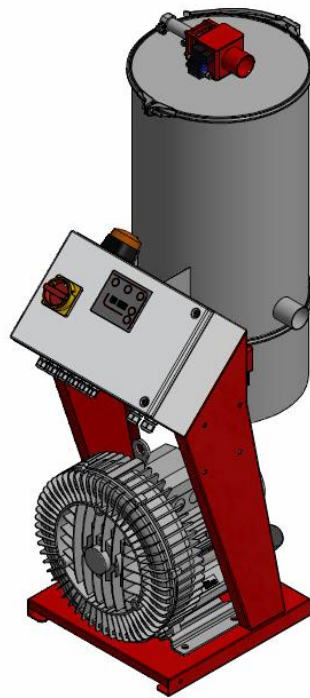


**MANUAL**

**MOVAC<sup>®</sup>**

## **GRANULES TRANSPORT SYSTEM**

Microprocessor control  
for  
8 VC-HOPPER LOADERS AND PUMP SYSTEM



**Ferlin**

plastics automation

Rudolf Dieselstraat 15A  
7442DR Nijverdal  
NEDERLAND





## EG DECLARATION OF CONFORMITY OF THE MACHINERY

Declaration according to Directive 2006/42/EC, as amended (hereafter called Machinery Directive). This language version of the declaration is a verified translated version.

### We (manufacturer):

Business name: Ferlin Plastics Automation  
Address: Rudolf Dieselstraat 15A, 7442DR Nijverdal  
Country: Nederland

### declare for the product described below:

Generic denomination: Material transportsysteem  
Commercial name: Movac  
Model: Microprocessor  
Type: MO-M15E  
Serial number: 20200816190  
Function: Keeping raw material level in feed hopper, suitable for dry and free flowing thermoplastic materials.

that all the relevant provisions of the Machinery Directive are fulfilled;

that the product also complies with the provisions of the following European Directives:

- 2004/108/EG | Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC | OJ L 390, 31.12.2004, p. 24–37

that the following harmonized standards have been used:

- EN-ISO 12100:2010 | Safety of machinery - General principles for design - Risk assessment and risk reduction
- EN 349:1993+A1:2008 | Safety of machinery — Minimum gaps to avoid crushing of parts of the human body
- EN 1088:1995+A2:2008 | Safety of machinery — Interlocking devices associated with guards — Principles for design and selection
- EN ISO 13849-1:2008/AC:2009 | Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design
- EN ISO 13849-2:2008 | Safety of machinery — Safety-related parts of control systems — Part 2: Validation
- EN ISO 13850:2008 | Safety of machinery — Emergency stop — Principles for design
- EN ISO 13857:2008 | Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs
- EN 60204-1:2006 | Safety of machinery — Electrical equipment of machines — Part 1: General requirements
- EN 61000-6-4 | Electromagnetic compatibility (EMC) - Part 6-4: General standards – Emission standards for industrial environments
- EN 61000-6-2 | Electromagnetic compatibility (EMC) - Part 6-2: General standards - Immunity for industrial environments
- EN 1037:1995+A1:2008 | Safety of machinery — Prevention of unexpected start-up
- EN-ISO 4414:2010 | General rules for pneumatic systems

and that the following natural or legal person established in the Community is authorized to compile the technical file:

Business name: Ferlin Plastics Automation  
Name in function: Wouter Maathuis, Managing Director  
Address: Rudolf Dieselstraat 15A, 7442DR Nijverdal  
Country: Holland

Holland, 2023

Wouter Maathuis  
Managing Director  
Ferlin Plastics Automation

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## 1. INTRODUCTION

This manual describes how to operate a MOVAC granules transport system. This system consists of a microprocessor with a pressure foil control and hopper loaders. You can set parameters so the system will function properly by using the control. The figures shown in the manual may differ from the system because of a difference in the number of hopper loaders and/or pump systems. All possible options are explained, also the ones your system may not have.

