

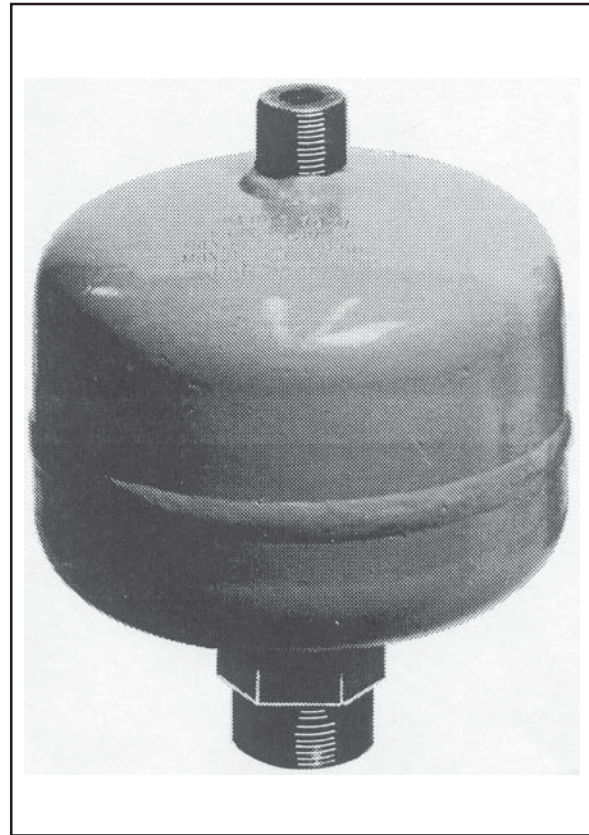
General

Pressure variations in hydraulic pipe layouts and tube fittings give rise to irregular operation and can, in cases of great amplitude variations, cause damage to the pipework and even fracture fittings. A pulsation frequency in the resonance range of the system is even more critical. Increasing pressure peaks which are not compensated can cause unpredictable damage.

Naturally pulsations are generated in piston and diaphragm dosing pumps and their intensity increases according to the pipe length. The smaller the pipe diameter, the higher the pressure peaks. Therefore it is important to protect the equipment with pulsation dampers when designing metering systems particularly when a rigid piping (without flexible tubing) is planned. These pulsation dampers represent a simple countermeasure to bring any increasing pressures to harmless proportions.

Their function is based upon the compression of a nitrogen gas cushion through the contents of the pipe, which has the effect of storing energy. During pressure increase (pump discharge stroke) a part of the contents pumped is stored. The latter is returned to the pipe network when pressure is decreased (suction stroke).

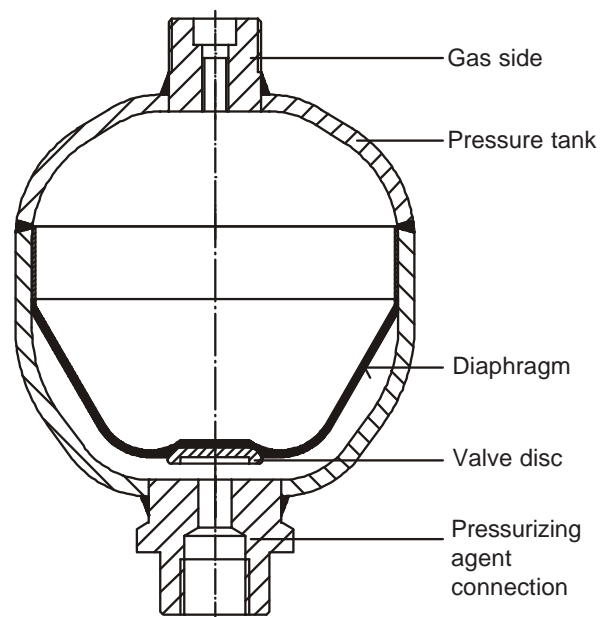
A basic distinction is made between pulsation dampers with and without separation diaphragm. In the case of pulsation dampers without separation diaphragm the medium is in direct contact with the nitrogen cushion which was pre-charged. After starting up the nitrogen is compressed to damping volume. As the nitrogen is gradually dissolved in the medium, fresh air must be added from time to time to compensate for the loss. This problem can be avoided by using pulsation dampers with separation chamber. In this type the nitrogen cushion is separated from the medium to be discharged by an elastic diaphragm which prevents absorption.



