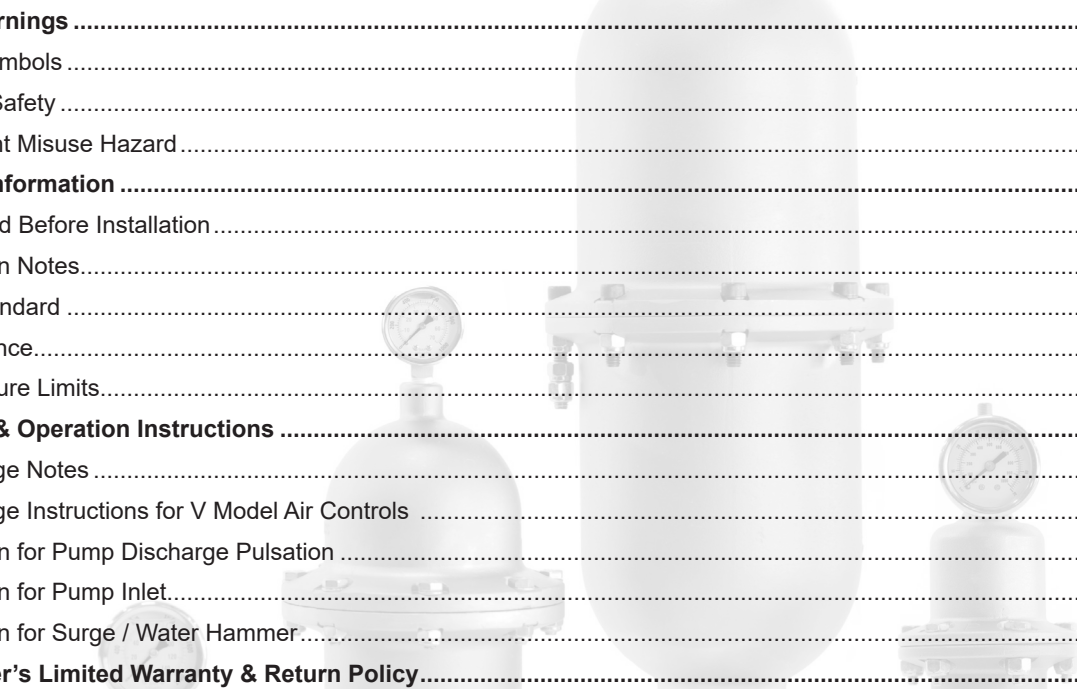




Installation and Operation Manual



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All dampeners manufactured by BLACOH use pressure bodies made in the USA to ensure quality. Prior to shipment, each and every dampener is factory pressure tested to assure proper function and leak-free operation.

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SAFETY Warnings

Dampeners should only be installed, operated and repaired by experienced and trained professional mechanics. Read and observe all instructions and safety warnings in this Manual before installing, operating or repairing dampeners.

Safety Symbols

The following symbols indicate cautions, warnings and notes that must be observed for safe and satisfactory installation, operation and maintenance of dampener.



WARNINGS

Danger of serious injury or death could occur if these warnings are ignored.



CAUTIONS

Equipment damage, injury or death could occur if these cautions are not observed.



NOTES

Special instructions for safe and satisfactory installation, operation and maintenance.

