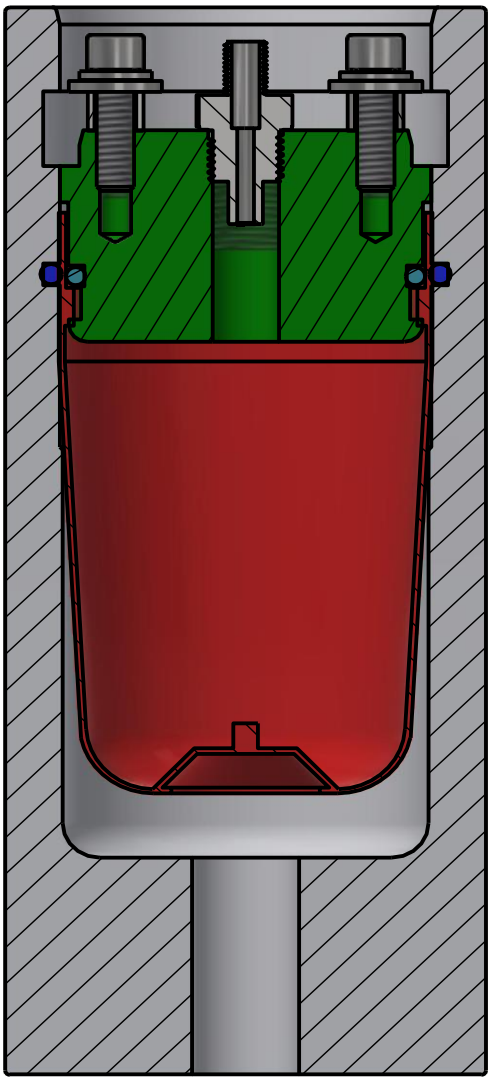
FLOWDEFENDER™ Series

Installation, Operation, & Maintenance



FLOWDEFENDER™ Series Gas Charged Pulsation Control Devices

Typically Utilized in API 675 Chemical Dosing & Metering & Industrial Applications Worldwide

PERFORMANCE PULSATION CONTROL

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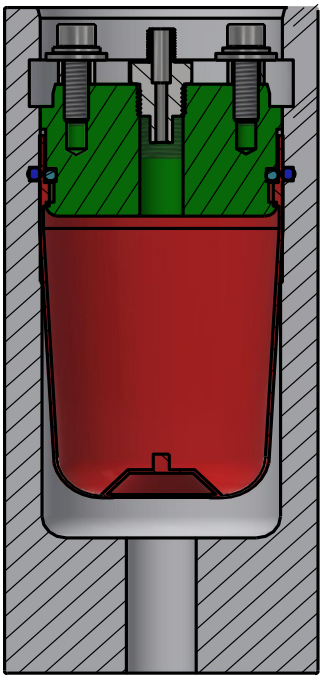
Issued: *11/2024.* ***Supersedes:*** *None Prior*

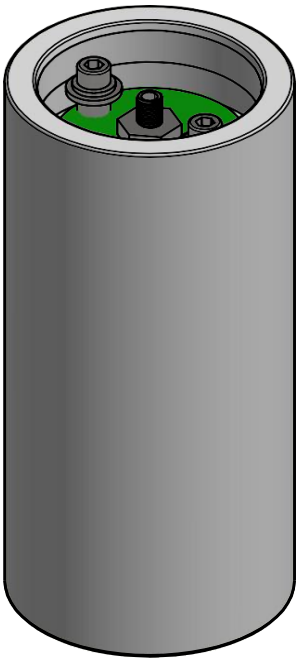
This manual describes the installation, operation, and maintenance procedures applicable to the ***FLOWDEFENDER™*** Series Pulsation Dampeners manufactured by Performance Pulsation Control, Inc.

The information contained herein reflects recommendations based on industry best practices and recognized safety protocols. Use of the information and procedures contained in this manual is voluntary and to be implemented at the user's sole discretion.

The user is always responsible for operating and maintaining pulsation dampeners in a safe manner that conforms to the users established business practices and is in conformance with applicable regulations.