The purpose of this manual is:

- To see to a proper installation and maintenance of the transport system.  
Ferlin Plastics Automation cannot be held responsible for any damage done to the system in relation to the installation, use and maintenance when things are not being done according to the instructions in this manual.
- To ensure the safety of the user by preventing improper actions and/or activities.  
Ferlin Plastics Automation cannot be held responsible for any personal injury or damage to property caused by inadequacy and/or disregarding the safety rules in this manual.

The contents of the manual apply to the complete life cycle of the machine: the buyer ought to preserve the manual from the moment of purchase until the moment of removal of the machine. Moreover, the manual ought to be provided to a possible buyer or owner of the machine. An extra manual can be provided digitally.

Important notes:

In case of any doubt relating the interpretation of words, passages, chapters, schemes and/or images in the manual, you can contact the seller of the machine for further explanation.

Ferlin Plastics Automation thus rejects any responsibility relating to the misuse of the machine.

A few images in the manual, placed for easy recognition of the components described, do not match the corresponding parts of the purchased machine; this is due to the need for generalization.

Finally, Ferlin Plastics Automation retains the right to adjust and improve this manual without prior notice, due to new insights.





## 2. WARRANTY

Ferlin Plastics Automation supplies according to the Metaalunie conditions in which also the warranty provision is defined by Article 14. If desired, Ferlin can forward these. In brief: Warranty is granted 12 months after invoice date. The warranty includes the delivery or replacement of parts defective within the mentioned period. The warranty does not include transport costs of spare parts or travel expenses of the engineer. Also not covered by the warranty are parts that are subject to wear and parts defective due to misuse.

## 3. SYMBOLS

The next chart contains symbols that refer to a specific dangerous situation on the left, the respective meaning of the symbol is described on the right side.

Symbols that do not replace a warning of danger, that are described on the right side, are meant to emphasize these warnings. Symbols are displayed in accordance with Directive 77/576 / CEE.

Symbol	Description
	<b>General sign of danger</b>
	<b>Pinching of limbs</b>
	<b>Danger: high voltage</b>
	<b>Mandatory warning sign: safety glasses mandatory</b>

## 4. SAFETY INSTRUCTION



Installation and repair of equipment must be carried out by qualified persons. When working on the machine the power supply and compressed air supply must be closed off. When cleaning the machine with compressed air safety glasses must be worn.



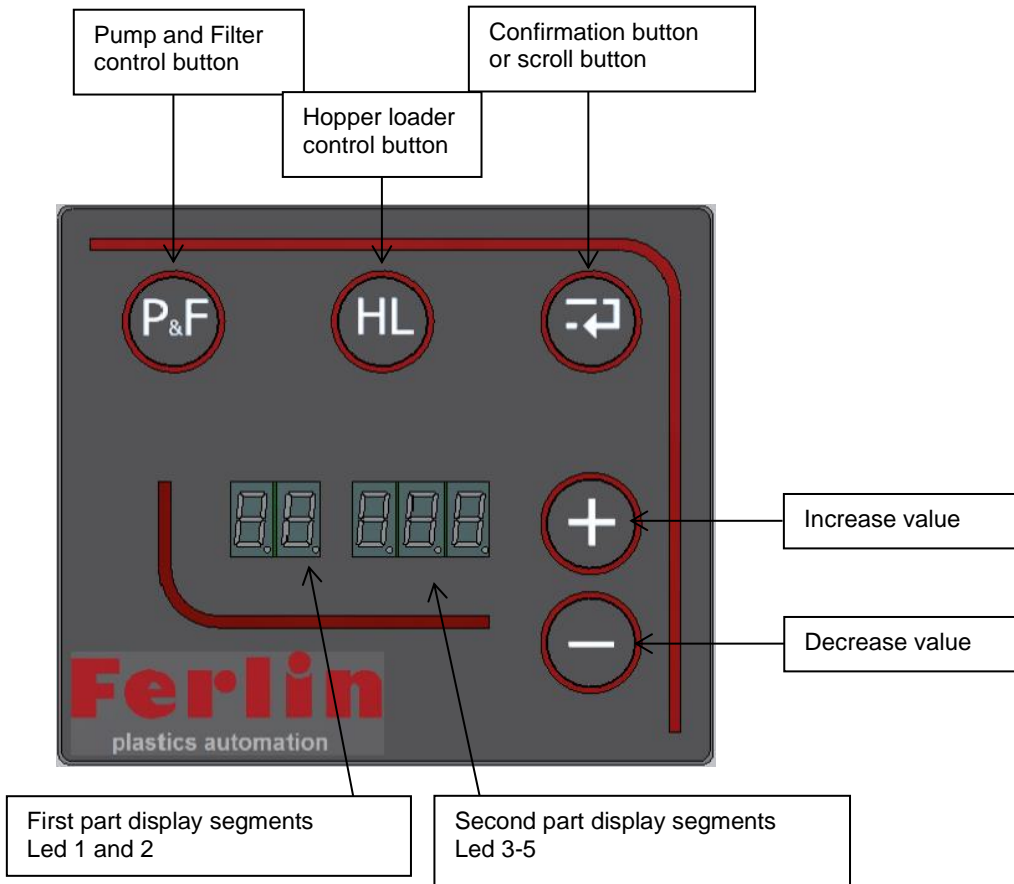
When opening the control box the power supply of the machine must be closed off.



