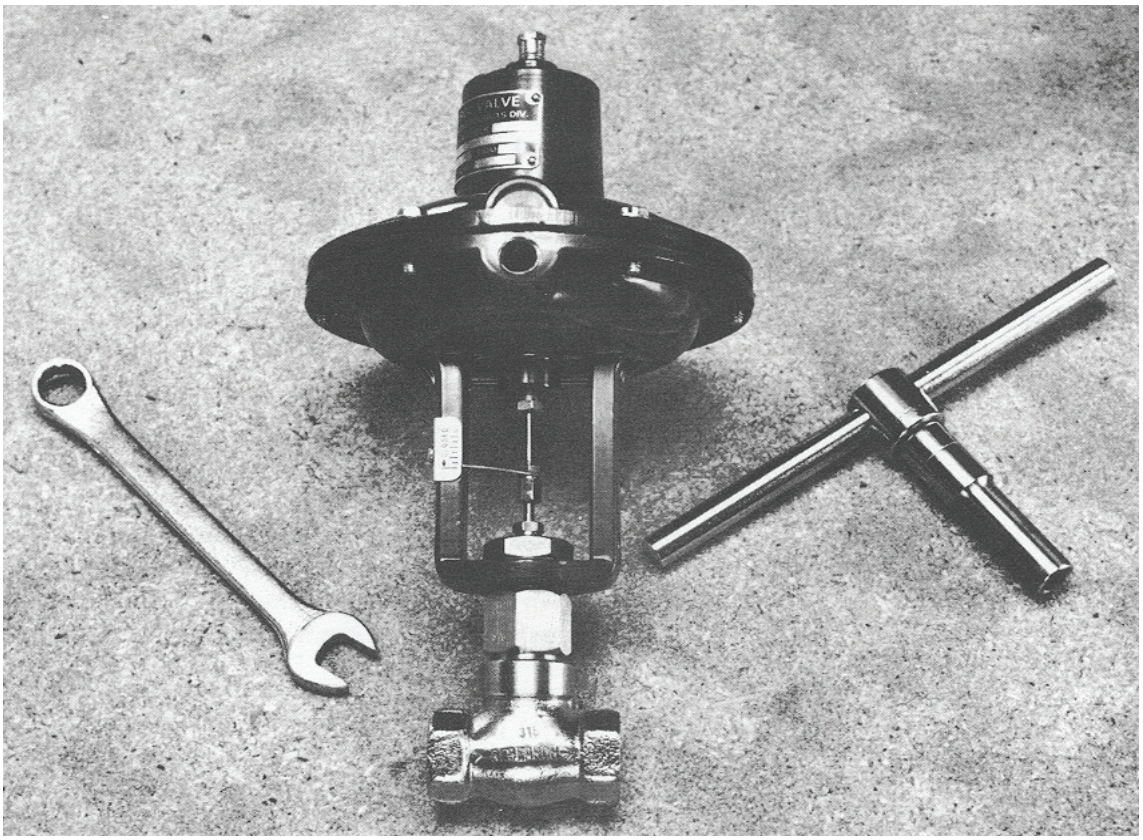
RCV
Research Control® | ReCo® Valves

Research Control® Valves



Badger Meter

RCV-UM-00562-EN-03 (February 2021)

User Manual

CONTENTS

GENERAL

The purpose of these instructions is to supply pertinent information for installation of original equipment, repair, adjustments, retrimming, repacking and other information necessary to achieve the best possible service from Research Control® Valves. Research Control Valves are engineered, designed, and manufactured with the end user in mind. Most parts are interchangeable with any other like assembly. The inner components (spare trims) are available in 39 flow coefficient (Cv) sizes and in many different materials compatible with most process conditions.

INSTALLATION

After inspecting the valve (or valves) and determining that the valve (or valves) meets the specifications, install as follows:

1. Normal installation is directly into any 1/4 in., 1/2 in., 3/4 in., or 1 in. piping system with flow direction arrow on body pointing downstream. This allows the stem packing to see the lowest pressure conditions after the pressure drop occurs. It should be noted that chevron ring stem packing is a dynamic seal that needs pressure to be energized.
2. Valves, especially plastic, should be bracket mounted in high vibration areas or where they may be subjected to damage from shock. If necessary, provide as required, bypass, manual block valve, filters, and so on. When installing valves that have the Low Flow "P" Series innervalves, small micron filters should be used where process permits.
3. Connect instrument air supply to diaphragm case using appropriate NPT fittings (1/8 in. NPT for 1/4 in. valves and 1/4 in. NPT for 1/2 in., 3/4 in., and 1 in. valves) to the desired tubing size adaptor (normally 1/4 in. tube fittings). All connections to standard positioners, Moore products or Badger Meter® are 1/4 in. NPT. (For positioner data, see *"Valve Positioners" on page 17*.)
4. All standard production valves as shipped are adjusted and preset at the factory with 90 psig air piped to the inlet port of the body. Air-to-open (ATO) valves are adjusted to come off seat at approximately 3.25 psig instrument signal and be fully opened at 15 psig. Air-to-close (ATC) valves are set to close when signal is at 14.75 psig and be fully open at 3 psig. Process conditions may dictate additional adjustment of the spring adjuster to hold unbalance created by higher pressure on actual application. It should be noted that on ATC valves with no pressure, the travel indicator will show over travel. With 3 psig to actuator, the indicator will be very close to the open position.