NOTE: Please read all instructions carefully before installing, operating, maintaining and charging this equipment. Contact ***Performance Pulsation Control, Inc.*** for assistance or questions concerning the information in this manual.





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GENERAL

The ***FLOWDEFENDER™*** Series pulsation dampeners can be used as Reciprocating Pump suction or discharge dampeners, Thermal Expansion Compensators, and Accumulation Dampeners. They all function by having compressible nitrogen gas on one side of a separating diaphragm and fluid on the other side connected to the system piping. When used correctly, they are totally safe and will give many years of reliable service.

SAFETY

- ✧ As with all hydro-pneumatic accumulators and pulsation control products, great care must be given when handling and charging this type of equipment. This should only be carried out by well-trained personnel, as they contain energy in the form of compressed nitrogen gas.
- ✧ It is essential to read and understand the complete dampener Charging Instructions before any maintenance work is carried out.
- ✧ It is perfectly acceptable for pressures below 6.895 Bar (100 psi) to pre-charge the dampener using dry air from a compressed "dry" airline, foot or hand pump, and nitrogen from a high-pressure cylinder above this pressure. (Refer to Pre-charging instructions).
- ✧ Unless otherwise specified in your purchase order, a small amount of soapy water may be present where used as a lubricant for the elastomer components during assembly at the factory. Please check/confirm that these lubricants will not affect the process, or the liquid being handled. Use of grease or oil is to be avoided.
- ✧ When provided, lifting eyes or lugs should be used for safe lifting of the pulsation dampener. Customers must always adhere to their own company safety protocols whether or not lifting eyes / lugs are provided.

SUITABLE SAFETY devices must be provided

- ✧ To protect the device from over pressure in the event the liquid line pressure exceeds the design pressure rating of the device, it is required that a system pressure relief valve, rupture disc or similar device be installed.
- ✧ Where a risk of fire exists that would cause the gas pre-charge pressure to rise above the design pressure limits of the device, the device must be protected by a suitable fire protection system or safety devices must be fitted to the gas side of the device such as a fusible plug or rupture disc.
- ✧ Should the unit be fitted with a heating jacket or trace heating elements, care must be taken to restrict the heat input to protect the device from over pressurization as mentioned in the two prior paragraphs.
- ✧ It is the responsibility of the user to establish a written set of inspections for the device in compliance with company, local and statutory regulations for their safe operation. In drafting a set of inspections, consideration must be given to condition monitoring of the diaphragm, internal and external surfaces of the pressure envelope ("Body"), that may be affected by corrosion, erosion or abrasion.
- ✧ Where equipment is installed in potentially explosive atmospheres, minimize and shield the device from a buildup of dust. The process fluid temperature shall not exceed the spontaneous ignition temperature of any accumulation of dust or other combustible materials.
- ✧ The maximum operating temperature of this equipment must not exceed the design temperature stamped on the device or device nameplate. This is not to be confused with the temperature rating shown on the label or compliance with ATEX or similar / alternative directives / specifications.

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STORAGE

Dampeners must be stored in such a way as to prevent mechanical damage to the Body and any provided flange connections.

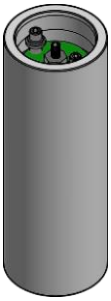
If the ***FLOWDEFENDER™*** is stored for more than 2 months, it is recommended that its gas pre-charge be released.

Where dampeners have a pre-charge exceeding 68.95 BAR (1,000 psig), the gas pressure should be released when they are stored for more than 2 weeks.

Store away from extreme temperatures. The Diaphragm and internal O-rings are manufactured from certain elastomers, which may suffer from heat exposure and time degradation at temperatures below 10 °C (14 °F) or above 90 °C (194 °F).

If the device was used, installed, or in service prior to storage, the diaphragm and internal O-rings should be removed and replaced with new parts prior to going back into service.

