

PM15 Pneumatic Valve Positioner

Installation, Operation and Maintenance Instructions

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1. STORAGE INSTRUCTIONS

PM15 Positioner Storage and Handling Procedures

PM15 positioners are precision instruments which should be stored and handled accordingly to avoid problems or damage.

Warehouse Storage

Stored in original shipping containers, units should be stored in an environmentally controlled area, i.e., clean, cool (15–26°C, 60–80°F) and dry, out of direct sunlight or weather exposure.

Field Storage

NOTE: Once the air supply to the positioner is connected and turned on, internal air bleed will prevent the ingress of moisture and protect the unit from corrosion. It is recommended that the air supply be left on at all times.

- If units are installed immediately, turn, and leave on, the air supply.
- If positioners must be stored outdoors, tighten all covers which may have loosened in shipment, make sure all open enclosure entry points are sealed.

Positioners should be wrapped and sealed air and watertight with desiccant inside the plastic, units should be securely covered with an opaque cover and not exposed to direct sunlight, rain or snow.

Units should have all ports sealed and be protected from direct exposure to weather. For long term storage (>1 month) or overseas shipment, units should be protected with plastic and desiccant.

Potential Damage to Mechanism

When units are stored in hot, humid climates, the daily heating/cooling cycle will cause air to expand/contract and be drawn in and out of the positioner housing.

Dependent on the local temperature variations, humidity and dew points and time in storage, condensation could occur and accumulate inside pilot valve causing erratic operation or failure due to water and corrosion. The potential for condensation damage is especially high in southern climates and aggravated if units are exposed to direct sunlight.

For further assistance, please contact your nearest Worcester distributor.

2. INSTALLATION

Before mounting the positioner, the relationship of the actuator to the valve must be determined. The actuator can be mounted inline or cross-line to the valve. In addition, the actuator can be mounted right-side-up or inverted. If a spring-return actuator is used, the actuator can be set up to fail with the valve closed or with the valve open. This gives the end user a total of eight possible set-up configurations.

A. MOUNTING GUIDE

The following notes pertain to Positioner Mounting Guide on next page:

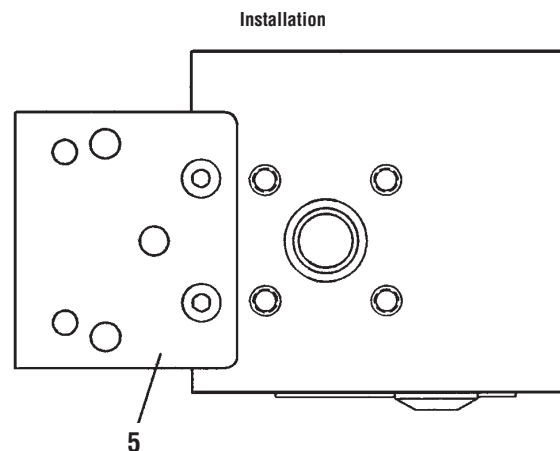
1. “Inverted” Actuator Position and “Cross-Line” Actuator Mounting applies to sizes 10-20 39 Series actuators only. On sizes 25 and larger, the output shaft is square, which allows for the coupling to be indexed 90° to the actuator shaft. Normal actuator position means that the actuator is mounted “right-side-up”.
2. For Spring-Return actuators only. “Fail-Open” actuators have a “9” in position 3 of the ordering code.
3. To change cam to Reverse-Acting, remove and reinstall upside down (see Section 7).
4. For Double-Acting actuators only. Normal hose positions refer to those described in Section 2.C, Connections.

B. MOUNTING INSTRUCTIONS

Mounting instructions for a Direct-Acting PM15 to a Spring-Return or Double-Acting 39 Actuator:

The most common installation configuration is with the actuator mounted inline, direct-acting, and with spring-return set for fail-closed. Direct-acting means that as the signal increases, the valve travels in the open direction.

- 1) Close the valve/actuator assembly if it is not already closed (fully CW).
- 2) Remove the position indicator, if any, from the actuator shaft.
- 3) Attach the mounting bracket to the top of the actuator such that the indicating scale is upright and on the same side of the actuator as the actuator nameplate. Use four (4) screws and lockwashers supplied with mounting kit.
- 4) Place coupling on actuator shaft. DO NOT tighten set screws at this time.
- 5) Install the indicating arm and locknut on the coupling such that the end of the arm points downward.
- 6) Place the positioner on the bracket so that the actuator nameplate and the side of the positioner with the zero adjustment are on the same side. Positioner is mounted to bracket using mounting adapter and screws (5).



