Pulsation Dampener PDS

General

Pressure fluctuations in hydraulic piping systems and fittings result in uneven operating conditions of tandem-connected consumers. If the amplitude of these fluctuations is large enough, the line network may even be disturbed or torn out of its anchoring. Pulsation frequencies which correspond to the resonance of the piping system are particularly critical. If increasing pressure peaks are not dampened, immense damages will be caused.
When using piston and diaphragm metering pumps, it is normal for pulsations to occur, the intensity of which grows with the length of the line. The smaller the line diameter, the larger the pressure peaks. When planning metering systems, especially if rigid piping is going to be used instead of flexible tubing, it is recommended to integrate pulsation dampeners. They are a simple and also effective way to reduce pressure fluctuations to a harmless level.
The function of the pulsation dampener is based on energy-converting compression and expansion of a gas cushion. A portion of the media being transported is stored and released to the piping system if the pressure decreases.
In general, a difference is made between pulsation dampeners **with** separating diaphragm and those **without** separating diaphragm.
For pulsation dampeners without separating diaphragm, the liquid is in direct contact with the gas cushion resulting from the compressed air accumulated before. After startup, the compressed air is reduced to its dampening volume. As the compressed air is gradually dissolved in the liquid, venting under pressureless condition is necessary from time to time. This disadvantage can be avoided by using pulsation dampeners with separating diaphragm. Here an elastic diaphragm separates the media from the dampening gas cushion which is thereby protected against absorption.

Discharge side of the pump

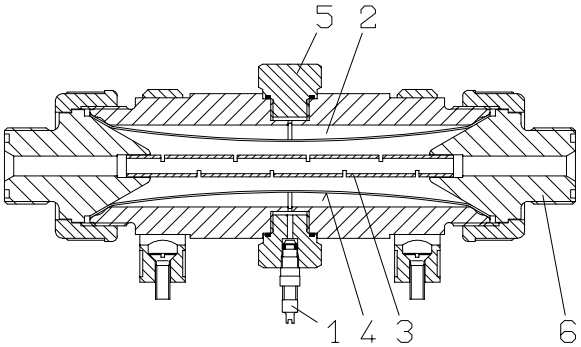
On the discharge side, metering pumps force the delivery of the media with all their power. Depending on the line length and fitting characteristics, important pressure peaks may occur, which must be smoothed by using pulsation dampeners.

Suction side of the pump

The liquid supply on the suction side must ensure that the liquid follows the suction stroke of the diaphragm or piston immediately.
The suction stroke acceleration may, however, be high so that the liquid mass in the suction line cannot follow the stroke. In this case, a cavity occurs in the column of liquid (cavitation).

Pulsation dampeners installed directly below the suction valve as „suction air chambers“ cause the liquid to flow smoothly through the suction line so that the medium reaches the metering pump with the lowest pressure loss possible.

Functional diagram



Any flow direction

1 Gas charging valve
2 Gas cushion
3 Support pipe
4 Separating diaphragm
5 Pressure gauge connection
6 Liquid connection

Pulsation dampener with tube-type diaphragm (PDS)

(registered design GM 80 11 452)

The PDS pulsation dampener described in this documentation has a separating diaphragm consisting of a tube which is positioned concentrically within a cylindrical plastic housing. The medium flows in this tube while the gas cushion is located outside the tube, in the annular gap between the tube and the plastic housing.

The advantage of this design is the possibility of manufacturing the pulsation dampener from a variety of plastics. The PDS is installed close to the pump either by means of a tee-fitting or integrating it in the supply line so that the fluid flows directly through. The PDS 80 can be mounted directly on the discharge valve.

Compressed air is used for filling. By **no** means must **oxygen** be used.

During filling according to BW 1 27 01, the pressure of the gas cushion is measured via a pressure gauge connected to the filling device. It is recommended to provide the PDS with a pressure gauge for operation as well.

Dimensioning of the pulsation dampener

If the pulsation dampener is used to reduce destructive pressure peaks, it is sufficient to choose a size which allows the remaining pressure fluctuations to be about 10 % of the average operating pressure. This value has been taken into consideration in the table.

The flow rates per stroke, on which the table values are based, can be found in the data sheets of the metering pumps. The larger the pulsation dampener, the better the dampening effect.