Spare Parts Kits should be stored in a cool, dry and dark place in their original packaging and away from:



- ✧ Extreme temperatures,
- ✧ Direct sources of heat,
- ✧ Humid conditions causing potential internal condensation,
- ✧ Equipment generating ozone, such as Mercury and high voltage equipment, and
- ✧ It is recommended that direct contact between stored elastomers of different materials be avoided.

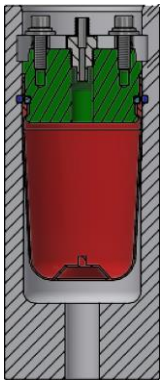
PRIOR TO INSTALLATION

Check that the correct dampener connection has been supplied.

Ensure that the maximum working pressure and temperature to which the unit may be subjected do not exceed the design pressure and temperature stamped on the dampener nameplate. If, for any reason, the dampener's design pressure cannot be verified, you must check with PPC by providing the dampener's serial number.

FLOWDEFENDER™ Dampeners are NOT supplied with a "factory" pre-charge.

As a rule, **Pre-charge Pressure** should be as follows.



- ✧ Pump Suction Stabilizers to 50% and Discharge Dampeners to 80% of the minimum system pressure at working temperature. If the pre-charge of any of your dampeners are significantly different to this or if you have any other questions regarding pre-charge, please contact PPC by email or phone referencing the dampener serial number.
- ✧ All units are tested at PPC prior to shipment and traces of test fluids (city water) may still be present inside the unit. Test fluid is normally city water. If these traces of fluid are likely to cause any problems when mixed with your process fluids, then the units must first be flushed clean.

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INSTALLATION

Generally, dampeners should be mounted vertically. **FD10, FD20 and FD40** dampeners can be mounted in a horizontal position.

Single ported dampeners should be fitted on a 'Tee' as close as practical to the pump (within ten pipe diameters), keeping the length of the tee as short as possible. The longer the tee, the less effective the dampener will be.

Unless otherwise mentioned on the Purchase Order, PPC has made no allowances for supporting the dampener. The installer must support the dampener and pipe work in such a manner to prevent excessive loadings or stresses on the dampener and associated piping.

PRE-CHARGING

- ✧ Ensure that the Charging Valve (a Test Coupling with Piston Valve) is properly installed (tightened), including the O-Ring located at its base by the male stud.
- ✧ Ensure there is no system pressure to which the dampener is exposed. Verify that the system pressure is reading zero (0) psig.
- ✧ Connect the CGA580 Fitting (Nipple &Nut) end of the Charging Hose to the nitrogen Gas regulator that is connected to the nitrogen bottle. Set the regulator to the desired gas pre-charge pressure.
- ✧ Remove the Charging Valve protective cover. The Protective Cover is chained to the Charging Valve.
- ✧ Install the Charging Hose by connecting the Charging Hose adapter to the Charging Valve. Tighten firmly by hand. Avoid using pliers.
- ✧ Opening the charging valve is automatic as the design has an internal piston valve. It is designed to be leakproof.
- ✧ Slowly open the nitrogen source bottle and fill the dampener diaphragm with the regulator to set pressure. You will know this has occurred once the pressure gauge on the Charging Hose reads the same as the regulator set pre-charge pressure. This may take some time to settle.
- ✧ You will need to verify that there are no nitrogen gas leaks from the charging hose connections to both the charging valve and regulator using soapy water and check for bubbles. If leaks are found, tighten and/or redo the connections as needed.
- ✧ Allow the pre-charge to rest (volume at pressure).
- ✧ Once the pre-charge pressure has been fully established (stabilized), close the valve on the nitrogen source bottle and regulator first.
- ✧ Then, slowly unscrew the charging hose from the charging valve. Some nitrogen gas may be heard expelling from the hose. That is to be expected. Use care and caution.
- ✧ The charging valve has a built-in piston isolation valve that prevents nitrogen from escaping from the dampener.

