

# HPP-5 Series Pneumatic Valve Positioner

## HPP-5 Series Pneumatic Positioners Provide Accurate Positioning of Double-Acting Actuated Control Valves with Reduced Bleed Emissions

The **Becker™** HPP-5 Series Double-Acting Positioner provides accurate valve positioning when utilized with a double-acting piston actuated control valve. The HPP-5 Series positioner accepts a pneumatic instrument signal and positions the double-acting actuator proportionally. The HPP-5 Series positioner may be utilized for most valve positioning applications. HPP-5 Series positioners are available in both reverse-acting and direct-acting configurations with a variety of different input signal ranges. Due to its low-bleed characteristics, the HPP-5 Series positioner is typically utilized when bleed gas must be discharged to atmosphere.



Figure 1 – Becker Model HPP-5 Series Pneumatic Positioner

### HPP-5 Series Positioner Applications

- Pressure Control
- Flow Control

### Compatible Actuators

- RPDA Series
- SYDA Series
- LPDA Series

## Application Guidelines

### Small Volume Actuators:

Small Volume Actuators are defined as actuators with piston displacement less than 2000 in<sup>3</sup> that typically require high flow volume instrumentation. For actuators larger than 2000 in<sup>3</sup>, it is recommended that a HPP-5 Series positioner with Model VB-Series Volume Boosters be utilized. HPP-5 Series Positioners are NOT compatible with VB-250 Volume Boosters.

### LPDA Series Actuators:

HPP-5 Series positioners may be utilized with LPDA Series Linear actuators, but are not capable of accepting an actuator with stroke length less than 2". This excludes usage of CVE Globe Valves of 4" nominal bore or less with HPP-5 Series Positioner.

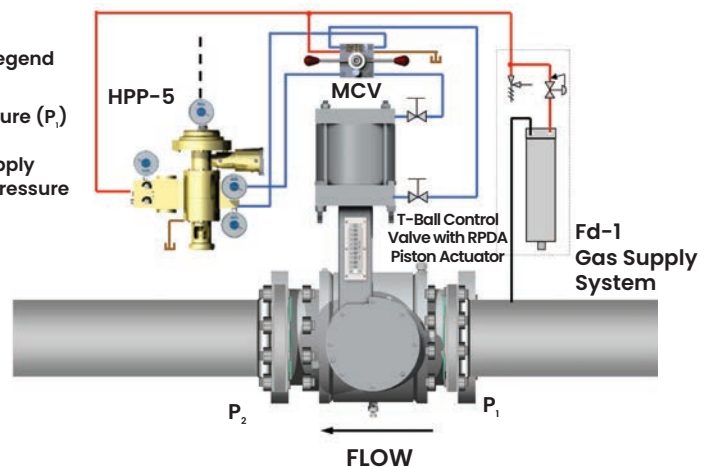
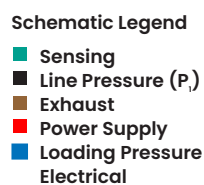
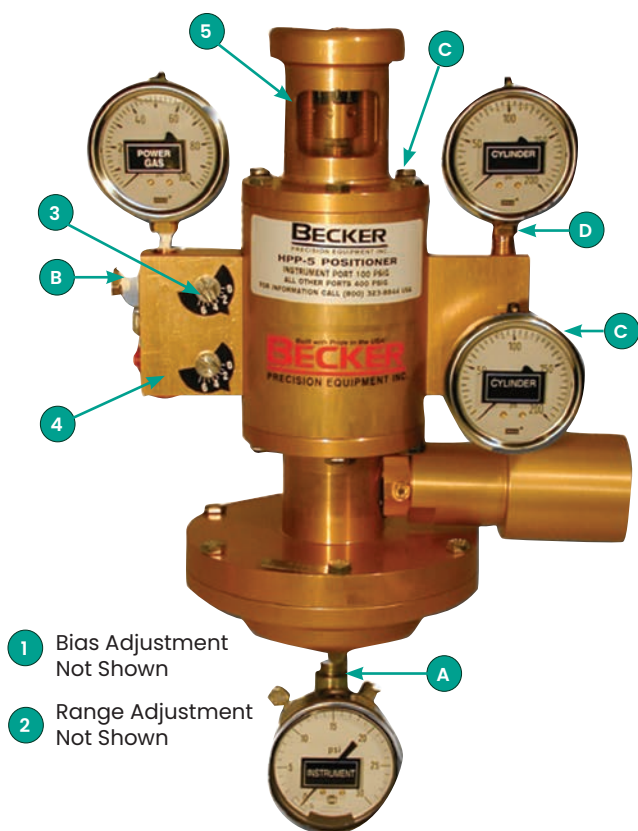


