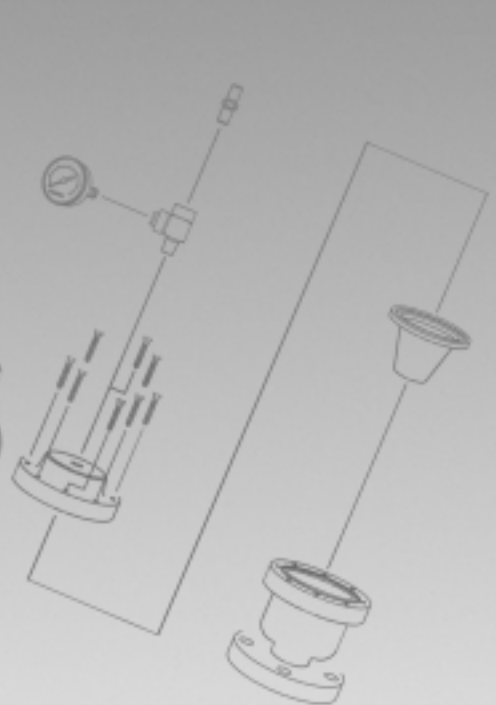
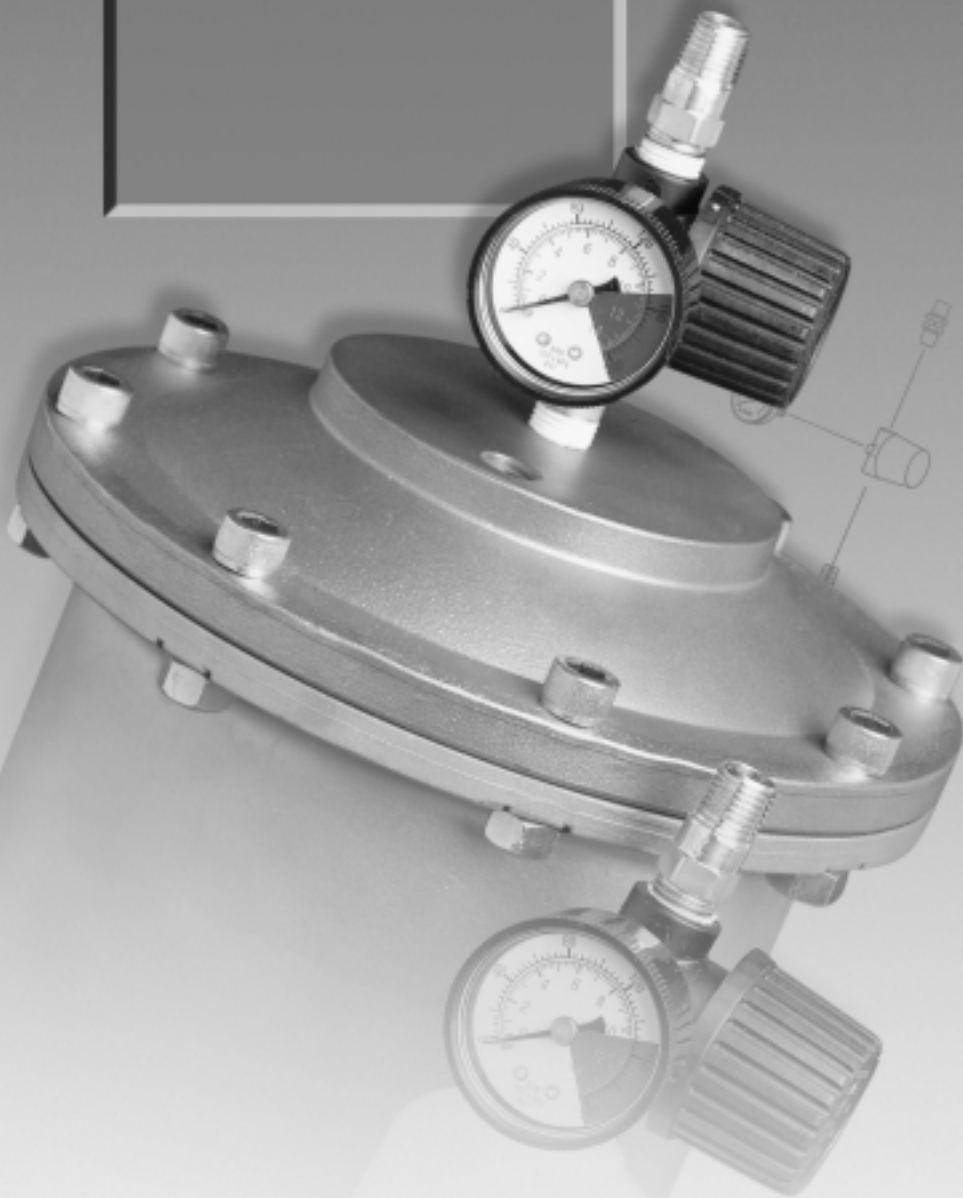