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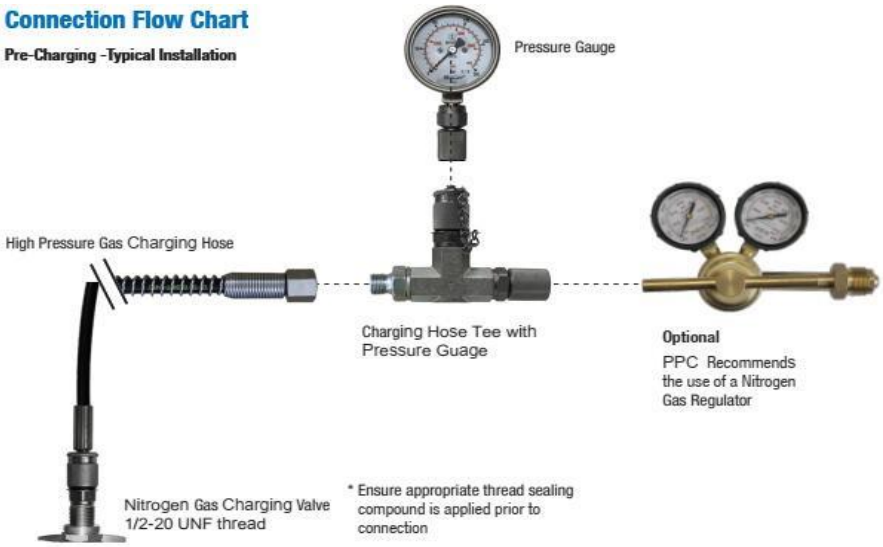
- ✧ Remove the charging hose from the regulator and nitrogen source.
- ✧ Once the charging hose has been removed, spray soapy water (50% dish soap mixed with water is ideal) onto the charging valve and dampener cover to ensure there are no leaks. This is best done with the unit at pre-charge pressure OR at normal working pressure.
- ✧ If a pressure gauge is fitted to the pump, watch the needle closely when the pump is first turned on. As pressure builds up to the pre-charge pressure and up to full system pressure, the flickering of the pressure gauge needle due to pulsations should cease or be considerably reduced. In the absence of using a Pre-Charge Tester, this is a reasonably accurate way of verifying the correct pre-charge.
- ✧ You have now successfully pre-charged your ***FLOWDEFENDER™*** dampener, and it can be safely and effectively operated.

RELEASE of Nitrogen Gas Pre-charge:

- ✧ First, verify if the dampener is isolated from the system (pressure).
- ✧ Mount the Regulator to the Nitrogen source bottle first.
- ✧ Connect the Charging Hose to the regulator.
- ✧ Then connect the Charging Hose to the Charging Valve on the dampener.
- ✧ Read the pressure gauge on the Charging Hose. If there is a nitrogen gas Pre-charge on the dampener, slowly begin to unthread the Charging Hose from the Regulator until gas begins releasing. Allow it to vent fully and confirm that no nitrogen gas Pre-charge is left in the dampener.
- ✧ It is now safe to perform maintenance on the Dampener.
- ✧ An alternative way to verify nitrogen gas Pre-charge is using PPC's Pre-charge Tester. See Page 10 for more details.

NOTE:

All parts shown are included in the Charging Hose, except the Regulator.



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MAINTENANCE

- ✧ Pulsation Dampeners typically require very little maintenance.
- ✧ The gas pre-charge should be checked periodically to ensure that no leak has occurred, using a PPC Charging Hose or PPC Pre-Charge Tester.
- ✧ Note, when checking the pre-charge pressure, a small amount of nitrogen is released from the vessel into the charging valve and the connected Charging Hose or Pre-Charge Tester. This will cause the reading to be slightly low.
- ✧ Any small losses in pre-charge pressure may also be due to slight temperature variations. If small losses are detected, the pre-charge pressure should be topped off. If losses are significant or persistent, the cause of the leak should be determined, and repairs should be made. This may require inspection of the Diaphragm as well.
- ✧ **EXTREME CAUTION** should be taken during disassembly when the dampener has been used in corrosive or toxic service. Even after flushing/cleaning the dampener, small amounts of residual fluids may remain, particularly if the diaphragm is punctured or failed. Proper flushing is required before removal. Use appropriate personal safety devices & procedures!