Figure 2 – HPP-5 Series Positioner installed on RPDA Series Actuator

The HPP-5 Series positioner may be utilized with double-acting Series actuators for accurate positioning of control valves. The HPP-5 Series positioner is designed to accept a pneumatic instrument signal from an I/P transducer or a pneumatic controller. The HPP-5 Series positioner is available in both reverse and direct-acting with a variety of instrument signal input ranges. The configuration shows the HPP-5 Series positioner mounted on a RPDA Series actuator with an optional NBV-100 to shutoff bleed when the control valve is at both full-open and full-closed positions.

## New HPP-5 Series Positioner Provides Improved Performance Over the Previous HPP-3 Positioner Design



**Figure 3 – HPP-5 Series Pneumatic Positioner**  
The HPP-5 Series Pneumatic Positioner is specifically designed for positioning.

## Benefits of the HPP-5 Series Positioner

- Increased sensitivity as compared with older HPP-3 Series positioner design
- Better resolution and positioning capabilities for improved process performance
- ZERO bleed when control valve is full open and full closed (requires addition of NBV or DPS Non-Bleed Device)
- Balanced seat design exhibits near ZERO bleed when process is at steady state
- Becker's unique *Bleed to Pressure System™* feature allows for complete elimination of atmospheric bleed gas by maintaining vent gas within the process piping
- Stable, accurate positioning with minimal overshoot
- Vibration resistant design performs in the most demanding applications and maintain calibration – no annual adjustments are required
- Anodized AL 2024 Aluminum and Stainless Steel construction provide rugged durability for long life

## Improve Performance and Minimize Bleed Gas Emissions!

If you already have existing Becker products' control valve actuators in service with older, obsolete pneumatic positioners, the addition of an HPP-5 Series positioner can improve performance, reduce maintenance, and minimize bleed gas emissions. Becker's HPP-5 Series positioners are compatible to retrofit Fisher Type 3570 Positioners originally installed on Becker RPDA Actuators. Consult Baker Hughes for more information.



**Table 1 – HPP-5 Series Positioner Port Definitions**

HPP-5 Positioner Port Definitions	Port Size	Item
Instrument Signal (Input)	1/4" FNPT	A
Power Gas Supply (Input)	1/2" FNPT	B
Cylinder Top (Output)	1/4" FNPT	C
Cylinder Bottom (Output)	1/4" FNPT	D
Exhaust (Discharge)	1/4" FNPT	E

Reference Figure 3.