Construction

The pulsation dampers in this data sheet are welded constructions.

They consist of a fluid and gas section and a diaphragm forming a gas-tight division.



Diaphragm material

The diaphragms are available in the following materials:

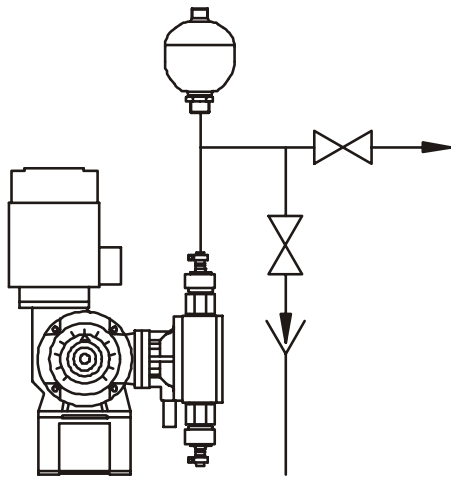
II R (butyl rubber, EPDM)
FPM (fluoride rubber, Viton)
other materials on request.

Corrosion protection

As a standard the pulsation dampers are available in stainless steel. Some sizes are also available in low-price design with the top part (filling side) made of steel and plastic coated.

Positioning

Basically the pulsation damper can be positioned as you like. If there is a danger of build-up of dirt it should be mounted vertically, with the pressurizing agent connection underneath.



Fixing

The pulsation dampers can be screwed directly onto a connecting pipe. An external thread can be used as additional fixation in the fixing holes.

In the case of strong vibrations the pulsation damper has to be secured so that it does not work loose.

Pulsation damper design

General

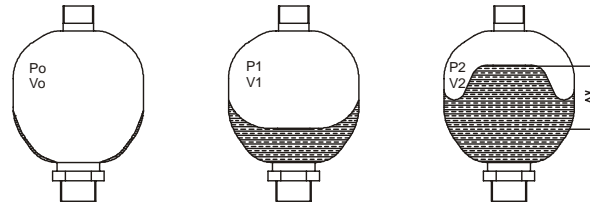
There are three working positions of the pulsation dampers:

1. The diaphragm filled with nitrogen takes on the inner contour of the pulsation damper. The valve disc closes the pressurizing agent connection, thus preventing the diaphragm from coming out.

2. Position at minimum working pressure. A small amount of fluid should remain in the tank to prevent the valve disc from hitting the bottom each time the tank is empty.

P° should therefore always be smaller than p_1 .

3. Position at maximum working pressure. The change in volume ΔV between the position at minimum and maximum working pressure corresponds to the stored fluid amount.



V_0 = total nitrogen volume of pulsation damper

V_1 = nitrogen volume at p_1

V_2 = nitrogen volume at p_2

ΔV = effective volume between p_1 and p_2

p_0 = pre-fill pressure

p_1 = minimum working pressure

p_2 = maximum working pressure

Hydraulic and pneumatic characteristics

- Effective nitrogen volume V_0 corresponds to nominal volume
- Only use nitrogen as pneumatic pressurizing agent for filling the pulsation damper. Do not use oxygen (danger of explosion!).
- Temp. range of pressuriz. agent -10°C to $+80^{\circ}\text{C}$.
- For operating overpressure p_{max} . (bar) see selection table.
- Service overpress. $p_2 \leq p_{\text{max}}$.
- For nominal volume (liter) see selection table.

Dimensioning of the pulsation damper

It turned out that sizing the damper so that the remaining pressure fluctuation amounts to approx. +/- 10% of the average working pressure is a reasonable dimensioning.

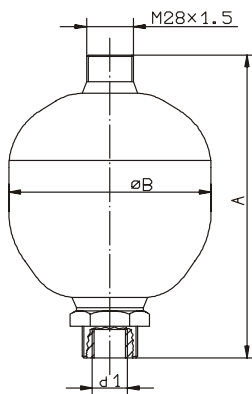
This value was taken into account in the table below. The capacity per stroke on which this table is based can be found in the data sheets of the corresponding metering pumps. The greater the sizing of the pulsation damper, the better the damping effect.

Caution! With diaphragm pumps it is recommended to use the next larger size because of the intermittent discharge characteristics.