General Safety ⚠

- Observe all safety symbols in installation and operation instructions.
- The internal dampener pressure will equal the maximum fluid pressure of the system in which it is installed.
- **DO NOT** exceed maximum allowable working pressure (MAWP) specified on dampener serial tag or marked on dampener. If missing, **DO NOT** use dampener without consulting distributor or factory for maximum pressure rating.
- Always make sure safety shutoff valves, regulators, pressure relief valves, gauges, etc. are working properly before starting system or assembly.
- Verify dampener model received against purchase order and shipper.
- Before starting a system or assembly make certain the discharge point of the piping system is clear and safe, and all persons have been warned to stand clear.
- **DO NOT** put your face or body near dampener when the system or assembly is operating or dampener is pressurized.
- **DO NOT** operate a dampener that is leaking, damaged, corroded or otherwise unable to contain internal fluid, air or gas pressure.
- **DO NOT** pump incompatible fluids through dampener. Consult distributor or factory if you are not sure of the compatibility of system fluids with dampener materials.
- Dampeners are designed to operate with compressed air or clean dry Nitrogen **only**. Other compressed gases have not been tested and may be unsafe to use. **DO NOT USE OXYGEN.**
- Always shut off air supply, remove internal dampener pressure and shut dampener isolation valve before performing dampener maintenance or repair.
- Remove all pressure from dampener AND pumping system before disassembly, removal or maintenance.
- **Static spark can cause an explosion resulting in severe injury or death. Ground dampeners and pumping system when pumping flammable fluids or operating in flammable environments.**

Equipment Misuse Hazard ⚠

General Safety

DO NOT misuse dampener, including but not limited to over-pressurization, modification of parts, using incompatible chemicals, or operating with worn or damaged parts. **DO NOT** use any gases other than compressed air or clean dry Nitrogen to charge dampener. **DO NOT USE OXYGEN.** Any misuse could result in serious bodily injury, death, fire, explosion or property damage.

Over-Pressurization

Never exceed the maximum pressure rating for the dampener model being used. Maximum allowable working pressure (MAWP) is specified on dampener serial tag or marked on dampener. Maximum allowable working pressure (MAWP) is rated at 70°F (21°C).

Temperature Limits

DO NOT exceed the operating temperature limits for the body and/or elastomer materials being used. Excessive temperature will result in dampener failure. For temperature limits, refer to the "Temperature Limits" section of this Manual. Temperature limits are stated at zero psi/bar.

Installation and Startup Hazards

Install dampener before charging or pressurizing. **DO NOT** start system or assembly without first charging or pressurizing dampener. Failure to charge may result in damage to the bladder or bellows.

Temperature & Pressure Hazard

Temperature and pressure reduce the strength and chemical resistance of plastic, metal, elastomers and PTFE.

Charging / Pressurization

Charge or pressurize dampener with compressed air or clean dry Nitrogen only. **DO NOT USE OXYGEN.**

Dampener Bladder/Bellows Failure

Dampeners utilize a bladder or bellows to separate system fluid from the air supply or gas charge. When failure occurs, system fluid may be expelled from the air valve. Always perform preventive maintenance and replace bladder/bellows before excessive wear occurs. O-rings for PTFE bellows and gaskets for Stainless Steel metal bellows cannot be reused.

Maintenance Hazards





Never overtighten fasteners. This may cause leakage of system fluid and damage to dampener body. Bolts should not be reused as re-torquing reduces bolt strength. **After dampener maintenance or disassembly, use new fasteners and torque fasteners according to specification on dampener tag. If missing, consult distributor or factory for torque specifications.**






GENERAL Information








For safe and satisfactory operation of dampener read all safety warnings, caution statements and this complete Manual before installation, startup, operation or maintenance.

Must Read Before Installation


-  **DO NOT** use Oxygen to charge dampener. Use compressed air or clean dry Nitrogen only.
-  **DO NOT** exceed maximum allowable working pressure (MAWP) specified on dampener serial tag or marked on dampener.
-  Turn pump off and remove all pressure from system prior to dampener installation.
-  Always wear safety glasses and other appropriate safety equipment when installing, charging or repairing dampener.

-  **Danger of static spark!** Grounding precautions must be considered when dampener is used in flammable or explosive environments.
-  ATEX models must be grounded (earthed) before operation.
-  **DO NOT** operate a dampener that is leaking, damaged, corroded or otherwise unable to contain internal fluid, air or gas pressure.
-  Temperature, pressure and chemicals affect the strength of plastic, elastomer and metal components.
-  Many plastics lose strength rapidly as temperature increases. Consult factory if in doubt.