CALL 1-800-577-8111 FOR SALES AND SUPPORT

BF

Engineering Operation & Maintenance



WILDEN[®]

A **DOVER** COMPANY

THE EQUALIZER[®]
WILDEN AUTOMATIC SURGE DAMPENER

**BF^{1/4}, BF^{1/2},
BF1, BF1^{1/2},
BF2, BF3,
& BF4**

THE BF EQUALIZER®

All reciprocating pumps experience a pressure fluctuation. The BF Equalizer® minimizes unwanted pressure fluctuation by providing supplementary pumping action. This is accomplished by using a bladder within the BF Equalizer® as a separation membrane between the air side and liquid side. As a positive displacement pump begins its next stroke, the pressure falls in the system and the BF Equalizer® supplies additional pressure to the discharge line via bladder movement. This additional pressure virtually eliminates pressure variation and pulsation.

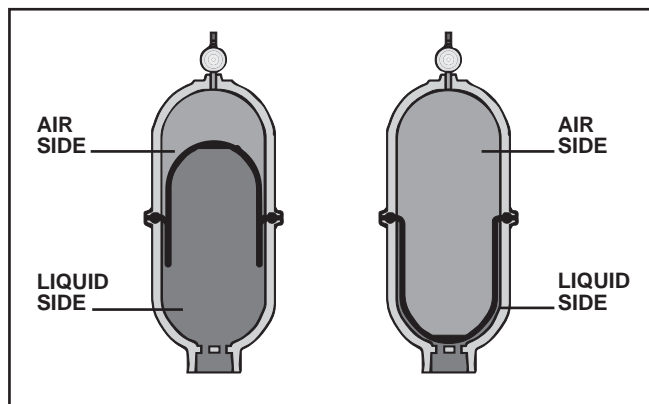
BF Equalizers® are available in six sizes with a variety of wet-

ted, non-wetted, and bladder materials. They can be installed on the suction of the pump as a suction stabilizer or on the discharge of the pump as a pulsation dampener. Three air regulator types are available to meet your application specifications: Automatic, Manual Adjustment, or Suction Stabilizer.

BF Equalizers® control fluid dynamics to ensure efficient and safe use of process systems. They have a proven track record in protecting your liquid process system from unwanted pulsation. Contact your local Wilden distributors for further information on the Equalizer® and other pumping solutions.

PRINCIPLES OF OPERATION

BF Equalizers® operate on the principle that volume is inversely proportional to pressure ($P_1V_1=P_2V_2$). Compressed air or gas is introduced into the air chamber of the BF Equalizer® to a specified pressure. The gas is entrapped by the elastomeric bladder, which prevents contact between the process fluid and compressed gas. Without the bladder, the gas will dissolve into the fluid and cause product contamination. When a pulse is created, fluid enters the wetted chamber of the BF Equalizer®, displacing the bladder, compressing the gas and absorbing the shock. When the liquid pressure decreases, the gas expands, pushing the fluid back into the process line, virtually eliminating pressure variation and pulsation.



AIR CONTROL OPTIONS

MANUAL

Manual BF Equalizer® models are equipped with a self-relieving regulator. It requires a permanent supply of compressed air and allows for easy adjustment of internal air pressure. This model can be used on the suction or discharge side of the pump. It is most effective when the air supplied is 4–6 psi below pump head pressure.

AUTOMATIC

Automatic BF Equalizer® models are equipped with an automatic valve installed on the air chamber. The Automatic BF Equalizer® model requires a permanent supply of compressed air and is self-adjusting to varying system pressure. It is used on the discharge side of air-operated pumps in varying pressure systems where manual adjustments are not feasible.