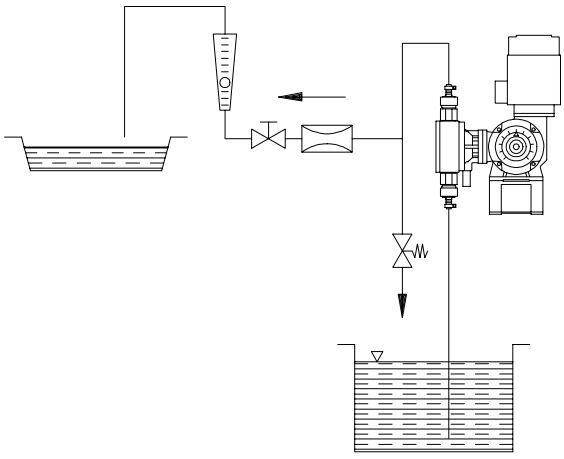
Type	Stroke volume[1] up to. . .ml/stroke	Perm. operating pressure [bar]
PDS 80	15	10
PDS 250	40	10
PDS 750	120	10
PDS2500	400	10
PDS7500	1200	4

[1] applicable for the remaining 10 % fluctuation of the nominal pressure in the case of single-head pumps

Initial pressure max. 6 bar
Operating pressure max. 10 bar
Temperature max. 50 °C

Dampening for flow meters

If the pulsation dampener is used to ensure constant flow for a flow meter, it might be necessary to install a throttle after the pulsation dampener. If, due to relatively short lines or a free outlet, the back pressure becomes too small, such a valve is particularly required in order to store the liquid smoothly in the pulsation dampener. The following installation is recommended.



Dimensioning diagram

The diagram shown on the next page helps to determine the size of the pulsation dampener in dependence of the stroke volume of the pump and the required smoothing level of the metering flow or the existing pressure fluctuations. The actual dampening capacity, however, is influenced by numerous parameters which can be neither precisely defined nor foreseen. In some cases, it might become necessary to change the system design or add supplementary fittings in order to solve a dampening problem.

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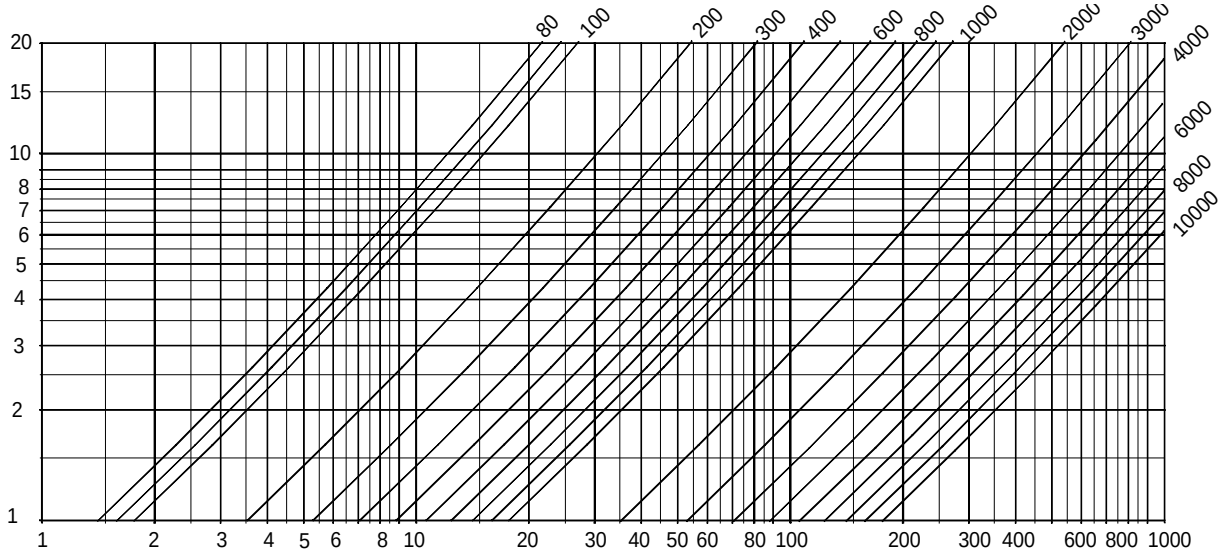
Dimensioning diagram

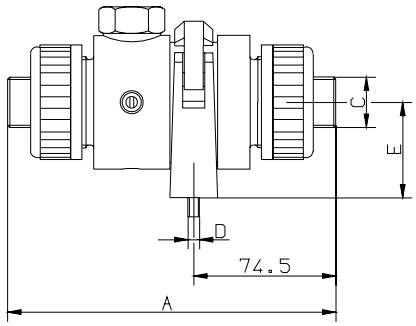
+/- % pressure or metering flow fluctuations around the average value

