Dampeners are pressure vessels containing a flexible bladder or bellows inside that separates an inert pressurized gas (air or Nitrogen) from a system fluid in the lower chamber. Depending on how dampeners are configured, they are used as PULSATION DAMPENERS, INLET STABILIZERS or SURGE SUPPRESSORS to control pressure fluctuations and spikes in liquid piping systems.

Dampeners work on the principle that volume is inversely proportional to pressure (P1V1=P2V2). Compressed air or Nitrogen (never Oxygen) is introduced into the non-wetted side of the dampener. The gas charge is contained by the bladder or bellows preventing contact between the system fluid and the gas.

When the dampener is sized correctly, properly installed and charged according to the instructions provided, it will greatly reduce the damaging effects of pressure variations in piping systems and significantly improve the efficiency of transferring liquids.

All dampeners covered by this Manual use pressure bodies made in the USA to insure quality. Prior to shipment, each and every dampener is factory tested at design pressure or higher to assure proper function and leak-free operation.
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MODEL SPECIFICATIONS & INSTALLATION INFORMATION

<table>
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<tr>
<th>Model No.</th>
<th>Serial No.</th>
<th>Installation Date</th>
</tr>
</thead>
</table>

/  /  /

Body Material: Wetted / Non-wetted  Bladder/Bellows Material  Pump Area and Number

Purchased From  Contact  Phone  E-Mail

THE WORD “DAMPENER”, AS USED IN THIS MANUAL, HAS THE SAME MEANING AS PULSATION DAMPENER, INLET STABILIZER, OR SURGE SUPPRESSOR.
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**

**CAUTION!**

- 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 serial tag is 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.
- **NOTE:** EC standard EN-13463-1 and EN-13463-5 (ATEX) require grounding (earthing) on dampeners when the potential for static sparking is present. A grounding point is located and marked on ATEX specific dampener models.
**CAUTION!**

**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 the Manual. Temperature limits are stated at zero psi/bar.

**Installation and Start-Up 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 elastomeric bladder or PTFE 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 an elastomeric membrane (bladder) or PTFE 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 cannot be re-used.

**Maintenance Hazards**
Never over-tighten fasteners. This may cause leakage of system fluid and damage to dampener body. Bolts on metal models should not be reused as re-torquing reduces bolt strength. AFTER MAINTENANCE OR RE-ASSEMBLY OF METAL MODELS, USE NEW FASTENERS AND TORQUE FASTENERS ACCORDING TO SPECIFICATION ON DAMPENER TAG.

**GENERAL INFORMATION**

For safe and satisfactory operation of dampener, read all safety warnings and 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

- Dampering of flow pulsations can only be effective if 5 to 10 psi (0.4 to 0.7 bar) back pressure downstream of dampener is available. A back pressure valve may be required downstream of dampener.

- It is recommended that a 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, do the following: **Adjustable and Chargeable models** — charge dampener to 80% of the system test pressure prior to test. **Automatic models** — dampener must be equipped with a constant source of compressed air prior to test; connect a compressed air line and dampener will pressurize itself.

- Install dampener in-line, 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 comply with the ATEX standard for use in potentially explosive atmospheres. These models have the AT designation at the end of the part number and comply with EC standard EN-13463-5 with protection degree of II 2GD TXC. 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 only ONE wear part – the elastomeric bladder or the PTFE bellows. There is no need for lubrication.

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 on metal models at each re-assembly with fasteners of equal grade/strength value. **DO NOT** re-use old nuts and bolts.

After the initial torque of fasteners, bolts will usually lose up to 20% of their 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 RE-ASSEMBLY OF METAL MODELS, USE NEW FASTENERS AND TORQUE FASTENERS ACCORDING TO SPECIFICATION ON DAMPENER TAG.

- **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

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.

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

**CAUTION!** Plastic materials lose strength as temperature increases which reduces the maximum pressure sustainable by the material.

<table>
<thead>
<tr>
<th>Non-Metallic Body Materials</th>
<th>Temperature Limits</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVC</td>
<td>See chart below.</td>
<td>Good general chemical resistance; looses strength quickly as temperature rises.</td>
</tr>
<tr>
<td>CPVC</td>
<td>+32°F to +180°F (0°C to +82°C)</td>
<td>Chlorinated PVC (CPVC) retains strength to higher temperatures.</td>
</tr>
<tr>
<td>Acetal*</td>
<td>+32°F to +175°F (0°C to +79°C)</td>
<td>Good flex life; low moisture sensitivity; high resistance to solvents and chemicals.</td>
</tr>
<tr>
<td>Noryl</td>
<td>+32°F to +220°F (0°C to +104°C)</td>
<td>Good resistance to acids and bases; good temperature stability.</td>
</tr>
<tr>
<td>Polypropylene*</td>
<td>+32°F to +175°F (0°C to +79°C)</td>
<td>Good general purpose plastic; broad chemical compatibility at medium temperatures.</td>
</tr>
<tr>
<td>PTFE</td>
<td>+40°F to +220°F (+4°C to +104°C)</td>
<td>Use with highly aggressive fluids.</td>
</tr>
<tr>
<td>PVDF</td>
<td>+10°F to +200°F (-12°C to +93°C)</td>
<td>Excellent resistance to most acids and bases; highest temperature plastic available.</td>
</tr>
</tbody>
</table>

* Conductive Acetal and Conductive Polypropylene available.