PROTECT

- Pipes and fittings from pulsation and vibration
- Valuable meters and in-line instrumentation
- Pump and valves from hydraulic shock and pressure surges
- Employees and the environment from leaked hazardous chemicals

ENSURE

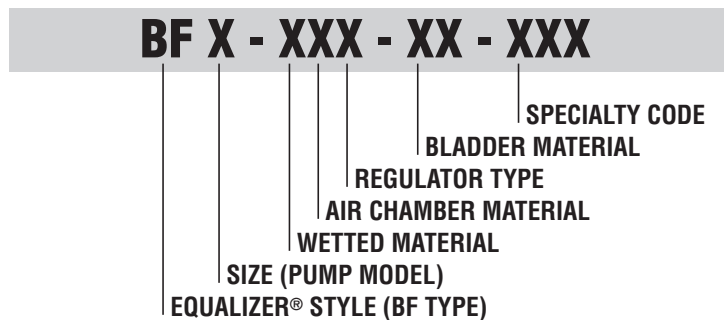
- Displacement per stroke accuracy and repeatability
- Uniform application of material in spraying and coating applications
- Steady pressure flows to filters which leads to increased filter life
- Complete suction stroke filling of pump liquid chamber

PREVENT

- Foaming, splashing and degradation of product
- Ruptured pipes and fittings due to thermal expansion and hydraulic shock
- Pump cavitation and the resulting premature diaphragm failure
- Hazardous material spills from failed equipment

WILDEN BF EQUALIZER®

DESCRIPTION LEGEND



SIZE (PUMP MODEL)

- ¼ = ¼" PUMP MODELS
- ½ = ½" PUMP MODELS
- 1 = 1" PUMP MODELS
- 1½ = 1½" PUMP MODELS
- 2 = 2" PUMP MODELS
- 3 = 3" PUMP MODELS
- 4 = 4" PUMP MODELS

WETTED MATERIAL

- A = ALUMINUM
- G = CONDUCTIVE ACETAL
- H = HASTELLOY
- K = PVDF (KYNAR)
- P = POLYPROPYLENE (GLASS-FILLED)
- S = STAINLESS STEEL

AIR CHAMBER MATERIAL

- A = ALUMINUM
- G = CONDUCTIVE ACETAL
- H = HASTELLOY®
- K = PVDF (KYNAR)
- N = NORYL
- P = POLYPROPYLENE (GLASS-FILLED)
- S = STAINLESS STEEL

AIR REGULATOR TYPE

- A = AUTOMATIC
- M = MANUAL ADJUSTMENT
- S = SUCTION STABILIZER

BLADDER TYPE

- BN = BUNA-N
- FG = FOOD GRADE SILICONE
- ND = NORDEL®
- NE = NEOPRENE
- TF = TEFLON®
- VT = VITON®
- W = WIL-FLEX™

SPECIALTY CODES

- 040 = BOLTED, ANSI FLANGE
- 041 = BOLTED, DIN FLANGE
- 070 = SANIFLO^{FDA}
- 072 = SANIFLO^{USDA}
- 280 = BOLTED NPT
- 281 = BOLTED BSP

BLADDER OPTIONS & TEMPERATURES

COMPOUND	TEMP. LIMITS	SUITABLE APPLICATION
Neoprene	0°F to 200°F -18°C to 93°C	Good abrasion resistance and flex; use with moderate chemicals.
Buna-N (Nitrile)	10°F to 180°F -12°C to 82°C	Good flex life; use with petroleum, solvents and oil-based fluids.
Nordel® (EPDM)	-60°F to 280°F -51°C to 137°C	Use in extreme cold; good chemical resistance with ketones, caustics.
Polyurethane	20°F to 150°F - 6°C to 65°C	Good flex life and excellent abrasion resistance; use in non-aggressive applications.
Viton®	-10°F to 350°F -23°C to 176°C	Use in hot and aggressive fluids; good with aromatics, solvents, acids and oils.
FDA Silicone	-20°F to 300°F -29°C to 149°C	FDA-approved food grade material; for use in food and pharmaceutical processing. Similar characteristics of non-FDA materials.
Teflon® PTFE	40°F to 220°F 4°C to 104°C	Bellows design; excellent flex life; use with highly aggressive fluids.
Wil-Flex™	-20°F to 250°F -29°C to 121°C	Low cost alternative to Teflon® in many acidic and caustic applications.



Teflon® bellows are machined from solid PTFE rod and backed by a three-year guarantee of performance.

