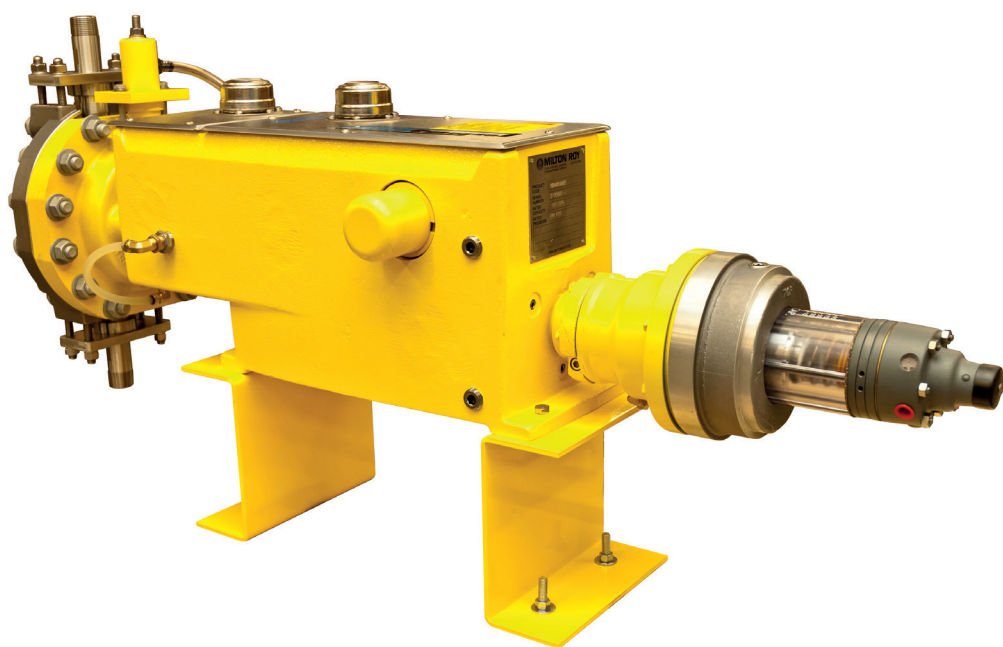




Milroyal® B Pneumatic Capacity Control Instruction Manual

Manual No : 54147

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PRECAUTIONS

The following precautions should be taken when working with metering pumps.
Please read this section carefully prior to installation.

Protective Clothing



ALWAYS wear protective clothing, face shield, safety glasses and gloves when working on or near your metering pump. Additional precautions should be taken depending on the solution being pumped. Refer to **Safety Data Sheets** for the solution being pumped.

Hearing Protection



It is recommended that hearing protection be used if the pump is in an environment where the time - weighted average sound level (TWA) of 85 decibels is exceeded (as measured on the A scale-slow response).

Electrical Safety



- Remove power and ensure that it remains OFF while maintaining pump.
- **DO NOT FORGET TO CONNECT THE PUMP TO EARTH / GROUND.**
- Electric protection of the motor (Thermal protection or by means of fuses) is to correspond to the rated current indicated on the motor data plate.

Liquid Compatibility



Verify if the materials of construction of the wetted components of your pump are recommended for the solution (chemical) to be pumped.

Pumps Water “Primed”



All pumps are tested with water at the factory. If your process solution is not compatible with water, flush the **Pump Head Assembly** with an appropriate solution before introducing the process solution.

Plumbing and Electrical Connections



Always adhere to your local plumbing and electrical codes.

Line Depressurization



To reduce the risk of chemical contact during disassembly or maintenance, the suction and discharge lines should be depressurized before servicing.

Over Pressure Protection



To ensure safe operation of the system it is recommended that some type of safety / pressure- relief valve be installed to protect the piping and other system components from damage due to over-pressure.

Lifting



This manual should be used as a guide only - Follow your company's recommended lifting procedures. It is not intended to replace or take precedence over recommendations, policies and procedures judged as safe due to the local environment than what is contained herein. Use lifting equipment that is rated for the weight of the equipment to be lifted.