Touching the microelectronics can cause damage to the electronics due to static discharge to the PCB. During maintenance and installation of the control box you must always wear a wristband and connect it to the earth contact of the box. Next is an image of such a wristband.



## 5. CONTROL PANEL



Meaning abbreviations:

Led 1 and 2		Led 3-5	
--	= System in idle	---	
t1	= Suction time 1 to 8	5 . 0	time / 10
l1	= Pipe draining suction time 1 to 8	3 . 0	time / 10
p1	= Proportional valve percentage 1 to 8	30	percentage
C1	= Cycle of changes prop. valve 1 to 8	2	quantity
sp	= Standby time pump	60	time / 1
ff	= Filter frequency	5	quantity
np	= Number of filter cleaning pulses	2	quantity
fp	= Filter cleaning pulse time	1 . 0	time / 10
A1	= Alarm hopper loader 1 to 8	---	
Ap	= Alarm pump	---	

## 6. PARAMETER SETTINGS HOPPER LOADER

### **h\_:**

You can use the hopper loader control key (HL) to adjust the settings of the hopper loader. When you push the button one time the first display segment shows h1 and the second display segment shows on/off. When you push the HL button more often it shows the on/off status of the other hopper loaders. To turn a hopper loader on or off, you must push the HL button as many times until it shows the right number of the hopper loader, then you can change the status by using the + or – button. The value or status needs to be confirmed by scrolling forward or pressing the P&F button.

### **t\_:**

When you want to adjust hopper loader specific settings, you must press the HL button as many times until the right hopper loader number is shown in the display. When you press the scroll button, the first display shows t1. The letter t stands for suction time and the number is the number of the hopper loader. The second display shows the current suction time accurate to 0,1 second. You should press the + or – button to adjust the time. When you keep the + and – button pressed for a longer period of time, the setting time will run faster. The time will be confirmed by pressing the confirmation button.

Depending on the type of control system, the first display will show L1, P1, c1 or h2 after pressing the scroll button.

### **L\_:**

When the system is equipped with an outlet suction valve to drain the pipe after the regular suction cycle, you can set the outlet suction time per hopper loader. When the first display shows L1, you can adjust the outlet suction time of hopper loader 1. You go about this in the same way as you would adjust the suction time.

### **P\_:**

You can change the percentage of the diverter valve or proportional valve when the first display shows P1. In the second display you can change the percentage by pressing the + and – button.

### **c\_:**

You can adjust the number of switches between the suction of material A and B so you get a kind of blendmode. These cycle exchanges can be adjusted when the first display shows c1. In the second display you can insert the number of exchanges.

## 6.1. PARAMETER SETTINGS PUMP AND FILTER

You can use the pump and filter control button (P&F) to adjust the settings of the pump and the filter. You can also use this button to return to the status screen of the control and thus confirming the changed settings of the control.

When both displays show horizontal stripes, the status of the system is on but there is no further activity; there is no demand of material and the pump is turned off.