POSITIONER MOUNTING GUIDE								
ACTUATOR				POSITIONER				
Actuator Mounting (Note 1)	Failure Mode (Note 2)	Actuator Position (Note 1)	Rotation to Open	Positioner Operation	Cam (Note 3)	Cam Setting	Actuator Supply Hoses (Note 4)	Valve Position at Min. Signal
Inline	Fail-Close	Normal	CCW	Direct-Acting	Direct-Acting	0° (Min. Signal) When Valve is Closed	Normal	Closed
Inline	Fail-Close	Normal	CCW	Reverse-Acting	Reverse-Acting	90° (Max.Signal) When Valve is Closed	Reverse	Open
Cross-Line	Fail-Close	Inverted	CW	Direct-Acting	Reverse-Acting	0° (Min. Signal) When Valve is Closed	Reverse	Closed
Cross-Line	Fail-Close	Inverted	CW	Reverse-Acting	Direct-Acting	90° (Max.Signal) When Valve is Closed	Normal	Open
Inline	Fail-Open	Inverted	CCW	Direct-Acting	Direct-Acting	90° (Max.Signal) When Valve is Open	Normal	Closed
Inline	Fail-Open	Inverted	CCW	Reverse-Acting	Reverse-Acting	0° (Min. Signal) When Valve is Open	Reverse	Open
Cross-Line	Fail-Open	Normal	CW	Direct-Acting	Reverse-Acting	90° (Max.Signal) When Valve is Open	Reverse	Closed
Cross-Line	Fail-Open	Normal	CW	Reverse-Acting	Direct-Acting	0° (Min. Signal) When Valve is Open	Normal	Open

- 7) Align the mounting holes and then use the two 5/16-18 socket head cap screws, lockwashers, hex nuts, and rubber washers (between bracket and positioner) supplied with the mounting kit to fasten the positioner to the bracket.
- 8) Tighten the set screw at the upper end of the coupling to the positioner shaft (seat the set screw in the positioner shaft groove). The other two set screws will be tightened after the actuator is cycled 90°. Proper alignment of the positioner spindle to the actuator shaft is very important since improper alignment can cause excessive wear and friction to the positioner.

C. CONNECTIONS

Air connections are tapped for 1/4" NPT male connectors and are clearly marked. We recommend use of tape, Loctite® 577 or similar user preferred for sealing.

Port I Input instrument pneumatic signal 20–100 kPa (3–15 psi)

Port S Supply air, maximum 0.9 MPa (125 psi)

Port C1, C2 Actuator connections (0.2–0.9 MPa). C2 opening port.

Connect the air supply line to port S.

For double-acting operation, connect the right-hand and left-hand ports of the actuator end cap (right-hand end cap when facing actuator nameplate) to port C2 and C1 respectively.

For single-acting operation, plug port C1 for increasing signal to open or close. Plug port C2 for decreasing (reverse) signal to close.

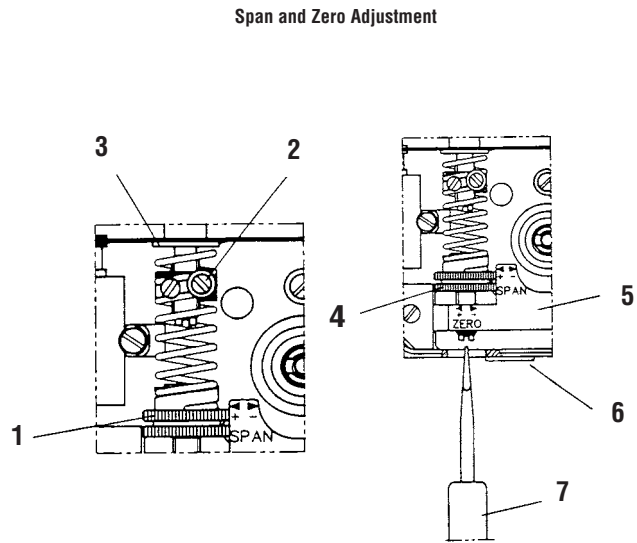
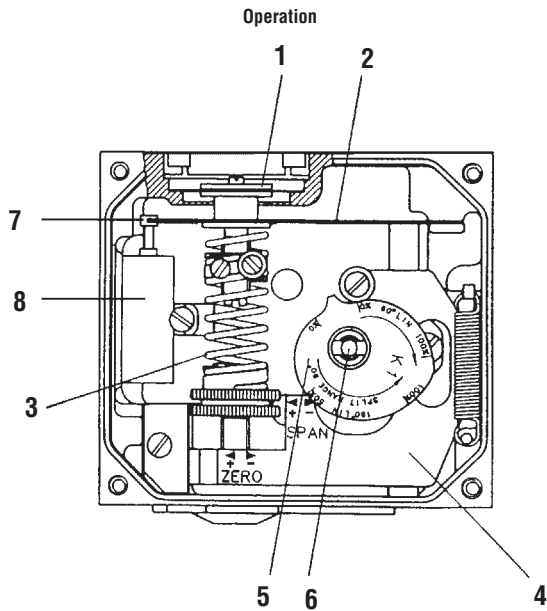
3. OPERATION

