MAINTENANCE MANUAL INDEX
REDUCED PRESSURE ASSEMBLY
MODELS 860, 880 AND 880V (2 1/2" - 10")

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DESCRIPTION **PAGE**

VANDALISM

If the unit is installed where vandalism may be a problem, the assembly should be protected and secured. A chain can be looped through both shut-off valve handwheels and locked in position to prevent tampering. Test cock valve handles can also be removed. On backflow prevention assemblies installed in conjunction with fire sprinkler systems, a tamper switch can be placed on the OS&Y shut-off valves that will trigger an alarm if an unauthorized closure should occur.

A protective enclosure can be installed over the unit to discourage vandals. If an enclosure is used, it should be installed so that adequate clearance is available for maintenance and testing.

Consult local codes before installing any type of protective enclosure.

FEATURES AND OPERATING PROCEDURES

REDUCED PRESSURE BACKFLOW PREVENTER

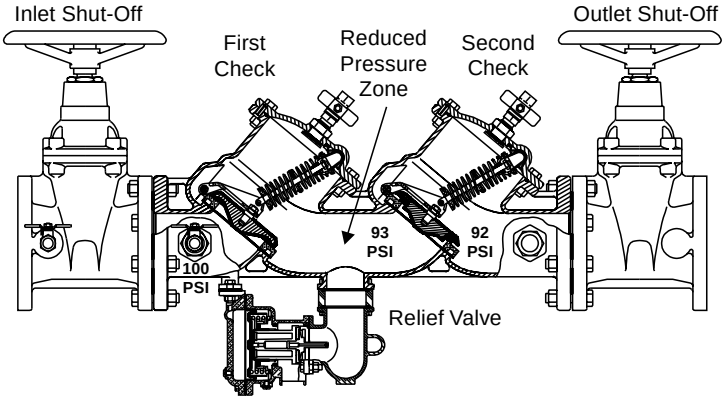
The FEBCO Reduced Pressure Backflow Preventer Assembly consists of two independently operating, spring loaded check valves with a pressure differential relief valve located between the two checks. The pressure drop across the first check valve is approximately 7.0 PSID with no flow. The relief valve consists of a hydraulically balanced diaphragm with the high pressure side hydraulically connected to the upstream side of the first check. The low pressure side is hydraulically connected to the reduced pressure zone, thus the relief valve remains closed during normal operation. The low pressure side of the diaphragm is spring loaded to force the relief valve open when the pressure drop across the first check (and across the diaphragm) reduces to approximately 3.0 PSID. A complete assembly includes two shut-off valves and four test cocks.

Example sectional views below show typical components and flow passages with corresponding pressure readings (no flow conditions) at the various locations within the assembly with 100 PSI line pressure.

NOTE: The 880V, when installed in the vertical orientation, must include vertical support under the second check body section. (See Figure #2.)

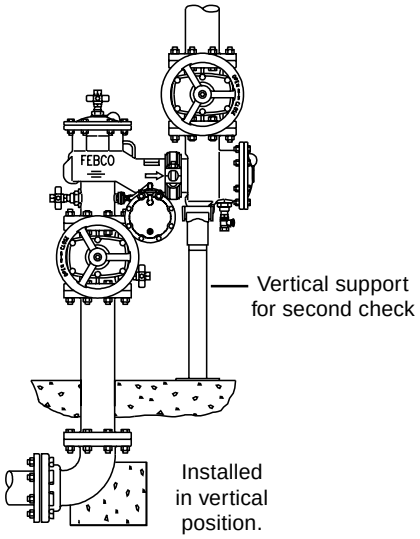
MODEL 860 (2½"-10")

FIGURE #1



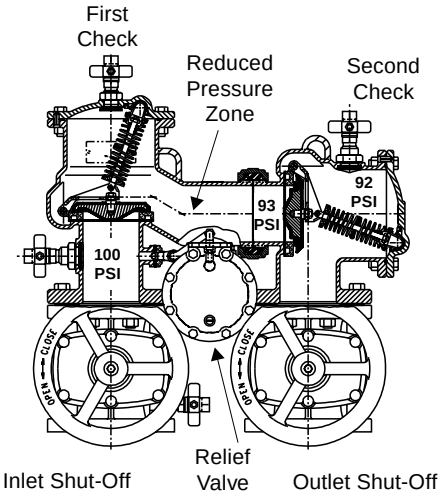
MODEL 880V (2½" - 10")