CAUTIONS – READ FIRST

- CAUTION:** Always wear safety glasses when installing, operating, or repairing pumps or BF Equalizers®.
- WARNING:** Remove all pressure from BF Equalizer® and pump system before attempting maintenance.
- CAUTION:** Charge BF Equalizers® with compressed air or nitrogen only; do not use oxygen.
- CAUTION:** Do not exceed 125 psig (8.6 Bar).

- CAUTION:** Plastic BF Equalizers® are not UV stabilized. Direct sunlight for extended periods of time can cause deterioration of plastic.
- CAUTION:** If a system pressure test is to be performed, BF Equalizers® must be charged with 80% of the system test pressure prior to test. This will avoid possible bladder damage.
- Temperature and pressure affect the strength and chemical resistance of plastic and rubber. Consult factory for assistance.

Buna-N, Nordel and Viton are registered trademarks of DuPont Dow Elastomers.
Teflon is a registered trademark of DuPont.

WILDEN BF EQUALIZER® INSTALLATION

MOUNTING POSITION

AUTOMATIC AND MANUAL MODELS

Mount the BF Equalizers® as close to the pump discharge as possible to absorb the pressure fluctuation at its source. If using a flexible connector to isolate the pump from the system piping (which is recommended), the BF Equalizer® should be mounted to the pump discharge manifold. The flexible connector should then be attached between the BF Equalizer® tee and the rest of the piping system.

Since pressure is equal in all directions, the BF Equalizer® can be installed in many orientations — vertical, horizontal, or upside down. Wilden does recommend a vertical position for better draining of the unit. Limitations for horizontal and upside-down mounting include applications or fluids that have high specific gravity, high viscosity, settling of heavy material or possible air entrapment concerns.

AIR LINE CONNECTION

AUTOMATIC AND MANUAL MODELS

Using a ¼" flexible air hose, run an air line to the top of the BF Equalizer® and connect it to the brass one-way check valve on the top of the regulator (Manual model) or to the ¼" NPT connection located on the top of the Automatic model. The air supply to the BF Equalizer® must be **greater** than the pump discharge and/or pump pressure. If the dampener is being used in conjunction with a Wilden air-operated, double-diaphragm

pump, a tee can be used to run the air line to the dampener from the pump's air supply line. The tee must be placed in the air supply line **before** any pump controller or instrumentation, such as filter, regulator, lubricator or other pump control valves. Exception: Automatic models fitted with Teflon® bellows should receive the air supply after (downstream from) the pump air controls.