Size of the pulsation dampener Vo / cm³

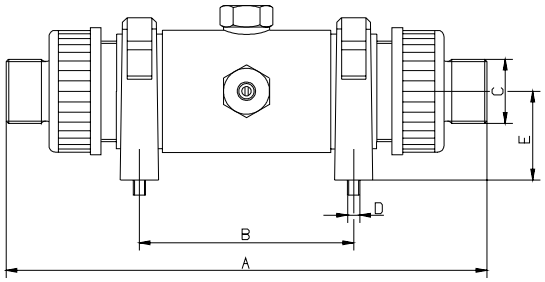


cm³/stroke
stroke volume

Dimensional drawings



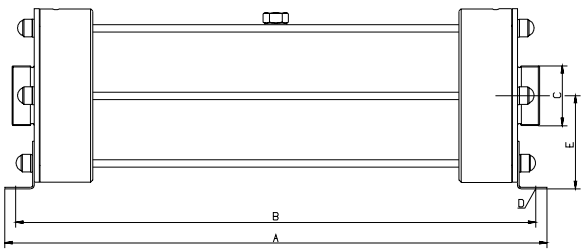
PDS 80



PDS 250

Dimensional tables

Type	Dimensions				
	A	B	C	D	E
PDS 80	172	--	G 3/4	M 6	50
PDS 250	314	140	G 1 1/4	M 8	64
PDS 750	363	347	G 1 1/4	ø 9	71.5
PDS 2500	541	525	G 2	ø11	99.5
PDS 7500	720	710	G 2 3/4	ø13	125.5



PDS 750 . . . 7500

Selection tables

To be able to offer the optimum version for each application, the PDS has been divided into the most important functional groups. Depending on the requirements, the different modules can be chosen from Tables 2 to 4. Standard pulsation dampeners are listed in Table 1.

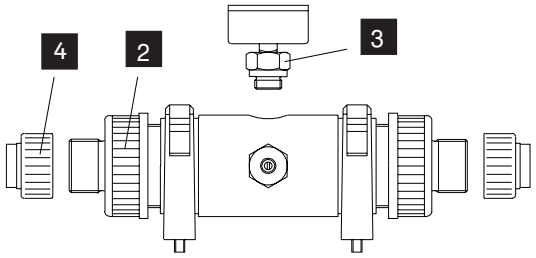
1 Standard pulsation dampener

2 Pulsation dampener (basic unit without connections)

3 Pressure gauge, complete

4 Connections / or 1 x dummy plug

1 —— Standard pulsation dampener compl. (without pressure gauge)



The numbers correspond to the relevant selection tables.

1						
Type	Diaphragm material	d_1 (input)	d_2 (output)	Stroke volume (1) up to ... ml/stroke	PVC Part No.	PP Part No.
PDS 80	Hypalon	G 5/8 i	d 6/12	15	12701007	-
PDS 80	Viton	G 5/8 i	d 6/12	15	12701010	-
PDS 80	Hypalon	G 3/4 i	d 6/12	15	12701049	-
PDS 80	Viton	G 3/4 i	d 6/12	15	12701055	-
PDS 80	Hypalon	d 6/12	d 6/12	15	12701169	-
PDS 80	Viton	d 6/12	d 6/12	15	12701170	-
PDS 250	Hypalon	d 20 i	d 20 i	40	12702085	12701085
PDS 250	Viton	d 20 i	d 20 i	40	12702097	12701097
PDS 750	Hypalon	d 20 i	d 20 i	120	12702171	12701171
PDS 750	Viton	d 20 i	d 20 i	120	12702172	12701172
PDS 2500	Hypalon	d 40 i	d 40 i	400	12702133	12701133
PDS 2500	Viton	d 40 i	d 40 i	400	12702180	12701180
PDS 7500	Hypalon	d 63 i	d 63 i	1200	12702145	12701145
PDS 7500	Viton	d 63 i	d 63 i	1200	12702146	12701148

(1) applicable for remaining 10% fluctuation of the nominal pressure in the case of single-head pumps

2						
Type	Diaphragm material	Connection f. basic unit	Rec. for Ø / DN	Perm. operating pressure [bar]	PVC Part No.	PP Part No.
PDS 80	Hypalon	G 3/4 a	16 / 10	10	32814	33297
PDS 80	Viton	G 3/4 a	16 / 10	10	32819	33298
PDS 250	Hypalon	G 1 1/4 a	25 / 20	10	33276	32815
PDS 250	Viton	G 1 1/4 a	25 / 20	10	33275	32820
PDS 750	Hypalon	G 1 1/4 a	25 / 20	10	33632	32816
PDS 750	Viton	G 1 1/4 a	25 / 20	10	33631	32821
PDS 2500	Hypalon	G 2 a	40 / 32	10	33634	32817
PDS 2500	Viton	G 2 a	40 / 32	10	33633	32822
PDS 7500	Hypalon	G 2 3/4 a	63 / 50	4	33636	32818
PDS 7500	Viton	G 2 3/4 a	63 / 50	4	34599	34615

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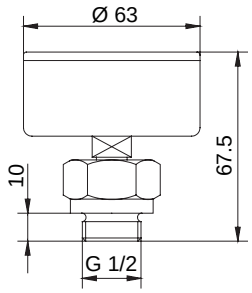
3

