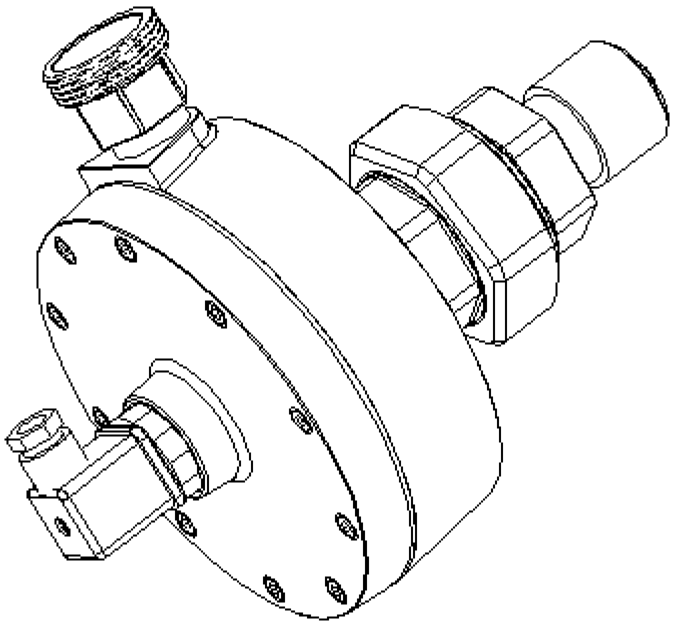
ALBRECHT - Pulsors

Pneumatic Loosening and Fluidisation of Bulk Solids and Filter Dust

Operating and Assembly Instructions



ALBRECHT Ingenieurbüro GmbH

Flow Promotion Technology for Bulk Solids and Filter Dust

Mangenberger Str. 33 • D - 42655 Solingen

Phone: +49 - (0)212 – 16393
Fax: +49 - (0)212 - 201644
Email: albrecht@pulsoren.com
Internet: www.pulsoren.com

Contents

0. General Notes

The Pulsors are to be used in keeping with the technical recommendations and documentation of ALBRECHT Ingenieurbüro. Only technically competent personnel may carry out the assembly of the equipment, especially the installation of the compressed air connections and the electrical connections, as well as the commissioning, under compliance with the relevant standards and specifications.

The instructions in this manual must be followed, especially when using the equipment in explosive atmosphere. No liability is accepted for improper use of the equipment and consequential damage.

.... **Please note:**

Important instructions for the assembly of the Pulsors can be found in Chapter 3 , pg. 4

1. System components

1.1 Mode of action and general description

ALBRECHT - Pulsors serve for the loosening, fluidisation and flow stimulation of bulk solids and filter dust in silos and similar tanks.

During the operation of the Pulsors, rapid, successive, short compressed air pulses (5 Hz) are blown into the bulk solids via metallic dust-proof nozzles with reverse flow preventers at high pressure (6 bar). The compressed air pulses are generated purely mechanically through the pneumatically forced oscillation of a valve disk in the Pulsor.

The pulse-like blowing of the compressed air results in a forced oscillation and fluidisation in the flowing material. As a result, cohesive forces of attraction between the bulk solid particles are nullified and hardening, bridging and hole formations are eliminated.

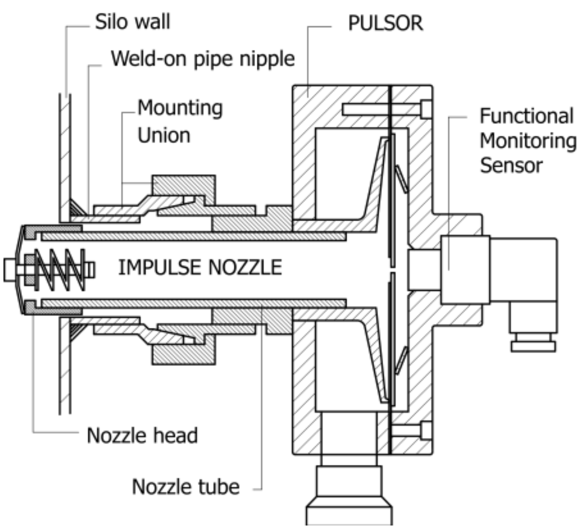
Thanks to the special construction of the nozzles, the compressed air that is blown in flows parallel to the tank wall. As a result, the air is homogeneously distributed in the bulk solids and friction forces are reduced, as is the case with an air cushion. The bulk solids also flow on in the outer zone of the silo (mass flow), so that segregation during discharge is reduced.

A complete functional unit consists, apart from the main components Pulsor and impulse nozzle, of two other components: a strong connection pipe (hydraulic pipe) for the compressed air supply from the existing supply network and a control valve for switching the Pulsors on and off. The pulse generation and blowing takes place automatically as long as the control valve is open and there is compressed air applied at the devices.

The pulse generation in the Pulsor can be monitored via a contact-less sensor in the Pulsor housing (optional).

1.2 Pulsor and impulse nozzle

The Pulsor and the impulse nozzle are fixed on the silo wall by means of weld-on threaded pipe nipples and conically sealing pipe unions. Here, the impulse nozzles project about 10-20 mm into the silo through the wall, which is drilled concentrically to the weld-on pipe nipple.



When compressed air is fed, the valve disk in the Pulsor is raised from its valve seat against the force of a plate spring. Compressed air from the feed pipe flows through the resultant ring gap between the valve disk and the valve seat into the nozzle pipe. The non-return valve of the nozzle head opens and the compressed air flows through several holes to all sides radially into the silo. Owing to the changed pressure conditions in the Pulsor, the valve disk closes again after a short time and the air stream is suddenly interrupted. This process repeats automatically at a frequency of about 5 Hz till the compressed air supply is blocked. The non-return valve in the nozzle head prevents the product in the silo from reaching the nozzle pipe.

1.3 Control valve

Generally, diaphragm valves with large flow coefficients are used for switching the Pulsors on and off. Usually the valves are opened for about one second and the activation is repeated several times a minute (see chapter 2.2 , pg.3)

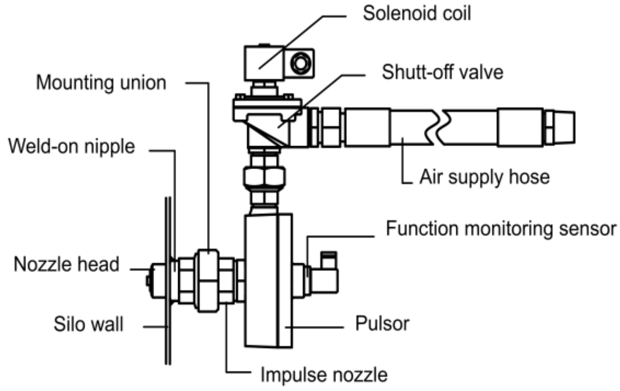
Depending on the application, either electromagnetically actuated valves are used for this purpose (2/2-diaphragm solenoid valves with internal servo-control), or pneumatically actuated valves in conjunction with pilot solenoid valves (2/2-diaphragm valves for external servo-control). If pneumatically actuated valves are used in conjunction with pilot solenoid valves, several Pulsors can be activated via one solenoid valve. Moreover, the pilot valve can also be fitted at some distance from the Pulsor, for example, outside a determined ATEX zone.