FIGURE #2



MODEL 880V
Stanard Configuration (2½"-10")

FIGURE #3



TROUBLE SHOOTING GUIDE

With Differential Pressure Gauge

Symptom #1:	Reading:	Problem:
Check Differential Across #1 Check Valve	2 to 3 PSID	Leak in #1 or #2 check valve
	6 to 8 PSID and steady	Malfunctioning pressure relief valve
	2 to 7 PSID and steady	Inlet pressure fluctuating

Symptom #2	Reading:	Problem:
Check Differential Across #1 Check Valve	2 to 3 PSID	#1 check valve held open
	6 to 8 PSID and steady	Malfunctioning pressure relief valve.

Without Differential Pressure Gauge

Symptom #1 and #2:	Result:	Problem:
A) Close Gate Valve #2	If discharge stops	Leak in #2 check valve
	If discharge does not stop	Go to "B"

	Result:	Problem:
B) Open #4 test cock to produce a flow greater than differential relief valve discharge.	If discharge stops	Leak in #1 check valve
	If discharge does not stop	Malfunctioning pressure relief valve

Symptom #1:	Cause:	Solution:
Continuous discharge from relief valve during NO FLOW conditions (Discharge stops with water flow). With this symptom, the pressure drop across the #1 check valve would be 2 to 3 PSID. If a flow of water (more than discharge) is created through the valve, the pressure drop should increase to approximately 7 PSI.	A. Debris fouling #1 check valve.	Inspect and clean
	B. Outlet pressure higher than inlet pressure and debris fouling #2 check valve.	Inspect and Clean
	C. Spring stem not moving freely.	Inspect for dirt or other foreign material
	D. Damaged seat or seat disc.	Inspect and replace.
	E. Leakage at seal under the seat ring.	Inspect and replace seal.

Symptom #2	Cause:	Solution:
Intermittent discharge from relief valve during NO FLOW conditions. With the symptom, the pressure drop across the #1 check valve would be varying from about 2 to 7 PSID.	A. Inlet line pressure variations causing relief valve to discharge.	Eliminate or reduce pressure variations by installing a soft seated, spring loaded check on upstream side of device.
	B. Pressure surges (water hammer) causing relief valve to discharge as pressure wave passes through the zone.	Eliminate or reduce pressure surges

Symptom #3	Cause:	Solution:
Continuous discharge from relief valve during FLOW and NO FLOW conditions. With this symptom, the pressure drop across the #1 check valve would be 7 PSID or more at all times.	A. Seat disc dislodged from cavity in the main stem (this can be caused by pressure surges during initial filling of system lines)	Reposition disc in main stem cavity. Repressurize system slowly.
	B. Debris fouling the relief valve seat	Inspect and clean.
	C. Debris blocking the relief valve sensing passage	Inspect and clean.
	D. Dirt or scale jamming main stem	Inspect and clean, or replace.
	E. Leakage at main stem	Inspect and clean, or replace.

TROUBLE SHOOTING GUIDE - CONTINUED

Symptom #4	Cause:	Solution
Relief valve does not open above 2.0 PSID during field testing.	A. Outlet gate valve not closed completely.	Check for debris blocking gate valve.
	B. Plugged low pressure hydraulic passage (from "ZONE" to inner diaphragm).	Inspect and clean.
	C. Improper alignment of internal parts during reassembly (causing high resistance to movement).	Reassemble.
	D. Jammed main stem due to debris.	Clean.

Symptom #5:	Cause:	Solution:
First check pressure drop is low (less than 5 PSID) during field testing.	A. Debris fouling first check seat.	Inspect and clean.
	B. Debris fouling second seat with backpressure.	Inspect and clean.
	C. Inlet pressure variations causing inaccurate gauge reading.	Eliminate pressure variations. (see (symptom 2A).
	D. Disc does not move freely in arm. (Therefore, disc not parallel to seat ring).	Inspect and clean if required.
	E. Damaged seat or seat disk.	Inspect and replace as required.
	F. Worn guide, bushing or stem.	Inspect and replace as required.
	G. Bearing not properly seated in cover.	Inspect and reassemble.

