En

Operating instructions and spare parts list

OptiSpray DPP01
Dense phase pump

Translation of the original operating instructions

Gema

Documentation OptiSpray DPP01

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General safety regulations

This chapter specifies the fundamental safety regulations that must be followed by the user and third parties using the OptiSpray DPP01 Dense phase pump.

These safety regulations must be read and understood before the OptiSpray DPP01 Dense phase pump is used.

Safety symbols (pictograms)

The following warnings with their meanings can be found in the Gema operating instructions. The general safety precautions must also be followed as well as the regulations in the operating instructions.

DANGER!
Danger due to live electricity or moving parts. Possible consequences: Death or serious injury

WARNING!
Improper use of the equipment could damage the machine or cause it to malfunction. Possible consequences: minor injuries or damage to equipment

INFORMATION!
Useful tips and other information

Conformity of use

1. The OptiSpray DPP01 Dense phase pump is built to the latest specification and conforms to the recognized technical safety regulations. It is designed for the normal application of powder coating.
2. Any other use is considered as non-conform. The manufacturer is not responsible for damage resulting from improper use of this equipment; the end-user alone is responsible. If the OptiSpray DPP01 Dense phase pump is to be used for other purposes or other substances outside of our guidelines then Gema Switzerland GmbH should be consulted.

3. Observance of the operating, service and maintenance instructions specified by the manufacturer is also part of conformity of use. The OptiSpray DPP01 should only be used, maintained and started up by trained personnel, who are informed about and are familiar with the possible hazards involved.
4. Start-up (i.e. the execution of a particular operation) is forbidden until it has been established that the OptiSpray DPP01 Dense phase pump has been set up and wired according to the guidelines for machinery (2006/42/EG). EN 60204-1 (machine safety) must also be observed.
5. Unauthorized modifications to the OptiSpray DPP01 Dense phase pump exempt the manufacturer from any liability from resulting damage.
6. The relevant accident prevention regulations, as well as other generally recognized safety regulations, occupational health and structural regulations are to be observed.
7. Furthermore the country-specific safety regulations must be observed.

Explosion protection	Protection type	Temperature class
CE Ex II 3 D	IP54	T6

Product specific security measures

- The installation work, to be done by the customer, must be carried out according to local regulations
- It must be observed, that all components are grounded according to the local regulations, before start-up

Note:
For further security information, see the more detailed Gema safety regulations!

About this manual

General information

This operating manual contains all the important information which you require for the working with the OptiSpray DPP01 Dense phase pump. It will safely guide you through the start-up process and give you references and tips for the optimal use of your new powder coating system.

Information about the function mode of the individual system components - reciprocators, booths, powder gun control units, powder guns etc. - should be referenced to their corresponding documents.

Function description

Field of application

OptiSpray DPP01 Dense phase pump

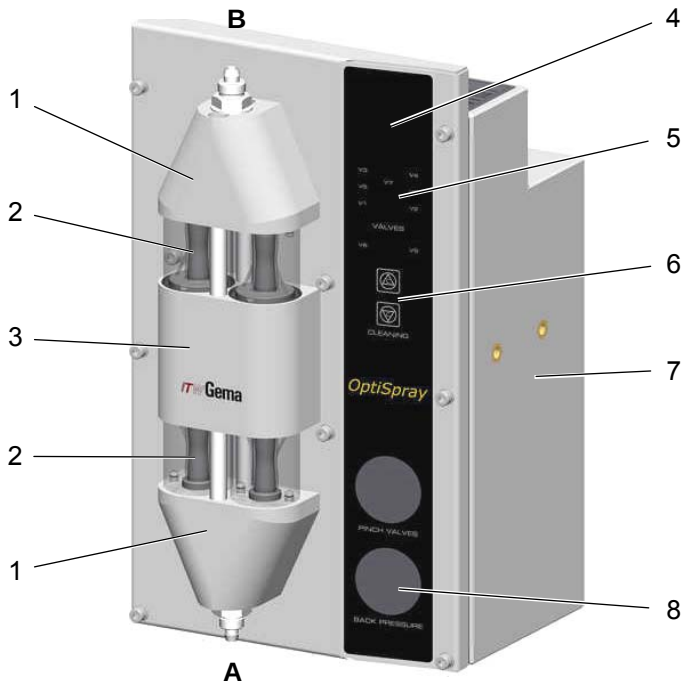
The OptiSpray DPP01 Dense phase pump is intended for conveying coating powder to the powder gun. Any other use is considered as non-conform. The manufacturer is not responsible for any damage resulting from this - the risk for this is assumed by the user alone!

The OptiSpray DPP01 Dense phase pump operates only in combination with the CG09-P Control unit.

OptiSpray DPP01 Dense phase pump

Structure and function

OptiSpray DPP01 - structure



OptiSpray DPP01 Dense phase pump - structure

A	Suction side	4	Status LEDs
B	Transport side	5	Diagnostic LEDs
1	Y-piece	6	Operating keys
2	Pinch valves	7	Pneumatic system and electronics
3	Distribution block with filter elements	8	Pressure gauge

Powder hoses

Depending the application, different powder hoses are used for the suction and conveying procedure. The corresponding hose connections with nuts with kink protection must be used!

Field of application	Suction side	Transport side
OptiFlex FP Manual equipment	Inside diameter 4.5 mm, hose length < 1.2 m	Inside diameter 7 mm
Automatic equipment	Inside diameter 4.5 mm, hose length < 3 m	Inside diameter 7 mm

Note:
On the transport side, a powder hose with conductive strip must be used (electrically conductive)!

Diffusers

The powder guns must be equipped with a corresponding diffuser. The diffuser is grounded by transport hoses with conductive strips!