DISASSEMBLY

- ✧ Prior to disassembly, ensure that the dampener is isolated from the process line, or the process line is depressurized and drained down.
- ✧ Release the gas pre-charge by reconnecting the Charging Hose to the Charging Valve and have the free end of the Charging Hose directed onto the floor or containment bucket. Use of the Charging Hose when releasing any residual gas pre-charge allows one to direct away the nitrogen gas release and possible fluid contaminants.

Remove the diaphragm from the dampener as follows:

- ✧ Once fully satisfied that there is no gas pre-charge or system pressure, remove the Charging Valve. As you unscrew the Charging Valve, the thread engagement should feel "loose", as in no back pressure. Verify this as you continue to unscrew the Charging Valve. If it feels tight, STOP and re-verify that there is no contained gas pre-charge or system pressure!
- ✧ Remove both Cover Keeper Bolts with Spacer and Washer.
- ✧ Fit Cover Puller - Eye Bolt or Cover Puller - Assembly with suitable mating thread into Charging Valve hole in the center of the Cover.
- ✧ The dampeners are fitted with four (4) split Locking Cams (two short & two long), which should be removed by tapping the dampener cover down the dampener bore with a soft-faced mallet until the Locking Cams (4) are fully exposed. The cover must be just below the Locking Cams. The Locking Cams may now be removed from the groove by sliding the Locking Cams together to form a single gap. Slide one of the two "short" locking cam segments out of the groove with a screwdriver and then lift out of the groove first. Then remove all remaining Locking Cams.

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- ✧ The cover may now be removed using the Cover Puller—Eye Bolt or Cover Puller—Assembly. When doing so, ensure the Cover remains square to the axis of the bore to prevent it from binding. Do not force the removal; gently re-center the Cover and pull evenly and centrally. This may take several retries to perfect. Patience is required.
- ✧ With the Cover separated from the dampener Body, the Diaphragm may now be removed and replaced with a new one.

NOTE: The **FD10, FD20, and FD40 diaphragms are molded with an integral SS bottom metal plug that bridges the dampener system orifice during pre-charge.** The diaphragm is a one-piece design with this SS bottom plug; the two are never separated.

REASSEMBLY

- ✧ It is recommended that the inner and outer O-Ring Seals are replaced each time the dampener is serviced. Each of these O-ring Seals is provided with a diaphragm kit. See Page 9 for details.
- ✧ Assemble the Diaphragm onto the Cover, ensuring that the inner O-ring seal is replaced and in the correct position on the Cover and the outer O-ring seal is correctly positioned in its groove in the dampener Body.
- ✧ Spray the inner portion of the dampener and top of the diaphragm (external) installed on the cover with soapy water that is compatible with the diaphragm and process fluids. Soapy water is used at the PPC factory unless otherwise stated on your purchase order.
- ✧ Insert the Cover with the installed inner O-ring and Diaphragm into the bore of the dampener housing fitted with the Outer O-ring.
- ✧ Fit the Cover Puller Eye Bolt or parts of the Cover Puller Assembly tool with suitable mating thread into Charging Valve hole (See Page 11) of the Cover.
- ✧ Tap the Cover down the bore of the dampener housing with a soft-faced mallet until the retaining ring groove is fully exposed. While tapping the Cover down, ensure the Cover is aligned and centric to the bore preventing it from seizing due to misalignment.
- ✧ The Locking Cams (4) may now be fitted into the groove. Ensure that the two (2) longest Locking Cam segments are opposed to each other and installed first, followed by the opposing short Locking Cam segments.
- ✧ Cover may now be lifted up using the Cover Puller Eye Bolt or Cover Puller Assembly to ensure the Cover remains square to the axis of the dampener bore and the Locking Cam segments are positioned and remain seated correctly.
- ✧ Install the Cover Keeper Bolts (2) (See Page 11) and Washers (2) and snug them down, ensuring the Cover is evenly set against the underside of the Locking Cams (4).
- ✧ Remove the Cover Puller Eye Bolt or Cover Puller Assembly, install the Charging Valve, and recharge the dampener with nitrogen to the specified pre-charge level (refer to Pages 4 - 6).
- ✧ Snoop test for leaks with soapy water in the area on and around the Charging Valve and Cover.
- ✧ Replace the provided Rain Cover if available/provided.