DISASSEMBLY AND REASSEMBLY

Perform disassembly and reassembly procedures at an instrument shop bench.

For the purpose of these instructions, consider the topworks (actuator) as a complete sub-assembly not to be dismantled except for replacing diaphragms or topworks packing. The only necessary topworks adjustment is made with the spring adjuster and/or the zero adjustment on positioner-equipped valves (see *"Valve Positioners" on page 17*). To position the stem, travel in relation to the 3…15, 3…9, 9…15 psig or other instrument signal operating the valve.

REPLACING TRIM SETS

Installing innervalve trim sets is accomplished with the body and bonnet subassembly separated from the topworks using appropriate wrenches. Tool kits are available at a nominal cost for 1/4 in., 1/2 in., 3/4 in., and 1 in. valves. To separate the body bonnet assembly from the topworks on ATO valves, apply 6…9 psig instrument air to the operator, lifting the innervalve off seat to prevent damage to the valve seating surfaces. This procedure is not necessary for ATC valves.

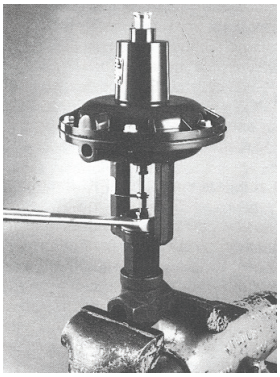


Figure 1: Separate body and bonnet from topworks

1. With innervalve off seat, use two open-end wrenches (1/4 in. for 1/4 in. valves and 3/8 in. for 1/2 in., 3/4 in., and 1 in. valves). Use one wrench to hold the stem connector in position, and the other wrench to loosen the topworks stem nut above the travel pointer. Remove the travel pointer.
2. With valve body in vise (clamp on ends), loosen the yoke-to-bonnet locknut (yoke locknut) with a slotted end wrench (7/8 in. boxed end for 1/4 in. valves, 1-1/8 in. for 1/2 in., 3/4 in. and 1 in. valves) and unscrew it completely.
3. With the open-end wrench, turn the stem connector counterclockwise (right hand threads), completely unscrewing it from the topworks stem. See *Figure 2*.
4. Remove topworks from the body bonnet assembly.
5. With the valve body in vise, use an open-end or crescent wrench to loosen and unscrew the bonnet from the body.

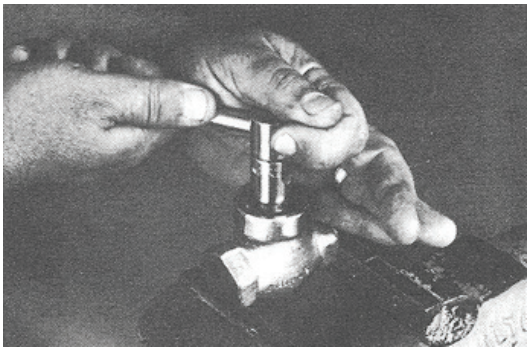


Figure 2: Unscrew the stem connector

6. Remove seat from body using a deep thin wall socket and T-handle assembly (3/8 in. hexagon for 1/4 in. valves, 5/8 in. hexagon for 1/2 in., 3/4 in. hexagon for 3/4 in. valves, and 15/16 in. hexagon for 1 in. valves).

⚠CAUTION

SOME PURCHASED LONG SET SOCKETS (HEAVY DUTY) WILL NOT FIT BODY CAVITY WITHOUT TURNING O.D. TO FIT PAST BODY THREADS. SEE FIGURE 2.

7. Most standard innervalves "K" through "P18" in 1/4 in. valves and "F" through the "P" series trim in 1/2 in. valves can be removed upward from the bonnet through the packing, all others by removing stem connector and withdrawing downward through the packing. When removing the larger trims down through packing, it is best to withdraw stems until threaded portion is in contact with packing and then rotate stem and allow the threads to screw through the packing area.

Installing Trim Sets

(Matching pairs do not separate.)
With all parts cleaned in an appropriate solvent, install desired trim set in body bonnet assembly as follows:

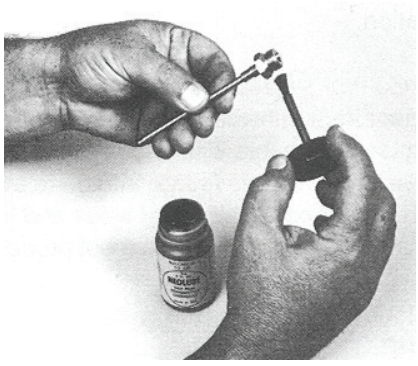


Figure 3: Apply lubricant

1. With trim as shown in *Figure 3*, apply a coating of Neolube (graphite dry film lubricant), process permitting, to the threads and seating surfaces of the seat. Air dry for 30 seconds. Do not use any thread sealing compounds containing metal particles.