**Table 2 – HPP-5 Series Positioner Adjustments**

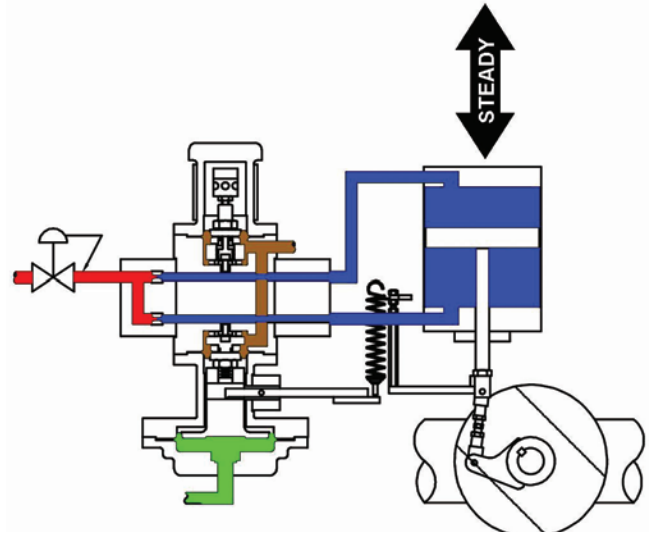
HPP-5 Positioner Adjustments	Item
Bias Adjustment (Zero/Offset)	1 <sup>(1)</sup>
Range Adjustment (Span)	2 <sup>(1)</sup>
Cylinder Top Adjustable Orifice	3
Cylinder Bottom Adjustable Orifice	4
Sensitivity (Deadband) Adjustment	5

Reference Figure 3.

1. Bias and range adjustments not shown

# How it works

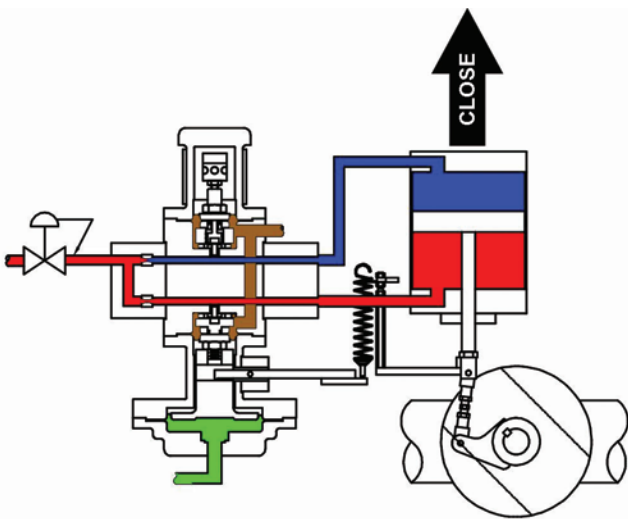
HPP-5 Series positioner configuration shown is “close on increasing instrument input signal.” The control valve will fail open on loss of instrument input signal. The HPP-5 Series positioner is a force-balanced instrument that provides a control valve position proportional to a pneumatic instrument signal. The energy to operate the control valve is obtained from the differential between supply gas pressure and discharge gas pressure. From a steady-state position (Figure 4.1), an increase in the instrument signal causes the internal pistons to move up and exhaust pressure from cylinder top (Figure 4.2), closing the valve. As the force from the positioner range spring increases to a point equal to the diaphragm force created by the instrument signal, the internal pistons will center. Centering of the internal pistons will close both of the balanced seats and cease stroking of the actuator (Figure 4.1). At steady state, the control valve will remain in a fixed position with near zero bleed. Decrease of the instrument signal will result in the opposite reaction, opening the valve (Figure 4.2). Note that loss of instrument signal causes the control valve to fail in the full open position in the configuration shown.



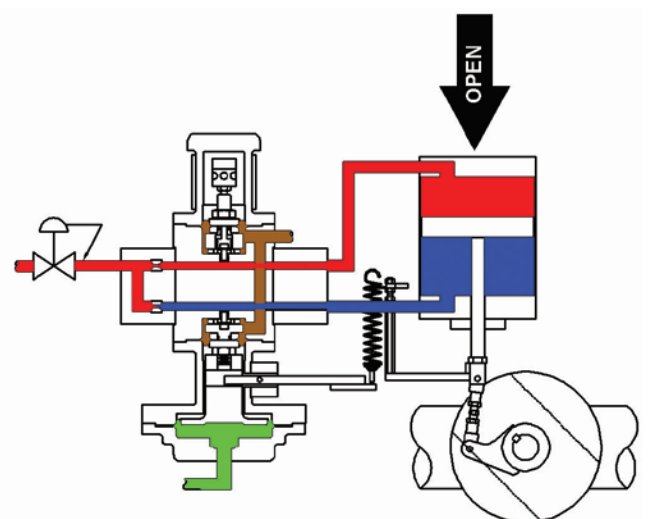
**Figure 4.1 - Steady State Position (Fixed)**  
At steady state, the instrumentation diaphragm force is equal to the feedback spring force, centering the internal pistons and loading Cylinder Top and Cylinder Bottom with equal pressures, holding the control valve in a steady position.