OptiSpray DPP01 Dense phase pump - functioning

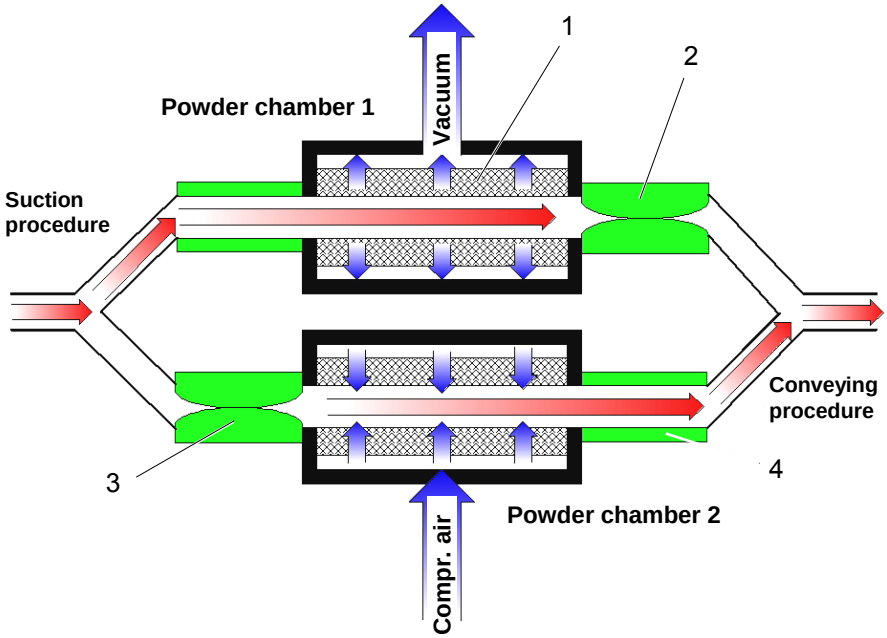
Suction procedure

In powder chamber 1, a vacuum (negative pressure) is produced. This vacuum aspirates the coating powder in the powder chamber. A fine-porous filter element (**1**) in the powder chamber separates the powder. The powder chamber is closed at the output side by a pinch valve (**2**).

Conveying procedure

The pinch valve (**3**) on the input side of the powder chamber 2 is closed, the pinch valve (**4**) on the output side is opened. The coating powder is pressed out of the powder chamber by overpressure, which is created with compressed air by the fine-porous filter element, and continued to convey.

The suction and the conveying procedure alternate between both powder chambers.



OptiSpray DPP01 Dense phase pump - functioning

Powder quantity control

The OptiSpray DPP01 Dense phase pump operates always with the same frequency. The powder quantity is controlled by the opening time of the pinch valves on the inlet of the dense phase pump. The longer the pinch valves on the inlet of the dense phase pump remain open during the suction procedure, the more powder will be aspirated into the powder chamber and then will be transported in conveying direction.

Main functions

- Conveying coating powder from or a fluidized container to the powder gun
- Processing signals from the superordinated CG09-P Control unit

Secondary functions

- Powder hose rinsing and cleaning of the filter elements - can be started in suction and blowing off direction
- Display of the pressure for the pinch valves and display of the backpressure during conveying procedure
- Internal pressure regulator for vacuum injector, pinch valve pressure and cleaning mode
- Keyboard lock - prevents an unmeant, manual intervention

Technical data

OptiSpray DPP01 Dense phase pump

Powder output (guide values)

OptiSpray DPP01	
Conveying hose till 25 m - internal Ø 7 mm Suction hose till 3 m - internal Ø 4,5 mm	400 g/min
Conveying hose till 20 m - internal Ø 7 mm Suction hose till 1.2 m - internal Ø 4.5 mm	500 g/min
Conveying hose till 20 m - internal Ø 7 mm Suction hose till 1.2 m - internal Ø 4.5 mm	700 g/min

Electrical data

OptiSpray DPP01	
Nominal input voltage	100-240 VAC
Frequency	50/60 Hz
Performance	20 VA
Protection type	IP54
Temperature range	0°C - 40°C (+32°F - +104°F)
Temperature class	T6
Approval	CE Ex II 3 D

Pneumatic data

OptiSpray DPP01	
Compressed air main connection	Quick release connection - 8 mm
Input pressure	6 bar
Max. compressed air consumption	12 Nm³/h
Max. water vapor content of the compressed air	1,3 g/m³
Max. oil vapor content of the compressed air	0,1 mg/m³

Dimensions

OptiSpray DPP01	
Height	360 mm
Width	210 mm
Depth	160 mm
Weight	11,9 kg

Start-up and operation

Preparation for start-up

Basic conditions

By the start-up of the OptiSpray DPP01 Dense phase pump, the following basic conditions, which have an influence on the powder transport, must be considered:

- Characteristic of hose layout (suction hose)
- Length and height difference of the suction distance - max. 3 m
- Length of the conveying distance - min. 10 m
- Powder preparation and powder quality
- Spatial arrangement of the OptiSpray DPP01 Dense phase pump (layout, length and internal diameter of the suction hose)

Basic information

The adherence of the following principles leads to a successful start-up of the OptiSpray DPP01 Dense phase pump:

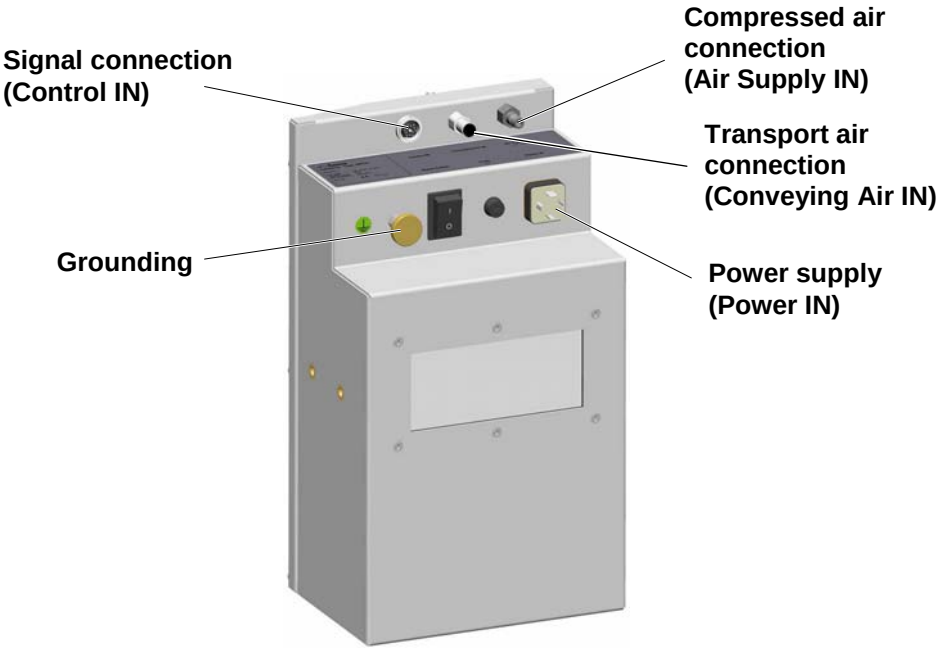
- The suction distance is to be kept as short as possible
- If the powder hose can be arranged wavy in plump line, then this is to be preferred to the horizontal arrangement (flat on the floor)
- At the suction area, a homogeneous fluidization must be ensured, so that no air ducts (craters) can be formed
- Basically, the powder transport with the OptiSpray DPP01 Dense phase pump works with every powder type, which can be fluidized. If the powder is for example humid or contaminated with other materials, then the conveying can be negatively influenced or does not work at all
- The OptiSpray DPP01 Dense phase pump has to be installed vertically

OptiSpray DPP01 - connections

The OptiSpray DPP01 Dense phase pump is supplied ready for use by the manufacturer. Just a few cables and hoses must be connected.