NOTE: New replacement innervalves come pre-coated with NeoLube, except those that are specially cleaned.

2. Remove seat from innervalve and place hex first into the long set socket wrench and T-handle assembly.

NOTE: Tissue paper can be stuffed into the socket to prevent seat from falling through.

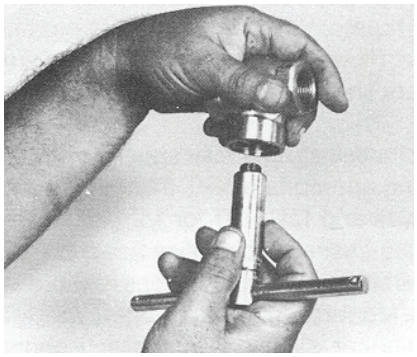


Figure 4: Start threads

3. With body inverted in palm of hand as shown in Figure 4, start seat threads into body, invert body and tighten seat. Do not over-torque. Standard torque figures using new parts at the factory are: 10/11 ft-lb on "P" trim seats, 8.5 ft-lb on other 1/4 in. seats, 35 ft-lb on 1/2 in., 3/4 in. and 1 in. seats. It should be noted that torque figures are applicable to new parts and may not be the same for used parts. For longest service life, on new or used parts, use the procedure detailed in the following step 4.
4. Torque seat firmly into body with the short T- handle assembly. Check seat to body seal, by making body a bubble chamber, using a pointed plastic plug-in seat to seal as shown in *Figure 5* with downstream port plugged and 50 psi air pressure upstream, check for leak. If leak exists, re-torque seat and recheck until bubble-tight seal is accomplished. On smaller letter or "P" series trim sets, over-torquing seat in the body can reduce the orifice size to where interference between innervalve and seat can cause a premature mechanical failure (galling) when stroking valve.

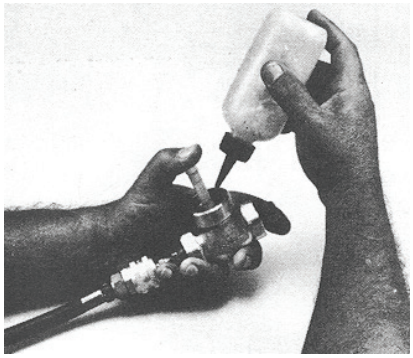


Figure 5: Plug-in seat

5. With body in vise, again clamping across ends—not sides—of body, place body bonnet gasket in place. (Process permitting, coat each side of gasket with lubricant such as Dow Corning or DuPont Krytox valve seal.) With the stem section of the trim set installed in the bonnet, coat the bonnet threads (body end) with lubricant. Screw bonnet into body and tighten with open-end or crescent wrench. Apply the proper torque to bonnet/ body joint as listed in the *Specifications* section of individual product data sheets.
6. Stroke innervalve manually to check for misalignment. Should misalignment exist, check straightness of innervalve or packing. See *"Packing, Chevron Ring" on page 11, "Packing, Braided Teflon" on page 12 and "Packing, Graphoil" on page 13*.

LAPPING

All replacement trim sets are pre-lapped at the factory. When installed per instructions, trims should leak no more than 1/10 of one percent of maximum flow for the given size (ANSI Class III). If necessary, with care, you can achieve bubble-tight shutoff by lapping in seating surfaces with the innervalve set installed in the body bonnet assembly using lapping compound (white aluminum oxide 38-1000 grit) with the packing removed, using the packing glands as the upper guide (brass lap bushing available at factory). See *Figure 6*.

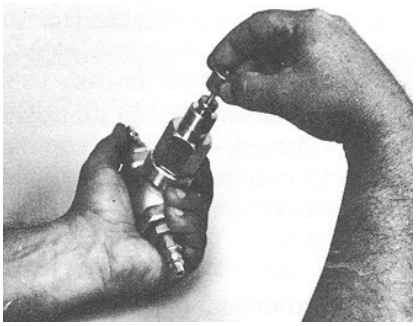


Figure 6: Lap the seating surfaces

Lapping should be done with a clockwise, counterclockwise motion between the thumb and forefinger, lifting the innervalve off seat and repositioning periodically to achieve a uniform lap ring. After each lapping operation, remove bonnet from body and clean innervalve and seat from body. Clean seat by submerging body in solvent and swabbing orifice with wetted pipe cleaner and blow dry with air. After cleaning, reassemble and check leak rate as shown in *Figure 7*. **Do not overlap**.

