaust Valve				•				•		
I/P Transducer						•	•	•		
SLV Series Signal Lock Valve						•	•	•		

1. Pressure control applications include: pressure letdown, primary regulation, monitors, standby, overpressure protection, underpressure protection, and relief valve.
2. All positioners require controller device to perform pressure control or flow control.
3. Power plant regulation includes all power plants and "fast-acting" short systems.
4. RPDA and LPDA Small Models are defined as actuator sizes 14L and smaller (< 2000 in³ / 0.033m³)
5. RPDA and LPDA Large Models are defined as actuator sizes 12T and larger (≥ 2000 in³ / 0.033m³)
6. LD Series Actuators are limited to Becker CVE Series Globe Valves
7. BPS™ is limited to discharge pressure systems below 300 psig (2068 kPa). Consult Becker for application assistance.
8. NBV No-Bleed Valves may only be utilized when $P_{\text{discharge}} \leq 60$ psig (414 kPa) and/or $P_{\text{supply}} \leq 150$ psig (1034 kPa).
9. PS-2 and DPS-2 Non-Bleed Sensors must be utilized when $P_{\text{discharge}} > 60$ psig (414 kPa) and/or $P_{\text{supply}} > 150$ psig (1034 kPa).
10. VB Series Volume Boosters are necessary for power plant regulation, surge control applications, or when large model RPDA are utilized.



Figure 9 - Model VRP-B-CH with Electrical Override

A Model VRP-175-B-CH is shown here with Model NBV-70 No-Bleed Valve and electrical override system. The VRP-175-B-CH is designed for lower pressure setpoint pressure control application. The VRP-175-B-CH features simplicity and minimal bleed when in control. The addition of the NBV-70 provides complete elimination of atmospheric bleed gas when the control valve is at full-open or full-closed positions. The electrical override will close the control valve upon application of close electrical signal and return to pressure control upon receipt of control electrical signal.

***CAUTION:** This information is intended as a guideline for application of Becker Precision Equipment products. Becker strongly recommends consulting Becker Engineering prior to application of any product.

Additional resources are available on our website. Sales literature, sizing software, and technical manuals are available for download at www.dresser.com/becker

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