### **SP:**

By pressing the P&F button the display shows SP, which is the standby time of the pump. When the final hopper loader sucked his material the pump will remain running for a certain period of time. At this moment the standby valve will open as to allow false air into the pump. You can adjust the standby time by pressing the + and – button, which will show in the second display in whole seconds.

It is not wise to turn the pump on and off very often, because this is not conducive to the durability of the pump. You should try not to let the pump start up for more than 10 times per hour. It is wise to set the standby time so that the pump does not switch on and off too often.

### **FF:**

After setting the standby time of the pump the first display will show FF. Here you can insert the frequency of the cleaning of the filter. This general parameter also applies to the hopper loaders. When a hopper loader has sucked for a certain number of times, the filter cycle will come into effect. Even though a hopper loader is not equipped with a cleaning device, the control will act as if the filter of the hopper loader is being cleaned. This setting also applies to the central filter. The system counts the number of suction cycles of all the hopper loaders and when the number has been reached, filter cleaning of the central filter will take place.

### **nP:**

After the frequency has been set, you can set the number of cleaning pulses per cleaning cycle. This applies to the central filter as to the hopper loader.



**FP:**

You can set the time of every cleaning pulse. This can be set up to 0,1 second.

**7. ALARM****A\_:**

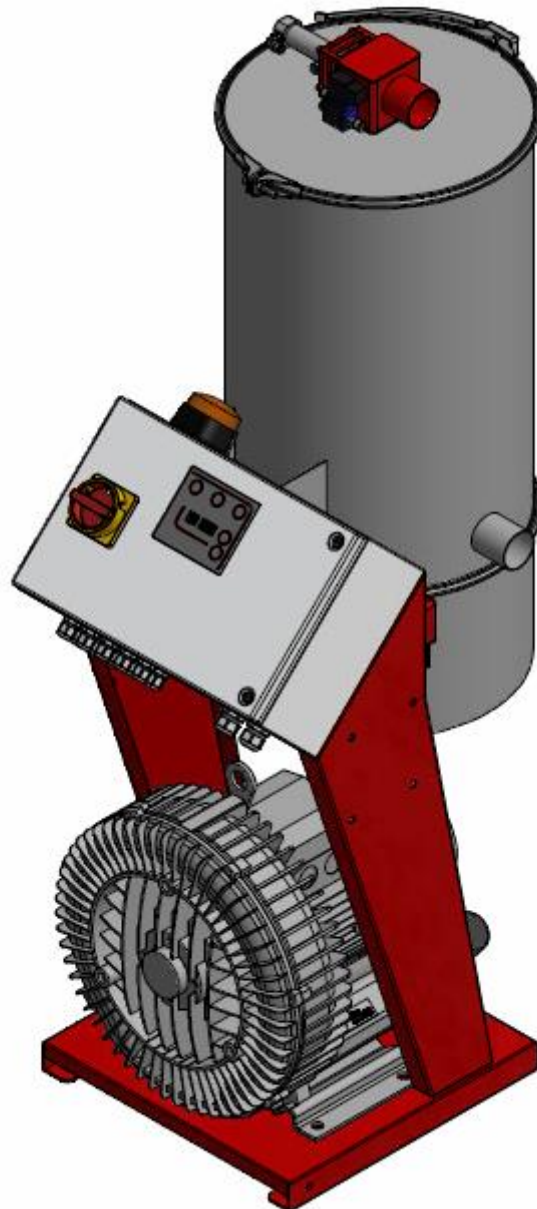
The system will set off an alarm when a hopper loader does not suck material two times in a row. The first display will show A1, meaning that hopper loader 1 is in a status of alarm. The hopper loader will no longer suck material for two minutes. After these two minutes the system will again try to get material. When the system does not get material, it will again wait for two minutes. When the system does get material, the alarm will reset and the hopper loader will again function normally. You can reset the alarm manually by pressing the confirmation button.

**AP:**

When the pump is overloaded, the pump will thermally switch off. The system will set off an alarm and the first display will show AP.