Lapping Sequence

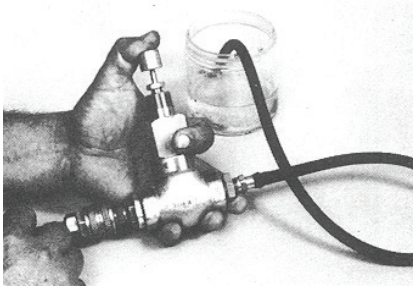


Figure 7: Clean the seat

Lap for about 30 seconds, clean and check leak rate. Repeat the sequence until you achieve the desired shutoff. If—after lapping three or four times—a leak still exists, check the seating surfaces of both innervalve and seat for excess nicks, scratches, or indication of galling, if the trim has previously been in service. Do not lap for shutoff any of the "P" series trims.

ASSEMBLY

1. With the body in a vise, place the topworks yoke on the bonnet with the yoke locknut slipped over the stem connector and down onto the bonnet threads (6…9 psig air on ATO topworks).
2. With the topworks in the correct position relative to the centerline of the body, use a boxed-end (slotted) wrench to tighten the yoke locknut.
3. Raise the innervalve and screw the stem connector on the topworks stem until the two stems are butted together.
4. Install a travel pointer between the stem connector and locknut on the topworks stem.
5. Hold the stem connector in place and tighten the topworks stem nut against the travel pointer positioned 1/32…1/16 in. away from travel scale.

STROKE ADJUSTMENT AND PRESSURE TEST

1. With valve completely assembled and with a manually regulated supply (3…15 psig) to the topworks, adjust with spring adjuster until the valve stroke is corresponds to the normal 3…15 psig instrument signal. To set this precisely, pipe 90 psig air to the upstream port and with rubber tubing piped from downstream port, bubble check the shutoff point. See *Figure 8*.
2. Set ATO valves to open at 3-1/4 in. psig.

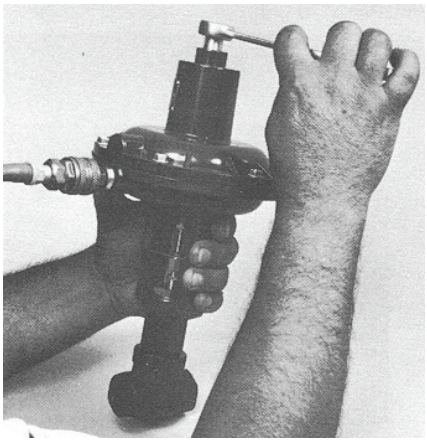


Figure 8: Adjust the valve stroke

3. Set ATC valves to close at 14-3/4 in. psig.

Nominal stem travel of 7/16 in. for 1/4 in. valves and 9/16 in. for 1/2 in., 3/4 in., and 1 in. valves is fixed in the topworks spring rate for a 12 psig span. If the valve has been set with a high bench setting because of pressure, full travel may not occur at 15 psig.

4. If necessary, reposition the travel scale relative to stroke.
5. Pressure test all seals with 90 psig air piped to the upstream port and the downstream port plugged with the valve open. Use a plastic squeeze bottle filled with a soapy water solution to flood each joint and inspect for leaks. Check and tighten the packing just until no leak is visible. Do not over-tighten. See *Figure 9*.

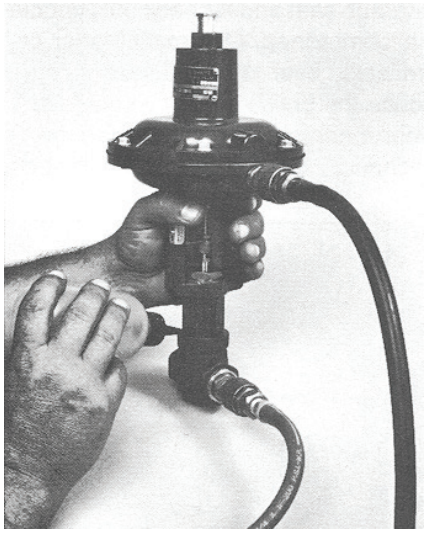


Figure 9: Pressure test the seals

6. Normal hysteresis (dead band) in valve stroke should be no more than 1/4 psig instrument signal. To check the hysteresis, place the thumb and forefinger on the valve stem in contact with the packing gland and manually regulate the 3…15 psig instrument signal (gauge in line) while watching the gauge and feeling the movement. See *Figure 10*.