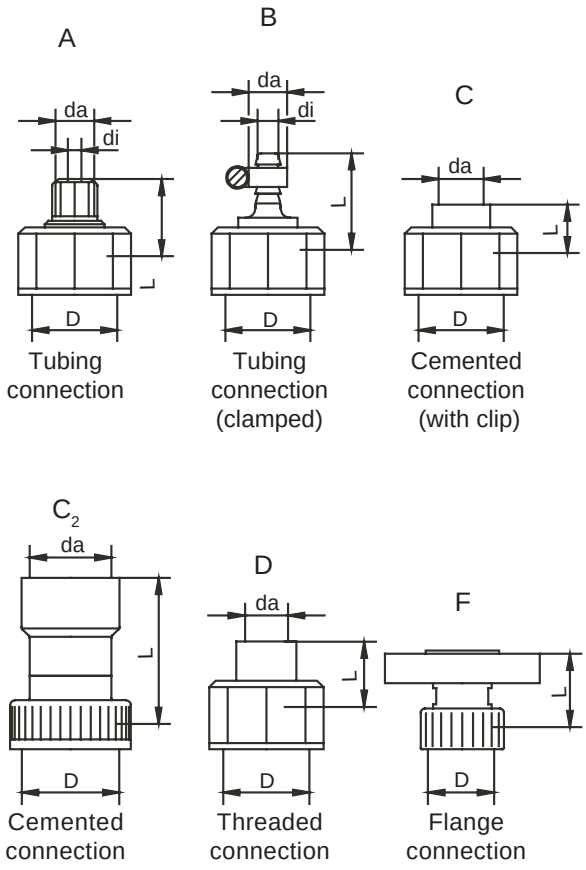
Pressure gauge complete with connection					
Glycerinedampening		without		with	
Material of connector		PP	PVC	PP	PVC
Measuring range	0... 6 bar	32949	35476	32948	35480
	0...16 bar	32951	35478	32950	35477

Do not use a pressure gauge for suction air chamber applications!



4

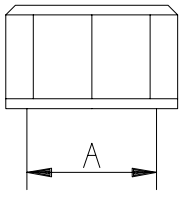
						Part No.	
Type	Fig.	D	di	da	L	PVC	PP
PDS 80	A	G 3/4	4	6	24	19480	34846
			6	8	30	28159	-
			6	9	30	34926	34708
			6	12	55	19175	-
	B		6	12	30	23342	-
	C		-	10	15	25167	-
			-	12	15	27518	-
			-	16	17	25625	33793
	D		-	G 1/4	20	25165	34676
PDS 250	B	G 1 1/4	9	15	41	25921	-
PDS 750			16	26	50	25936	35694
	C		-	12	22	25923	-
			-	16	22	27672	27664
			-	20	22	25937	35490
	D		-	G 3/8	28	25930	33797
			-	G 1/2	22	25943	33798
	F		-	-	47	25956	-
PDS 2500	C_2	G2	-	32	29	32932	-
			-	40	29	32933	-
			-	50	90	32934	-
PDS 7500	C_2	G 2 3/4	-	50	41	32935	-
			-	63	41	32936	-



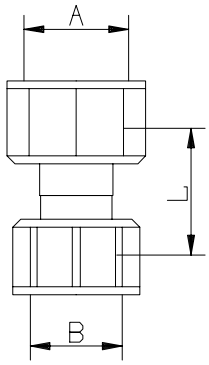
4

Type	Dummy plug	
	Dimension A	Part No.
PDS 80	G 3/4	32941
PDS 250	G 1 1/4	32947
PDS 750	G 1 1/4	32947
PDS 2500	G 2	32973
PDS 7500	G 2 3/4	32974

If the pulsation dampener is connected via a tee-fitting a dummy plug is required.

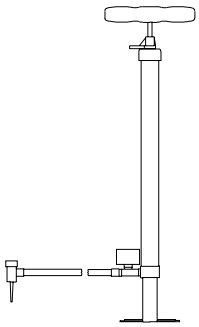


PDS 80 with screwed connection for direct pump mounting

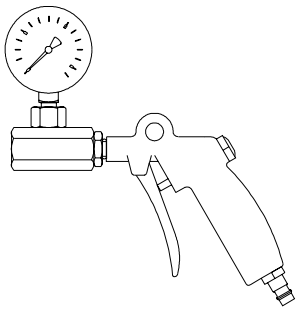


Screwed PDS 80 connection for direct pump mounting			
A	B	L	Part No.
G 3/4	G 5/8	32	32937
G 3/4	G 3/4	30	32938

Filling devices



Filling device for compressed air up to 6 bar;supply by foot pump;
Part No.: 12724332



Filling device for compressed air up to 6 bar;supply by compressed air system;
Part No.: 12724321