Your *FLOWDEFENDER™* dampener is now ready for its intended use.

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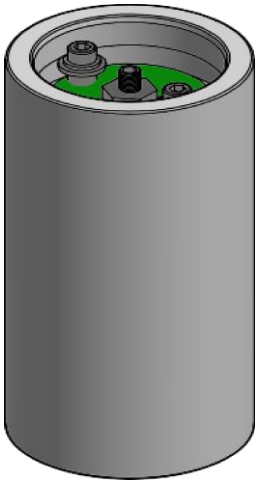
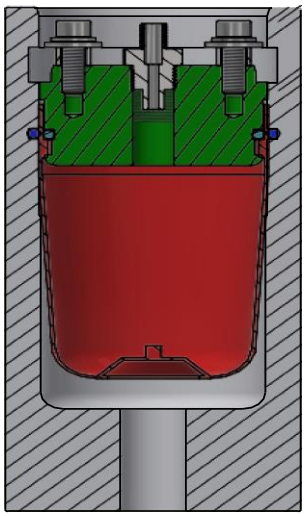
CAUTION! Operating below atmospheric pressure (vacuum)

All ***FLOWDEFENDER™*** dampeners, which may be subject to operating pressures close to or below atmospheric pressure (vacuum), are fitted with two Cover Keeper Bolts and Washers to prevent the Cover from being sucked down into the dampener Body allowing the Locking Cams (4) to falling out of their groove. The Keeper Bolts must be reinstalled and aligned at the middle of the two shorter Locking Cams and torqued to 3 ft-lbs dry (2 ft-lbs lubricated) after all maintenance procedures!





DIAPHRAGMS & DIAPHRAGM KIT PARTS LIST

Model	Material	Diaphragm KIT Part Number
FD10	NBR	FD10-01-DK
	EPDM	FD10-03-DK
	HNBR	FD10-07-DK
	Viton-B	FD10-08-DK
FD20	NBR	FD20-01-DK
	EPDM	FD20-03-DK
	HNBR	FD20-07-DK
	Viton-B	FD20-08-DK
FD40	NBR	FD40-01-DK
	EPDM	FD40-03-DK
	HNBR	FD40-07-DK
	Viton-B	FD40-08-DK

Diaphragm KITS consist of the Diaphragm, Inner and Outer O-Ring Seal comprised of the same material.
Diaphragms, Inner & Outer O-Ring Seals are not sold separately. Must be purchased in Diaphragm KIT form.

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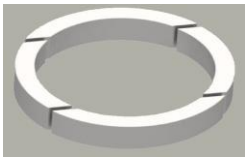
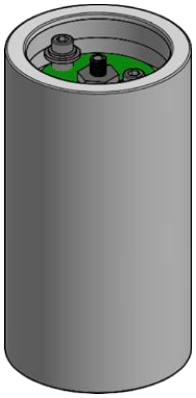
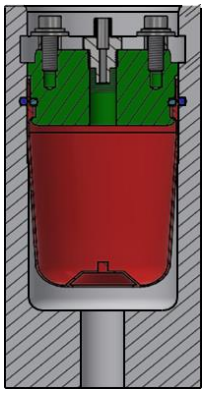
BASIC ACCESSORIES & SPARES