**CAUTION!** PVC loses strength more rapidly than other plastic materials as temperature increases. Certain chemicals can also affect material strength reducing maximum pressure ratings. The chart below shows reduced maximum pressure ratings based on temperature for PVC only. Note that these are general guidelines only; selection of dampener materials must be determined by each individual application to avoid equipment damage and unsafe operation.

### PVC Maximum Pressure Guidelines by Temperature

<table>
<thead>
<tr>
<th>Temperature</th>
<th>73.4°F (23°C)</th>
<th>80°F (27°C)</th>
<th>90°F (32°C)</th>
<th>100°F (38°C)</th>
<th>110°F (43°C)</th>
<th>120°F (48°C)</th>
<th>130°F (54°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Pressure</td>
<td>150 psi (10.3 bar)</td>
<td>142.5 psi (9.8 bar)</td>
<td>135 psi (9.3 bar)</td>
<td>112.5 psi (7.6 bar)</td>
<td>97.5 psi (6.7 bar)</td>
<td>90 psi (6.2 bar)</td>
<td>75 psi (5.2 bar)</td>
</tr>
</tbody>
</table>
INSTALLATION & OPERATION INSTRUCTIONS:
DAMPENER (CHARGEABLE MODEL)

⚠️ 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.

⚠️ ATEX MODELS MUST BE GROUNDED (EARTHED) BEFORE OPERATION.

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 compressed air or clean dry Nitrogen to charge dampener. DO NOT USE OXYGEN.

DO NOT exceed maximum allowable working pressure (MAWP) specified on dampener serial tag.

Always wear safety glasses and other appropriate safety equipment when installing, charging or repairing dampener.

READ ALL SAFETY WARNINGS AND INSTALLATION & OPERATION INSTRUCTIONS IN THE MANUAL BEFORE INSTALLATION.

IMPORTANT! AFTER MAINTENANCE OR RE-ASSEMBLY OF METAL MODELS, USE NEW FASTENERS AND TORQUE FASTENERS ACCORDING TO SPECIFICATION ON DAMPENER TAG.

Before performing a system pressure test, dampener must be charged with 80% of system test pressure to avoid possible damage to bladder/bellows.

The following pre-charge notes are for plastic dampener models with a maximum pressure rating up to 150 psi (10.3 bar) and metal models with a maximum pressure rating up to 2000 psi (138 bar).

NOTE: Damper can be pre-charged with compressed air up to a maximum pressure of 150 psi (10.3 bar). If maximum pressure will exceed 150 psi (10.3 bar), dampener must be pre-charged with Nitrogen only. DO NOT USE OXYGEN.

Pre-charge pressure should be checked at least monthly as gas molecules will diffuse through elastomeric bladders, the speed of which depends on the elastomer 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 (20.7 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.

Step 1 — Installation Position

Install the dampener in-line, 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. Damppener 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 Start-Up (see Pre-Charge Notes)

Chargeable models do not require an air line connection. Damppener can be pre-charged with compressed air up to a maximum pressure of 150 psi (10.3 bar). If maximum pressure will exceed 150 psi (10.3 bar), dampper must be pre-charged with Nitrogen only. Use a hand pump, Nitrogen tank or air compressor to charge dampener. DO NOT USE OXYGEN. Charging hose kits are available separately.
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.

**Step 1 — Installation Position**

Install the dampener in-line, 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 Start-Up (see Pre-Charge Notes)**

Chargeable models do not require an air line connection. Dampener must be pre-charged with compressed air or Nitrogen, using a hand pump, Nitrogen tank/bottle, or compressor. **DO NOT USE OXYGEN.** Charging hose kits are available separately.

**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.

**FIGURE 1**
Step 1 — Installation Position

Install the dampener in-line, 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. 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 Start-Up (see Pre-Charge Notes)

Chargeable models do not require an air line connection. Dampener can be pre-charged with compressed air up to a maximum pressure of 150 psi (10.3 bar). If maximum pressure will exceed 150 psi (10.3 bar), dampener must be pre-charged with Nitrogen only. Use a hand pump, Nitrogen tank or air compressor to charge dampener. DO NOT USE OXYGEN. Charging hose kits are available separately.

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 start up 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 re-check dampener charge every month.
SHIPPING EQUIPMENT FOR REPAIRS

Equipment can not be accepted for repair without a Return Material Authorization. Items returned should be clearly labeled to indicate the liquid being handled. Process liquid should be flushed from the equipment before the equipment is shipped.

NOTE: Federal law prohibits handling of equipment that is not accompanied by an OSHA Material Safety Data Sheet (MSDS). A completed MSDS must be packed in the shipping crate with any equipment shipped for repair. These safety precautions will aid the troubleshooting and repair procedure and preclude serious injury to repair personnel from hazardous residue in equipment. A Materials Safety Data Sheet must accompany all returns.

All inquiries or parts orders should be addressed to your local Milton Roy representative or distributor.

Before returning any equipment, contact Milton Roy for authorization and instructions.

WARRANTY, TERMS, AND CONDITIONS

Information regarding warranty, terms, and conditions is available at Milton Roy’s website: www.miltonroy.com