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SECTION 1 - DESCRIPTION

1.1 DESCRIPTION

Milton Roy Pneumatic Actuators are an accurate and convenient capacity control device. They are ideal for plants which currently employ pneumatics or which need automatic explosion proof pump capacity adjustment. An optional air control station can provide local or remote manual adjustment and an auto / manual selector valve when required.

1.2 PRINCIPLE OF OPERATION

1.2.1 Major Components

Figure 2 illustrates the physical relationships of the parts and subassemblies described below.

Basically, the operating principle of the Pneumatic Capacity Control is similar to a conventional pneumatic valve control, except the regulated supply air pressure (metered by the Moore Valve Positioner) is used to pressurize the oil reservoir which transfers the oil to the back of the Actuator Piston (1150).

Major components of the Pneumatic Capacity Control are:

1. The Actuator Piston (1150) is connected to the pump gear housing and moves to establish and maintain the pump capacity.
2. The Oil Reservoir (1290).
3. The Transfer Shaft (1220) connected to the Actuator Piston(1150) to transmit the piston position to the Range Spring (1420) in the transparent plastic cylinder (1430).
4. The Moore Products Valve Positioner (1440) monitors the Actuator Piston position as a function of the applied instrument air signal and develops the necessary metered supply air pressure required to reposition or maintain the position of the piston.

1.2.2 Operating Description

The Actuator Piston incorporates the differential area principle with the supply air pressure (80-100 psi) (551-689 kPa) applied directly to the small area of the piston. This establishes a constant preload through the piston transfer shaft and range spring to the Moore Valve positioner. Hydraulic pressure is not used on the preload side of the actuator piston, since the pressure is constant and the hydraulic snubbing effect is not required in this direction.

In order to move the Actuator Piston in both directions, the force on the opposite side of the piston must be variable to a higher and lower value than the preload force developed by the supply pressure acting on the small area side of the piston.

The Moore Valve Positioner compares the applied instrument air signal with the Actuator Piston position, as indicated by the range spring force, and adjusts the air pressure applied to the oil in the reservoir. Since the oil reservoir is connected directly to the large area side of the Actuator Piston, a force proportional to the oil pressure is obtained. This force opposes the fixed force caused by the supply air pressure on the small area side of the piston.

In the Milroyal® pump, the pulsating plunger thrust load is applied directly onto the capacity control, through the adapter shaft (1320) which must be capable of opposing this pulsating force without moving. Air, which is compressible, cannot be used directly to load the large area side of the Actuator piston to oppose this pulsating load. Therefore, the air pressure established by the Moore Valve Positioner is changed to an equivalent hydraulic pressure. To accomplish this, the oil in the reservoir is pressurized by the air pressure from the Moore Valve Positioner and the oil is routed internally from the reservoir through the transfer shaft to the large side of the Actuator Piston. To effectively prevent movement of the stroke adjustment when the plunger thrust load is applied, an oil check valve is required to prevent flow back from the hydraulic cylinder(1240) to the reservoir. This valve action is obtained where the actuator shaft (1100) bears against the Actuator Piston.

The Actuator Shaft retention in the Actuator Piston allows for approximately 0.005 to 0.020 inch (0.127 to 5.080 mm) lost motion and is spring loaded for Actuator shaft-piston contact. On the suction stroke the thrust reversal overcomes the spring force and separated the surfaces to open the oil passage between the reservoir and the hydraulic piston-cylinder, thus permitting readjustment of the piston position. Then at the end of the suction stroke, these surfaces are brought into contact to close this passage and create a closed hydraulic cylinder with an incompressible fluid to hold the Actuator Piston position on the next pressure stroke.

When the oil pressure in the transfer shaft passage is 5-10 psi (34.5-68.9 kPa) higher than the oil in the hydraulic cylinder, the spring loaded check valve in the adapter shaft will open to supply oil to the hydraulic cylinder. This oil valve bypass is used to increase the speed of response when reducing stroke position and to provide for control movement when the pump is not operating.

A small quantity of oil is continuously bled from the top of the hydraulic cylinder and routed internally to the bottom of the oil reservoir. This bleed flow also tends to increase the speed of response when increasing stroke position.