The connection of the OptiSpray DPP01 Dense phase pump takes place according to following instructions:

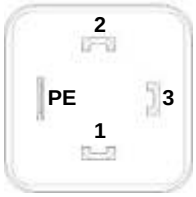
1. Connect the powder hoses to the dense phase pump input and output
2. Connect the compressed air supply to the connection **Air Supply IN**
3. Connect the transport air to the connection **Conveying Air IN**
4. Connect the control signal cable to the connection **Control IN**
5. Connect the grounding cable (or ensure the grounding by fasten it to a grounded plate)
6. Connect the pump operating voltage to the connection **Power IN**



Note:
The further start-up procedure for the OptiSpray DPP01 Dense phase pump is explicitly described in the CG09-P Gun control unit operating instructions (chapter "Initial start-up" and "Daily start-up")!

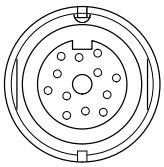
OptiSpray DPP01 - connections

Pin assignment



Power IN connection

1	Neutral conductor N
2	Phase (100-240 VAC) P
3	empty
PE	Grounding PE



Control IN socket, 12 pins

A-J	Control signal
K	IDENT / Recognition
L	REQUEST / Request
M	GND
	Enclosure - shield

OptiSpray DPP01 - start-up

Configuration

The start-up of the OptiSpray DPP01 Dense phase pump takes place according to following instructions:

1. Connect the compressed air supply (6 bar)
2. Connect the power supply (100-240 VAC)
3. Ensure the grounding
4. Switch on the OptiSpray DPP01 Dense phase pump
5. Adapt the adjusting parameters for total air and powder output (see also the CG09-P operating instructions)
6. Adjust the fluidization on the control unit
7. Start the pumping procedure by pressing the gun trigger

Fluidized powder hopper

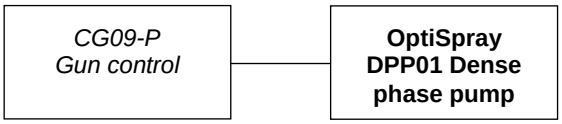
The powder is fluidized in the powder container by fluidizing air forced through a porous plastic plate from below. Thereby, the powder becomes loose and acquires fluid-like characteristics.

Note:
For a better understanding of the interrelationships in powder coating, it is recommended to read completely the operating instructions of the control unit and the powder gun, so as to be familiar with their functions too!

Connection and control

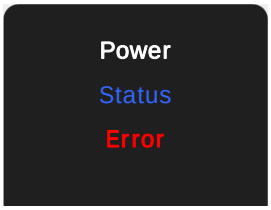
Connection by the Control IN connector

The OptiSpray DPP01 Dense phase pump is connected and controlled with CG09-P Gun control unit by the **Control IN** connection.



OptiSpray DPP01 - operating elements

LEDs and operating keys

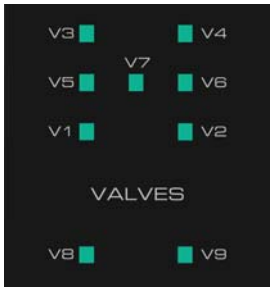


Status LEDs

Power - equipment is switched on

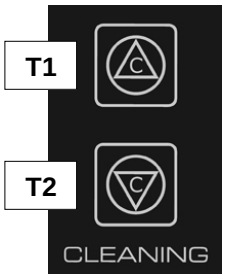
Status - reserved

Error - reserved



Diagnostic LEDs

These LEDs are assigned to the corresponding valves and illuminate when the valve is activated. If the LED does not or does constantly illuminate, a valve or the controlling by the control unit can be defective.



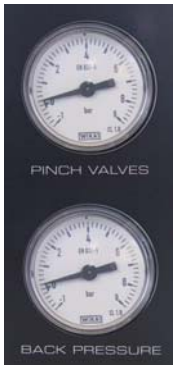
Operating keys

Key **T1** - rinsing in conveying direction (in upwards direction)

Key **T2** - rinsing in suction direction (in downwards direction)

The cleaning programs can be terminated by pressing any key.

Pressure display



Pinch valve pressure (PINCH VALVES)

This pressure gauge indicates the adjusted pinch valve pressure. This value is set on 2.4 bar by factory.

Backpressure (BACK PRESSURE)

This pressure gauge serves for the procedure monitoring. In normal operation, the value ranges between 0.3 and max. 1.0 bar.

OptiSpray DPP01 - characteristics

Conveying direction

The OptiSpray DPP01 Dense phase pump conveying direction is defined by the direction of arrow, that means, the suction side is on the bottom, the transport side on the top (see picture).

Powder hose rinsing

The powder hose rinsing enables the cleaning of the powder hoses and the filter elements in the dense phase pump. If color changes take place, rinsing must be done in conveying and in suction direction.

Manual rinsing for color change preparation

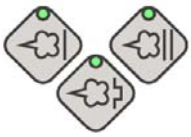
Rinsing in conveying direction is activated by pressing the **T1** key.

Rinsing in suction direction is activated by pressing the **T2** key.

The cleaning program (controlled by the control unit) takes place with an external compressed air source in conveying direction.

Attention:
Large dust formation possible!
The suction hose and the conveying hose must be kept in the booth during the rinsing procedure!

Cleaning programs



The CG09-P Gun control units feature three cleaning programs:

- Powder chamber emptying
- Cleaning the hose to the gun
- Cleaning the hose on the suction side

(For details, see the operating instructions of the corresponding gun control unit)

Attention:
Large dust formation possible!
The conveying hose and the powder gun must be kept in the booth during the rinsing procedure!

Maintenance interval monitoring

This function is provided by the CG09-P Control unit.

OptiSpray DPP01 - functional check and operation

Note:
By the assembly or the first start-up, it is recommended to carry out the functional check without powder!

Operation

The OptiSpray DPP01 Dense phase pump is switched on by pressing the **Mains Switch** key on the rear side, the status LED **Power** on the front side illuminates. The OptiSpray DPP01 Dense phase pump is ready for operation.

Switching on and off the conveying procedure

The conveying procedure is switched on and off by the CG09-P Control unit (see the corresponding operating manual).

Switching on and off the rinsing procedure

The rinsing procedure is switched on and off by the CG09-P Control unit (see the corresponding operating manual).

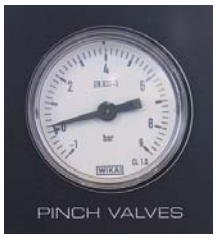
Manual switching on and off the rinsing procedure on the pump

By pressing the corresponding key (depending on the desired rinsing direction), the rinsing procedure will be started. The powder chambers are cleaned thoroughly by the internal cleaning program. Afterwards the pump switches off.