The following overview shows various valve combinations that can be used:

Combination 1

(Standard)

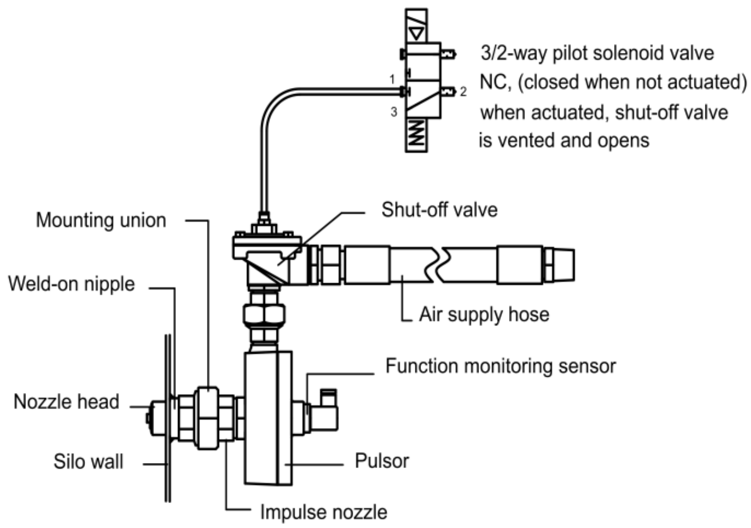
Pulsor with **electromagnetically** actuated shut-off valve



Combination 2

Pulsor with **pneumatically** actuated shut-off valve and pilot solenoid valve

internal control air supply



Combination 3

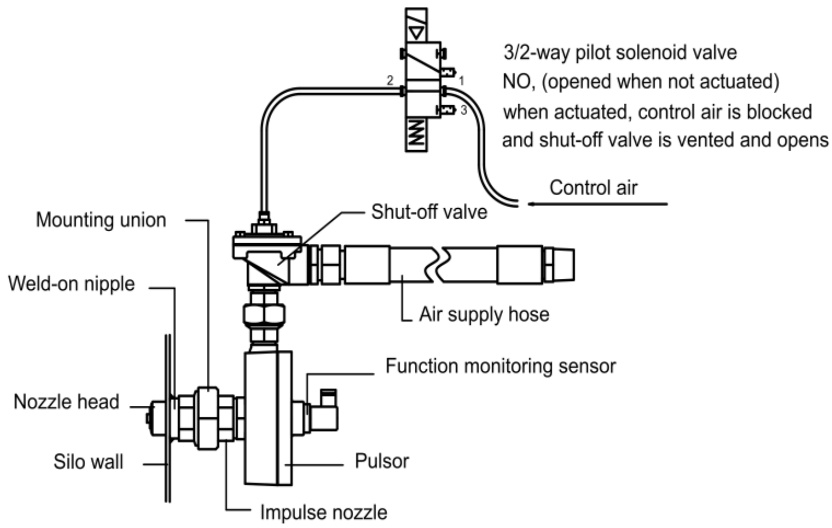
Pulsor with **pneumatically** actuated shut-off valve and pilot solenoid valve

external control air supply

ATTENTION:

In this case the diaphragm of the shut-off valve must not have a hole

(Valve diaphragm without hole)



1.4 Function monitoring

In the standard version, the function monitoring of the Pulsors consists of a pressure-resistant, inductive proximity switch integrated in the housing lid with an integrated timing element. This sensor senses the movement of the Pulsor valve disk and in case of a fault, reports the absence of the pulse generation.
The sensors are designed in 3-conductor technology either as normally open or normally closed versions and are switched on in parallel to the solenoid valves of the respective Pulsors (see chapter 6.3 , pg.10):

For use in ATEX zones, intrinsically safe NAMUR sensors with the corresponding isolating amplifiers may be used (optional).

2. Arrangement and Activation of the Pulsors

2.1 Arrangement of the Pulsors at the silo

The Pulsors are offered in three sizes that are different in their air throughput and the radius of action. The placement of the Pulsors on a tank, the selection of the correct sizes and a matching activation scheme are decisive for an optimum effect and depend on the silo geometry, the properties of the bulk solids and the process engineering goal. Please follow the recommendations of your supplier or call us for advice.

Some examples of the arrangement of devices on various tanks and the process engineering reasons for that arrangement can be found on our website: ***www.pulsoren.com***

2.2 Activation of the Pulsors

The Pulsors are activated by opening the upstream control valves. The pulse time of the Pulsors is then just about 0.75 sec in each case (during this time, 4-5 compressed air pulses are generated). The activation is repeated after a pause time of a few seconds to a few minutes depending on the need and the product properties. To achieve this, a suitable clock pulse generator is to be used, which starts isochronally and automatically when the respective discharge device is switched on (rotary feeder, screw conveyor etc.).

The Pulsors may not be operated over a prolonged period if no product is being discharged, so that no impermissible overpressure is built up in the silo. In addition, there is a danger that the bulk solids get consolidated in the silo as a result. Just as unsuitable is the activation of Pulsors by hand according to requirement.

.... **Please note:**

Fundamentally, the operation of the Pulsors must always be coupled to the activation of the product discharge.

If there are several Pulsors on one silo, the Pulsors can be activated according to need and air consumption either in succession or simultaneously, or even in groups. Here too, please follow the recommendations of your supplier, or consult us for advice.

2.3 Changing the flow stimulation intensity

Changing the flow stimulation intensity can be achieved by setting the pause time in the activation cycle and matching it to the operational requirements. The pulse time, in contrast, should not be significantly reduced or increased.

Reduction of the pulse time to a value below 0.5 seconds ultimately can result in the non-return valve of the pulse nozzle not working correctly any more, and bulk solid penetrating into the Pulsor, or the pulse generation in the Pulsor not working properly any more.

Increasing the pulse time to more than one second does not effect any increase in the flow stimulation intensity, but only an increase in air consumption. If the stimulation intensity is to be increased, the pause time of the activation cycle must be reduced, or additional Pulsors have to be retrofitted.

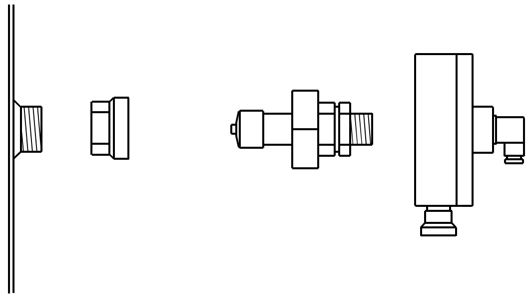
3. Assembly Instructions

.... **Please note:**

If the devices are used in an ATEX zone, compliance is required without fail with the specifications in Chapter 8.

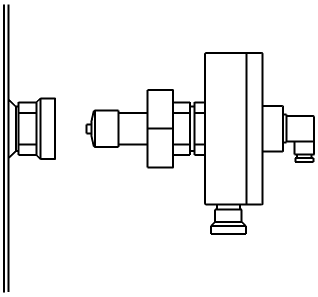
3.1 Installing the impulse nozzle and the Pulsor

At the intended assembly location, the supplied weld-on nipple is welded to the tank wall. The tank wall is then drilled concentrically to the weld-on pipe nipple with sufficient width (see Chapter 6.1 , pg.10), so that the impulse nozzle can be pushed in easily and without getting stuck can be easily turned inside the pipe nipple. If the nozzle cannot be inserted easily, the hole must be suitably re-worked (deburring, reaming or grinding).