The Transfer Shaft (1220) is extended through the reservoir into the transparent Plastic Cylinder (1430) so that this shaft is also used to transmit the position of the Actuator Piston to the Range Spring (1430). The transparent cylinder provides a direct visual indication of the actual position of the actuator piston by comparing the position of the ring groove in the Range Spring Piston (1380) with the percent capacity scale on the outside diameter of the cylinder.

The complete Pneumatic Capacity Control assembly is mounted on the pump using an adapter flange clamped on the boss of the housing. The position of the adapter is adjusted at the factory to establish the correct stroke calibration and the control assembly can be removed for servicing in the field without disturbing this.

1.3 MODEL PRODUCT CODING

Milroyal® B pumps can be ordered with or without a pneumatic capacity control (PCC) unit already attached. If the PCC is ordered with the pump, it is indicated in the pump model code by a "PN" in the 11th & 12th or 13th & 14th positions. The pump model code can be found on the pump data plate, mounted to the pump.

SECTION 1 - DESCRIPTION

1.4 SPECIFICATIONS

Control Air Signal	• 3-15 PSI; specify direct or reverse acting
Supply Air Requirements	• 80-100 PSI
Air Consumption	• 0.25-0.4 SCFM
Linearity	• $\pm 5\%$ full scale
Accuracy	• $\pm 1\%$ or better
Loss of Supply Air Action	• Travel to 100%
Loss of Signal Air Action	• Direct acting-travel to 0%
	• Reverse acting-travel to 100%
Pump Capacity Variation over Instrument Pressure Range	• 0-100% (standard)
	• Reduced range (optional)
Minimum Pressure Change Required to Reset Pump Capacity	• 0.25 PSI
Accessories	• Air Control Panel
	• Electro-Pneumatic Relay (converts milliamp signal to 3-15 PSI)

2.1 INTRODUCTION

The Pneumatic Capacity Control is an integral accessory designed for mounting on the Milroyal® B frame pumps in place of the manual micrometer adjustment. Two air line connections are required to place the unit into operation:

1. The instrument air signal.
2. The supply air pressure regulated to 80 to 100 psi (551 to 689 kPa). As for all precision pneumatic devices, clean, filtered, dry air should be used at all times.

These connections are also shown in *Figures 1 & 2, pages 12-13*. Factory installed controls have been adjusted for operation between 0 and 100% capacity for the specified instrument air signal range. For field installation, *refer to Section 3, "Maintenance"*.

2.2 UNPACKING

Units are shipped Free on Board (FOB) factory and the title passes to the customer when the carrier signs for receipt of the unit. In the event that damages occur during shipment, it is the responsibility of the customer to notify the carrier immediately and to file a damage claim.

Carefully examine the shipping crate upon receipt from the carrier to be sure there is no obvious damage to the contents. Open the crate carefully so accessory items fastened to the inside of the crate will not be damaged or lost. Examine all material inside crate and check against packing list to be sure that all items are accounted for and intact.

2.3 SAFETY PRECAUTIONS

When installing, operating, and maintaining the Pneumatic Capacity Control, keep safety considerations foremost. Use proper tools, protective clothing, and eye protection when working on the equipment and install the equipment with a view toward ensuring safe operation. Follow the instructions in this manual and take additional safety measures appropriate to the liquid being pumped. Be extremely careful in the presence of hazardous substances (e.g., corrosives, toxics, solvents, acids, caustics, flammables etc.).

2.4 FIELD INSTALLATION (RETROFIT)

This Pneumatic Capacity Control can be installed on pumps in the field to replace the manual micrometer stroke adjustment. It will be necessary to disassemble the micrometer adjustment in order to disconnect and remove the stroke adjustment lead screw from the pump gear housing. In preparation, turn the micrometer to zero stroke setting. Refer to the applicable Milroyal® Instruction Manual which was furnished with the pump for the disassembly instructions. Manuals will be supplied by the factory when the request is accompanied with the Pump Serial Number.