The rinsing procedure can be terminated by pressing a key again.

Note:
If the "Rinsing" function was activated locally on the equipment, the rinsing procedure will be terminated by a control unit command!

Note:
The suction hose and the conveying hose must be emptied before the rinsing procedure starts!



Display of the pinch valve pressure (PINCH VALVES)

The pinch valve pressure is indicated on the **PINCH VALVES** gauge. The presetting by factory is 2.4 bar static (Hot Coating: 3.0 bar) and depends on the backpressure in the powder hose.

Display of the backpressure (BACK PRESSURE)

The backpressure created during powder transport will be displayed. This consists of following influences:

- Adjusted transport air volume
- Filter elements resistance
- Powder quantity to be transported
- Internal diameter and length of the conveying hose

By correct operation, this value ranges between 0.3 and max. 1.0 bar. The backpressure may not exceed 1.2 bar (Hot Coating: 1.8 bar).

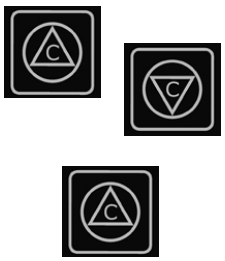
OptiSpray DPP01 - shutdown

The OptiSpray DPP01 Dense phase pump is switched off by pressing the **Mains Switch** on the rear side and the **Power** status LED on the front side expires.

The compressed air supply to the dense phase pump must also be interrupted!

Special functions

Keyboard lock



If the keyboard lock is activated, no local operation with the keys **T1** and **T2** is possible. The **Status** display illuminates briefly by every switch-on.

Activation/deactivation of the keyboard lock

By switching on the equipment, keep the key **T1** pressed, until the **Status** display blinks briefly. The keyboard lock will be activated/deactivated.

Test program for error diagnosis

The OptiSpray DPP01 Dense phase pump has an internal test program, which simplifies the error diagnosis.

The test mode will be activated by pressing both keys, when switching on the device. The activated test mode is indicated by the illuminated **STATUS** and **ERROR** displays.

The test steps are activated in sequence by pressing the key **T1** (for approx. 1 sec.).

After test step 3, the dense phase pump returns to normal operation by pressing the key **T1** again.

Test step	Purpose	Notes
1	Leak-tightness test	Preparation: Close tightly the dense phase pump input and output, remove the injector and bypass both connections with a hose Test: Apply compressed air with a pressure of max. 4 bar and stop again. Observe the pressure gauge (the air should not escape too fast out of the closed system)
2	Valve test	All valves are switched one after the other every second. Thereby, the corresponding display illuminates
3	Conveying	In this test step, the valves switch according to an internal defined sequence

Cleaning and maintenance

Note:
Regular and conscientious maintenance increases the service life of the OptiSpray DPP01 Dense phase pump and ensures a longer, more constant coating quality!
The parts, which are to be replaced during maintenance work, are available as spare parts. These parts will be found in the corresponding spare parts list!

Cleaning the dense phase pump (color change)

For the preparation of a color change, the pump has to be rinsed in conveying direction and in suction direction. As described, the rinsing procedure can be started and stopped manually or externally.

Maintenance of the OptiSpray DPP01 Dense phase pump

The OptiSpray DPP01 Dense phase pump is designed in such a way, that only a minimum maintenance is required.

Daily maintenance

Clean the dense phase pump with a dry cloth and check the connection points of the powder hoses. Replace the powder hoses, if necessary.

Rinse the dense phase pump in conveying direction and in suction direction by using the rinsing program. Therewith, the filter elements are cleaned and possible, unintended powder deposits in the dense phase pump and in the powder hoses are avoided.

OptiSpray DPP01 - maintenance plan

The following components or modules are subject to a maintenance plan:

- Pinch valves
- Filter elements

The service life of the filter elements depends on the service duration, the powder quality and the quality of the compressed air supply.

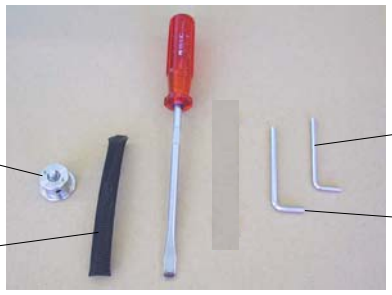
Maintenance set

The wearing parts to be replaced during the OptiSpray DPP01 Dense phase pump maintenance, are available in two maintenance sets (see the spare parts list). One set contains 2 filter elements, the other set contains 8 pinch valves.

Replacing the filter elements

Attention!
Before dismantling/changing the filter elements, it is necessary to clean the dense phase pump in both directions by using the local cleaning keys T1 and T2!

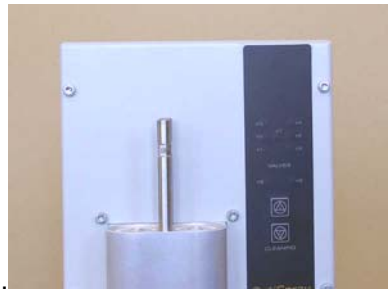
Required spare parts - 2 filter elements (spare parts set)



1. 

2. 

3. 

4. 

5. 

6. 

7. 

8. 

9. 

10. 

Note:
The assembly takes place in reverse order!
By assembling the Y-piece, do not tighten the screws too strong!

11. 

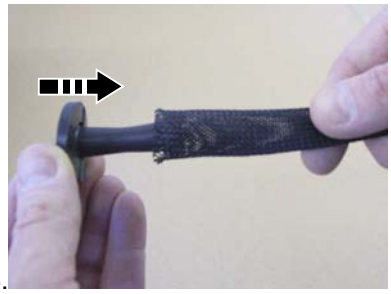
12. 

Replacing the pinch valves

Required spare parts - 4 pinch valve hoses NW 7.5 (spare parts set)

1. 

2. 

3. 

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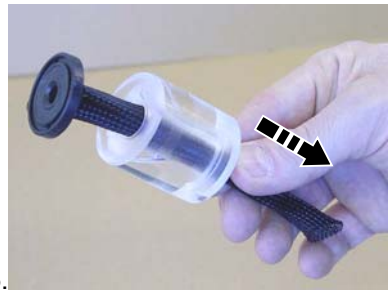
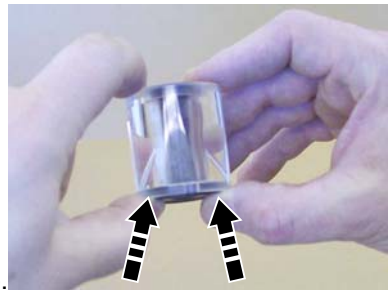
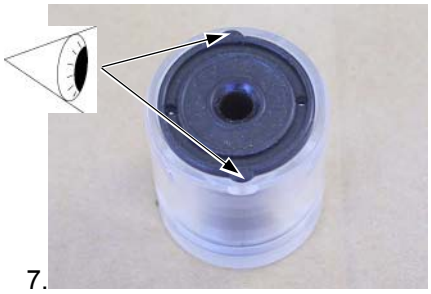
5. 