Installation Notes

-  Dampening of flow pulsations can only be effective if a minimum of 5 to 10 psi (0.4 to 0.7 bar) back pressure downstream of dampener is available. A BLACOH back pressure valve may be required downstream of dampener, except when dampener is used as an inlet stabilizer for the inlet side of the pump.
-  It is recommended that a BLACOH pressure relief valve be installed in all pump systems to ensure compliance with pressure limits on system equipment.
-  To avoid possible damage to bladder/bellows from a system pressure test:
Adjustable and Chargeable models — charge dampener to 80% of the system test pressure prior to test.
Automatic model — prior to test, dampener must be equipped with a constant source of compressed air with pressure equal to or greater than system test pressure.
Inlet Stabilizer model — maximum pressure test 30 psi (2.0 bar), charge to 20 psi (1.3 bar) for system pressure test.
-  Install dampener inline as close to the pump discharge/inlet or quick closing valve as possible. Dampener installation should be no more than ten pipe diameters from pump discharge/inlet or quick closing valve.
-  It is recommended that an isolation valve be installed between the dampener and system piping.

ATEX Standard

-  Certain models made for the European market are intended for use in potentially explosive atmospheres and meet the requirements of ATEX directive 2014/34/EU. These models have the AT designation at the end of the part number, comply with ISO 80079-36, and have an ATEX rating of II 2GD Ex h IIB T4 Gb Db. AT models have a grounding lug and must be grounded (earthed) before operation.


Maintenance

-  **Remove all pressure from dampener AND pumping system before disassembly, removal or maintenance.**

Dampeners require very little maintenance. There is no need for lubrication with bladders or bellows.


Elastomeric bladder replacement should be part of a preventive maintenance program. Dampeners used in conjunction with diaphragm pumps should have the bladders replaced at least every second time the diaphragms in the pump are replaced. As with any pumping system, wear is dependent on many factors including material, temperature, chemicals, fluid abrasiveness and system design. This suggested maintenance program may need to be adjusted according to specific applications.


Periodic inspection of the dampener and fasteners should be conducted to visually check for signs of over-pressurization, fatigue, stress or corrosion. Body housings and fasteners must be replaced at first indication of deterioration.

-  **CAUTION! Replace nut and bolt fasteners at each reassembly with fasteners of equal grade/strength value. DO NOT reuse old nuts and bolts.**

After the initial torque of fasteners, bolts may lose strength when re-torqued. Failure to replace both nuts and bolts upon each vessel reassembly will void the product warranty given by the manufacturer and the manufacturer will have no liability whatsoever for any vessel failure or malfunction.

Where dampeners are used in corrosive environments, nut and bolt fasteners should be regularly inspected and replaced with nut and bolt fasteners of equal grade/strength value if corrosion is observed. Failure to conduct such regular inspections and replacement will void the product warranty given by the manufacturer and the manufacturer will have no liability whatsoever for any vessel failure or malfunction.

-  **IMPORTANT!** After maintenance or disassembly, use new fasteners and torque fasteners according to specification on dampener tag. If missing, consult distributor or factory for specifications.

-  **DO NOT** use dampener if the fasteners (nuts and bolts) are corroded. Check for fastener corrosion frequently, especially in atmospheres containing salt or corrosive chemicals, or if dampener leakage has occurred.

Temperature Limits

- ① Operating temperatures are based on the maximum temperature of the wetted dampener components only. Non-wetted dampener components may have a lower temperature limit. Temperature and certain chemicals may reduce the maximum allowable working pressure (MAWP) of the dampener.
- ① **CAUTION!** Plastic (non-metallic) body materials lose strength as temperature increases, which reduces the maximum pressure sustainable by the material. All plastic materials must have an appropriate derating factor applied when working at elevated temperatures above 73.4°F (23°C) to determine maximum allowable working pressure (MAWP).