CHARGING AND START-UP

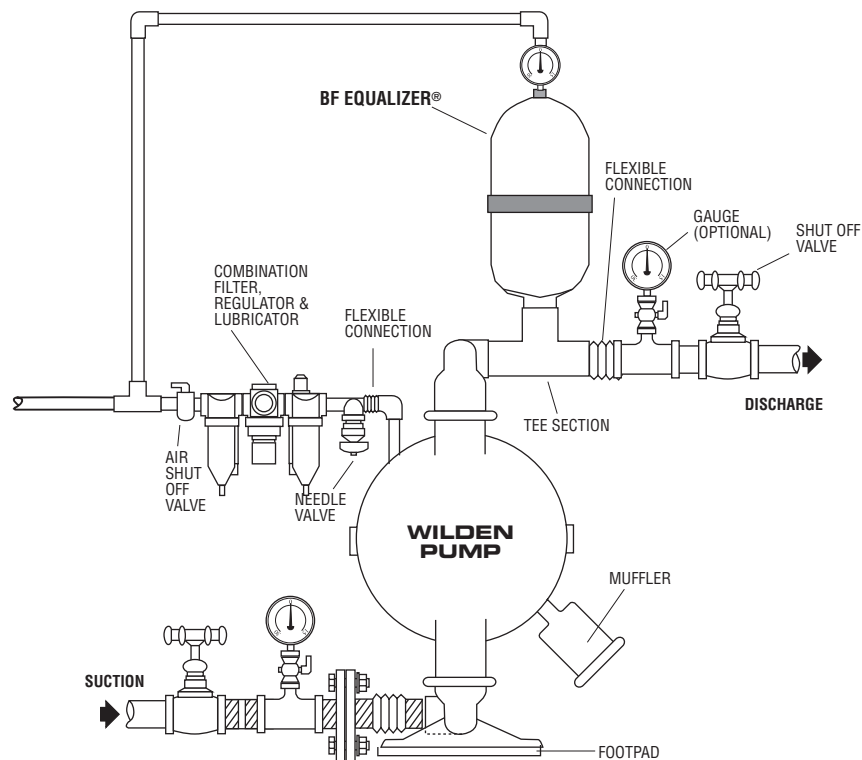
AUTOMATIC MODELS

Prior to starting the pump, Automatic models must have the air supply connected as stated above and compressed air available to the BF Equalizer® prior to pump start-up to avoid possible bladder rupture. The Automatic model pressure gauge will remain at zero pressure even after the line is connected because the dampener will only allow air into the air chamber when it is required to offset increases to the liquid discharge head. Once the air supply line is attached to the one-way check valve and air is available to the dampener, the pump can be started. No further adjustments are necessary.

MANUAL MODELS

Prior to starting the pump, charge the BF Equalizer® with air line pressure to exceed the system pressure (maximum of 150 psi) by opening the regulator. Start the pump to generate head. As head is achieved, gradually decrease the regulated air supply pressure into the BF Equalizer® by adjusting the regulator on top. Allow the system to respond to the adjustment (this may take a minute or two) before continuing any further adjustments. Generally, pulsation is most effectively minimized when the air supply is regulated at 4–6 psi below the pump head.

SUGGESTED INSTALLATION Automatic & Manual Models



SUCTION STABILIZER INSTALLATION

Install the Suction Stabilizer, in line, as close to the pump inlet as possible. No other equipment should be installed between the Stabilizer and the pump. The Stabilizer should be no more than ten pipe diameters from the pump inlet. If using a flexible

connector from the pump to the system piping, the Stabilizer should be installed to the pump inlet manifold. The flexible connector should then be attached between the Suction Stabilizer tee and the rest of the piping system.

SUCTION STABILIZER CHARGING & START-UP

POSITIVE INLET PRESSURE (TANK IS ABOVE PUMP)

1. Close the ball valve (Part #2, Figure 1).
2. Attach an air chuck (not included) to venturi valve (Part #1, Figure 1).
3. Open the ball valve (Part #2, Figure 1) and with a finger, partially cover the exhausting air from the venturi valve. Observe the compound gauge (Part #3, Figure 1) and when the pressure in the Stabilizer reaches 50% of the pump's inlet pressure, close the ball valve. When proper stabilizer pressure is reached, pump inlet pressure gauge will have minimum fluctuation.

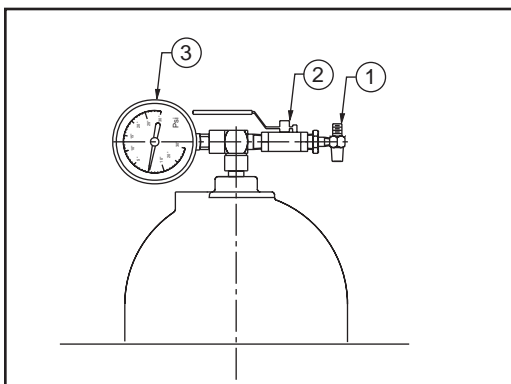
NEGATIVE INLET PRESSURE (TANK IS BELOW PUMP)

Note: to properly set the Stabilizer, a vacuum gauge must be installed in the inlet piping.