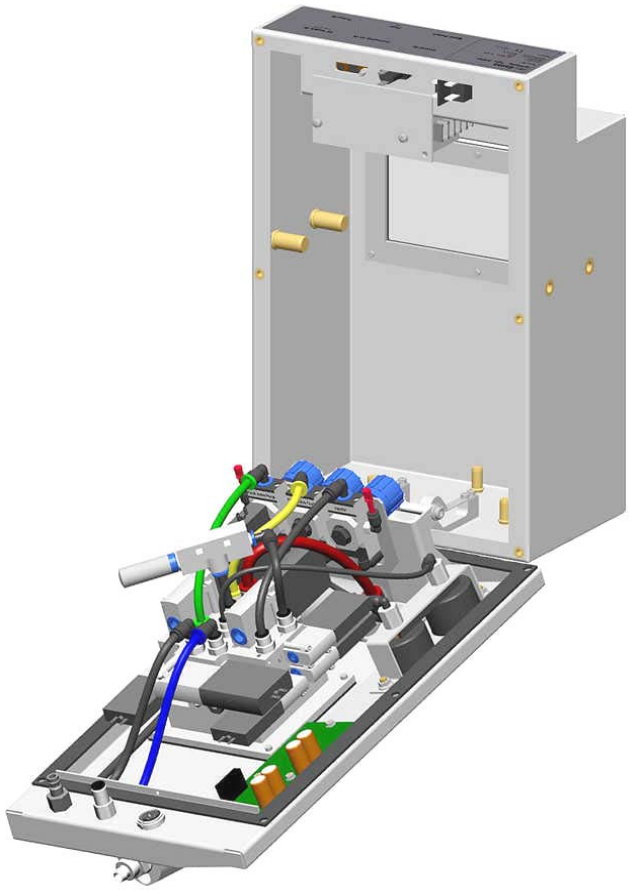
6. 

7. 

8. 

Attention!
When cleaning the acryl pinch valve bodies, do not use alcohol, acetone, benzol or other solvents!
For cleaning, use benzine, light lye or acid, acryl glass cleaner or a cleaning agent!

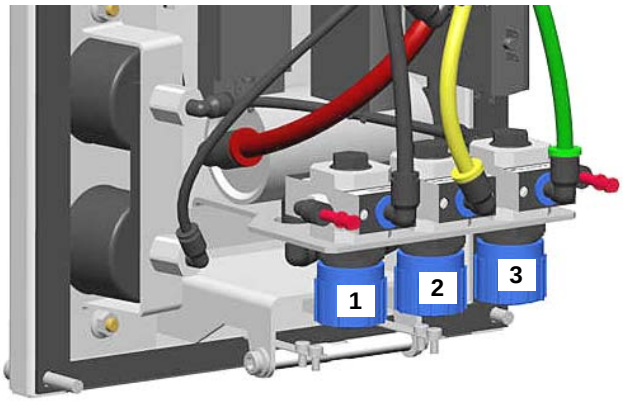
Service position



Service position

The front plate can be opened and swiveled in service position by loosing the six screws.

Internal pressure regulators



Internal pressure regulators

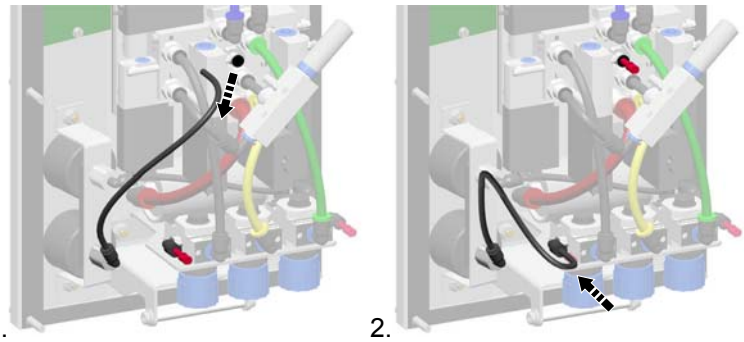
Values set by factory (static):

Pressure regulator no.	Standard Operation	Hot-Coating Operation
1 **Injector** (Vacuum)	3.5 bar	3.5 bar
2 Pinch valve **Transport**	2.4 bar	3.0 bar
3 Pinch valve **Cleaning**	5.0 bar	5.0 bar

Indicator **BACK PRESSURE**	0.3 – 1.0 bar	0.3 – 1.8 bar

Checking the injector set pressure

The set pressure can be checked by simple disconnecting/switching of the pneumatic hose.