Symptom #6	Cause:	Solution:
Second check fails to hold back pressure during field testing.	A. Outlet gate valve not closed completely.	Check for debris blocking gate valve.
	B. Debris fouling second check seat.	Inspect and clean.
	C. Disc not moving freely in assembly.	Inspect for dirt or other foreign material.
	D. Damaged seat or seat disk.	Inspect and replace if required.
	E. Worn guide, bushings or stem.	Inspect and replace if required.
	F. Bearing not properly seated in cover.	Inspect and reassemble.

Note: If check valve seat disc has been severely cut at the seat ring diameter, the assembly is being subjected to extremely high and repeated back pressure. Either thermal water expansion or water hammer are the most likely causes.

GENERAL SERVICE PROCEDURES

1. FEBCO backflow prevention assemblies can be serviced with commonly available tools and are designed for ease of maintenance. The assemblies are designed to be serviced in line, so the unit should not need to be removed from the line during servicing. **NO special tools required.**

2. The most common cause of check fouling and relief valve discharge is dirt and debris in the seating areas. The line should be flushed clean of debris before installation of the assembly. To flush the line after installation of the assembly, slowly close the inlet shut-off valve, remove the covers and spring assemblies of both check valves and open the inlet shut-off valve to allow sufficient flow of water through the assembly to clear all sand, debris, etc. from the line. If debris in the water continues to cause fouling, a strainer may be installed upstream of the assembly. (Check local codes.)

3. Rinse all parts with clean water before reassembly.

4. Carefully inspect diaphragms, seals and seating surfaces for damage or debris. If the check valve seat disc has been severely cut at the seat ring diameter, the assembly has been subjected to extremely high and repeated back pressure. Either thermal water expansion or water hammer are the most likely causes. If back pressure persists, consider installation of a pressure relief valve downstream of the assembly.

5. Use caution to avoid damaging any guiding surfaces while handling parts. Do not force parts together. The o-ring seals used in FEBCO assemblies require only a small tightening force to insure a positive seal.

6. Test unit after servicing in accordance with the locally approved test method to insure proper operation.

7. Refer to applicable parts list and cut-a-ways (See pages 10-15 for visual aid information).

8. Use petroleum jelly (food grade).

CHECK VALVE DISASSEMBLY

SPRING MODULE REMOVAL (See pages 10-11)

1. Slowly close outlet shut-off valve and inlet shut-off valve. Bleed residual pressure by opening #4, #3, and #2 test cocks.

2. Remove cover bolts, removing the two bolts last that are located next to the retainer pin. Remove cover.

   NOTE: Spring module is positioned in the body by the cover. Spring module is captured.

3. Remove pivot bearing (item 13) from the upper spring retainer of the spring module. Inspect pivot bearing (item 13) and bearing socket (item 15). Small hole in bearing socket indicates replacement is required. Remove retaining clip (item 5.1) from groove on one end of the load pin (item 7). Hold spring module with one hand while sliding out load pin (item 7) from arm (item 4). Lift out spring module and inspect for wear or damage. Replace spring module if necessary .

CHECK DISK REMOVAL (See pages 10-11)

1. Remove jam nut (item 16) and washer (item 17) from check disc stem threads. Lift the arm and remove the check disc (item 6). Inspect sealing surface for debris or damage. Replace check disc if necessary.

   NOTE: When jam nut (item 6) is tight, check disc is designed to “wobble.”

SEAT RING ASSEMBLY REMOVAL (See pages 10-11)

NOTE: Remove the seat ring assembly only if the seat ring (item 3) or arm (item 4) appear to be worn or damaged.

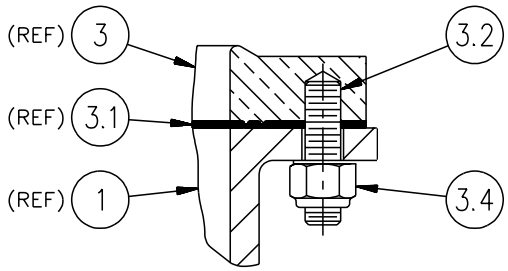
1. Remove locknuts (item 3.4) and washers (item 3.3). (See Figure #4 below.)

2. Remove seat ring assembly.

   NOTE: When reassembling, tighten locknuts to 12 - 15 ft./lbs. If leaking occurs around bolt, further tighten until leaking stops. Do not over tighten.