Elastomer Materials	Temperature Limits		Applications
Aflas	0°F to +400°F	(-18°C to +204°C)	High temperature, petroleum based chemicals, strong acids and bases.
Buna-N	+10°F to +180°F	(-12°C to +82°C)	Good flex life; use with petroleum, solvents and oil-based fluids.
FDA Buna-N	+10°F to +180°F	(-12°C to +82°C)	FDA-approved food grade; similar characteristics of regular Buna-N.
EPDM	-60°F to +280°F	(-51°C to +138°C)	Use in extreme cold; good chemical resistance with ketones, caustics.
FDA EPDM	-50°F to +225°F	(-45°C to +107°C)	FDA-approved food grade; similar characteristics of regular EPDM.
Hypalon	-20°F to +275°F	(-29°C to +135°C)	Excellent abrasion resistance; good in aggressive acid applications.
Neoprene	0°F to +200°F	(-18°C to +93°C)	Good abrasion resistance and flex; use with moderate chemicals.
PTFE Diaphragm	+40°F to +220°F	(+4°C to +104°C)	Use with highly aggressive fluids.
PTFE Bellows	-20°F to +220°F	(-29°C to +104°C)	Exclusive bellows design with excellent flex life; use with highly aggressive fluids.
Santoprene	-20°F to +225°F	(-29°C to +107°C)	Excellent choice as a low cost alternative for PTFE in many applications.
FDA Silicone	-20°F to +300°F	(-29°C to +149°C)	FDA-approved food grade material; for use in food and pharmaceutical processing.
Viton®	-10°F to +350°F	(-23°C to +177°C)	Use with hot and aggressive fluids; good with aromatics, solvents, acids and oils.

Non-Metallic Body Materials	Temperature Limits		Applications
Acetal*	+32°F to +175°F	(0°C to +79°C)	Good flex life; low moisture sensitivity; high resistance to solvents and chemicals.
CPVC	+32°F to +180°F	(0°C to +82°C)	Chlorinated PVC (CPVC): Good general chemical resistance; loses strength as temperature rises.
Noryl	+32°F to +220°F	(0°C to +104°C)	Good resistance to acids and bases; good temperature stability.
Polypropylene*	+32°F to +175°F	(0°C to +79°C)	Good general purpose plastic; broad chemical compatibility at medium temperatures.
PTFE	+40°F to +220°F	(+4°C to +104°C)	Use with highly aggressive fluids, high temperatures.
PVC	+32°F to +140°F	(0°C to +60°C)	Good general chemical resistance; loses strength as temperature rises.
PVDF	+10°F to +200°F	(-12°C to +93°C)	Excellent resistance to most acids and bases; high temperatures.

* Conductive Acetal and Conductive Polypropylene available.

- ① Maximum allowable working pressure is reduced slightly for metal bellows at temperatures above 400°F (204°C). Apply an appropriate derating factor to determine maximum allowable working pressure (MAWP).

Metal Bellows	Temperature Limits		Applications
SS w/Gaskets*	-200°F to +800°F	(-129°C to +426°C)	Excellent for applications pumping frigid and molten fluids, outdoor applications in extreme temperatures, chemical applications where elastomers or PTFE would fail.

* Contact Blacoh for more information regarding temperatures below -200°F (-129°C).

[T22E11_030]

Installation & Operation Instructions

- ⓘ **HIGH PRESSURE H & TG models are leak tested under pressure. All pressure is removed from dampener prior to shipment; however, always assume dampener is pressurized. Dampeners fitted with Stainless Steel metal bellows are charged with compressed air to 10 psi (0.68 bar) for shipment to prevent damage to bellows; remove all pressure prior to installation.**
- ⓘ **Only charging systems with components designed to be used at or above the maximum allowable working pressure (MAWP) specified on dampener serial tag can be used for charging. Nitrogen source (tank or bottle) must be equipped with a regulator set at no more than the MAWP specified on dampener serial tag.**
- ⓘ **ATEX models must be grounded (earthed) before operation.**
- ⚠ **IMPORTANT! High pressure is dangerous. Only qualified persons are allowed to charge, install and repair high pressure models.**
- ⚠ Turn pump off and remove all pressure from system prior to dampener installation.
- ⚠ Remove all pressure from dampener AND pumping system before disassembly, removal or maintenance.
- ⚠ Use clean dry Nitrogen to charge dampener. **DO NOT USE OXYGEN.**
- ⚠ **DO NOT exceed maximum allowable working pressure (MAWP) specified on dampener serial tag.** If missing, consult distributor or factory for specifications.
- ⚠ Always wear safety glasses and other appropriate safety equipment when installing, charging or repairing dampener.
- ⚠ Read and observe all safety warnings and instructions in this Manual before installation, operation or repair.
- ⚠ **IMPORTANT! After maintenance or disassembly, use new fasteners and torque fasteners according to specification on dampener tag.** If missing, consult distributor or factory for specifications.
- ⚠ Before performing a system pressure test, dampener must be charged with 80% of system test pressure to avoid possible damage to bladder/bellows.