The PM15 operates on a force balance principal. Force is originated by the signal pressure transmitted through a diaphragm onto the balance arm. The opposing force is achieved through the feedback spring and is proportional to the position of the lower arm. The lower arm position is determined by the position of the cam which is secured to the spindle and connected to the actuator shaft thus providing the feedback from the actuator/valve. When these two forces are equal, the balance arm and the spool in the pilot valve is in a neutral position — the complete unit is in a balanced position. Air is supplied to the pilot valve through port S, and controls the air flow through ports C1 and C2.

Assume an equilibrium position.

An increased control pressure will deflect the diaphragm (1) down, compressing the feedback spring (3). The balance arm (2) moves the spool (7) in the pilot valve (8) furnishing supply air to the actuator, while at the same time air is exhausted from actuator and is vented to atmosphere through the pilot valve.

With the increased supply air, the actuator rotates (or moves linearly) moving the positioner spindle (6). The spindle and cam (5) rotate, forcing the lower arm (4) upwards compressing the feedback spring (3). This motion will continue until two forces are equal and the unit is an equilibrium position.



4. AIR REQUIREMENTS

Maximum supply pressure is 0.9 MPa (125 psi).

Supply air shall be clean, dry and free from oil, water, moisture, foreign parts and debris.

The air shall be freeze-dried or similar to a dew point of at least 10°C (18°F) below lowest expected ambient temperature.

A <40 micron filter/regulator is recommended to be installed as close to PM15 as possible to ensure proper supply air quality.

5. SPAN AND ZERO ADJUSTMENT

Span is adjusted with the brass-colored (upper) thumb wheel (1) located on the feedback spring.

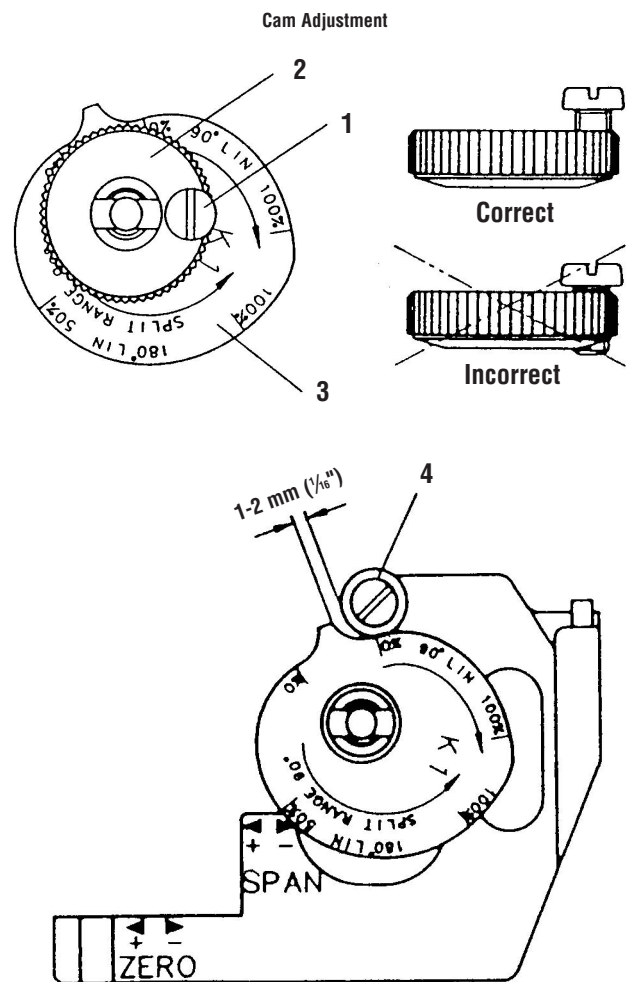
To adjust the span, always return to minimum input signal first, then loosen the locking screw (2) and turn thumb wheel (1). Tighten screw (2) when span is set. Do not allow the top of the spring to contact the spring guide (3).