Checking the injector set pressure

Troubleshooting

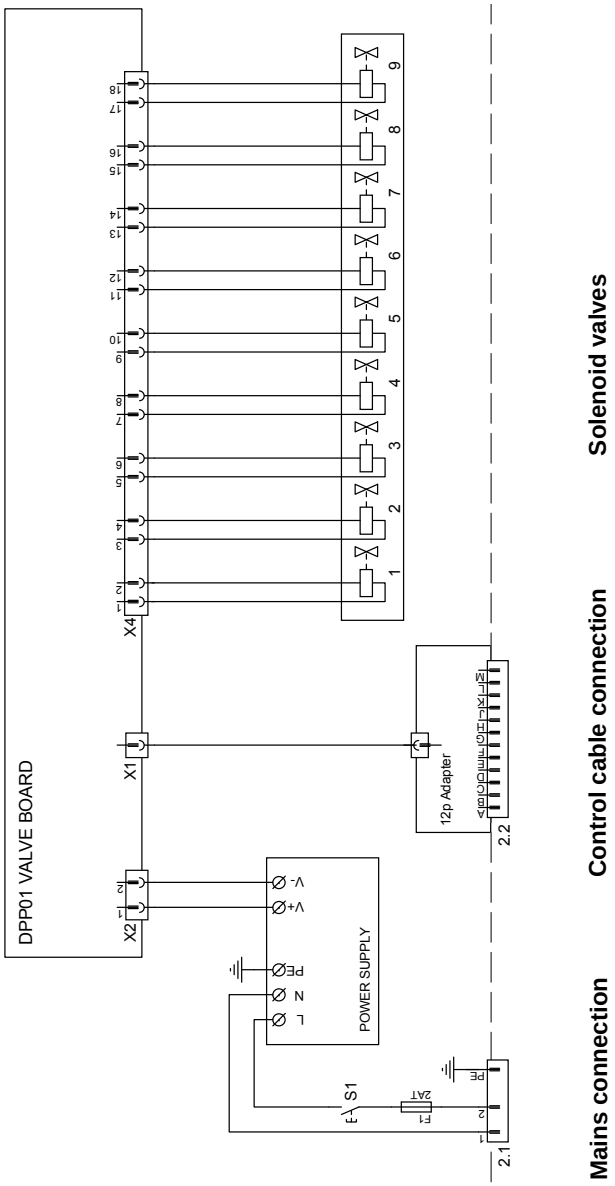
General information

Fault	Causes	Troubleshooting
Power display does not illuminate	No operating voltage	Check the power supply (100-240 VAC) Check the power switch
	Fuse is defective	Replace the defective fuse
Dense phase pump does not convey	No control signal	Check the control cable, check the autonomic pumping with test program 3 - so it can be determined, if the control or the dense phase pump is defective
	Compressed air supply failed or pressure too low	Check the compressed air source (ensure an air pressure of 7-10 bar), check the pressure gauge of the local pressure regulator
	No transport air present	Check the hose connection of the control unit to the dense phase pump Check the compressed air supply
	No fluidization in the suction zone	Ensure the fluidization
	Service life of the pinch valve runs off (defective)	Change the pinch valve, check the pneumatic system for defects and replace, if necessary

Fault	Causes	Troubleshooting
Dense phase pump conveys irregularly or too little powder	Scratch development in the powder container, powder will not be fluidized well	Adjust the fluidization correctly
	Backpressure is larger than 1.2 bar (Hot Coating: 1.8 bar)	Powder hose is too long Powder hose is clogged (clean or replace it) Filter elements are clogged (clean or replace them) Sintering in Y-piece or hose connection (clean)
	Filter elements tend to clogging	Run the rinsing program in conveying and in suction direction, replace the filter elements
	Powder hoses tend to clogging due to sintering	Clean or replace the powder hoses
	Oil or water in the system	Ensure that oil or water will be separated before entering into the dense phase pump
Equipment cannot be operated by the keys	Keyboard lock is activated	Deactivate the keyboard lock

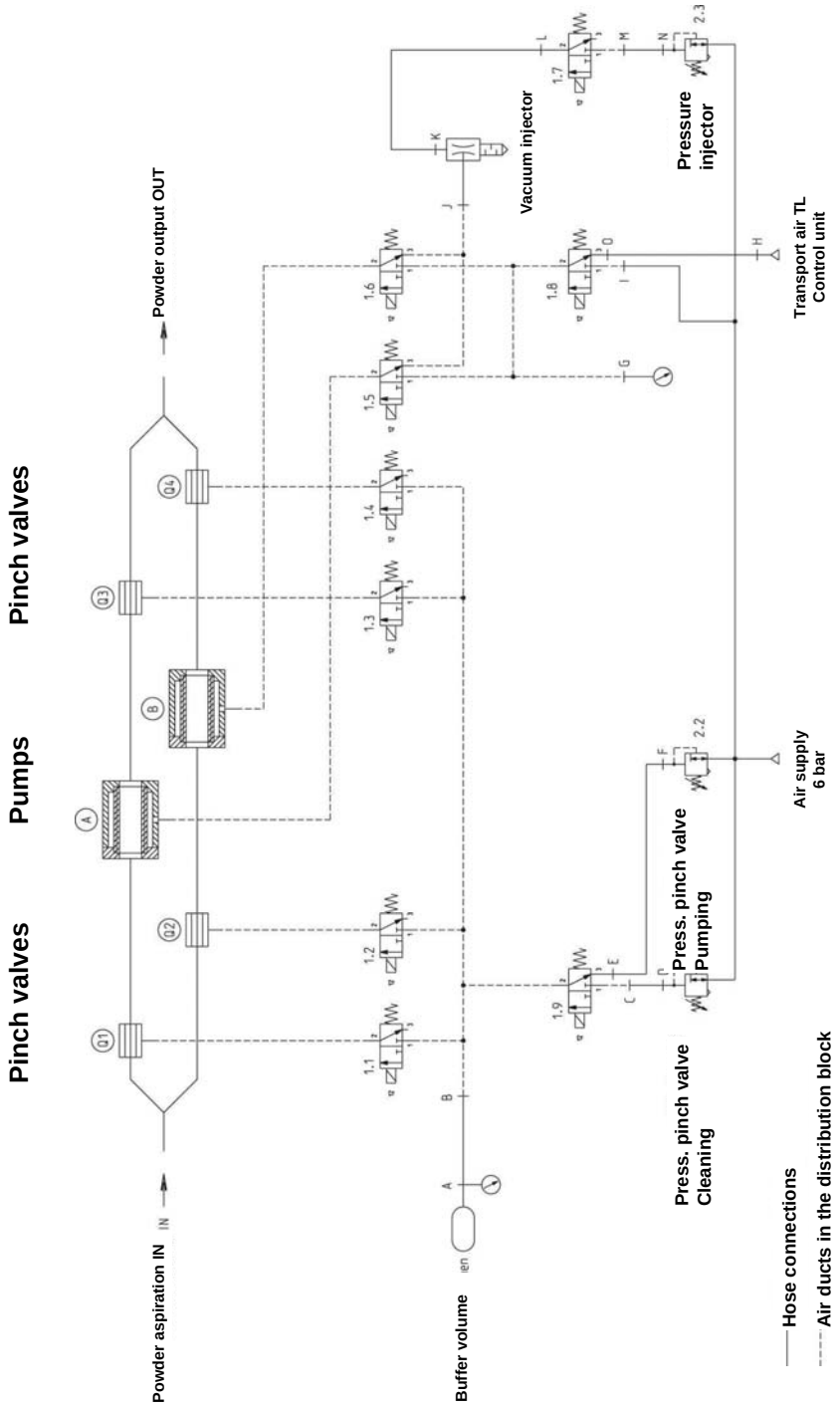
Schematic diagrams

OptiSpray DPP01 - block diagram



OptiSpray DPP01 - block diagram

OptiSpray DPP01 - pneumatic diagram



OptiSpray DPP01 - pneumatic diagram

Spare parts list

Ordering spare parts

When ordering spare parts for powder coating equipment, please indicate the following specifications:

- Type and serial number of your powder coating equipment
- Order number, quantity and description of each spare part

Example:

- **Type** OptiSpray DPP01
  Serial number 1234 5678
- **Order no.** 203 386, 1 piece, Clamp - Ø 18/15 mm

When ordering cable or hose material, the required length must also be indicated. The spare part numbers of this yard/meter ware is always marked with an *****.