SECTION 2 - INSTALLATION

1. After removing the micrometer stroke adjustment screw (1110) from the pump housing, clean and degrease the threads in the boss inside the pump housing and also the threads of the new adapter bushing (1470) supplied. Apply a medium grade of Loctite® compound to the adapter threads and install the adapter in the adjustment boss bore from outside the housing to obtain complete thread engagement.
2. Prepare to install the capacity control assembly by slightly loosening (finger tight) the six hex head screws (1350) and one socket screw (1360) in the mounting collar. Place O-ring (70) in the adapter shaft ring groove and apply a generous film of seal lubricant on the O-ring.
3. Install the capacity control assembly on the pump boss using care to guide the adapter shaft (1320) through the adapter bushing and to compress the O-ring into the boss. Position the mounting collar within 1/8" (3 mm) of the housing.
4. Inside the pump housing, reassemble the lead screw keys to engage the groove in the end of the capacity control adapter shaft (1320) and install the locking set screws in the gear housing. Remove the set screw (1540) because it may collapse the threaded adapter bushing. Rotate the worm shaft to position the crank arm at the top of its travel.
5. Refill the pump drive casing with oil and complete the reassembly of the pump.
6. Complete the connection of the signal and supply pressure air lines to the capacity control and fill the oil reservoir as outlined in the installation section. Tighten the mounting collar clamping socket screw (1360).
7. Apply supply pressure and use signal pressure to position the control at 0% capacity as indicated by the percent capacity scale on the transparent cylinder. Loosen the mounting collar clamping socket screw (1360) and move the mounting collar and control on the pump boss until the gear housing is positioned for zero plunger travel to correspond to 0% capacity setting of the control. The zero stroke position can be determined by rotating the input shaft by hand (turn the coupling between input shaft and motor through open bottom of motor mounting) so that the crank rotates through a full revolution, checking the crosshead in "lateral" area for a movement. At "zero" stroke there will be no perceptible movement of the crosshead when crank goes through a full revolution.
8. Tighten the mounting collar clamp screw (1360) and the six mounting screws (1350). Remove set screw (1540) from top of mounting collar (1330) and spot drill through the set screw hole in mounting collar with a 1/4" (6.35 mm) diameter drill to a depth of approximately 1/16" (1.5 mm). Blow out chips from drilling. Install and tighten half dog set screw.
9. Actuate the control through the full stroke range to bleed all air from the hydraulic cylinder. Then check the calibration of the control % capacity indication against the plunger stroke at zero and full stroke positions.

2.5 OIL FILLING INSTRUCTIONS

Although all pump mounted stroke controls are factory filled with hydraulic oil and operated before shipment, it is advisable to check the oil level in the hydraulic oil reservoir before placing unit in operation. This level can be checked, and filled if required in the following manner:

1. Adjust instrument air signal to position the piston in the pump-mounted plastic cylinder to its 100% position.
2. Shut OFF the supply air, then shut OFF the instrument air to the unit. The 100% position will be maintained.
3. Remove the filler plug (*Drawing 102209500020 on page 12*) on the top of the reservoir and note the 1/8" (3 mm) diameter tube located in the opening below the plug. When filling the reservoir do not pour oil onto or into this small tube.
4. Fill the reservoir with any light oil (SAE 5 or SAE 10) (32 to 72 kPa) until the oil level is within one inch (25 mm) below the top edge of the small tube.
5. Install the oil fill plug and readjust air supply to 80-100 psi (551-689 kPa).
6. Adjust the control between the maximum and minimum instrument air signals several times to allow the oil to enter and fill the chamber behind the piston and the system passages.
7. Repeat first five steps to insure that the reservoir is filled to within 1" (25 mm) of the top of the small tube when control is at the 100% capacity position.

SECTION 3 - OPERATION

3.1 OPERATION

The Pneumatic Capacity Control automatically adjusts pump capacity as a linear function of the applied instrument air (signal) pressure. Once the control has been adjusted to the process requirement, only periodic visual maintenance checks are necessary to determine satisfactory operation.

3.2 CALIBRATION

The factory installed Pneumatic Capacity Control assembly has been adjusted between 0 and 100% of rated capacity over the specified instrument air pressure range.

4.1 RECOMMENDED SPARE PARTS

The Pneumatic Capacity Control accessory is designed to provide long term, trouble free operation with a minimum of maintenance required. However, when the pump is installed in a process where maintenance downtime must be kept to a minimum, the following spare parts should be on hand. *Refer to Figure 1 on page 12* for location of part, description, and item number.