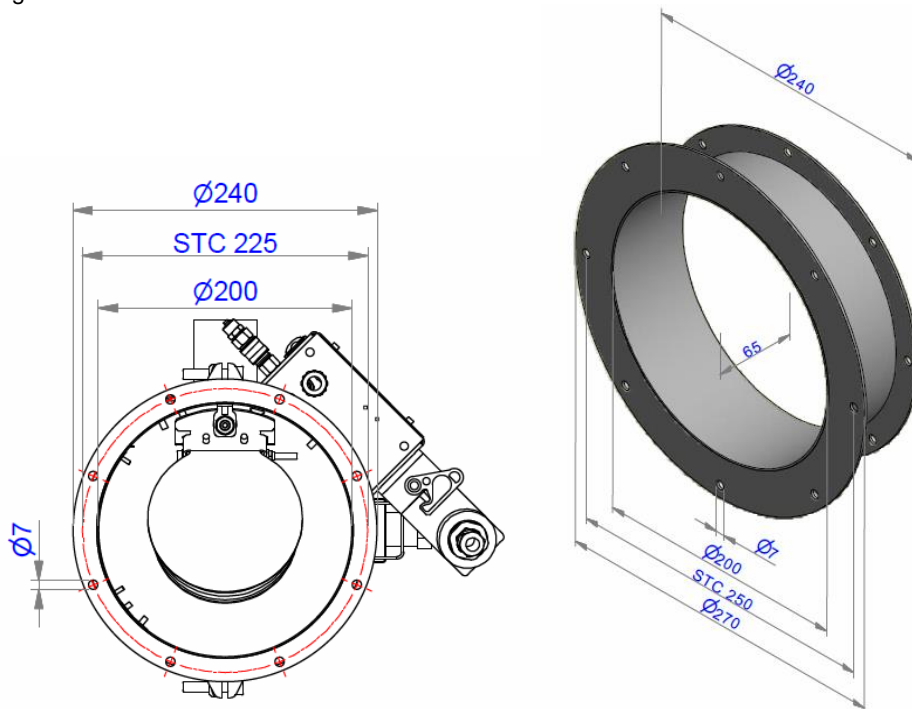
## 8. PUMP AND FILTER

The pump creates a vacuum that is needed to suck the material from a stock to the machine. The pump is connected to a filter by a hose. The filter protects the pump from dust and granules. When the filter is not cleaned or when the filter has been damaged, the pump will also get damaged. This can easily be prevented by cleaning the filter on a regular basis and replacing the filter element if needed. The dust container should also be emptied on a regular basis. If this is not done regularly, the filter element cannot discharge its dust anymore, which can cause damage to the pump.



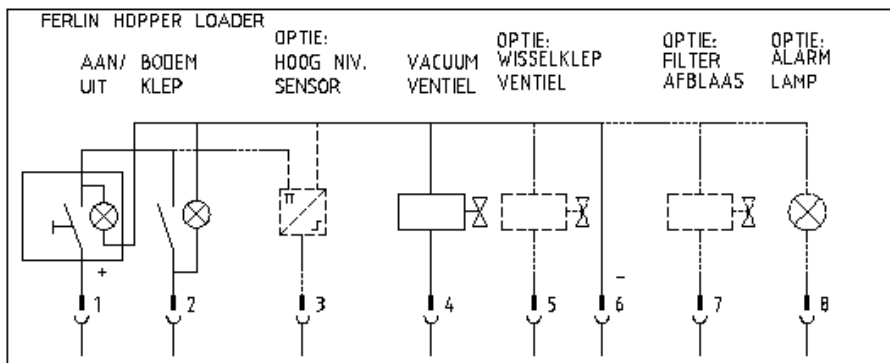
## 9. INSTALLATION VC-2 AND VC-3 HOPPER LOADER

The flange of the VC-2 and VC-3 hopper loader has 8 holes with  $\varnothing$  7mm on a pitch circle of 225 mm, see the left image below.



An adapter flange is also available with quick release. The adapter flange has a different foot print than a hopper loader, see the right image above. In order to prevent abutting edges a hole of  $\varnothing$ 200-210mm should be made in the lid of the hopper.