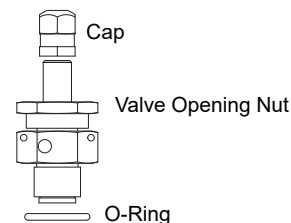
Pre-Charge Notes

Pre-charge pressure should be checked at least monthly as gas molecules will diffuse through bladders/bellows, the speed of which depends on the material, temperature and pressure. Checks must occur when no system pressure is present or inaccurate readings will be recorded. If temperature is above 72°F (22°C) and/or pressure is over 300 psi (20.6 bar), checks should be performed more frequently. **To prevent pre-charge loss through the fill valve, always replace the fill valve cap after charging.** A proper gas charge is the key to dampener effectiveness and bladder/bellows life.

Pre-Charge Instructions for V Model Air Controls

The Chargeable V Model air control assembly has a machined stainless steel charging valve and seal for rugged leak-proof operation in corrosive environments. To pre-charge V Model dampeners, turn the Valve Opening Nut counterclockwise to open for charging. The valve on these dampeners has no valve core to prevent the air charge from escaping. Because there is no valve core, the pressure in the dampener will escape if the valve is not closed prior to removing the charging hose. To close the valve, turn the Valve Opening Nut clockwise.

V Model Charging Valve



Installation for Pump Discharge Pulsation

Step 1 Installation Position

Install the dampener inline as close to the pump discharge as possible to absorb the pulse at its source and before any downstream equipment such as risers, valves, elbows, meters or filters. Dampener installation should be no more than ten pipe diameters from pump discharge. If using a flexible connector on the discharge side of the pump between the pump and system piping, the dampener should be installed at the pump discharge manifold. The flexible connector should be attached to the dampener's tee and system piping (see FIGURE 1). Since pressure is equal in all directions, the dampener can be installed in a vertical, horizontal or upside-down position. A vertical installation is recommended for better drainage of the dampener. Limitations for horizontal and upside-down mounting include high specific gravity, high viscosity, settling of solid material or possible air entrapment which could result in shortened bladder/bellows life and/or reduced dampening performance.

Step 2 Charging and Startup (see Pre-Charge Notes)