## Schematic Legend

- Exhaust Pressure (Discharge)
- High Pressure Gas
- Intermediate Pressure Gas
- Instrument Signal



**Figure 4.2 - Increase in Instrument Input Signal to CLOSE Valve**  
An increase in the instrument input signal causes the internal pistons to move up, simultaneously loading Cylinder Bottom and unloading Cylinder Top. The actuator pressure differential moves the valve toward the CLOSED position.



**Figure 4.3 - Decrease in Instrument Input Signal to OPEN Valve**  
A decrease in the instrument input signal causes the internal pistons to move down, simultaneously loading Cylinder Top and unloading Cylinder Bottom. The actuator pressure differential moves the valve toward the OPEN position.

**Table 3 – Technical Specifications for Model HPP-5 Series Positioner**

Technical Specifications	
Steady State Gas Consumption	See Table 2
Supply Gas	Dry, filtered (100 micron gas 500 psig maximum)
Maximum Flow Capacity	500 scfh (14.2 scmh)
Maximum Supply-Discharge Differential	150 psig (1034 kPa)
Minimum Supply-Discharge Differential	50 psig (348 kPa)
Operative Ambient Temperature Range	-20°F to +160°F (-29°C to +71°C)
Approximate Weight	10 lbs. (4.5 kg)
Minimum Deadband	0.2% instrument signal
Independent Linearity	±1.0% of positional range
Resolution	0.1% of position range
Instrument (Input) Signal Ratings	3-15 psig, 6-30 psig (standard)
Ranges	See Table 3
Available Stroke Lengths	2", 4", 6", 8", 12" (See Table 3) reverse-acting/direct-acting
Housing	Meets NEMA 3 Classification
Installation Orientation	Vertical position recommended
Materials of Construction	
External Parts	Anodized AL 2024, 316 SS available (for marine environments)
Internal Parts	316 SS and anodized AL 2024
Springs	Plated 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

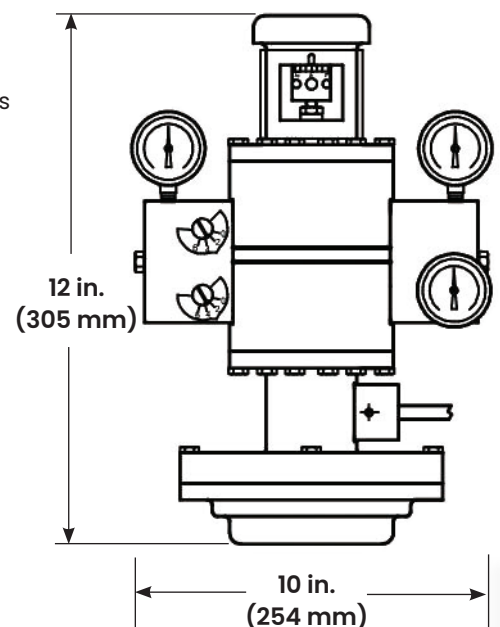
1. Direct-Acting: increasing instrument signal causes control valve to open (fail closed upon loss of instrument signal).
2. Reverse-Acting: decreasing instrument signal causes control valve to open (fail open upon loss of instrument signal).