The wear parts are always marked with a #.

All dimensions of plastic hoses are specified with the external and internal diameter:

Example:

Ø 8/6 mm, 8 mm outside diameter (o/d) / 6 mm inside diameter (i/d)

WARNING!
Only original Gema spare parts should be used, because the hazardous location approval will be preserved that way! The use of spare parts from other manufacturers will invalidate the Gema guarantee conditions!

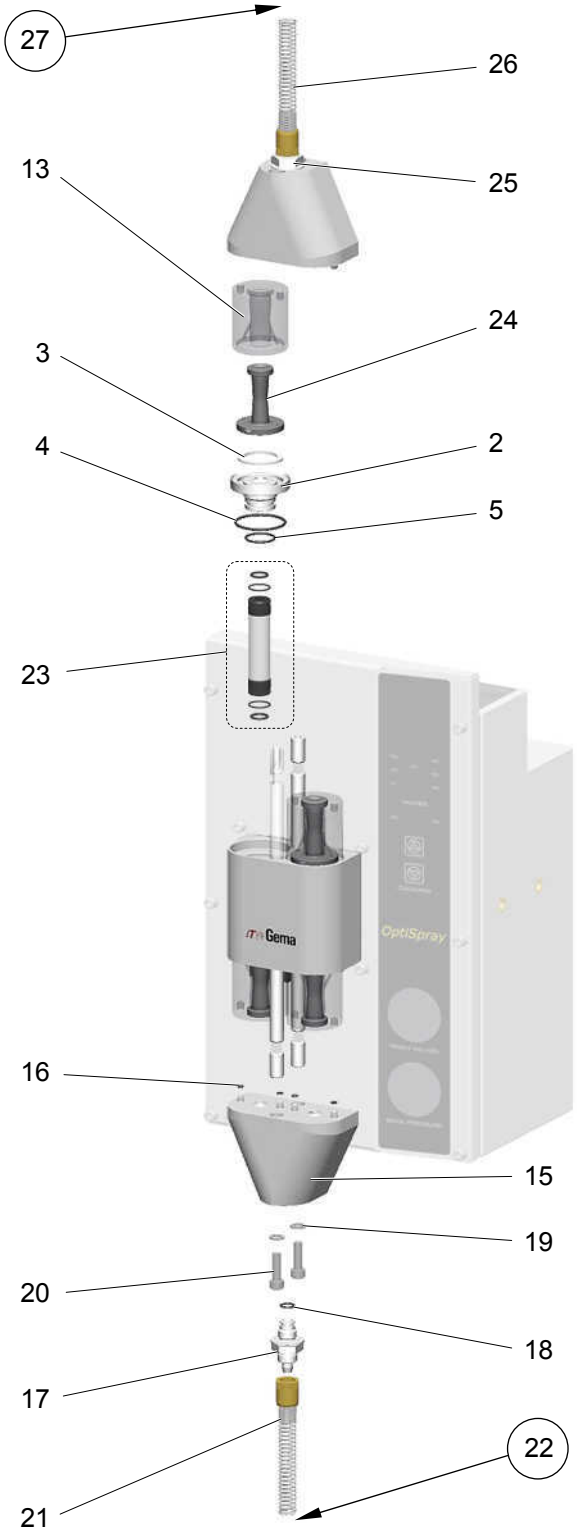
OptiSpray DPP01 - spare parts list

	OptiSpray DPP01 Dense phase pump - complete	1005 823
	OptiSpray DPP01 Dense phase pump (HF version) - complete	1005 822
	Filter ring bush - complete (pos. 2, 3, 4, 5)	1004 832
2	Filter ring bush	1004 699
3	Filter ring	1004 696#
4	O-ring - Ø 32x2 mm	1005 930#
5	O-ring - Ø 19x1.5 mm	1005 749#
13	Pinch valve body	1004 694
15	Y-piece	1004 698
16	O-ring - Ø 3x1 mm	1000 377#
17	Hose connection – 4.5 mm	1005 474
18	O-ring - Ø 8x1.5 mm	248 878#
19	Washer - Ø 6.4/11x1.6 mm	1005 254
20	Allen cylinder screw - M6x20 mm	216 429
21	Nut with kink protection - M12x1 mm, Ø 8 mm	201 316
22	Powder hose suction side - Ø 4.5 mm (not shown)	1005 454*
23	Maintenance set 1 – 2 x filter elements 3 µm, complete	1005 257
24	Maintenance set 2 – 8 x pinch valves with Short instructions (not shown)	1005 256
25	Hose connection - 7 mm	1005 596
26	Nut with kink protection - M16x1 mm	1005 443
27	Powder hose transport side - Ø 11.5/7 mm (not shown)	1005 097*
28	Assembly tool for powder chamber connection fitting (not shown)	1005 058