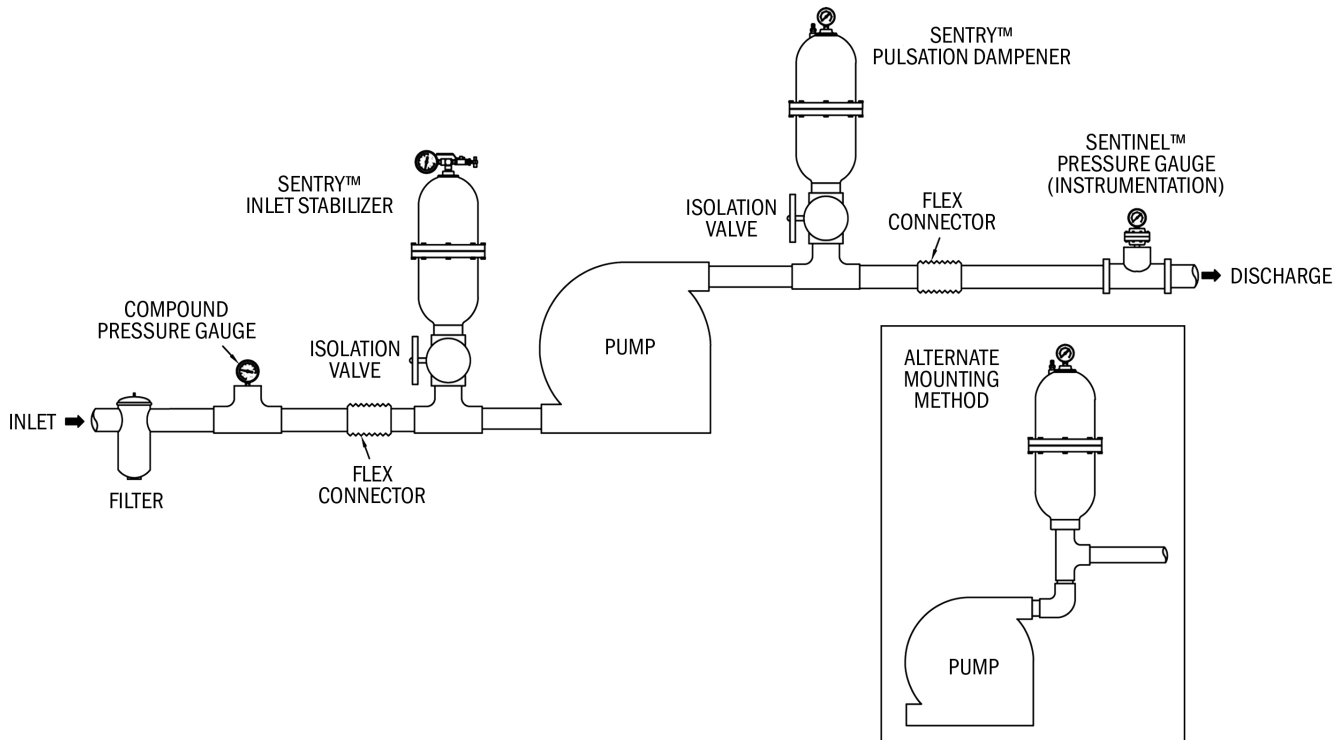
Chargeable models do not require an air line connection. Dampener must be pre-charged with Nitrogen using a regulated tank or bottle. **DO NOT USE OXYGEN.** Charging kits are available from BLACOH.

- ① **CAUTION! Nitrogen source (tank or bottle) must be equipped with a regulator set at no more than the MAWP specified on dampener serial tag.** If missing, consult distributor or factory for specifications.
- ① **Dampeners fitted with Stainless Steel metal bellows are charged with compressed air to 10 psi (0.68 bar) for shipment to prevent damage to bellows; remove all pressure prior to installation.**

Prior to starting the pump, pre-charge the dampener to approximately 80% of expected system pressure and replace fill valve cap. **DO NOT USE OXYGEN.** The pre-charge pressure in the dampener must always be lower than pump discharge pressure. Generally, pulsation is most effectively minimized when the gas pre-charge is 80% of system pressure. Start the pump to generate system pressure. The dampener charge pressure may need to be adjusted up or down to be most effective in reducing pulsation. **NOTE:** The most effective method to set the proper dampener charge is to install a pressure gauge downstream of the dampener and adjust the dampener to minimize needle movement on the gauge.

Once system pressure is in contact with the bladder/bellows, the gas charge will be compressed to the system pressure and the dampener gauge will read the system pressure, not the initial charge pressure. Once working pressure is achieved adjustment may be necessary. Gradually increase or decrease the gas charge in the dampener by bleeding or filling through the gas valve. Allow the system to respond to each adjustment (this may take a minute or two) before making further adjustments.

Figure 1



Installation for Pump Inlet

Step 1 Installation Position

Install the dampener inline as close to the pump inlet as possible and after any upstream equipment such as risers, valves, elbows, meters or filters. Dampener installation should be no more than ten pipe diameters from pump inlet. If using a flexible connector on the inlet side of the pump between the system piping and pump, the dampener should be installed on a tee at the pump inlet manifold. The flexible connector should be attached to the dampener's tee and system piping (see FIGURE 1). A compound pressure gauge should be installed upstream of the dampener to aid in proper dampener adjustment.