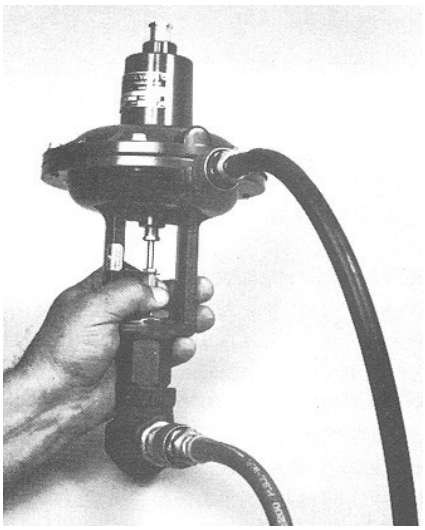


Figure 10: Check hysteresis

PACKING, CHEVRON RING

1. Proceed with disassembly of body-bonnet assembly as in changing trims.
2. Remove the packing gland and all components from within the cavity. If the Teflon packing follower has been damaged due to over tightening and is extruded into the threads of the packing cavity, drive a standard screwdriver into the teflon to unscrew the follower. In this case, the packing follower needs to be replaced.
3. Clean and inspect the cavity and parts for damage.
4. Place the packing adaptor in the cavity, making sure the flat side is down and in place.
5. Place the first ring into the cavity at a 90 degree angle to its seated position. When the ring is at the bottom of the cavity, use a small plastic or wooden probe to tip it over with the cup side down. Continue this procedure with the two additional rings. This method prevents the threads of the cavity from damaging the lips of the rings.
6. Place the packing follower on top of the rings, making sure the inverted "V" is down. (The arrangement for reversed Cv ring vacuum packing requires special parts.)
7. Replace the packing gland. Tighten the gland until it makes contact with the packing follower.
8. If the plug portion of the trim is machined integral on the stem, the stem connector should be tightened onto the stem before insertion into the bonnet and may be inserted through the packing from the top of the bonnet. If the plug portion of the trim is screwed onto the stem, the stem should be placed through the packing from the bottom of the bonnet by gently screwing the stem threads through the packing. The stem connector can then be tightened onto the stem.
9. Retract the stem sufficiently to keep the trim from seating and screw the bonnet into the body. Be sure to install the gasket.
10. Apply the proper torque to bonnet/body joint as listed in the *Specifications* section of the individual product data sheets .
11. Proceed with assembly and adjustments per *"Assembly" on page 8*.
12. Test the packing by tightening the gland 1/4 turn past finger tight. Do the initial test with low pressure (80…100 psi). If the packing leaks, tighten the gland just until leak stops. Excess torque can damage Teflon components. Once this procedure is complete, the valve can be tested at higher pressures.

⚠CAUTION

DO NOT TIGHTEN GLAND MORE THAN IS NECESSARY TO STOP LEAKS.

NOTE: On valves supplied prior to October 1993, the packing follower on all valves was virgin Teflon and packing adaptor was the same metal material as valve. To improve on the total packing function in regard to sealing and replacement, both the follower and adaptor materials have been changed to now available Teflon PFA. This denser Teflon material allows the guide diameter to be closer for better alignment and solves the cold flow problem of the original virgin Teflon follower.

PACKING, BRAIDED TEFLON

The original packing for Research Control valves was braided Teflon, which used a smaller gland nut. After molded chevron rings became available (and for a period of time after), there was a difference between the bonnet packing cavities, depending on the type of packing used. The components parts were not interchangeable until the current design was introduced in 1972 and became standard in 1981, using a common cavity for all types packing.

Braided Teflon is available and used in current packing cavity by putting in a dummy stem to fit the packing over, as shown in *Figure 11*.

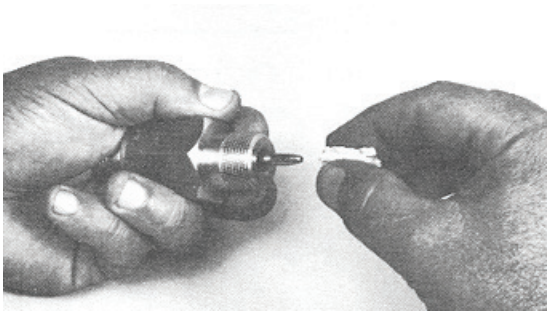


Figure 11: Dummy stem

1. Fill the cavity with sock- or rope-type packing, tamping it into the cavity with a packing tool or a piece of appropriately sized copper tubing, as shown in *Figure 12*, until the cavity is full with a couple threads showing. Screw the gland in and tighten it to compress packing.