***** Please indicate length

Wearing part

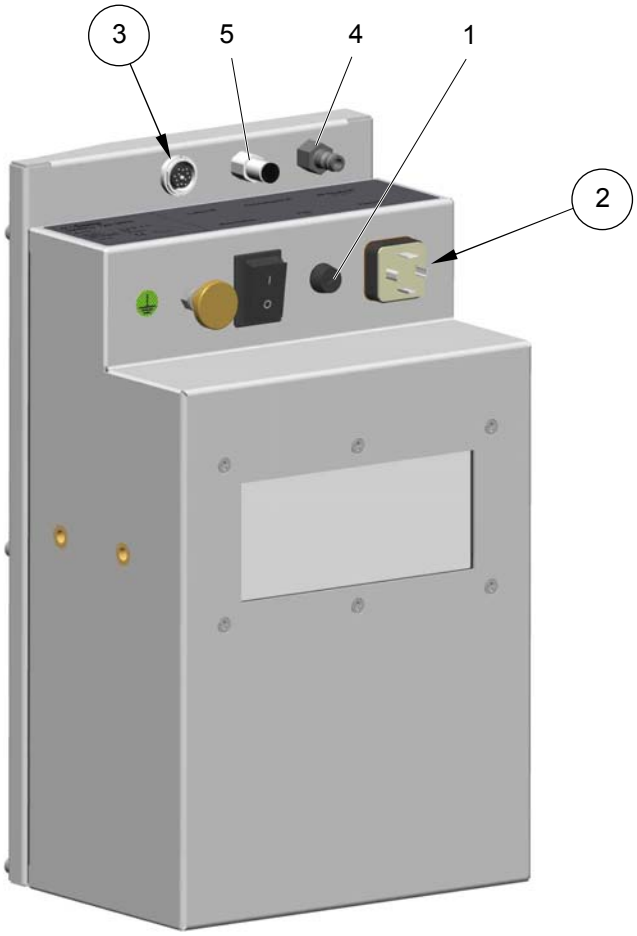
OptiSpray DPP01 – Spare parts



OptiSpray DPP01 Dense phase pump - spare parts

OptiSpray DPP01 - rear view

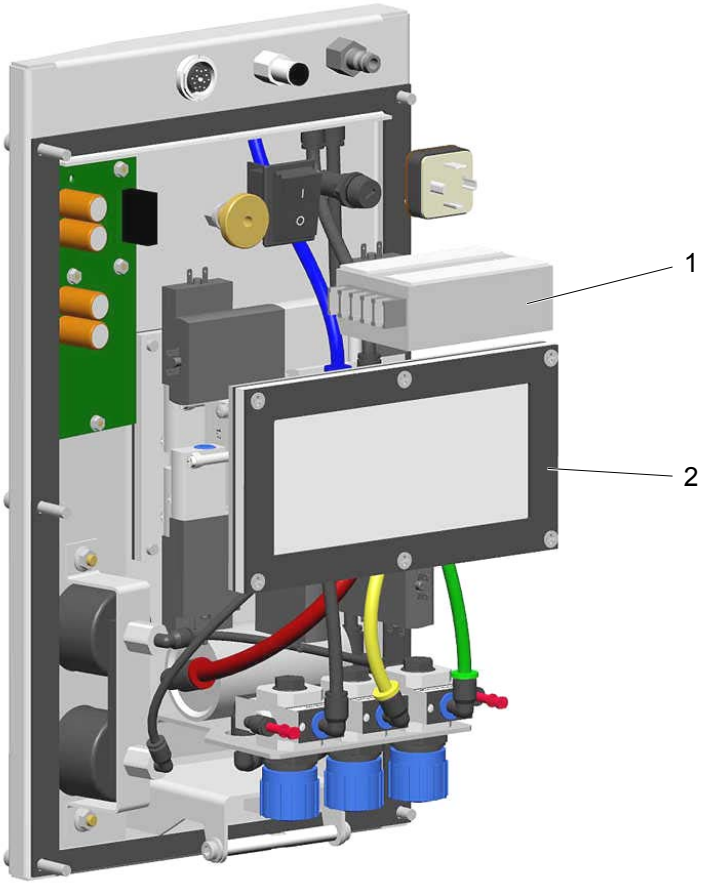
1	Fuse - 2 AT	221 872
2	Power supply extension - 1.2 m	1002 636
	Power supply extension - 12 m	1002 637
3	Connecting cable - 12 pins, 1.5 m	1000 991
	Connecting cable - 12 pins, 5 m	1000 975
	Connecting cable - 12 pins, 10 m	1000 976
	Connecting cable - 12 pins, 15 m	1000 977
	Connecting cable - 12 pins, 20 m	1000 978
4	Connector - NW5, 1/8"i	200 859
5	Connection sleeve - 1/8", Ø 6 mm	233 412



OptiSpray DPP01 - rear view

OptiSpray DPP01 - inside rear view

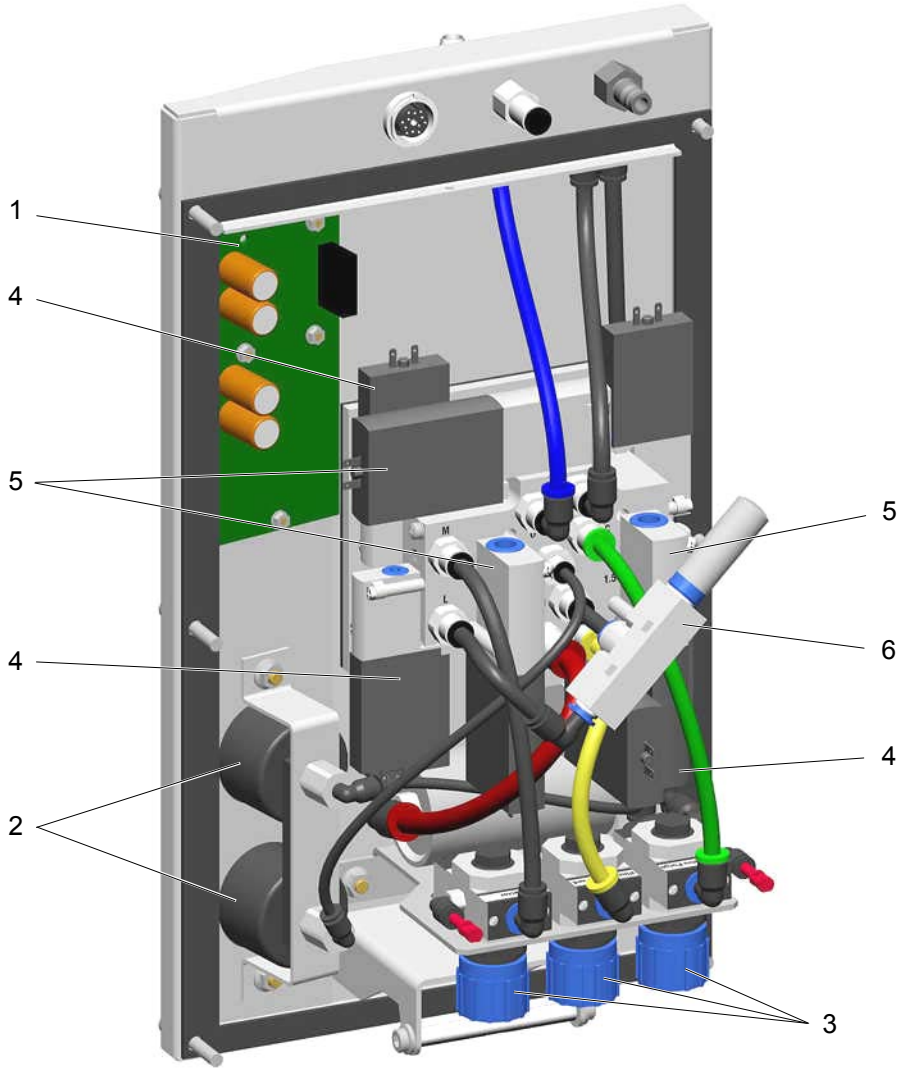
1	Power pack - 24 VDC	1003 100
2	Filter plate	1004 846



OptiSpray DPP01 - inside rear view

OptiSpray DPP01 - inside front view

1	Electronics board - complete	1004 171
2	Pressure gauge - 1-9 bar	1005 827
3	Pressure regulator - 0.5-7 bar	1005 177
4	Solenoid valve - MHA2	1004 317
5	Solenoid valve - MHA3	1004 318
6	Vacuum suction nozzle	1005 251



OptiSpray DPP01 - inside front view