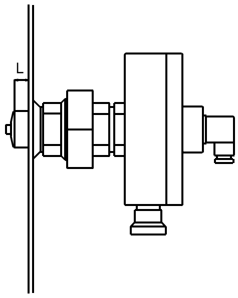


The threaded part of the union is then firmly screwed onto the weld-on pipe nipple using a thread sealant.

The impulse nozzle is screwed into the Pulsor housing. The impulse nozzle and the Pulsor housing lock into and seal each other purely metallically. No sealant, Teflon tape or hemp may be used when screwing in the nozzle pipe into the Pulsor housing. If sealants are used, the Pulsor can get damaged when unscrewing the nozzle. The pulse nozzle is first screwed into the Pulsor housing and tightened by hand, and then tightened further with a screw wrench about 1/8 - 1/4ths of a revolution. A suitable pipe or similar lever can be inserted in the air inlet opening for locking.



The Pulsor with the impulse nozzle fitted into it is inserted in the weld-on nipple in such a way that the air inlet union of the Pulsor points to the right ("3-o'clock position"). If the spatial conditions do not permit this position, have the air inlet union point up or down. The "9-o'clock position" must be avoided at all cost, since the Pulsor can then get detached from the pulse nozzle. Thereafter, the union nut of the assembly union is tightened firmly.

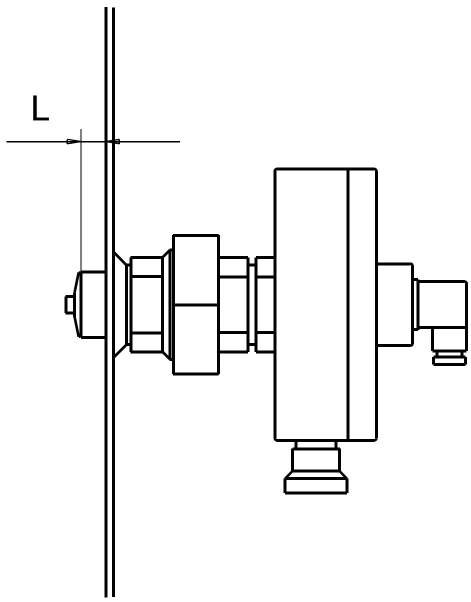


.... **Please note:**

The length of the weld-on nipple must thus be matched to the length of the nozzle pipe. The nozzle cap must at least:

L = 10 mm (Pulsor Type 100),
L = 15 mm (Pulsor Type 150),
L = 20 mm (Pulsor Type 300)

project by the above values into the tank. (See Chapter 6.1, pg. 10)

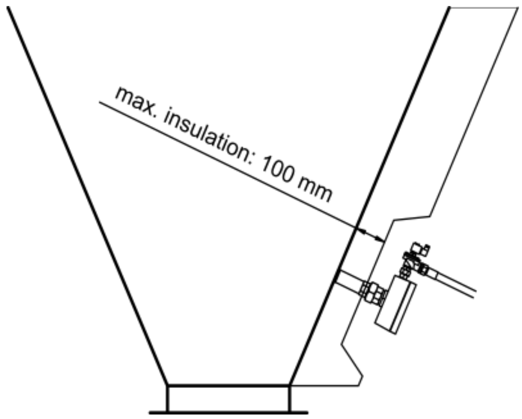


3.2 Installation of the Pulsors on heated and insulated tanks

The use of the devices on heated tanks, such as on the electric filters of incineration plants, is possible up to temperatures of approx. 200 °C, since the impulse nozzles contain only metallic components.

However, it must be remembered that the Pulsor housing and the control valve are located outside the insulation. Therefore, in such cases, longer weld-on nipples and nozzle tubes are used.

If the insulation of a tank is thicker than 100 mm, the aluminium cladding of the insulation mats in the vicinity of the Pulsors must be correspondingly drawn inwards, as shown in the following diagram. The union nut of the assembly union must be accessible, so that the pulse nozzle can be easily taken down for inspection and maintenance purposes.



......................**Please note:**

<u>With insulated silos, the Pulsor and the valve must be fitted outside the insulation.</u>

3.3 Installation of the compressed air supply pipes

Dried compressed air at approx. 6 bar is required for operating the Pulsors. The action of the Pulsors is essentially based on their relatively high air throughput during the pulsing phase (see Chapter 6.2 , pg.10). The air feeding pipes are therefore to be designed in such a manner that during operation of the equipment, the preliminary pressure does not drop below 4 bar. The following guide value applies: The main air feeding pipes should be made at least in nominal width DN 40 (1 ½"), the branches to the individual Pulsors in nominal width DN 25 (1"). The feeding pipes must not contain any filters, controllers or other cross-section reductions that are unfavourable for the flow. Ball valves with full passage cross-section are recommended as shut-off fittings. In case the available compressor system is not powerful enough, or only air pipes of small nominal width are available, the use of an air chamber as a buffer volume in the vicinity of the silo is necessary.

.... **Please note:**

<u>Before fitting the connecting hoses, the compressed air supply pipe must be blown out to remove any foreign bodies like dirt, metal chips or sealant residues from the pipes.</u>

3.4 Assembly of solenoid valve and connecting hose

After blowing out the supply pipes, the control valve with the pre-fitted union is connected to the Pulsor and the connecting hose between the valve and the piping is installed.

It should be possible to connect the control valve to the Pulsor without torsion or warping of the connecting hose. The weight of the valve and the hose as well as the restoring force of the hose bend must exert a right-rotating torque on the Pulsor, since otherwise, there is a danger that the Pulsor will get detached from the impulse nozzle.

3.5 Installation of the control air pipes in the case of pneumatically operated control valves

The control valves of the Pulsors and the pilot solenoid valves (see Chapter 1.3 , pg. 2) are supplied with push-in fittings for plastic pipes (PU or PA pipe, diameter 6 or 8 mm).

.... **Please note:**

The pneumatically actuated rapid control valves are kept closed with compressed air. If there is a drop in pressure in the control air pipe, the Pulsors are activated.

In case of an external control air supply (see Fig. 3 on page 2), the pressure of the control air must not be less than the pressure of the operating air. Care must be taken that this external pressure supply is not accidentally blocked, to avoid unintentional activation of the Pulsors.

3.6 Installation of the electric cables

For connecting the solenoid valves, flexible control cables (2+PE) are required, e.g. type YSLY-JZ 3x1.

For connecting the operation monitoring sensors, flexible 3-core control cables without the yellow-green cores are required, e.g. type YSLY-OZ 3x1. Alternatively, a 4-core cable can be used, e. g. type YSLY-JZ 4x1, with the PE conductor not being required. The plug layout of the sensor plug is shown in chapter 6.3, pg. 10.