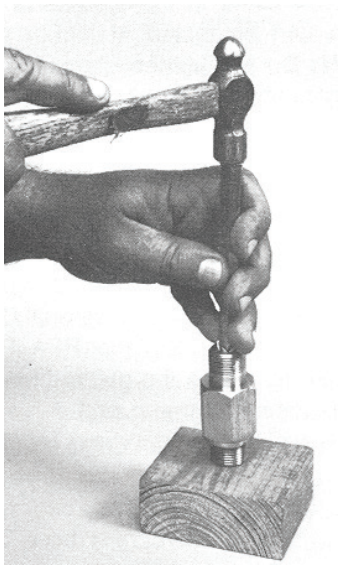


Figure 12: Tamp the packing

2. Remove the gland and blow or pick out any small pieces that may be in the threads. See *Figure 13*.

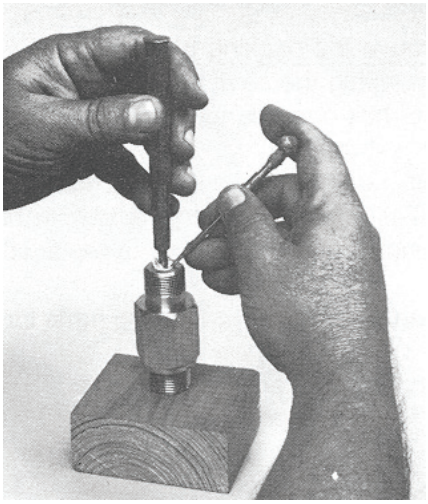


Figure 13: Clean the threads

3. Replace the gland finger tight and remove the dummy stem (*Figure 14*) and replace it with the new innervalve and stem. Tighten the packing gland and test the seal at final assembly using the same procedure as with chevron ring packing.

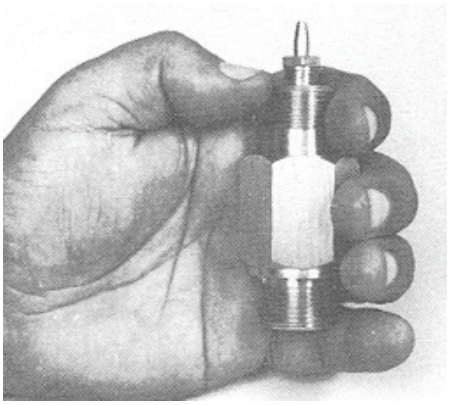


Figure 14: Position the new innervalve

PACKING, GRAPHOIL

Depending on the application, graphoil packing is available in preformed rings to fit standard packing cavities for all Research Control valves. When a process must run hot to prevent material from solidifying or for other purposes where finned bonnets are used to dissipate heat to protect the packing are not applicable, graphoil may be the solution. If the application is quick opening (on-off) and graphoil packing is used, the standard actuator will work with higher operating pressure. If application is to control, a positioner should be used to overcome additional drag, or hysteresis, created by graphoil making stem seal, especially on high pressure gases.

BELLOWS SEAL ASSEMBLY

General

On applications involving toxic gases, radioactive materials and others where the primary seal at the valve stem is critical, a metal bellows stem seal can be used to preclude leakage as long as the integrity of the bellows remains intact. Extreme care should be exercised in removing and/or installing the Bellows Seal Assembly (see) to preclude damage. The metal thickness of the low pressure bellows is only 0.005…0.007 in. thick, and excess torsion will twist and deform the convolutions, damaging the assembly.

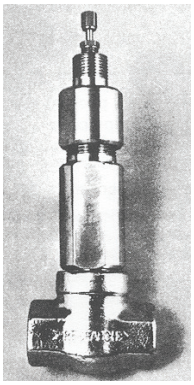


Figure 15: Bellows seal assembly

Removal of Assembly from Valve

1. Remove the valve from the process line and hold valve in a bench vise clamped on the body ends.
2. On ATO valves apply air pressure to diaphragm to raise innervalve off seat. (Not necessary for ATC valves).
3. Loosen stem connector locknut above travel indicator.
4. Loosen yoke nut holding topworks to bonnet.
5. Rotate entire topworks counterclockwise; topworks stem will unscrew from stem connector.

⚠CAUTION

UNSCREW STRAIGHT UP OR STEM COULD BE BENT.

6. Finish unscrewing yoke nut and lift off topworks.
7. Loosen and unscrew bonnet assembly from body. See *Figure 16*.

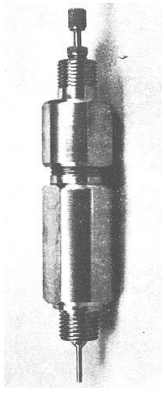


Figure 16: Bonnet assembly

8. Loosen and unscrew bonnet cap and bellows assembly from bonnet. See *Figure 17*.

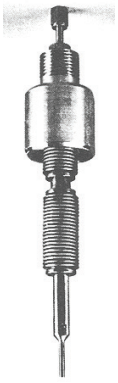


Figure 17: Remove bellows assembly

9. Grasp bonnet stem located immediately under connector with sharp nose pliers and remove connector without allowing stem to turn.
10. Remove the bellows from the bonnet cap. At times, it is necessary to cut and fish out the Teflon bellows gasket in order to free up the bellows assembly for removal.

Removing Innervalve from Bellows Assembly and Seat from Body

1. Hold stem of bellows in a lathe collet or suitable holding device (1/8 in. for 1/4 in. valves or 3/16 in. for 1/2 in., 3/4 in., and 1 in. valves) and gently unscrew innervalve counterclockwise using a small end wrench fitting the flats on the innervalve. Avoid any side motion or bending. See *Figure 18*.