**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 environmental impact.

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

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 5 – Overall dimensions of HPP-5 Series positioner (standard range)**

**Table 5 – Bias Range Spring Part Numbers for HPP-5 Series Actuator Stroke Lengths**

Signal Range	Spring Type	2" (51 mm)	4" (102 mm)	6" (152 mm)	8" (203 mm)	12" (305 mm)
3-15 psig (21-103 kPa)	Range Spring	25-1151	25-1151	25-1152	25-1153	25-1154
	Bias Spring	Not Required				
6-30 psig (41-207 kPa)	Range Spring	25-1218	25-1218	25-1219	25-1220	25-1221
	Bias Spring	Not Required				
3-9 psig (21-62 kPa)	Range Spring	01-6288	01-6288	01-6287	01-6287	01-6801
	Bias Spring	Not Required				
9-15 psig (62-103 kPa)	Range Spring	01-6288	01-6288	01-6287	01-6287	01-6801
	Bias Spring	Not Required				
6-24 psig (41-166 kPa)	Range Spring	25-1599	25-1599	25-1600	25-1601	25-1601
	Bias Spring	Silver (25-1038)				
18-30 psig (124-207 kPa)	Range Spring	25-1151	25-1151	25-1152	25-1153	25-1154
	Bias Spring	Red (25-1037)				

Standard model range spring and bias spring part numbers for the Model HPP-5 Series positioner. Other configurations are available upon request.

### Repair or Rebuild?

Becker instrumentation rebuild kits are available from stock for regular maintenance or emergency needs. To order repair kits for your Becker products, please contact your local sales representative.

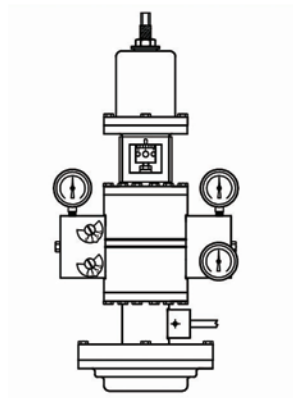
**Model HPP-5 Series Pneumatic Positioner Repair Kit\* (Standard Range) Part Number 30-9601**

**Model HPP-5 Series Pneumatic Positioner Repair Kit\* (Split Range) Part Number 30-9602**

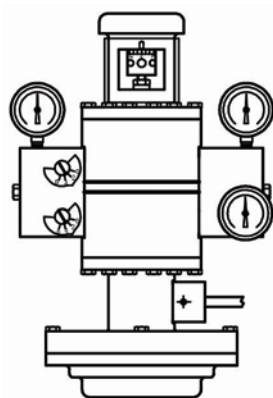
\*Includes all rubber goods and finite life items for rebuild or repair for HPP-5 Series positioner.

**Figure 6 – Becker HPP-5 Series Pneumatic Positioners**

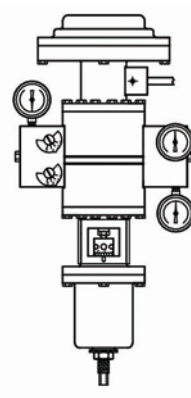
Becker HPP-5 Series positioners are available in both reverse-acting and direct-acting. Standard instrument signal ranges are 3-15 psig (kPa) and 6-30 psig (kPa). Alternate instrument ranges are available for split range control to enable staging of control valve runs.



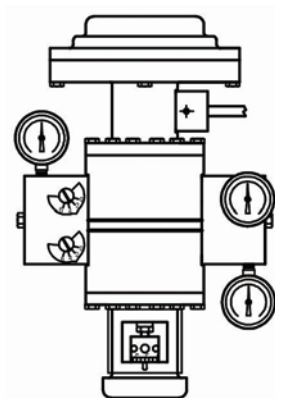
**Figure 6.1 – HPP-5 Series Reverse-Acting Positioner (Standard Range)**



**Figure 6.2 – HPP-5 Series Reverse-Acting Positioner (Split Range)**



**Figure 6.3 – HPP-5 Series Direct-Acting Positioner (Standard Range)**



**Figure 6.4 – HPP-5 Series Direct-Acting Positioner (Split Range)**



# HPP-5 Series Positioner Accessories

Realize Optimum Performance of your HPP-5 Series Positioner with these popular instrumentation accessories!