3.7 Assembly tools

For tightening the various pipe unions to the devices, as far as possible, pipe wrenches should not be used; suitable open-jaw spanners should be used instead to avoid damage to the galvanised fittings. The required spanner sizes are given below:

Pulsor type	Mounting union on the impulse nozzle	Valve union	Pipe union
Type 100	50 mm / 32 mm	46 mm	30 and 36 mm
Type 150	75 mm / 54 mm	50 mm	36 and 41 mm
Type 300	90 mm / 65 mm	55 mm	36 and 41 mm

3.8 Test Run

A test run of the Pulsors is carried out to check for proper installation of the Pulsors, the air feed pipes and the electrical controls.

.... **Please note:**

The air feed pipes must be blown out before the first trial run.

During the operation of the Pulsors, there must occur clearly audible "pulses" (which can be felt on the Pulsor lid), which result from the settling of the valve disk on the valve plate in the Pulsor. The compressed air pulses can also be felt on the connecting hose.

In case of doubts or problems:

Telephone: +49 - (0) 212 - 1 63 93
Fax: +49 - (0) 212 - 201644
E-mail: albrecht@pulsoren.com

4. Function tests and Troubleshooting

4.1 Service life of the devices, wear parts

Pulsors, nozzles and valves work maintenance-free, but should be subjected to a visual inspection and performance check at regular intervals. Depending on the operational frequency, compressed air quality and abrasiveness of the bulk solids in the silo, after an operational time of approx. 2-3 years, wear of the components must be reckoned with. What is involved is primarily the nozzle heads projecting into the tank. The valve disks with sealing diaphragm and the plate springs in the Pulsor are also susceptible to wear after a few years. All wear parts are marked in the parts lists (chapter 7, pg. 12f).

4.2 Checking during operation

- The Pulsor housing must be firmly fitted on the nozzle pipe and must not move during operation. The assembly union at the nozzle must be firmly tightened.
- During the operation of the Pulsors, during the activation, there must be about 5 clear pulses that are audible, which result from the valve disk settling on the valve plate in the Pulsor. The pulses can also be felt by hand on the Pulsor housing and on the connecting hose. If only a uniform flow of compressed air is audible, perhaps in conjunction with a high-frequency hooting noise, the Pulsor must be replaced. The Pulsor may only operate when the rapid-control valve is activated. If a Pulsor works without a pause, the diaphragm of the shut-off valve is faulty and must be replaced.

4.3 Inspection after unscrewing the Pulsor housing from the impulse nozzle

- After unscrewing the Pulsor housing from the nozzle (see Chapter 5.1, pg. 9), the nozzle pipe can be checked from the inside. The nozzle pipe and the Pulsor housing must be dry on the inside and free of powder deposits. Fouling is a pointer to a fault in the nozzle head. In that case, the Pulsor and the impulse nozzle must be replaced.

4.4 Inspection after dismantling the impulse nozzle

- After dismantling the impulse nozzle (see chapter 5.2, pg. 9), the nozzle head can be examined. If there is significant corrosion or visible wear at the nozzle cap, nozzle tube or nozzle plate, the nozzle or the nozzle head must be replaced.
- The nozzle plate must be pressed firmly on the end face of the cap by the pre-tensioning of the nozzle spring. It must not be loose, and it should just about be possible to turn it by hand on the end face of the cap. The nozzle bolt must be movable in its guide.

4.5 Inspection of the control valve

- The valve must close off the air supply tightly and must not blow out any air when it is not activated. If, after removing the valve from the Pulsor, a leak can be observed, the valve diaphragm may have to be replaced.

.... **Danger of injury! Please note:**

Before inspecting the diaphragm in the rapid-control valves, the air supply must be blocked. Do not look into the output side of the removed valve without protective eyewear.

4.6 Repairing of faulty equipment

As the manufacturers of the Pulsors and pulse nozzles, ALBRECHT Ingenieurbüro also takes on all inspection and repair work. It is therefore recommended that faulty equipment should be sent to us for repair. Before starting repairs, a detailed damage report and cost quotation will be generated. Every Pulsor has a device number on the type plate, which allows a simple and comprehensible check of the service life. There is an operational warranty of 12 months for equipment repaired in our workshop.

4.7 Checklist for Pulsor troubleshooting

FAULT	POSSIBLE CAUSES	RECTIFICATION
Pulsor not working, there is no air flow audible, no air is blown through the nozzle.	a) Air pressure absent or too low a) Activation pulse missing b) Control valve does not open, upon activation.	a) Minimum air pressure of 4 bar is required a) Insert solenoid valve plug, clear activation b) Clean valve exhaust, if required, replace valve
Pulsor only blows continuously when activated, without clear pulsing.	a) Impulse nozzle worn a) Pulsor faulty	a) Replace impulse nozzle a) Replace Pulsor
Pulsor runs continuously, even without activation. (control valve does not close)	a) Valve diaphragm worn a) in the case of pneumatically controlled valves with external compressed air supply: control air missing	a) Replace valve or valve diaphragm a) Check the control air supply

5. Replacing the Pulsor and the Impulse Nozzle

5.1 Replacement of the Pulsor housing with the impulse nozzle installed

Danger of injury! Please note:

Before starting the work, block off the compressed air supply and vent the feed pipe.

a) Loosen and remove the solenoid valve plug.
b) Loosen the pipe union between the Pulsor and the valve. Detach the valve from the Pulsor and hang it to the side.
c) Unscrew the Pulsor housing from the nozzle pipe, for which the threaded joint must first be loosened: either insert a suitable pipe lever into the air inlet union and jerk suddenly in the counterclockwise direction, or briefly hammer the union with a rubber hammer in the direction of rotation (counterclockwise). After jerky loosening, the Pulsor housing can be easily rotated off the nozzle pipe.
d) Screw on the replacement Pulsor onto the nozzle without using a sealant (see 3.1) and first tighten it by hand. Use a lever pipe or rubber hammer to tighten it by 1/8 - 1/4th of a revolution.
e) The air inlet union must now still be aligned so that the solenoid valve can once again be installed without tension and torsion in the pipe. To do so, slightly loosen the union nut of the assembly union at the nozzle without unscrewing it completely. Loosen the conical pipe union with light strokes (rubber hammer!) till the nozzle with the Pulsor can be turned inside the weld-on nipple. Align the Pulsor and the nozzle in such a way that the valve can be installed easily. Tighten the union nut of the assembly union on the nozzle back on again. If necessary, fix the nozzle pipe with a screw wrench (counter-lock it).
f) Attach the valve, tighten the pipe union, check everything and fit the solenoid valve plug back on again.

5.2 Replacement of the impulse nozzle

The pulse nozzle can be dismantled together with the Pulsor housing or separately after unscrewing the Pulsor housing (see above). When the pulse nozzle is dismantled, there is always the danger that the product will get discharged from the silo. As far as possible, empty the silo before replacing a nozzle. If a pulse nozzle has to be dismantled with the tank full, keep a piece of cloth or a plug handy without fail, to be able to immediately close the mounting opening if product starts to get discharged. Replacement is only possible if there is no overpressure in the silo or tank. Render the silo pressure-less before replacing a nozzle. Always wear protective eyewear.

Danger of injury! Please note:

Before starting the work, block off the compressed air supply and vent the feed pipe.