System hopper loaders are connected by a 9-pin connector, which is supplied with every order. Depending on the version of the hopper loader, one should use a 5 to 10 wire cable with a diameter of 0,5 to 1 mm<sup>2</sup>.



Normally hopper loaders are produced with components suitable for 24 VDC. When other voltages are required, this should be consulted with Ferlin.

All types of hopper loaders use compressed air. Minimal pressure is 4 bar and maximum pressure is 7 bar. We advise you to use 6 bar. When the pressure is set too low, it is possible that the vacuum valve will not be able to open, because it will lack the power. The under pressure of the vacuum valve will be greater than the traction of the pneumatic cylinder. When the pressure is higher than 7 bar, one should place a reducer. When the pressure is set too high the 3/2 or the 4/2 valve will malfunction.

A standard hopper loader can handle a temperature of 80° Celcius. When hopper loaders are mounted onto dryers and exceed the maximum temperature, one should use a special high temperature hopper loader.

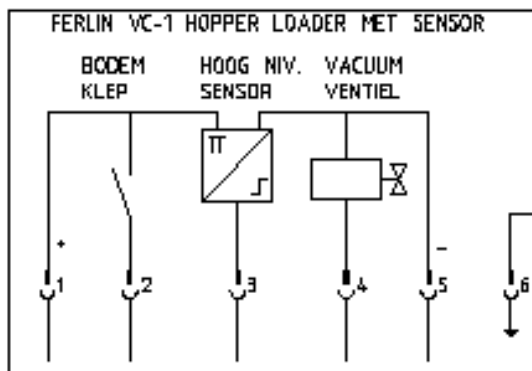
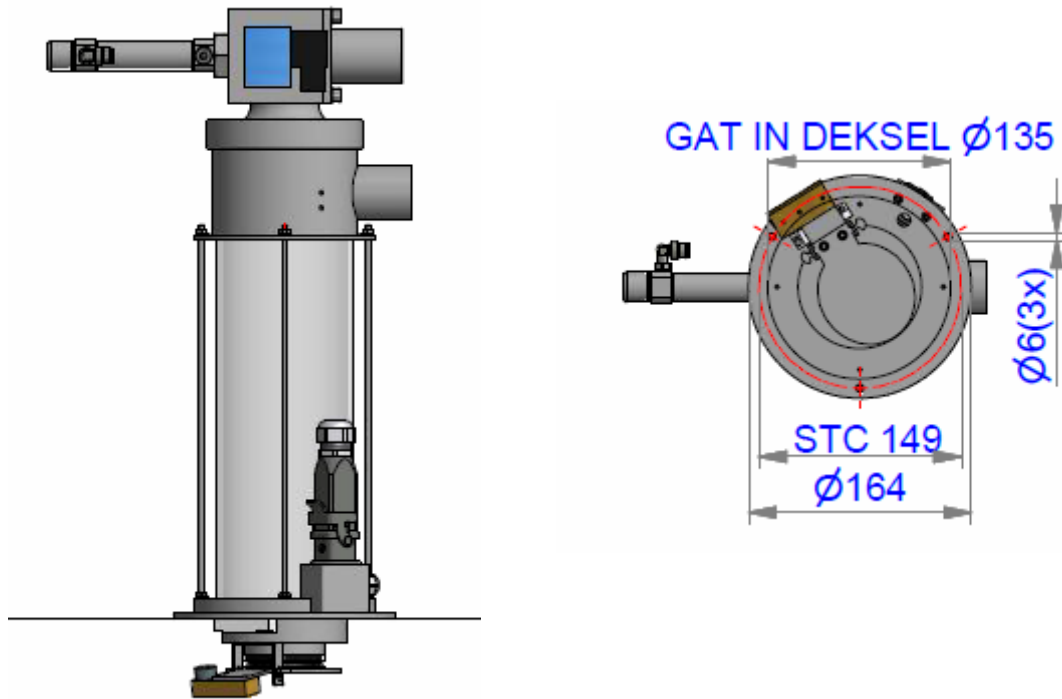


Warning:

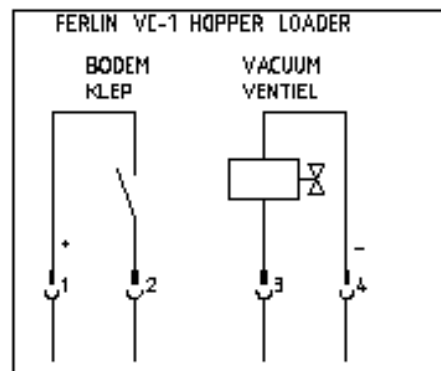
Faulty electrical connection may lead to dangerous situations. Always check whether the hopper loader is connected to the correct control voltage.

## 9.1. INSTALLATION VC-1 HOPPER LOADER

The flange of the VC-1 hopper loader has 3 holes with  $\varnothing$  6mm on a pitch circle of 149mm. In order to be able to mount the hopper loader onto a plate, one should make a hole with  $\varnothing$  135-140 mm, into which the hopper loader can be lowered, see image below.



6-pin connector



4-pin connector

The VC-1 hopper loader has a 4 or 6-pin connector. Depending on the number of pins, one needs a control cable with  $\varnothing$  0,5 to 1 mm  $^2$ . Normally a hopper loader is produced with components suitable for 24 VDC. When other voltages are required, this should be consulted with Ferlin.

## 10. CLEANING AND MAINTENANCE



The lid of the hopper loader can be opened with 3 quick-release fasteners. The lid has an opening angle of 90° and can be blocked to prevent the lid from slamming shut. When the blocking is not done properly, the lid can slam shut and pinching may occur.

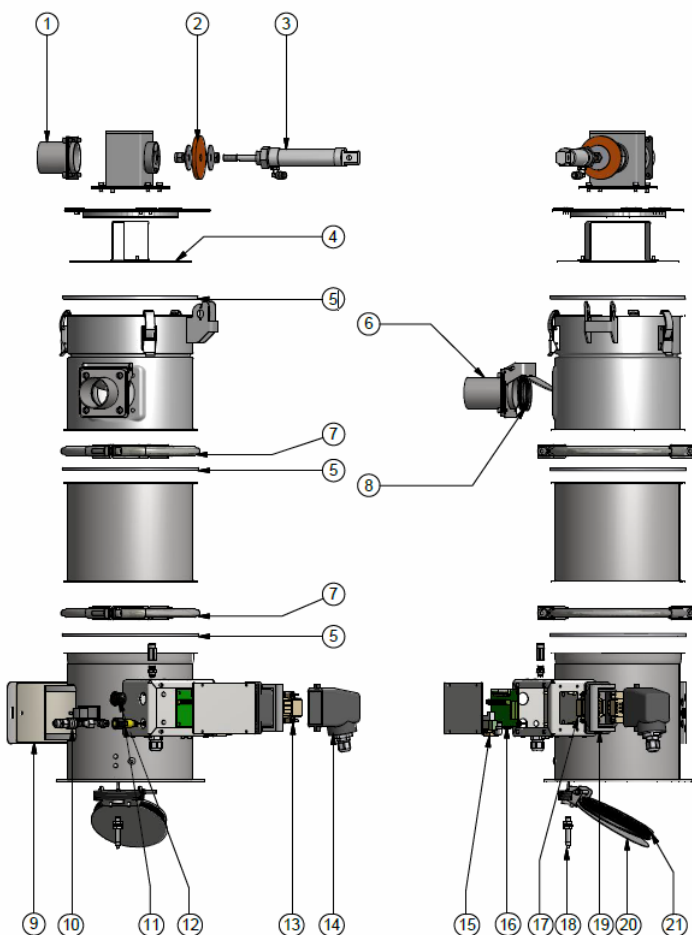


The use of aggressive liquids for cleaning is not allowed, these may affect the seals. When the hopper loader is cleaned with compressed air, safety glasses are mandatory for personal safety.



During cleaning and maintenance, compressed air and power supply should be disconnected at all times.