## Bleed to Pressure System (BPS)

Most Becker control instrumentation feature the unique capability to discharge vent gas into the downstream pipeline or alternate low pressure gas system. This feature is exclusive to Becker and provides complete elimination of atmospheric bleed gas emissions.



## 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 full-open or full-closed positions. This is ideal for monitor regulators and both ends of valve travel without adjustment. The NBV is the primary choice for non-bleed technology or Becker double-acting control instrumentation. The NBV is compatible with all Becker double-acting Valve Regulator Pilots (VRP) and double-acting High Pressure Positioners (HPP).

Reference Becker NBV No-Bleed Valve sales literature for more information.



## AB Series Atmospheric Bleed Control

When conditions allow discharge to pressure system only part of the time, install an AB-Control. When conditions allow discharge to pressure system only part of the time, install an AB-Control for automatic switching that temporarily permits atmospheric bleed. The AB-Control will maintain adequate differential pressure between supply gas pressure and discharge pressure to operate the control valve actuator and the HPP-5 Series positioner. The AB-Control is not applicable when the HPP-5 Series positioner discharges to atmosphere all of the time.

Reference Becker AB Atmospheric Bleed sales literature for more information.



## DPS Series Non-Bleed Sensor

The DPS Series Non-Bleed Sensor renders the HPP-5 Series positioner non-bleeding when the control valve reaches 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. The DPS features bleed shutoff at one end of valve travel. If bleed shutoff is required at both ends of travel, two DPS Non-Bleed Sensors will be required. The DPS is the secondary choice for Non-Bleed technology and should be used only in applications where the NBV will not function such as when the HPP-5 Series positioner must discharge to high pressure systems (above 60 psig).

Reference Becker DPS Non-Bleed Sensor sales literature for more information.



## I/P Transducer

The I/P Transducer provides communication between the flow computer and the control valve, and converts the analog electrical signal (4-20 mA typical) to a pneumatic input signal (3-15 psig or 6-30 psig). All of Becker I/P Transducers are rated Explosion Proof Class 1, Div. 1 for use in hazardous locations. I/P transducers are compatible with all Becker HPP positioners. Typically a pneumatic positioner and I/P Transducer combination may be required for fast-acting processes.

# HPP-5 Series Positioner Accessories



## QEV Series Quick Exhaust Valve

QEV Series Quick Exhaust Valves are utilized in conjunction with Becker single-acting control instrumentation and single-acting actuators to provide fast stroking speed. When control instrumentation loads pressure to a 'single-acting actuator the QEV provides normal straight through flow. When the control instrumentation unloads the single-acting actuator, the QEV opens to provide increased exhaust capacity allowing quick stroking. QEVs may be added in parallel to provide even greater actuator unloading (stroking) speed where required.



## Stainless Steel Option

All Becker products are manufactured from high-strength anodized aircraft aluminum alloy (AL2024). The standard aluminum construction typically will provide adequate durability in most installation environments. In applications where the installation environment is unusually 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
- Offshore platforms
- Chemical plants
- Coastal regions



## SLV-30 Signal Lock Valve

The Becker SLV-30 Signal Lock Valve is designed to prevent any instrument signal loss from affecting actuator positioning. In the event of instrument signal failure, the SLV-30 valve will maintain the last position of the control valve and positioner. The Becker SLV-30 valve can be factory installed or easily retrofit to most existing pneumatic actuator/ positioner models, and is compatible with all pneumatic controllers and I/P transducers.

For more information see Becker SLV brochure.

## Improve Performance and Minimize Bleed Gas Emissions!

If you already have existing control valve actuators in service with older, obsolete pneumatic positioners, the addition of an HPP-5 Series positioner can improve performance, reduce maintenance, and minimize bleed gas emissions. Becker HPP-5 Series Positioners are compatible to retrofit many manufacturers' piston style valve actuators. Consult Baker Hughes for more information.