Drawing Location Reference	Description	Qty. Req.
1310*	Lock Washer	1
1400*	Gasket	2
1120	Poppet-Check Valve	1
1130	Seat Check Valve	1
1110	Spring-Check Valve	1
1440**	Moore Valve Positioner	1
1230	Retainer Ring	1
1200	Retainer Ring	1
1270*	O-Ring	1
1280*	O-Ring	2
1250*	O-Ring	2
1210*	O-Ring	1
1170*	Piston Seal (Small)	1
1160*	Piston Seal (Large)	1
1140*	O-Ring	1
70*	O-Ring	1
* Expedable part; replace at disassembly. ** Moore Valve Positioner should not be over hauled in the field. Contact factory for replacement valve.		

Parts orders must include the following information:

1. Quantity required.
2. Part number.
3. Part description.
4. Pump serial number.
5. PCC model number.

Always include the serial and model numbers in all correspondence regarding the unit.

4.2 RETURNING UNITS TO THE FACTORY

PCC units will not be accepted for repair without a Return Material Authorization, available from the Factory Repair Department. If the PCC is being returned attached to a Milroyal® B pump, process liquid should be flushed from the pump liquid end and oil should be drained from the pump housing before the pump is shipped. Label the unit clearly to indicate the liquid being pumped.

NOTE:

Federal law prohibits handling of equipment that is not accompanied by an OSHA Safety Data Sheet (SDS). A completed SDS must be packed in the shipping crate if the PCC is returned attached to a pump. These safety precautions will aid the troubleshooting and repair procedure and preclude serious injury to repair personnel from hazardous residue in pump liquid end.

All inquiries or parts orders should be addressed to your local Milton Roy representative or sent to: www.miltonroy.com.

4.3 REMOVAL OF CONTROL UNIT

Before removing the Control from the pump, it is necessary to position the control at 100% capacity by applying proper instrument air signal (usually 15 psi (103 kPa)). Then:

1. Shut OFF supply air pressure and disconnect line at the control.
2. Shut OFF instrument air pressure and disconnect line at the control.
3. Remove the oil drain plug (1460) (*see drawing on page 12*) from the bottom of the reservoir and collect oil in a shallow pan.
4. Remove Control mounting screws (1350) and pull Control away from mounting collar (1330) until adapter shafts (1100 & 1320) are exposed.
5. Unbend locking tabs on lock ring (1310) located against flat actuating shaft (1100).

SECTION 4 - MAINTENANCE

6. Use wrench on flats of both shafts (1100 & 1320) to unscrew shaft connection which has approximately one inch threaded engagement.

NOTE:

Provide adequate support for the control assembly as the shaft connection is being unscrewed to prevent binding or damage to the threads.

NOTE:

An alternate method for removing the control from the pump is by disengaging the clevis keys from the groove in the adapter (1320), located in the gear housing, and remove as an assembly. This eliminates the need for the difficult procedure of breaking the Loctite® joint and bending the tab on the locking washer, but will require draining the oil from the pump drive casing.

7. The control assembly can now be removed from the pump and should be taken to the work bench for further inspection, disassembly or checkout.

4.4 DISASSEMBLY

1. Disconnect the plastic tube (1520) at supply.
2. Pressure tee fitting. Remove the nuts (1450) from the mounting stud (1410). The Moore Products Valve Positioner and the transparent cylinder (1430) can now be removed from the mounting studs. Before the transparent cylinder is slipped OFF (see *Figure 1*), the range spring and spring seat (1420) should be taken out.
3. Remove the screw (1390), holding the range spring piston (1380) to transfer shaft (1220). Remove the range spring piston (1380) from the transfer shaft (1220).

4. Remove the reservoir-cylinder screws (1370) and then pull the reservoir housing (1290) and end plate (1260) OFF over the transfer shaft (1220).
5. The Actuator Piston assembly (1150) with the transfer shaft (1220) and actuating shaft (1100) can now be removed from the cylinder (1430).
6. To remove the transfer shaft from the piston, remove the retaining ring (1230) with right angle retaining ring pliers. Discard the O-ring (1210) under the transfer shaft flanged if a replacement ring is available.
7. To remove the adapter shaft (1320) from the actuator piston (1150), remove the retaining ring (1200) with right angle retaining ring pliers.