Gas filling pressure

Fundamentally the preload pressure of a stress-relieved damper on the medium side should amount to approx. 60% of the subsequent working pressure. To achieve optimum exploitation of the storage volume, the following gas filling pressures are recommended:

p_0 for delivery state 10 bar at 293 K (20° C), unless otherwise ordered.



Selection table

Model	Housing material	Material	Working pressure	Medium connection d1	Housing [mm]		Pump Stroke Volume up to	Item number
	Medium filling side	Diaphragm	max. admissible		Dimensions Ø B	A		
PDM 160	1.4571/st. coated	Buthyl	210 bar	G 1/2 internal	75	125	24 ml/stroke	12760001
PDM 160	1.4571/st. coated	Viton	210 bar	G 1/2 internal	75	125	24 ml/stroke	12760032
PDM 160	1.4571/1.4571	Buthyl	160 bar	G 1/2 internal	75	125	24 ml/stroke	12760031
PDM 160	1.4571/1.4571	Viton	160 bar	G 1/2 internal	75	125	24 ml/stroke	12760030
PDM 320	1.4571/st. coated	Buthyl	210 bar	G 1/2 internal	93	137	48 ml/stroke	12760002
PDM 320	1.4571/1.4571	Viton	160 bar	G 1/2 internal	93	137	48 ml/stroke	12760033
PDM 320	1.4571/1.4571	Buthyl	160 bar	G 1/2 internal	93	137	48 ml/stroke	12760007
PDM 750	1.4571/1.4571	Buthyl	140 bar	G 1/2 internal	121	168	120 ml/stroke	12760008
PDM 750	1.4571/1.4571	Viton	140 bar	G 1/2 internal	121	168	120 ml/stroke	12760014
PDM 2000	1.4571/1.4571	Buthyl	80 bar	G 3/4 internal	160	218	300 ml/stroke	12760009
PDM 2000	1.4571/1.4571	Viton	80 bar	G 3/4 internal	160	218	300 ml/stroke	12760015

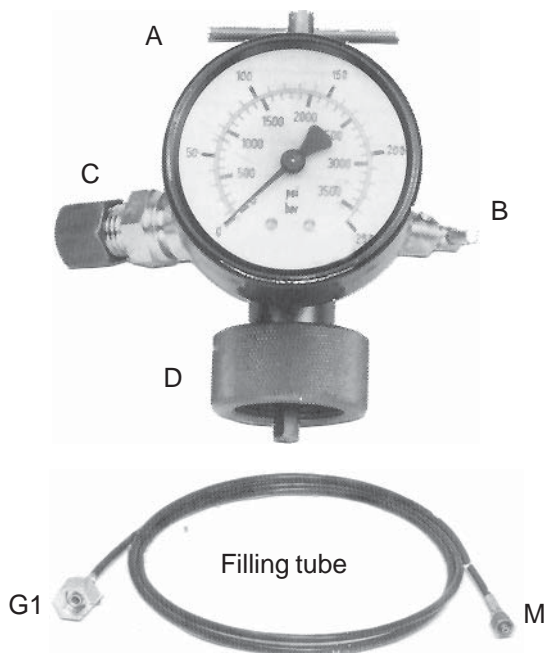
Other sizes and designs are available upon request.

Optional accessories for nitrogen filling

With the pulsation dampers described overleaf nitrogen losses are normally very low. In order to avoid too strong a deformation of the diaphragm in the case of a preload pressure reduction p_0 regular testing of the nitrogen preloading is recommended.

Description

Using the filling and testing device our pulsation dampers are filled with nitrogen or the existing nitrogen preload overpressure is changed. For this purpose the filling and testing device is screwed onto the filling valve of the pulsation damper and connected to the commercial nitrogen cylinder by means of a flexible filling tube. If the nitrogen preload overpressure is only being checked or reduced, the connection of a filling tube is unnecessary.