Step 2 Charging and Startup (see Pre-Charge Notes)

Chargeable models do not require an air line connection. Dampener must be pre-charged with Nitrogen using a regulated tank or bottle. **DO NOT USE OXYGEN.** Charging kits are available from BLACOH.

- ❗ **CAUTION! Nitrogen source (tank or bottle) must be equipped with a regulator set at no more than the MAWP specified on dampener serial tag.** If missing, consult distributor or factory for specifications.
- ❗ **Dampeners fitted with Stainless Steel metal bellows are charged with compressed air to 10 psi (0.68 bar) for shipment to prevent damage to bellows; remove all pressure prior to installation.**

A. Suction Lift/Dampener: When using the dampener in a suction lift application no pre-charge is required. Start the pump to generate working pressure. As system pressure and vacuum is created, the acceleration head created with each suction stroke will compress the air trapped in the bladder/bellows.

B. Positive Inlet Pressure: Pre-charge the dampener with 50% of the static system pressure realized at the pump inlet. Start the pump to generate working pressure. Minor pressure adjustments may be required. Allow the system to respond to each adjustment (this may take a minute or two) before making further adjustments.

Installation for Surge / Water Hammer

- ❗ **CAUTION! DO NOT use plastic models as Surge Suppressors at quick closing valves. Use metal Surge Suppressors for water hammer or quick closing valve applications. Consult factory for options.**

Step 1 Installation Position

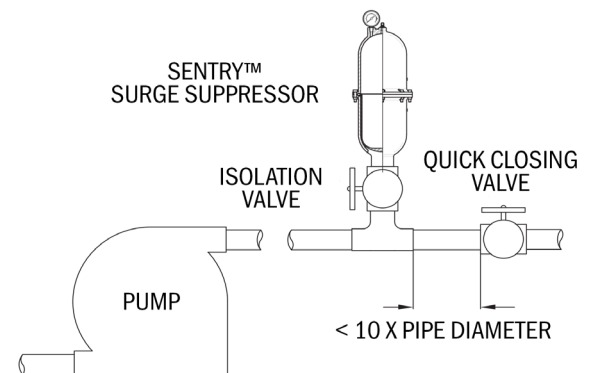
Install the dampener inline as close as possible to and before the device causing the water hammer pressure spike (see FIGURE 2). For example, if a quick closing valve is causing water hammer, install the dampener on a tee or elbow as close as possible upstream of the valve. Dampener installation should be no more than ten pipe diameters from the valve. **It is advisable to install an isolation valve between the dampener inlet and the mounting tee so maintenance and pressure checks can be done while the system is operating.**

Step 2 Charging and Startup (see Pre-Charge Notes)

Chargeable models do not require an air line connection. Dampener must be pre-charged with Nitrogen using a regulated tank or bottle. **DO NOT USE OXYGEN.** Charging kits are available from BLACOH.

- ❗ **CAUTION! Nitrogen source (tank or bottle) must be equipped with a regulator set at no more than the MAWP specified on dampener serial tag.** If missing, consult distributor or factory for specifications.
- ❗ **Dampeners fitted with Stainless Steel metal bellows are charged with compressed air to 10 psi (0.68 bar) for shipment to prevent damage to bellows; remove all pressure prior to installation.**

The dampener must be pre-charged **after** installation but prior to system operation. The only method to get an accurate pressure charge in the dampener is to charge it prior to system startup or with a closed isolation valve at the dampener inlet. Pre-charge the dampener with 90% to 95% of expected system pressure. **DO NOT USE OXYGEN.** A fill valve similar to a Schrader type tire valve but designed for suppressors is mounted to the top of the dampener. Replace fill valve cap after charging dampener and recheck dampener charge every month.



Manufacturer's Limited Warranty & Return Policy

Details regarding warranty and return policy are available on Blacoh's website at Blacoh.com

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