CAUTION

THE SPRING (1180) UNDER THE RING (D) MUST BE RESTRAINED AS THE RETAINING RING IS REMOVED AND THEN THE COMPRESSION RELEASED SLOWLY.

8. Remove and discard the O-ring (1140) on the adapter shaft (1320).
9. To remove the check valve seat (1130), install a hex head 10-24 screw in each of three tapped holes in face of seat. Alternately tighten each screw to pull the seat out of the adapter shaft. The nylon poppet (1120) and spring (1110) are loose and will be free after seat is removed.

This completes the disassembly of the Pneumatic Capacity Control. To reassemble the Pneumatic Capacity Control, follow the above disassembly procedure in reverse order.

5.1 PNEUMATIC CAPACITY CONTROL PARTS DRAWING

Drawing Location Reference	Description	Qty Req	Part Number
1330	Mounting Collar	1	204-0077-002
1380	Range Spring Piston	1	212-0061-062
1150*	Actuator Piston	1	212-0201-006
1190	Ring	1	219-0047-006
1310	Lock Ring	1	219-0046-006
1400	Gasket	2	225-0030-098
1410	Stud	6	232-0010-206
1530	Decal	1	253-0029-598
1220	Transfer Shaft	1	268-0029-006
1120	Poppet	1	212-0074-074
1130	Check Valve Seat	1	224-0037-006
1100	Actuating Shaft	1	268-0027-006
1110	Check Valve Spring	1	280-0049-041
1320	Adapter Shaft	1	272-0069-006
1470	Adapter	1	272-0029-062
1420	Range Spring; 3-15 PSI	1	280-0042-018
	Range Spring; 3-27 PSI		280-0042-026
1180	Actuating Shaft Spring	1	280-0041-000
1240	Hydraulic Cylinder	1	281-0316-006
1430	Cylinder (Clear)	1	281-0173-298
1260	Reservoir Housing Plate	1	281-0116-006
1510	Elbow	1	402-0079-011
1490	Tee	1	402-0021-024
1520	Tubing	1	402-0139-010
1480	Nipple	1	402-0050-019
1500	Connector	1	402-0074-021
1460	Oil Drain Plug	1	402-3522-000
1440	Valve Pos; 3-15 Direct	1	403-0043-009
	Valve Pos; 3-15 Reverse		403-0043-002
	Valve Pos; 3-27 Direct		403-0043-009
	Valve Pos; 3-27 Reverse		403-0043-004
1230	Retaining Ring	1	491-0762-006
1200	Retaining Ring	1	60064
1340	Lock Washer	14	L12216

Drawing Location Reference	Description	Qty Req	Part Number
1450	Hex Nut	6	C0-0095
1390	Filister Hd. Screw	1	405-0112-039
1360	Soc. Hd. Cap Screw	1	405-0028-166
1370	Hex Head Screw	8	C0-0199
1350	Hex Head Screw	6	901-2213-1CE
1540	Set Screw	1	405-0044-034
1270	O-Ring	1	408-9993-023
1280	O-Ring	2	408-0068-032
1250	O-Ring	2	408-0095-431
1210	O-Ring	1	408-0109-111
1170*	Small Piston Seal	1	40179
1160*	Large Piston Seal	1	40180
1140	O-Ring	1	BR-222
70	O-Ring	1	408-0095-051
40	Set Screw	3	405-0045-034
1300	Pressure Transfer Tube	2	245-0002-106
1290	Reservoir Housing	1	281-0141-062
1550	Hydraulic Fluid	1 Qt.	407-0126-020

NOTE:

**A new style actuator piston (1150) and piston seals (1170 & 1160) have been used on all pneumatic capacity control units manufactured since January 1, 1997. The old style piston is not compatible with the new seals. Therefore, if an old style actuator piston requires new seals, the piston must be replaced as well. A kit (part number 30244) is available to upgrade old style pneumatic capacity control units to the new style. The kit consists of parts 1150, 1170, and 1160.*