Always check zero after adjusting span.

Zero is adjusted by turning the silver (lower) thumb wheel (4) located on the lower arm (5) or externally with a screwdriver (7), through the zero adjustment opening. Remember to install cover (6) to ensure the units sealing.

6. CAM ADJUSTMENT

With the cover and indicator removed, loosen the screw (1) and turn the cam locking nut (2) counterclockwise until the cam loosens. Adjust the cam (3) as desired making sure that the ball bearing (4) always is riding on an active lobe on the cam. To secure the cam, make sure that screw (1) is backed out from the locking nut (2) then finger tighten the locking nut and tighten screw (1). Install and adjust the indicator and reinstall cover.



7. REVERSE-ACTING AND SPLIT-RANGE

Reverse-Acting

For reverse-acting operation, invert cam. Also reverse connections C1 and C2. For single-acting actuators, move actuator connection from C2 to C1 and plug C1.

Split-Range

For split-range, reposition the cam, noting the markings on the cam— for 3–9 psi use initial 50% zone; from 9–15 psi, use 51–100% zone.

8. MAINTENANCE

A. PILOT VALVE

To remove the pilot valve for cleaning or inspection, remove the screw (1) and carefully lift out the complete assembly (2). Gently remove the spool (3) from the block and clean the parts, using methylate cleaner or similar. Blow the parts dry with compressed air.

Should the parts show signs of wear, a new assembly is recommended. Mixing spool valves and valve bodies may result in very high bleed rates and poor performance. Check the O-rings, then secure and install the pilot valve assembly to the positioner unit and secure it with the screw (1). Make sure that the leaf spring (4) on the balance arm (5) is properly fitted in the groove on spool (6). Check again to ensure smooth operation of the assembly.

To maintain original factory performance specifications, use only Worcester spool valve assemblies.

B. DIAPHRAGM

Loosen screws (1) and remove the diaphragm cover (2). Loosen screw (3), diaphragm (4) and washers (5) can be removed.

When installing the diaphragm, make sure to place one washer on each side of the diaphragm. Make sure that the raised circle on the washer is facing the diaphragm.

Install the screw (3) and tighten.

Check the O-ring on the diaphragm cover (2), then install and secure the cover with screws (1).

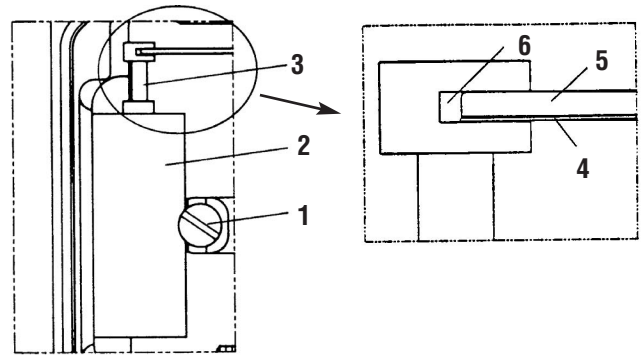
C. FEEDBACK SPRING

Once the front cover and indicator are removed, the feedback spring can be easily accessed.

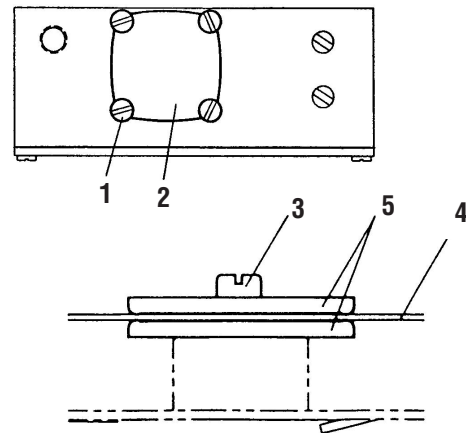
Hold the spring (1) from the top, pull down and out.

When installing, hold the assembly at the top, guide the lower part to position on the zero screw, then press down until it fits easily under the balance arm (2). Make sure that the assembly is aligned properly against the lower arm and the notch is engaged in the tab on the balance arm (2).