Never dismantle the pulse nozzle when product has just been filled or with a fluidised product. Switch off all fluidisation devices, render the tank pressure-less and wait for the product to get vented of air.

With irritating, poisonous or corrosive products, wear protective clothing without fail (eyewear, mask, etc.).

a) Loosen and remove the solenoid valve plug.
b) Loosen the pipe union between the Pulsor and the valve. Detach the valve from the Pulsor and hang it to the side.
c) Loosen the union nuts of the assembly union. Loosen the conical pipe union with light blows (rubber hammer) and pull out the Pulsor with the pulse nozzle.
d) Insert the new Pulsor with the pulse nozzle screwed in. When screwing in the pulse nozzle into the Pulsor hou sing, do not use any sealant (see also Chapter 3.1, pg. 4). First screw in the pulse nozzle into the Pulsor hou sing and tighten it by hand and then using a screw wrench, tighten it through 1/8 - 1/4th of a revolution. Insert a suitable pipe or a similar lever into the air inlet opening for counter-locking.
e) Align the Pulsor in such a way that the valve can be installed easily. Tighten the union nut of the assembly uni on on the nozzle. If necessary, fix the nozzle pipe with a screw wrench (counter-lock it).
f) Attach the valve, tighten the pipe union, check everything and fit the solenoid valve plug back on again.

6. Technical Data

6.1 Materials, dimensions and weights

The housings of the Pulsors are made of cast aluminium, the nozzle pipes of stainless steel. The nozzle heads projecting into the tank are made of hardened stainless steel.
Three different sizes are offered, which have various air throughput and action radius. The following table contains information on the dimensions and weights of the individual components. The given weights all refer to a complete unit, consisting of the Pulsor, nozzle, valve and pipe.

	Pulsor type 300 with impulse nozzle type 50	**Pulsor type 150 with impulse nozzle type 40**	**Pulsor type 100 with impulse nozzle type 20**
Pulsor diameter	310 mm	160 mm	110 mm
Nozzle pipe	NW 1 1/2“	NW 1“	NW 1/2“
Weld-on nipple	NW 2"	NW 1 1/2"	NW 3/4"
Wall bore hole	Ø 52.5 mm	Ø 40.5 mm	Ø 21.5 mm
Length of the nozzle pipe (L_D)	160 – 250 mm	130 – 220 mm	90 – 160 mm
Length of the weld-on nipple (L_N)	$L_N = L_D$ - 125 mm	$L_N = L_D$ - 100 mm	$L_N = L_D$ - 65 mm
Connecting pipe	1“ x 1100 mm	1“ x 1100 mm	3/4“ x 900 mm
Weight, incl. nozzle, valve, pipe	approx. 21 kg	approx. 7.5 kg	approx. 4 kg
Central action zone	approx. Ø 80 cm	approx. Ø 60 cm	approx. Ø 40 cm

6.2 Compressed air requirement

Dried, condensate-free compressed air of about 6 bar is required for operating the Pulsors (min. 4 bar, max. 8 bar). The use of an adsorption dryer with a dew point of -40° C is recommended.

At an operating pressure of 6 bar, the following air throughput is generated in an activation phase of 0.75 s (measured in atmospheric litres):

Pulsor type 100: 30 litres
Pulsor type 150: 80 litres
Pulsor type 300: 150 litres

The air consumption of the devices per hour or minute, and hence the required compressor intake capacity, is then obtained from the number and type of the devices and the number of the activation phases per hour or minute.

The compressed air supply should be so designed that the preliminary pressure at the Pulsors does not drop below 4 bar during operation.

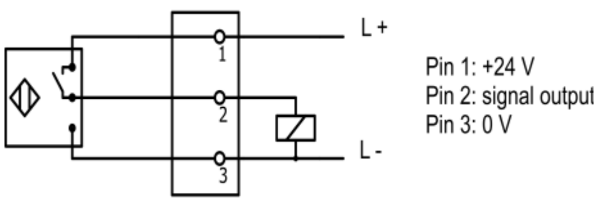
6.3 Function monitoring

The operation monitoring sensors are inductive proximity switches in 3-conductor technology, designed as PNP normally open or normally closed switches, with a switching amplifier and timing element integrated in the plug part.

<u>Technical Data:</u>

Operating voltage: 24 V DC
Current drawn: max 10 mA
max. switching current: 50 mA
Integrated freewheeling diodes
for switching inductive loads
Connection via device plug
DIN 43650

Connection diagram

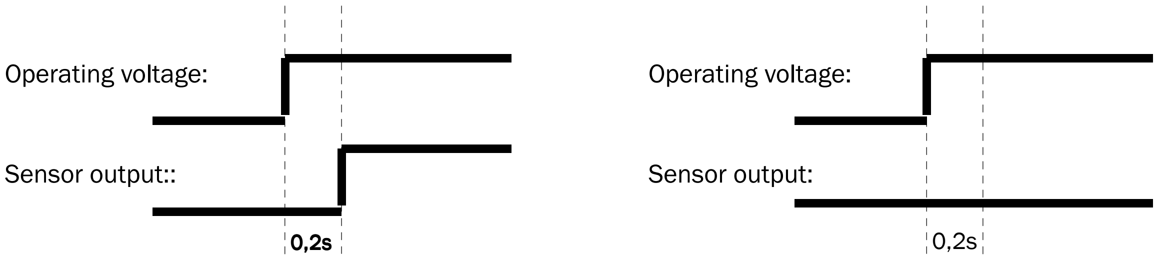


Two different sensor types are used, which differ in their switching behaviour,
the output signal of each of the two sensor types is the inverted signal of the other.

a) Sensor type 0221 ('fault detector / NO contactor'):

The output of the sensor switches 0.2 sec after applying the operating voltage of 0 to 24 V, if it is undamped (the Pulsor is not running).
With normal working of the Pulsor, the sensor is damped by the oscillating valve disk, and the sensor does not return any output voltage. In case of a fault, the output switches from 0 to +24 V.

Function diagram:



Sensor undamped,
Pulsor not running

Sensor damped,
Pulsor OK

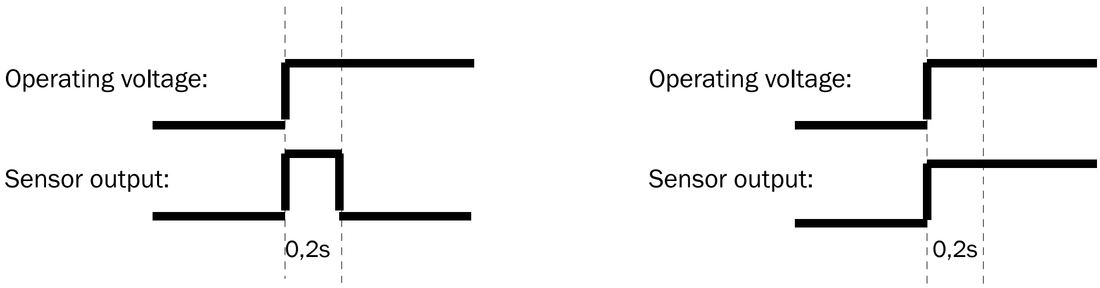
The following cases result in a fault being reported:

- Pulsor fault
- too little air pressure or none at all
- Cable rupture of the solenoid valve feed line

b) Sensor type 0517 ('Operation sensor / NC contactor'):

The output of the sensor switches 0.2 seconds after applying the operating voltage, from 24 V to 0 V, if it is undamped (the Pulsor is not running).
With normal working of the Pulsor, the sensor is damped by the oscillating valve disk, and the sensor supplies an output voltage of +24 V. In case of a fault, the output switches from 24 V to 0 V.