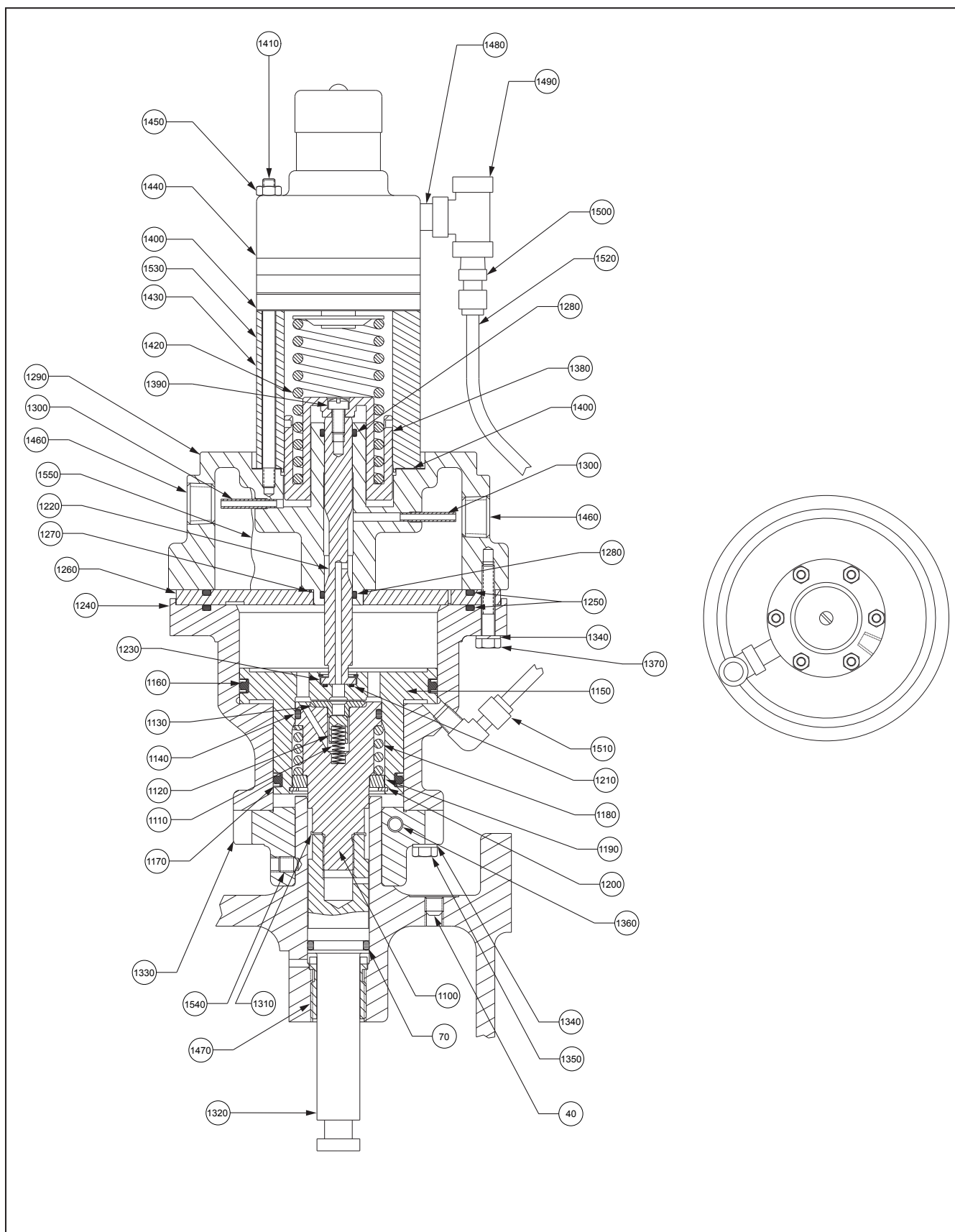


Figure 1. Milroyal® B Pneumatic Capacity Control (Drw-102209500020).