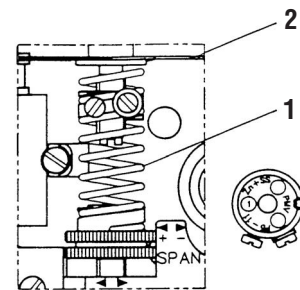
Maintenance — Pilot Valve



Maintenance — Diaphragm



Maintenance — Feedback Spring



D. BALANCE ARM

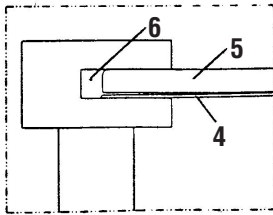
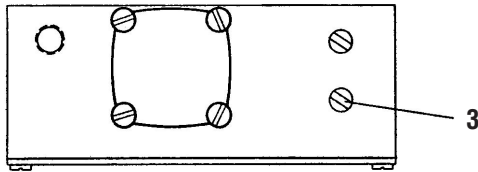
The balance arm can only be removed after diaphragm and feedback spring have been removed. (See Section 8.C. and Section 8.B.)

Loosen the screws (3) and the balance arm can be removed.

When installing the balance arm make sure that the leaf spring (4) on the underside of the balance arm (5) is properly engaged into the groove (6) of the spool in the pilot valve.

Tighten the two screws (3) holding the balance arm to the positioner.

Maintenance — Balance Arm



E. LOWER ARM

Once the front cover is removed, the lower arm can be easily accessed. Remove the indicator, feedback spring and the cam. Loosen screw (2) and remove twist stop (1). Remove screw (3), lower arm (4), rod (5) and spring (6).

Check rod and lower arm for wear, replace if necessary. Clean the rod and install it in the lower arm. The lower arm should move easily and smoothly.

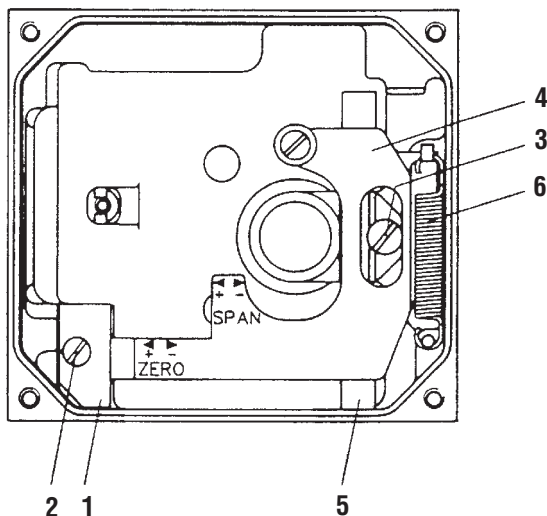
Install the lower arm and rod assembly into the positioner housing, making sure that the spring (6) is attached properly to the lower arm and positioner housing.

Secure the lower arm and rod assembly with the screw (3). Check again that the lower arm moves smoothly.

Apply a small amount of grease on the small tongue on the lower arm, then install and secure the twist stop.

Install cam, feedback spring, indicator and front cover.

Maintenance — Lower Arm



F. O-RINGS

With time and use, O-rings can become brittle. This can cause poor operation and even failure of the positioner.

Always check O-rings when performing any work on the positioner and replace bad O-rings.

A thin layer of silicon grease applied on the Buna N (Black) O-rings prolongs their life. On Q (Red Silicon) O-rings, use a non-silicon based grease.

9. TROUBLESHOOTING

NOTE: All PM15 positioners are serialized and date coded. Please note and provide the serial number when contacting the factory for troubleshooting or service.

Signal change results in actuator running to end positions:

- Check coupling between positioner and actuator.
- Check cam position and locking screw.
- Check input signal.

Signal change has no effect on the actuator position:

- Check indicator and screw.
- Check air supply to positioner and tubing to the actuator.
- Check input signal to positioner.
- Check diaphragm for damage or leakage.
- Check pilot valve function.
- Check cam for correct setting.

Inaccurate positioning:

- Dirty or worn pilot valve.
- Defective or leaking diaphragm.
- Input signal fluctuates.
- Incorrect sizing of actuator.
- Valve/actuator “stiction”.
- High valve/actuator breakaway torque.
- Loose cam.