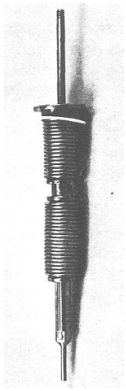


Figure 18: Unscrew innervalve

2. If the bellows stem threads unscrews before the innervalve unscrews, make a strap wrench by cutting a strip of 80 grit emery paper the width of the bellows length and roll about three revolutions clockwise around the bellows assembly with the coarse side against the bellows. Grasp the emery paper by hand and with the wrench on the innervalve flats, remove the innervalve from the bellows. Normally this procedure prevents damaging the bellows because the emery paper wrapped around the bellows gives it more support transferring the twisting forces to where the bellows is welded to the lower end plate.

IMPORTANT

Do not try to remove stem from bellows assembly. Do not grasp the bellows in any manner other than above nor allow it to twist.

3. Unscrew seat from body with a long set socket wrench.

NOTE: If the above procedure is being done because of bellows failure, it is not necessary to be concerned about damage to the bellows.

Installing Bellows Seal Assembly, Innervalve and Seat

Generally the foregoing steps are the reverse of disassembly, but best results will be experienced by processing in the following sequence:

1. Screw innervalve into bellows assembly only hand tight.
2. If the secondary packing in bonnet cap has not been damaged, proceed; otherwise, remove old packing but do not replace until later.
3. Place bellows-bonnet gasket carefully over bellows to flange.
4. Insert stem into bonnet cap, carefully turning in a clockwise direction until flange is seated all the way into bonnet cap.
5. Be sure gasket is home and not damaged.
6. With bellows upward, carefully screw bonnet into bonnet cap by hand until it is seated.
7. Holding bonnet in a vise, screw bonnet cap home firmly with a wrench.
8. At this point install new secondary packing if necessary, tightening gland firmly by finger tight as with a standard packed valve. See *"Packing, Chevron Ring" on page 11*.
9. Remove from vise and hand-install connector by hand.
10. With small wrenches on connector and flats on the innervalve, tighten firmly but prevent using any side motion.
11. With body held in a vise as instructed, screw the bonnet, bellows seal and innervalve assembly into the body.
12. When body bonnet assembly is complete, the innervalve should be off seat with the bellows in its free state and should move approximately 1/8 in. when pushed down before touching seat.

⚠CAUTION

WITH VALVES HAVING "P" TRIMS, BE SURE THE PLUG ENTERS THE SEAT BEFORE STARTING THE BONNET THREADS INTO THE BODY.

13. Assemble the topworks to the body-bonnet assembly in the exact reverse order from dismantling. On ATO topworks remember to have air on the diaphragm, rotating the topworks until the topworks and bellows stem butts together in the middle of the connector. Use two wrenches to tighten travel indicator lock nut to preclude twisting the bellows. If the topworks is not in the correct position with the stems butted together in the middle of the connector, rotate the topworks counterclockwise to the correct position before locking down the stem locknut. Do not rotate more than 90°.
14. See *"Stroke Adjustment and Pressure Test" on page 9*.

VALVE POSITIONERS

General

Badger Meter valve positioners use the full force of the air supply pressure to drive the diaphragm or piston of the pneumatic actuator to a position corresponding to the pneumatic instrument signal output from a controller (pressure, temperature, flow, for example) and hold that position, regardless of the forces that tend to change valve position.

Like all valve positioners, Badger Meter positioners have a feedback circuit that measures the position of the actuator's diaphragm or piston. The built-in valve positioner supplies or vents air in response to the control-instrument signal stroking the valve to the required position.

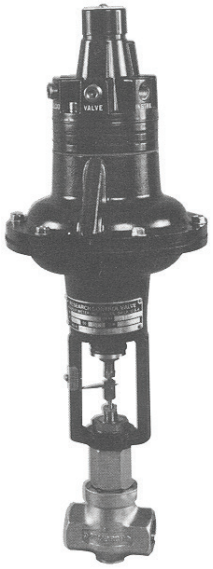


Figure 19: Valve positioner

Integral Mounting

The Badger Meter compact valve positioners incorporate a single axis force-balance principal of operation to insure accurate and stable positioning of Research Control valves. The positioners become an integral part of the valve actuator. In all cases, including bottom loading applications, the built-in valve positioner is mounted directly on the topworks with no external piping or other exposed mechanisms.

Range Springs

The position of the diaphragm or piston in the valve actuator is sensed by the amount of compressive force exerted by the range spring on the valve actuator diaphragm assembly. Standard strokes are 7/16 in. and 9/16 in.. Standard signal ranges are 3…15, 3…9, 9…15 and 6…30 psig. Consult the factory for other ranges.

Top Loading, Air-to-Close

Air pressure from the control instrument is exerted between the two lower diaphragms. Because of the difference in the two diaphragm areas, the resultant force is exerted in an upward direction. In balance condition, the pneumatic force on the diaphragm plus the upward force exerted by the range spring is balanced by the downward force of the zero adjustment spring. In balance condition, positioner vents to atmosphere.