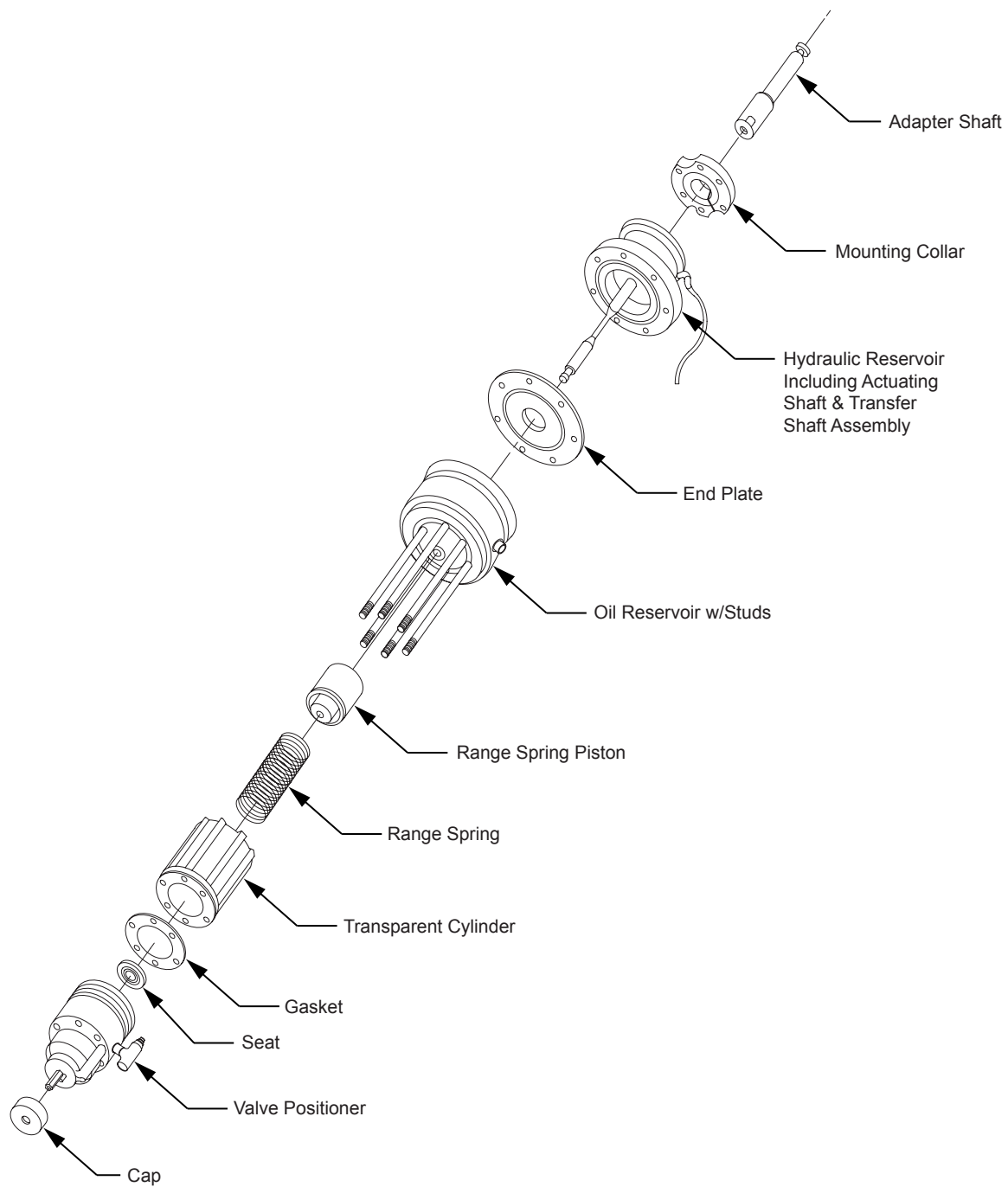


Figure 2. Exploded View of Pneumatic Capacity Control

Ingersoll Rand (NYSE:IR) advances the quality of life by creating comfortable, sustainable and efficient environments. Our people and our family of brands— including Club Car®, Ingersoll Rand®, Thermo King® and Trane®—work together to enhance the quality and comfort of air in homes and buildings; transport and protect food and perishables; and increase industrial productivity and efficiency. We are committed to a world of sustainable progress and enduring results.