10. TECHNICAL DATA

Input Signal	20–100 kPa/3–15 psi
Linearity	< 0.5%*
Hysteresis	< 0.5%*
Repeatability	< 0.5%*

Gain Factor at:

80% Load (Supply Pressure 0.6 MPa/87 psi)	250 kPa/kPa psi/psi +20%
50% Load (Supply Pressure 0.6 MPa/87 psi)	500 kPa/kPa psi/psi +20%

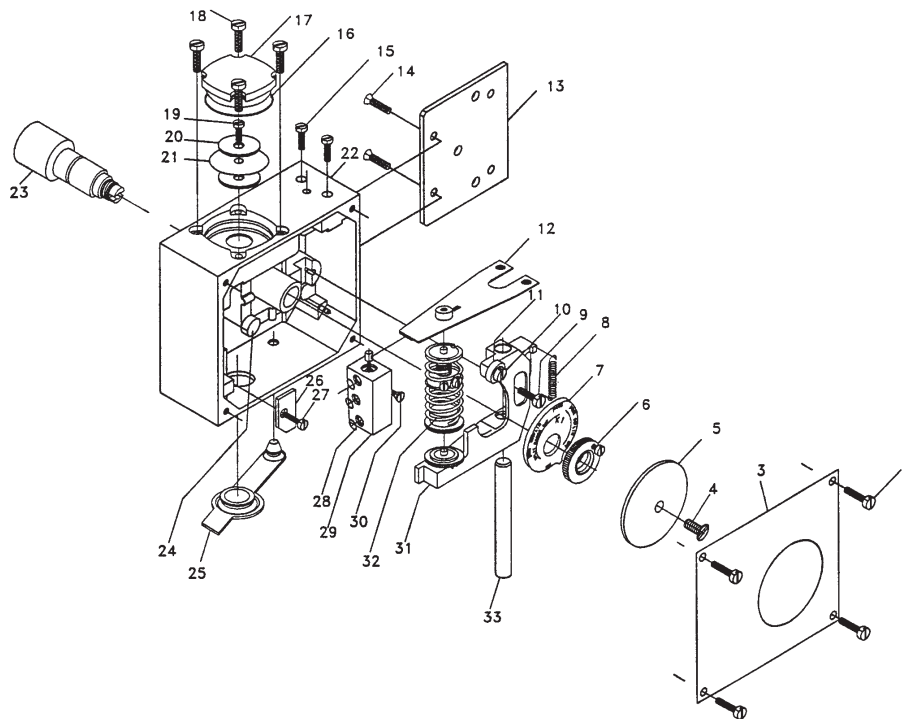
Air Consumption at Supply Pressure:	± 20%
0.6 MPa/87 psi	7.5 nl/min (0.27 scfm)

Air Delivery at Supply Pressure:	± 20%
0.2 MPa/29 psi	135 nl/min (4.7 scfm)
0.4 MPa/58 psi	240 nl/min (8.4 scfm)
0.6 MPa/87 psi	340 nl/min (11.9 scfm)

Supply Pressure	Max 0.9 MPa/125 psi
Temperature Range	-20°C to +85°C (-4°F to 185°F)
Connector Threads	¼" NPT
Weight	1.1 kg/2.4 lb
Housing	Die Cast Aluminum
Surface Treatment	Epoxy Painting

*Percent of full scale.

Exploded Drawing



11. SPARE PARTS LIST

Item	Qty	Description	Item	Qty	Description
2, 4, 9, 15, 18, 19, 20, 27, 30	1 Set	P4 Screw Set	20, 21	1	P4-20 Diaphragm Assembly/Nitrile
3	1	P4-3 Front Cover	23	1	P4-C3 Spindle
5	1	P4-5 Indicator Arrow-Standard	24	1	P4-24 Mounting Hole Sealing Cap
6	1	P4-6 Cam Locking Nut	25	1	P4-25 Zero Adjust Cover
7	1	P4-K1 Cam	26	1	P4-26 Lower Arm Stop Plate
8	1	P4-8 Lower Arm Spring	28	1	P4 O-Ring Set, Nitrile
12	1	P4-12 Balance Arm	29	1	P4-29 Pilot Valve Assembly
13, 14	1	P4-13 Adapter Plate	31, 10, 11	1	P4-31 Lower Arm Assembly
16, 17	1	P4-17 Diaphragm Cover with Nitrile O-Ring	32	1	P4-32 P4 Spring Assembly, 12 psi
			33	1	P4-33 Guide Rod

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