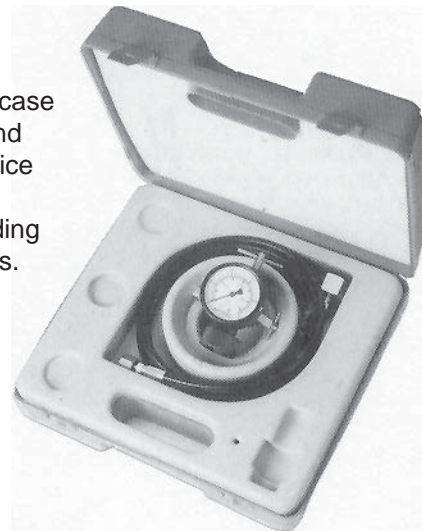
Filling and testing device

Construction

The filling and testing device for our pulsation damper PDM consists of:

- The connecting unit with the connection C for the filling tube and the pulsation damper connection D, spindle A, relief valve B and a pressure gauge.
- The filling tube with cap nut G1 for connecting the nitrogen cylinder valve in the following countries: Germany, the Netherlands, Switzerland, Sweden, USSR, Finland and Belgium with internal thread W 24, 32x1/4".

Protecting case for filling and testing device as well as corresponding accessories.



Adapter for permanent pressure indication

By means of a permanent indication during operation the function of the pulsation damper can be monitored indirectly. With the correct dimensions the maximum pressure fluctuation should amount to only -10% of the working pressure. For the pressure gauge there are two pressure ranges available.

The adapter is screwed onto the filling valve of the pulsation damper, after having unscrewed the locking screw from the filling valve.

Reducer for connection G1

Great Britain	G 5/8 BS 2279	external= G2
France	W 21,7 x 1/14"	internal= G3
USA	24,51 x 1/14"	external= G4
Italy	21,7 x 1/14"	external= G5

Pressure reducing valve

For adjusting the desired charging overpressure between nitrogen cylinder and storage tank.

Optional accessories

Filling and testing device with pressure gauge indication		Pressure relief valve recommended if cylinder pressure higher than max. admissible filling overpressure		Permanent pressure indication including: adapter and pressure gauge			Protective case for filling and testing device and accessories	Reducer for nitrogen cylinders from countries other than Germany
0-25 bar	0-25 bar	0-50 bar	0-100 bar		0-25 bar	0-250 bar		
12750015	12750017	12750024	12750025	12750018	87381	87382	12750019	G 2 - 12750020 G 3 - 12750021 G 4 - 12750022 G 5 - 12750023

Accessories for filling compressed air

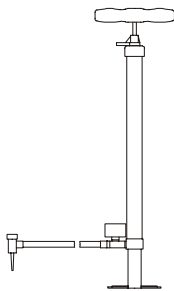
Adapter with filling valve

After unscrewing the valve screw N from the filler cap of the PDM a filling valve can be mounted so that the PDM can be filled with compressed air.

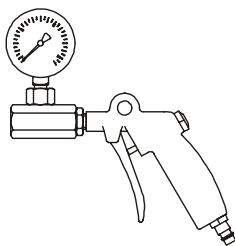
Filling device for compressed air

There are two filling devices for compressed air available.

Depending on the application site a filling device for supply from a foot-operated pump or from a permanently installed compressed air line system can be chosen.



Filling device for supply of compressed air from foot-operated pump.



Filling device for supply of compressed air from permanently installed compressed air line system.

Reducer with filling valve for compressed air	Filling device for compressed air up to 6 bar	
	Supply from foot-operated pump	Supply from permanently installed compressed air system
26447	24332	24321

Order example - requirements:

For the treatment of boiler feed water Hydrazine is used. Using a metering pump REKOS KR 40, 40l/h Hydrazine are metered against 80 bar into a high-pressure steam boiler. Selection of pulsation damper: Depending on the flow rate, 40l/h corresponding to 6.8 ml/stroke the dimensions of the pulsation damper are determined according to the selection table. The smallest PDM with a content of 0.16l is adequate. In this case PDM 160 with item number 12760001 is suitable. The wet end housing is made of stainless steel 1.4571 and it has got a butyl diaphragm.

As an accessory to the pulsation damper a filling and testing device with pressure gauge indication 0-250 bar can be chosen from the selection table. The corresponding item number is 12750017. As it is possible that the nitrogen pressure available on site is higher than the maximum admissible working overpressure of the PDM (in this case 210 bar), a pressure reducing valve must be used. The filling pressure p_o of 48 bar (60% of the subsequent working pressure) can be adjusted using pressure reducing valve 12750024.

For safekeeping the filling and testing device as well as the accessories, a protective case 12750019 is recommended.

Therefore the order is as follows:

- 1 pulsation damper 0.1l, item number 12750001.
- 1 filling and testing device with pressure gauge 0-250 bar, item number 12750017
- 1 protective case, item number 12750019.