## Becker Model HPP-5 Series positioners are compatible for retrofit with the following:

- Fisher Type 470/480 Piston Actuators
- Fisher Type 1061 Piston Actuators
- Other types and other manufacturers' actuators. Contact your local Baker Hughes sales representative for assistance.



**Figure 7 - Becker Model HPP-3 Positioner Retrofit to Fisher Type 470 Actuator.**

The entire HPP positioner series easily retrofit to existing piston style actuators. In this application, the customer replaced a total of four existing high-bleed pneumatic positioners with Becker HPP-3 positioner. The retrofit was efficient and eliminated constant bleed associated with other manufacturers' pneumatic valve positioners. Ultimately, the customer directed all emissions into a nearby medium pressure distribution system, thus eliminating all atmospheric emissions and maintaining all discharge gas within the process piping system.



Table 6 – Selection table for Becker Control Valves and Actuators

	VRP-CH Pilot	VRP-B-CH Pilot	VRP-SB-CH Pilot	VRP-SB-GAP Pilot	VRP-SB-PID Pilot	HPP-4 Positioner	HPP-5 Positioner	HPP-SB Positioner	DNGP Positioner	Notes
<b>Applications</b>										
Pressure Control	•	•	•		•	•	•	•	•	1, 2
Flow Control						•	•	•	•	2
Power Plant Type Pressure Control	•				•	•		•	•	3
Power Plant Type Flow Control						•		•	•	3
Surge Control On/Off				•				•		
<b>Compatible Actuators</b>										
RPDA Series (Small Models)	•	•		•		•	•		•	4
RPSR Series (Large Models)	•			•	•				•	4
RPSR Series			•	•	•			•	•	
LPDA Series (Small Models)	•	•		•		•			•	4
LPDA Series (Large Models)	•			•		•	•		•	5
LPSR Series			•	•	•			•	•	
LD Series			•	•	•			•	•	5
<b>Instrumentation Options</b>										
Bleed to Pressure System BPS	•		•	•		•	•	•	•	6
AB Series Atmospheric Bleed Control	•		•	•		•	•	•	•	
NBV Series No-Bleed Valve	•	•				•	•			7
DPS-2 Series Non Bleed Sensor	•	•				•	•			8
PS-2 Series Non Bleed Sensor	•					•				8
SP Series Setpoint Pump	•	•	•	•	•					
RSM Series Remote Setpoint Module	•	•	•	•	•					
Panel Mounting	•	•	•	•	•				•	
Stainless Steel Option	•	•	•	•	•	•	•	•		
VB Series Volume Booster	•	•			•	•	•	•		9
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 in<sup>3</sup> / 0.033m<sup>3</sup>) 5. RPDA and LPDA Large Models are defined as actuator sizes 12T and larger (≥ 2000 in<sup>3</sup> / 0.033m<sup>3</sup>)
5. LD Series Actuators are limited to Becker CVE Series Globe Valves.
6. BPS is limited to discharge pressure systems below 300 psig (2068 kPa). Consult Becker for application assistance.
7. 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).
8. 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).
9. VB Series Volume Boosters are necessary for power plant regulation, surge control applications, or when large model RPDA are utilized.



Figure 8 – Becker HPP-3 Positioner with LPDA Actuator

Becker HPP Family Pneumatic Positioners are compatible with LPDA actuators. This particular installation involved a retrofit of a Becker LPDA actuator and HPP-3 Positioner on an existing globe pattern valve to reduce atmospheric emissions.



Figure 9 – Becker HPP-3 Positioner with RPDA Actuator

Becker HPP Family Pneumatic Positioners are compatible with RPDA actuators. This particular installation provided flow control for a large volume meter station.

### CAUTION

This information is intended as a guideline for application of Becker Control Valve products. Baker Hughes strongly recommends consulting Becker Engineering prior to application of any product.

**Baker Hughes** 

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