Function diagram:



Sensor undamped,
Pulsor not running

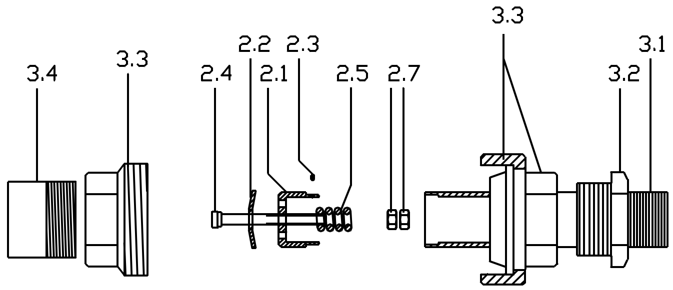
Sensor damped,
Pulsor O.K

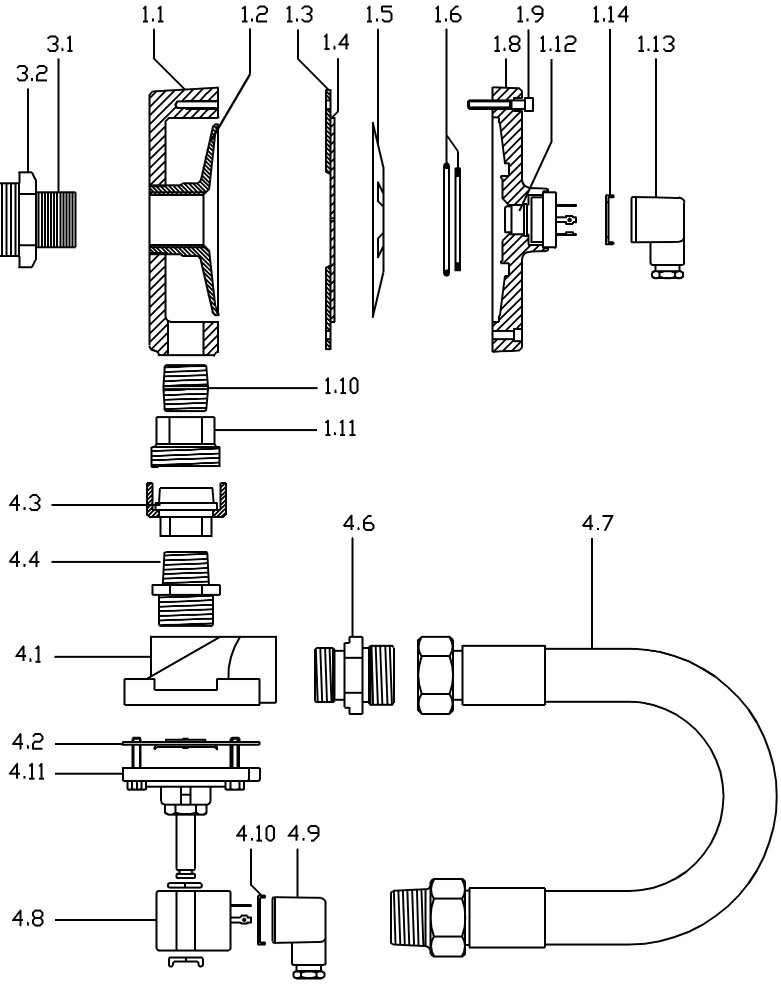
The following cases result in a fault being reported:

- Pulsor fault
- Too little air pressure or none at all
- Cable rupture of the solenoid valve feed line
- Cable rupture of the sensor feed line

7. Illustration of Parts and List of Spares

7.1 Pulsor type 100 with impulse nozzle type 20 and solenoid valve





	Part no.	Description
PULSOR		**Pulsor type 150**
	100-1.1	Housing
	100-1.2	Plate
	100-1.3 *	Sealing diaphragm
	100-1.4 *	Valve disc
	100-1.5 *	Plate spring
	100-1.6 *	Seat rings
	100-1.8	Housing cover
	100-1.9	Hexagon socket head screw
	100-1.10	Pipe double nipple
	100-1.11	Assembly union, screw-in part
	Additional parts for Pulsor type 100 R	
	100-1.12	Monitoring sensor
	100-1.13	Angular connector
	100-1.14	Gasket

* Wear parts

	Part no.	Description
NOZZLE	**100-2.X**	**Impulse nozzle type 20**
	100-2.1 *	Nozzle cap
	100-2.2 *	Nozzle plate
	100-2.3	Locking pin
	100-2.4 *	Nozzle bolt
	100-2.5	Nozzle spring
	100-2.7	Nut and lock nut
	100-3.1	Nozzle tube
	100-3.2	Reducer
	100-3.3	Mounting union, taper seat
		Weld-on nipple type 20
	100-3.4	Pipe nipple R3/4

* Wear parts

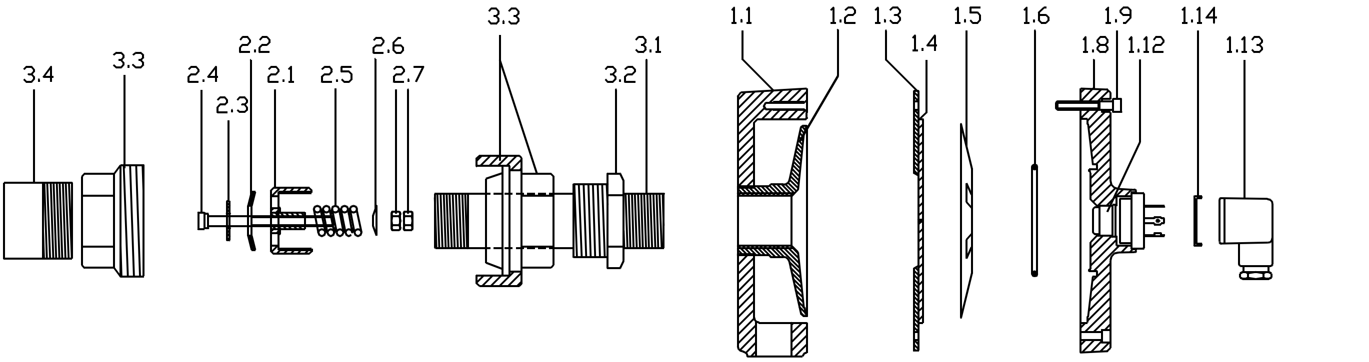
	Part no.	Description
VALVE		**Solenoid valve type 100**
	100-4.1	Valve housing
	100-4.2 *	Valve diaphragm
	100-4.3	Assembly union, insert part
	100-4.6	Hose nipple
	100-4.4	Reducer double nipple
	100-4.8	Solenoid coil
	100-4.9	Angular connector
	100-4.10	Gasket
	100-4.11	Valve cover with magnet system
		Connecting hose type 100
	100-4.7	Hydraulic hose DN20