3. Remove retaining clip (item 5) from one end of the swing pin (item 4.2). Hold arm (item 4) while sliding out swing pin (item 4.2). Inspect bushings (item 4.1) and pin (item 4.2) for wear or damage. Replace if necessary. Inspect gasket (item 3.l) for debris and/or damage. Replace if necessary.

   NOTE: Reverse the procedure above, to reassemble the components. Seat ring will only fit into body one way. Check alignment of seat ring if studs don't align with body holes. Gasket is also non-symmetric. Both seat ring and gasket have a notch that indicates non-symmetric hold. Clean all parts thoroughly with clean water before reassembly. Reassemble and bleed test cocks #4, and #3. Repressurize the assembly and test assembly in accordance with the locally approved test maethod.



SEAT RING
FIGURE #4

RELIEF VALVE REMOVAL

(See pages 10-11)

1. Remove capscrews (item 24), washers (item 24.1) and nuts (item 25) at base of relief valve body and hydraulic sensing port. Remove relief valve seat ring (item 34) from bottom of relief valve. Inspect seat ring (item 34), seat disc (item 32), and guide (item 33) for debris, wear, or damage. Replace as necessary. (See below.)

RELIEF VALVE SEAT DISC REPLACEMENT

(See pages 10-11)

1. Separate relief valve from elbow and sensing line flange. Remove cover bolts (item 22) and cover (item 20).

2. Lift out diaphragm (item 37) and inspect for damage. Replace if necessary.

3. Grasp spring button (item 28) and pull out relief valve module.

4. Turn over relief valve assembly module so that guide (item 33) stem is facing up. Use tabs on guide (item 33) to loosen guide. Unscrew guide and replace seat disc (item 32).

5. **Reassemble in reverse order.**

RELIEF VALVE DISASSEMBLY (See pages 10-11)

1. Remove o-ring (item 34.1) and RV seat ring (item 34) from the bottom of RV body.

2. Remove RV cover (item 20) from RV body by removing eight capscrews (item 22).

3. Remove diaphragm from RV body. Remove RV assembly module from RV body (item 21).

4. Loosen tabs on guide (item 33) and remove guide and seat disc (item 32), remove instruction label (item 28.2) from center of button, covering flow screw (item 28.1).

5. Loosen flow screw (item 28.1) **CAUTION spring is captured.** Remove spring (item 29) from main guide (item 31), remove flow washer (item 30) from top of diaphragm (item 37).

6. Remove stem (item 30) and stem washer (item 30.1), on end of stem, from diaphragm guide assembly.

7. Unscrew retainer from main guide (item 31) and remove slip ring (item 38.1) from retainer.

8. Remove small diaphragm (item 37) from main guide (item 31).

RELIEF VALVE ASSEMBLY (See pages 10-11)

NOTE: Clean all parts thoroughly with clean water before reassembly.

1. Place small diaphragm (item 37) into main guide (item 31) with beaded side of flange pointed down.

2. Drop slip ring (item 38.1) into retainer (item 38) and screw retainer into main guide (item 31) as shown, being careful not to bind the diaphragm's cup shape with your finger.

3. Place stem washer (item 30.1) on end of stem (item 30) and insert stem into diaphragm guide assembly. When the stem is fully inserted it does not bottom out against diaphragm, so do the following: Press diaphragm against stem with your thumb and forefinger and slowly pull the stem back out with the diaphragm. Place stem guide assembly on bench with diaphragm pointed up.

4. Place flow washer (item 39) on top of diaphragm (item 37) with slots facing up and with holes lining up. Set spring (item 29) on main guide (item 31) and compress spring with button (item 28). With spring fully compressed insert and tighten down flow screw (item 28.1), being careful not to twist button or assembly which will distort the diaphragm.

5. Stick instruction label (item 28.2) in center of button, covering flow screw (item 28.1). Install seat disc (item 32) into stem (item 30) and install guide (item 33) to retain disc. Using tabs on guide, tighten until shoulder on guide contacts stem.

6. Lubricate o-ring (item 31.1) with petroleum jelly (food grade) and install on main guide (item 31).

7. Install assembly into relief valve body (item 21). Place large diaphragm (item 27), with cap facing down, into RV body and fold over stem assembly button. Pull diaphragm flange up onto RV body flange.