Description	Part Number
FD10 Locking Cams, set of four (2 short & 2 long) FD20 Locking Cams, set of four (2 short & 2 long) FD40 Locking Cams, set of four (2 short and 2 long)	 FD10S3_LOCKING-CAMS FD20S3_LOCKING-CAMS FD40S3_LOCKING-CAMS
FD10 KEEPER BOLT ASSEMBLY ((Bolt, Washers & Spacer) FD20 KEEPER BOLT ASSEMBLY (Bolt, Washers & Spacer) FD40 KEEPER BOLT ASSEMBLY (Bolt, Washers & Spacer)	FD10S_BOLT-KEEPER-ASSEMBLY FD20S_BOLT-KEEPER-ASSEMBLY FD40S_BOLT-KEEPER-ASSEMBLY
Cover Puller - Eye Bolt - 1/2" UNF Thread Cover Puller - Eye Bolt - 1/4" BSP Thread	FDTOOL_COVER-PULLER-ASSEMBLY Consult PPC
Cover Puller - Assembly - 1/2" UNF Thread Cover Puller - Assembly - 1/4" BSP Thread	 FDTOOL_COVER-PULLER-ASSEMBLY Consult PPC
Standard SS Charging Valve – 1/2-20 UNF thread Optional SS Charging Valve – BSP thread	VLVS1_LOAD_SKK121/2UNFVCW5 Consult PPC
Charging Hose (0 - 600 psig) Charging Hose (0 - 2,000 psig) Charging Hose (0 - 3,000 psig MAX Pre-charge)	 PD-CH-6-FD-01 PD-CH-6-FD-02 PD-CH-6-FD-03
Pre-charge Tester (0 - 600 psig) Pre-charge Tester (0 - 2,000 psig) Pre-charge Tester (0 - 3,000 psig) (Max Pre-charge)	 PD-PT-01 PD-PT-02 PD-PT-03



***FLOWDEFENDER™* Body & Cover NOT sold separately.**



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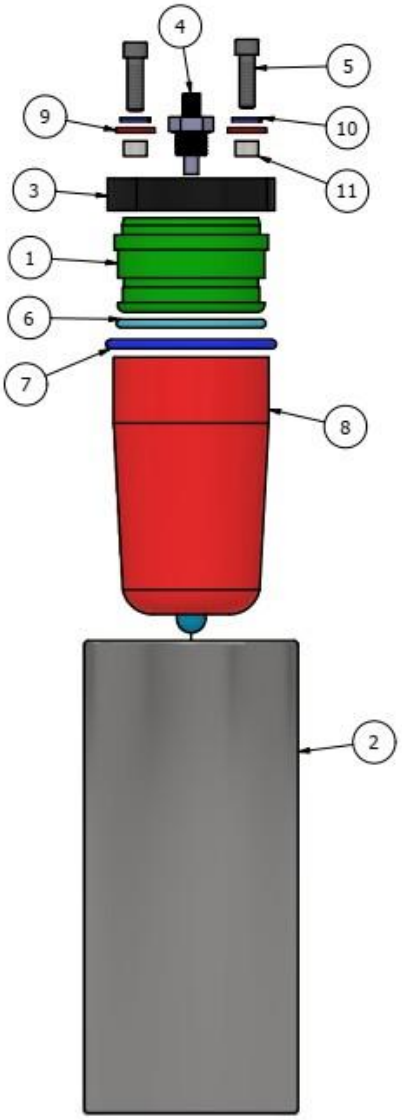
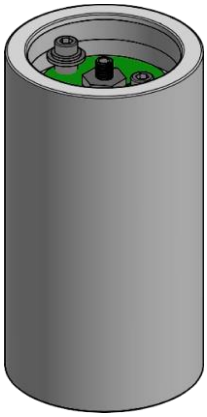
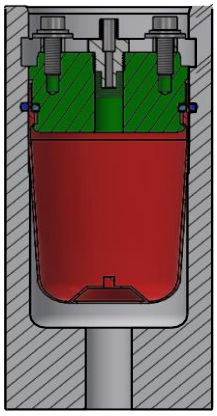


1. COVER
2. BODY
3. LOCKING CAM - Four (2 Short & 2 Long)
4. CHARGING VALVE
5. KEEPER BOLT (2)
6. INNER O-RING
7. OUTER O-RING
8. DIAPHRAGM
9. WASHER, FLAT (2)
10. WASHER, LOCK (2)
11. TUBING SPACER (2)



FLOWDEFENDER™ **Body & Cover NOT sold separately.**



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