* Wear parts

Recommended spare parts for an operating time of 2 years (each Pulsor system):

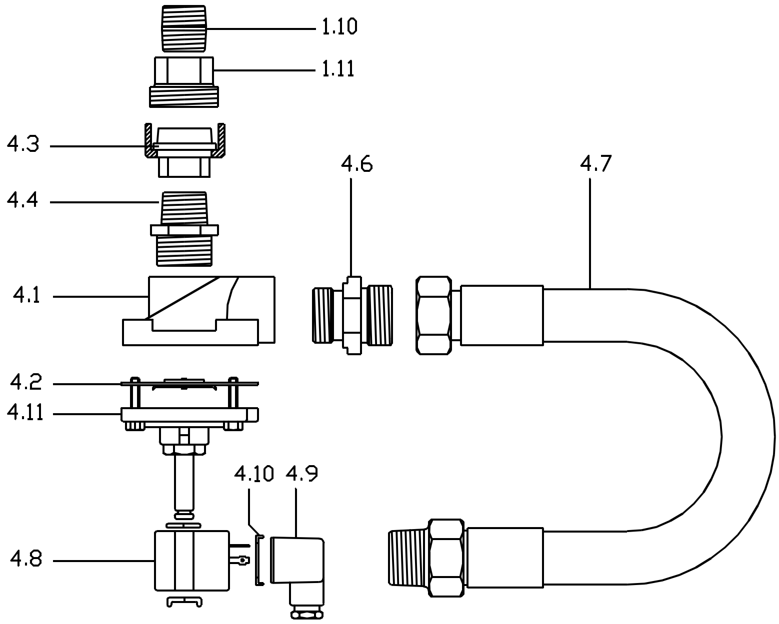
Spare part no.	Description	Material
100-1.3+1.4	Pulsor valve disc with sealing diaphragm	Steel 1.4021 / CR rubber, fabric-reinforced
100-1.5+1.6	Pulsor plate spring with seat ring	Spring steel 50CrV4
100-2.X	Nozzle head type 40	Steel 1.4112 / 1.4568
100-4.2	Valve diaphragm	Hytrel (TPE)

7.2 Pulsor type 150 with impulse nozzle type 40 and solenoid valve



Part no.		Description
		Pulsor Typ 150
	150-1.1	Housing
	150-1.2	Plate
	150-1.3 *	Sealing diaphragm
P	150-1.4 *	Valve disc
U	150-1.5 *	Plate spring
L	150-1.6 *	Seat ring
S	150-1.8	Housing cover
O	150-1.9	Hexagon socket head screw
R	150-1.10	Pipe double nipple
	150-1.11	Assembly union, screw-in part
	Additional parts for Pulsor Type 150 R	
	150-1.12	Monitoring sensor
	150-1.13	Angular connector
	150-1.14	Gasket

* Wear parts



Part no.		Description
	150-2.X	**Nozzle head type 40**
	150-2.1 *	Nozzle cap
	150-2.2 *	Nozzle plate
N	150-2.3	Adapter disc
O	150-2.4 *	Nozzle bolt
Z	150-2.5	Nozzle spring
Z	150-2.6	Centring disc
L	150-2.7	Nut and lock nut
E		**Nozzle tube type 40**
	150-3.1	Pipe nipple
	150-3.2	Reducer
	150-3.3	Mounting union, taper seat
		Weld-on nipple type 150
	150-3.4	Pipe nipple R 1½"

* Wear parts

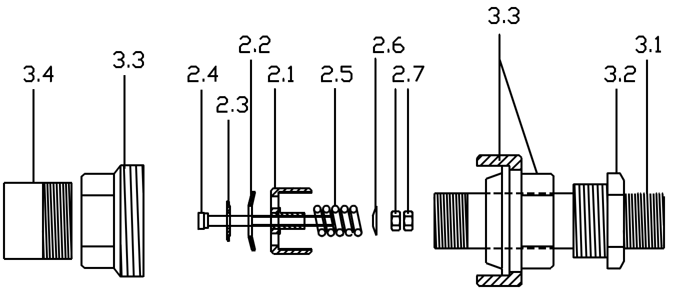
Part no.		Description
		Solenoid valve type 150
	150-4.1	Valve housing
V	150-4.2	Valve diaphragm
A	150-4.3	Assembly union, insert part
L	150-4.6	Hose nipple
V	150-4.4	Reducer double nipple
E	150-4.8	Solenoid coil
	150-4.9	Angled connector
	150-4.10	Gasket
	150-4.11	Valve cover with magnet system
		Connecting hose type 150
	150-4.7	Hydraulic hose DN25

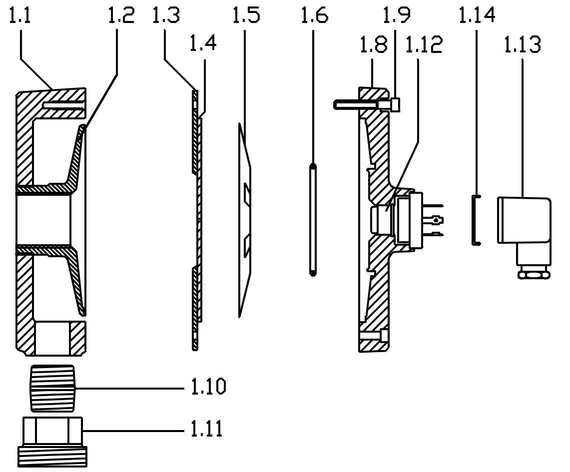
* Wear parts

Recommended spare parts for an operating time of 2 years (each Pulsor system):

Spare part no.	Description	Material
150-1.3+1.4	Pulsor valve disk with sealing diaphragm	Steel 1.4021 / CR rubber, fabric-reinforced
150-1.5+1.6	Pulsor plate spring with seat ring	Spring steel 50CrV4
150-2.X	Nozzle head type 40	Steel 1.4112 / 1.4568
150-4.2	Valve diaphragm	Hytrel (TPE)

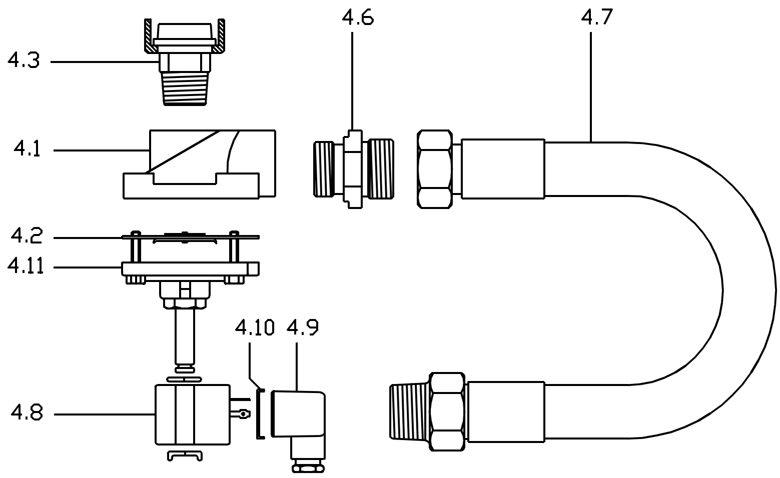
7.3 Pulsor type 300 with impulse nozzle type 50 and solenoid valve