When control-instrument pressure increases, the diaphragm assembly will move upward closing the exhaust port and opening the pilot valve allowing supply air to pass directly to the actuator diaphragm. The supply air will drive the actuator downward. As the actuator moves down, the range spring relaxes until its force decreases enough to offset the increase in control- instrument pressure, allowing the pilot valve to close and exhaust to open. On ATC valves with positioners, the supply pressure should be sufficient for function, but never excessive. For function the positioner supply pressure needs to be a minimum of 3 psig above instrument signal. Excessive supply pressure can result in damage to trims when the innervalve touches the seat and the signal continues down. The positioner sees this as resistance and reacts, causing the full supply pressure to be applied to the main diaphragm in the actuator.

Bottom Loading, Air-to-Open

Air pressure from control instrument is inserted between the dual upper diaphragms and the center diaphragm. Because of the difference in the two diaphragm areas, the resultant force is exerted in a downward direction. In balance condition, the pneumatic force on the diaphragm, plus the downward force exerted by the zero adjustment spring, is balanced by the upward force of the range spring. In balance condition, positioner vents to atmosphere.

When control-instrument pressure increases, the diaphragm assembly will move downward allowing the spool valve to close the exhaust port and allow the supply air to pass through interior porting to the bottom side of the diaphragm or piston in the actuator. The supply air will drive the actuator upward. As the actuator moves up, the range spring will compress until its force increases enough to offset the increase in control-instrument pressure causing the spool valve to move, shutting off supply air to the actuator and opening exhaust.

Adjusting Zero

For ATC valves with type TLDA or Moore 73N12F positioners, zero adjustment is made with 15 psi instrument air (for 12 psi span) to the positioner, turning zero adjustment screw until valve seats at 15 psi.

For ATO valves with type BLRA or Moore 73B positioners, zero adjustment is made with 3 psi instrument air to the positioner, turning zero adjustment screw until valve seats at 3 psi.

Full travel within tolerances governed by the range spring should occur on ATO or ATC valves using the standard 3…15, 3…9, 9…15 and 6…30 psig instrument signal.

NOTE: Factory zero adjustments are made on Research Control valves with positioners, using 90 psig air pressure piped to the upstream valve port, connecting a Tygon or rubber tubing to the downstream port and immersing the end in a water filled container to detect any leakage across the seat during zero adjustment.

Servicing

The Badger Meter valve positioners must be isolated from the system before service or removal can be accomplished. The recommended procedure is to move complete valve with positioner to instrument repair bench where necessary tools and manual set air regulators are available.

To clean pilot or spool valve, remove brass hex head sealing screw under the top cap and with small sharp nose pliers, tweezers or other device, remove and clean pilot or spool valve and replace. On ATC TLDA and Moore 73N positioners, the pilot is a one piece unit that seldom fails due to dirty air or material such as Teflon tape getting into the pilot and causing malfunction. On ATO BLRA and Moore 73B positioners, the functional clearances around the spool valve are very close and more likely to fail due to dirty air or Teflon tape. Clearance is a function of bleed and must be as close as possible, but large enough to function. To replace the diaphragm assembly, unscrew the six screws holding the positioner to the adaptor and remove the positioner assembly. Invert the positioner and remove the two assembly screws in the bottom ring. When assembling the positioner diaphragm assembly to the main housing, make sure to align the index grooves.

Positioners must be correctly assembled in order to function. Individual sub-assemblies, such as the diaphragm assembly, should be replaced as one unit.

TERMINOLOGY

PCV	Pressure Control Valve
LCV	Level Control Valve
TCV	Temperature Control Valve
FCV	Flow Control Valve
Topworks (Actuator)	The assembly that provides force
Positioner	Instrument added or attached to topworks for more precise control
ATO	Air-to-Open. Increasing air signal opens valve
ATC	Air-to-Close. Increasing air signal closes valve
F/O	(Fail Open) Valve opens on air failure
N/O	(Normally Open) Valve opens on air failure
F/C	(Fail Close) Valve closes on air failure
N/C	(Normally Close) Valve closes on air failure
Body Bonnet Assy	That assembly consisting of body, bonnet, gasket, innervalve, stem, seat, packing, gland and yoke nut
Trim Set	The interchangeable components in a set consisting of innervalve, stem and seat
=%	Equal Percentage. Lift versus flow characteristic
Lin.	Linear lift versus flow characteristics
Q.O.	Opening ON-OFF service
P1	Inlet pressure to valve
P2	Downstream pressure from valve
LP	Delta P; Pressure drop across valve
Cv	Flow Coefficient; Water flow at 1 psi pressure drop
Chevron Rings	Packing, molded V-rings (normally 3 per set)
Braid Tef.	Packing, rope-type braided Teflon with Teflon suspensoid lubricant

Control. Manage. Optimize.

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