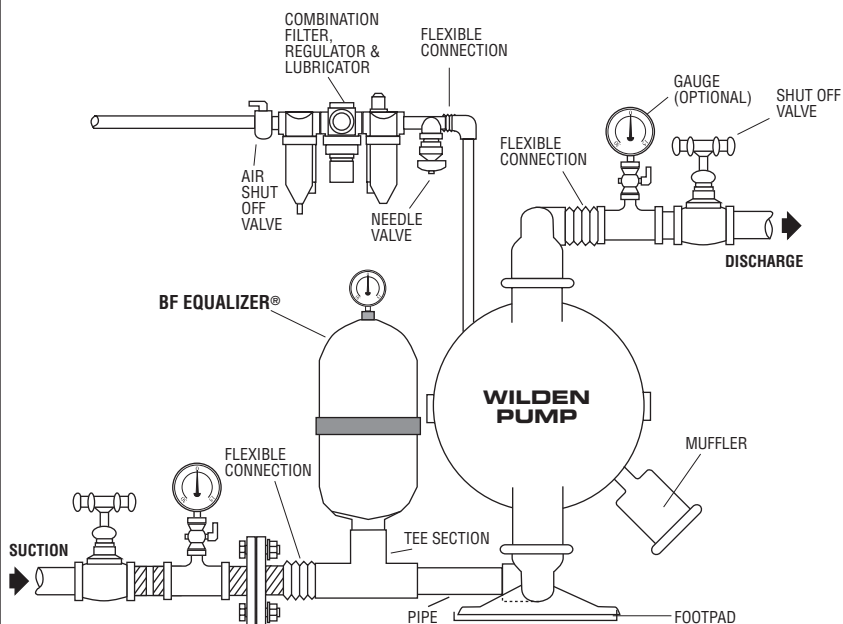
1. Close ball valve (Part #2, Figure 1).
2. Supply air to pump.
3. Attach an air chuck (not included) to venturi valve (Part #1, Figure 1).
4. Open the ball valve. As compressed air flows through the venturi valve, observe gauge (Part #3, Figure 1) on the Stabilizer. As soon as the stabilizer gauge reads 5 to 6 inches of mercury, close the ball valve. If the ball valve is left open too long, the bladder will be drawn to the top of the Stabilizer (see caution below).
5. The vacuum observed on the Stabilizer's gauge should read approximately the same as that on the inlet pipe's gauge. The vacuum may need to be adjusted up or down to obtain minimum movement on pipe vacuum gauge.

CAUTION: Excessive vacuum applied to the Stabilizer will cause the bladder to be drawn completely to the top of the air chamber. The Stabilizer will be less effective in this condition. If this occurs, turn pump off and then add 10 psi pressure to the Stabilizer to push the bladder back down and then repeat Steps 1 through 4 above.

FIGURE 1



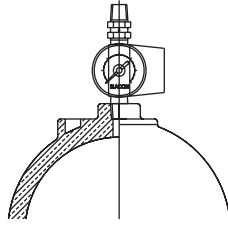
SUGGESTED INSTALLATION Suction Stabilizer



WILDEN BF EQUALIZER®

AIR CONTROL OPTIONS

MANUAL MODEL



CONTROL CONFIGURATION:

- Units come with an adjustable air regulator assembly, mounted on a single port. Includes an air regulator, a gauge, and a one-way brass check valve.

MAXIMUM OPERATING PRESSURES:

- Plastics: 150 psi
- Metals: 150 psi

REQUIREMENTS:

- Must have a constant air supply/connection.
- Must be installed within 10 pipe diameters of the pump discharge.
- Must have an 80% charge of the discharge **operating** pressure.

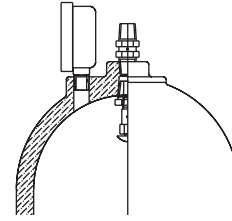
PARTICULARS:

- Designed for air-operated pumps.
- Performs best on system with a steady or constant pressure.
- Adjustable air regulator allows user to manually bleed or charge unit to 80% of system pressure, or to fine-tune for the best setting.
- May be used on any type of positive displacement pump as long as it has an air supply piped to it.

APPLICATION AREAS & PRESSURE SETTING:

- Pulsation dampener at pump discharge.
Charged to 80% of system **operating** pressure.

AUTOMATIC MODEL



CONTROL CONFIGURATION:

- Units come with a gauge mounted on its own port, and an automatic valve assembly on a separate port, which includes a one-way brass check valve connected to an internal poppet valve assembly.

MAXIMUM OPERATING PRESSURES:

- Plastics: 150 psi
- Metals: 150 psi

REQUIREMENTS:

- Must have a constant air supply/connection.
- Must be installed within 10 pipe diameters of the pump discharge.

PARTICULARS:

- Designed for air-operated pumps.
- Specially designed to operate on systems with a varying system pressure
- Automatic unit is used on applications such as a filter press, where the system pressure will steadily rise.
- Automatically self-adjusts as the system pressure rises or falls. Unit does not require air to be bled out; unit will automatically reset itself to be ready to start dampening again when the system restarts.

APPLICATION AREAS & PRESSURE SETTING:

- Pulsation dampener at pump discharge.
(Just attach constant air supply and unit is ready.)