	Part no.	Description
PULSOR		**Pulsor Type 300**
	300-1.1	Housing
	300-1.2	Plate
	300-1.3 *	Sealing diaphragm
	300-1.4 *	Valve disc
	300-1.5 *	Plate spring
	300-1.6 *	Seat ring
	300-1.8	Housing cover
	300-1.9	Hexagon socket head screw
	300-1.10	Pipe double nipple
	300-1.11	Assembly union, screw-in part
	Additional parts for Pulsor Type 300 R	
	300-1.12	Monitoring sensor
	300-1.13	Angular connector
	300-1.14	Gasket

* Wear parts



	Part no.	Description
NOZZLE	**300-2.X**	**Nozzle head type 50**
	300-2.1 *	Nozzle cap
	300-2.2 *	Nozzle plate
	300-2.3	Adapter disc
	300-2.4 *	Nozzle bolt
	300-2.5	Nozzle spring
	300-2.6	Centring disk
	300-2.7	Nut and lock nut
		Nozzle tube type 50
	300-3.1	Pipe nipple
	300-3.2	Reducer
	300-3.3	Mounting union, taper seat
		Weld-on nipple type 300
	300-3.4	Pipe nipple R 2”

* Wear parts

	Part no.	Description
VALVE		**Solenoid valve type 300**
	300-4.1	Valve housing
	300-4.2 *	Valve diaphragm
	300-4.3	Assembly union, insert part
	300-4.6	Hose nipple
	300-4.8	Solenoid coil
	300-4.9	Angled connector
	300-4.10	Gasket
	300-4.11	Valve cover with magnet system
		Connecting pipe type 300
	300-4.7	Hydraulic hose DN25

* Wear parts

Recommended spare parts for an operating time of 2 years (each Pulsor system):

Spare part no.	Description	Material
300-1.3+1.4	Pulsor valve disk with sealing diaphragm	Steel 1.4021 / CR rubber, fabric-reinforced
300-1.5+1.6	Pulsor plate spring with seat ring	Spring steel 50CrV4
300-2.X	Nozzle head type 50	Steel 1.4112 / 1.4568
300-4.2	Valve diaphragm	Hytrel (TPE)

8. Important Notes on the Use of the Devices "Pulsor with Impulse Nozzle" in Explosive Atmosphere ("ATEX Deployment")

ALBRECHT Pulsors and impulse nozzles are not devices with a potential ignition source in the meaning of the Directive 94/9/EC (ATEX Directive) and therefore do not carry an ATEX marking.
They can be safely operated in areas with explosive atmospheres by paying heed to the following points and restrictions (8.1 - 8.3).

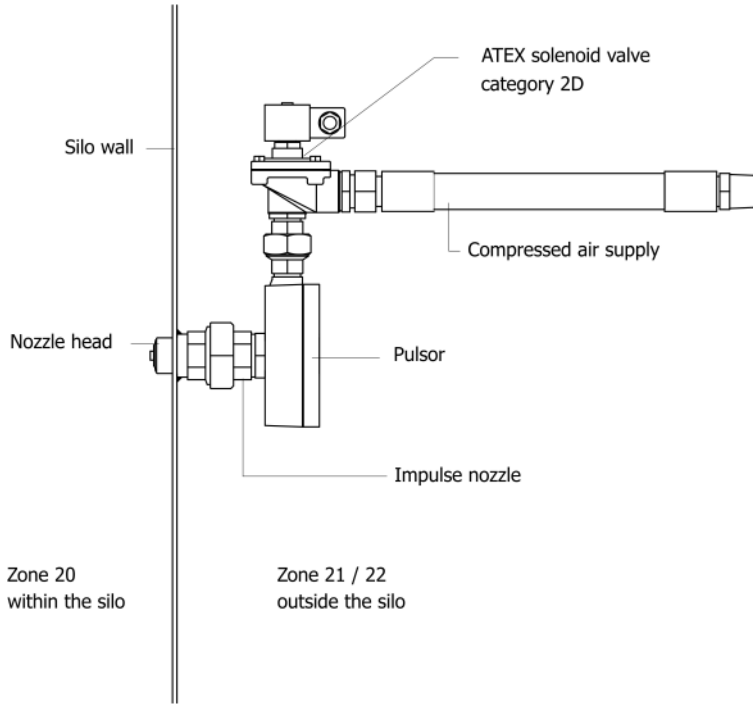
8.1 Application areas

- The use of ALBRECHT - Pulsors and impulse nozzles is limited to the area of **flammable dust** (Zone 20, 21 and 22) with a **minimum ignition energy** of **> 3mJ** at regulation-conformant tank inner temperatures.

If used with dust with a low minimum ignition energy than 3 mJ, a special hazard evaluation is necessary.

- With the Pulsors are used with an upstream series-connected shut-off solenoid valve in ATEX version, the **operating manual of the solenoid valves** as well as the respective device category must be noted and **followed**, especially with regard to the maximum surface and ambient temperatures.
  In the combination solenoid valve / Pulsor + impulse nozzle, this can result in limitations of the possibilities of use of the overall system.

A **typical application** is shown in the following diagram:



- The use of the Pulsors and impulse nozzles on explosion-resistant silos is only possible if the **permissible maximum pressure** of the Pulsor system (Pulsor housing, pulse nozzle, solenoid valve) of **10 bar** is not exceeded, for process engineering reasons.

- Pulsors and impulse nozzles may only come in contact with such materials as do not change the properties of the materials used.

8.2 Special instructions for installing the devices

- If used in explosive atmospheres, the Pulsors and impulse nozzles must be earthed. The **shunt resistance** must have a value of **$< 10^6\ \Omega$ with respect to earth.**
  The earthing of the devices can be achieved via the assembly union of the pulse nozzle and the earthing of the tank, or via a separate earth cable/ earthing strap.
  After installation of the devices, the prescribed shunt resistance should be verified by measurement.

- When installing suitable solenoid valves in conjunction with the Pulsors, the **Assembly Instructions of the solenoid valves** must be **followed**.

8.3 Special instructions for operating the devices

- During the operation of the Pulsors and during maintenance work on the devices, explosive atmospheres can sometimes be generated, with an influence on the zone division.
  In particular, e.g. during the **dismantling of devices, special precautionary measures** are necessary, since dust can get discharged from the tank.

- The Pulsors and pulse nozzles do not generate any heat during operation. Their maximum surface temperature corresponds to the maximum surface temperature of the upstream shut-off valve or the resultant temperature from the temperature in the insides of the tank (process temperature), compressed air temperature, ambient temperature, tank wall temperature (heating temperature). The Pulsor system may only be used if the following **temperature differences are maintained**:

1)	**maximum surface temperature of the Pulsor system**	**less than**	**2/3rd of the ignition temperature of the swirled dust**
2)	**maximum surface temperature of the Pulsor system**	**less than**	**the smoldering temperature of the deposited dust minus 75 Kelvin**

- Pulsors, nozzles and valves must be freed of dust deposits at regular intervals of time.