8. Assemble RV cover (item 20) to RV body using eight capscrews (item 22) and tighten to 120 inch-pound torque wrench limit.

9. Insert RV seat ring (item 34) into bottom of RV body (aligning it with guide (item 33)) and install o-ring (item 34.1).

   N-SHAPE (V) ONLY - Assemble complete relief valve assembly to valve body as shown with o-ring (item 35) and back-up ring (item 35.1), using four capscrews (item 24), eight washers (item 24.1) and four nuts (item 25). Tighten to 120 inch-pounds torque wrench limit. Attach sensing line flange cover (item 36). **Do not over tighten.**

   IN-LINE ONLY - Assemble completed unit to valve body and elbow with gasket (item 26) install with screen facing valve body) using six capscrews (item 24), twelve washers (item 24.1) and six nuts (item 25). Tighten to 120 inch-pounds torque wrench limit. **Do not over tighten.**

TESTING

All mechanical devices should be inspected on a regular basis to ensure they are working correctly. The assembly should be tested at time of initial installation, after servicing or maintenance, and at least annually thereafter. Acceptable test procedures are published by Foundation for Cross Connection Control and Hydraulic Research at the University of Southern California (USC), The American Water Works Association (AWWA), The American Society of Sanitary Engineering (ASSE Series 5000) and the Canadian Standards Association (CAN/CSA B64•10). Please consult the regulatory authority in your area for more specific information.

FREEZE PROTECTION

The Reduced Pressure Backflow Prevention Assembly may be subject to damage if the internal water is allowed to freeze. It is suggested that all assemblies be installed with resilient seated shut-offs so that a drip tight closure can be achieved to prevent refilling of the assembly after the freeze protection procedure is performed. The unit must be protected from freezing using a heated enclosure, insulation using heat tape, or other suitable means. If the system will be shut down during freezing weather, use the following procedure to drain internal passages. A system should have a shut off valve located upstream of freeze protection area, and a means for draining upstream of the #1 shut off and downstream of the #2 shut-off valve.

REDUCED PRESSURE ZONE AND RELIEF VALVE

For more detailed instructions on freeze protection procedures request "Freeze Protection Instructions for RP Devices."

1. Slowly close supply valve upstream of freeze protected area, open all test cocks on the backflow preventer. All water within the zone will be drained to the lowest point of the relief valve discharge port (relief valve seat). A small amount of water will remain in the bottom of the main valve body, but this is not sufficient to cause freeze damage. Leave test cocks and ball valves in half open, half closed position for the winter.

2. All water on the inlet side, and within the zone, will be drained down to the #1 test cock on the Model 880 and 880V. All water will be drained from the inlet side and the zone of the Model 860.

3. For sizes 2½" - 10", remove both drain plugs from bottom of relief valve assembly. Replace when draining is complete.

4. Drain upstream of the #1 shut-off valve and downstream of the #2 shut-off valve.

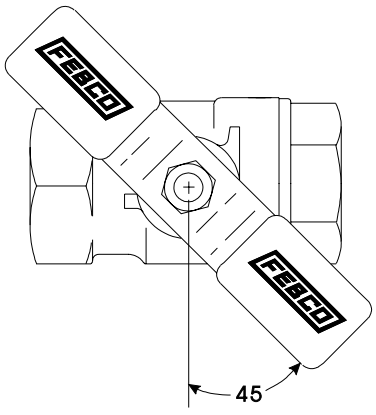
5. Proceed to step 6 Ball Valve Shut Off Draining Procedure.

BALL VALVE SHUT-OFF DRAINING PROCEDURE

6. If the assembly has been installed with ball valve shut-off valves, they must also be properly drained to prevent freeze damage. After the draining procedure has been completed on the backflow prevention assembly, position all ball valve shut-offs and test cocks in a half open/half closed (45 degree) position. (see Figure #5)

7. Open the ball valve approximately 45 degrees, while draining the pipeline and assembly, to allow water between the ball valve and valve body to drain. Leave the ball valve in this position for the winter to prevent freeze damage.

8. The ball valves must be fully closed before the system is repressurized. **OPEN AND CLOSE BALL VALVES SLOWLY TO PREVENT DAMAGE TO THE SYSTEM CAUSED BY WATER HAMMER.**



BALL VALVE (2½" - 2")
Figure #5