MAINTENANCE NOTES

Gas molecules will diffuse through elastomer membranes, the speed of which depends on elastomer material, temperature and pressure/vacuum. As a rule of thumb, the pre-charge pressure should be checked every three months. When working with a vacuum, pre-charge vacuum checks should occur frequently during

the initial one-month period to ensure vacuum seal. Checks must occur when no system pressure is present or inaccurate readings will be recorded. If temperature is above ambient, checks should be performed more frequently. A proper gas charge is the key to dampener effectiveness and bladder life.

WEAR PARTS FOR BF EQUALIZER® MODELS

PUMP MODEL	QTY REQUIRED	PART DESCRIPTION	PART NUMBER
BF 1/4	1	BLADDER, NEOPRENE	73-1025-51
BF 1/4	1	BLADDER, BUNA-N	73-1025-52
BF 1/4	1	BLADDER, NORDEL® (EPDM)	73-1025-54
BF 1/4	1	BLADDER, FOOD GRADE SILICONE	73-1025-80
BF 1/4	1	BLADDER, VITON®	73-1025-53
BF 1/4	1	BELLOWS, TEFLON®	73-1025-55
BF 1/4	2	O-RING, TEFLON®-ENCAPSULATED	73-1070-60
BF 1/4	1	BELLOWS, TEFLON®	73-1027-55
BF 1/4	2	O-RING, TEFLON®-ENCAPSULATED	73-1071-60
BF 1/2	1	BLADDER, NEOPRENE	74-1025-51
BF 1/2	1	BLADDER, BUNA-N	74-1025-52
BF 1/2	1	BLADDER, NORDEL® (EPDM)	74-1025-54
BF 1/2	1	BLADDER, FOOD GRADE SILICONE	74-1025-80
BF 1/2	1	BLADDER, VITON®	74-1025-53
BF 1/2	1	BELLOWS, TEFLON®	74-1026-55
BF 1/2	2	O-RING, TEFLON®-ENCAPSULATED	74-1070-60
BF1	1	BLADDER, NEOPRENE	75-1025-51
BF1	1	BLADDER, BUNA-N	75-1025-52
BF1	1	BLADDER, NORDEL® (EPDM)	75-1025-54
BF1	1	BLADDER, FOOD GRADE SILICONE	75-1025-80
BF1	1	BLADDER, VITON®	75-1025-53
BF1	1	BELLOWS, TEFLON®	75-1025-55
BF1	2	O-RING, TEFLON®-ENCAPSULATED	75-1070-60

PUMP MODEL	QTY REQUIRED	PART DESCRIPTION	PART NUMBER
BF1 1/2	1	BLADDER, NEOPRENE	76-1025-51
BF1 1/2	1	BLADDER, BUNA-N	76-1025-52
BF1 1/2	1	BLADDER, NORDEL® (EPDM)	76-1025-54
BF1 1/2	1	BLADDER, FOOD GRADE SILICONE	76-1025-80
BF1 1/2	1	BLADDER, VITON®	76-1025-53
BF1 1/2	1	BELLOWS, TEFLON®	76-1026-55
BF1 1/2	2	O-RING, TEFLON®-ENCAPSULATED	76-1070-60
BF2	1	BLADDER, NEOPRENE	77-1025-51
BF2	1	BLADDER, POLYURETHANE	77-1025-50
BF2	1	BLADDER, BUNA-N	77-1025-52
BF2	1	BLADDER, NORDEL® (EPDM)	77-1025-54
BF2	1	BLADDER, FOOD GRADE SILICONE	77-1025-80
BF2	1	BLADDER, VITON®	77-1025-53
BF2	1	BELLOWS, TEFLON®	77-1026-55
BF2	2	O-RING, TEFLON®-ENCAPSULATED	77-1070-60
BF3 & BF4	1	BLADDER, NEOPRENE	78-1025-51
BF3 & BF4	1	BLADDER, POLYURETHANE	78-1025-50
BF3 & BF4	1	BLADDER, BUNA-N	78-1025-52
BF3 & BF4	1	BLADDER, NORDEL® (EPDM)	78-1025-54
BF3 & BF4	1	BLADDER, FOOD GRADE SILICONE	78-1025-80
BF3 & BF4	1	BLADDER, VITON®	78-1025-53
BF3 & BF4	1	DIAPHRAGM, TEFLON®	78-1010-55
BF3 & BF4	1	BACKUP DIAPHRAGM, NEOPRENE	78-1050-51