Regularly the hopper loader needs to be checked for wearing and defects. A hopper loader has several seals. When one of these seals is damaged, the hopper loader will experience vacuum loss and this will influence the performance. Especially the v-rings with no. 8 and 21 need monthly checking and, if necessary, to be replaced. The vacuum valve no. 2 needs to be checked annually. Rubber no. 5, placed under the lid, also needs checking monthly.

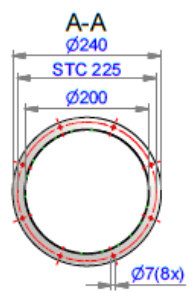
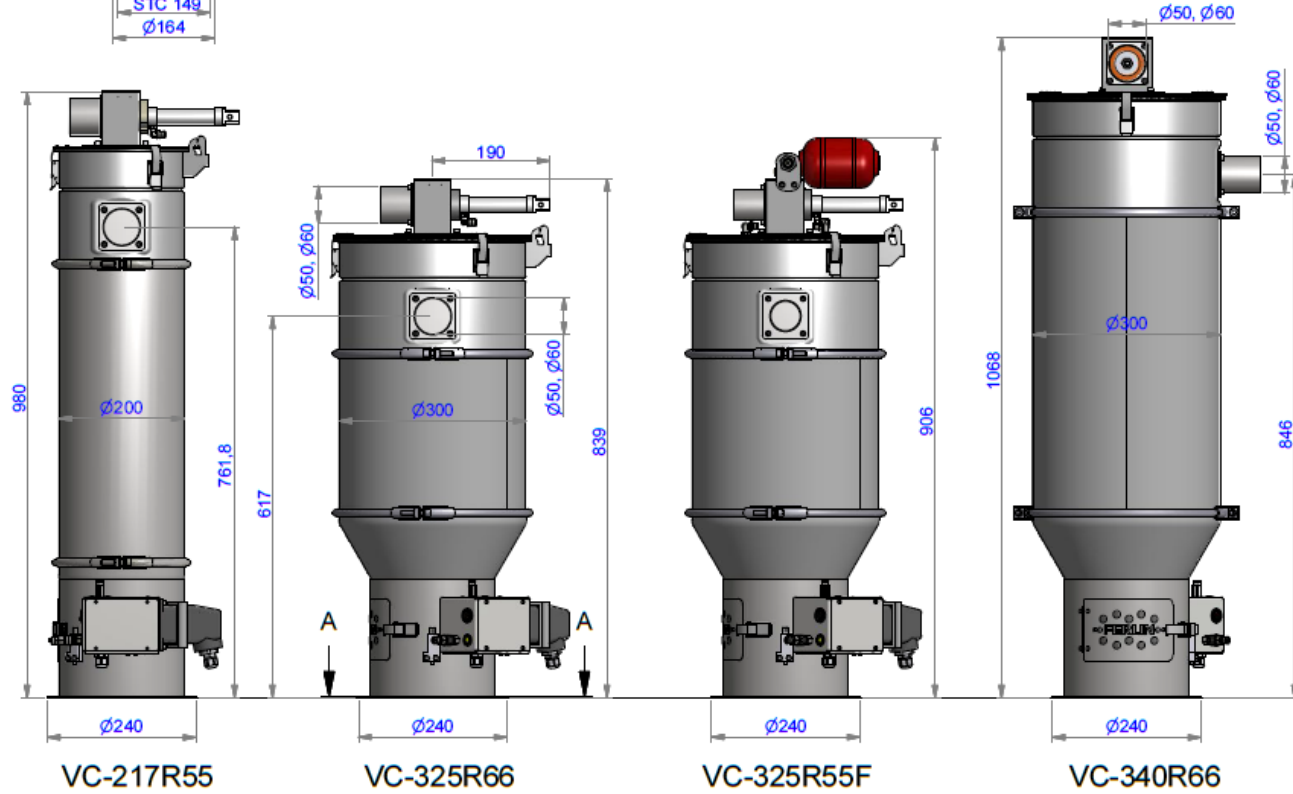
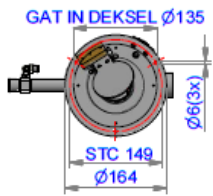
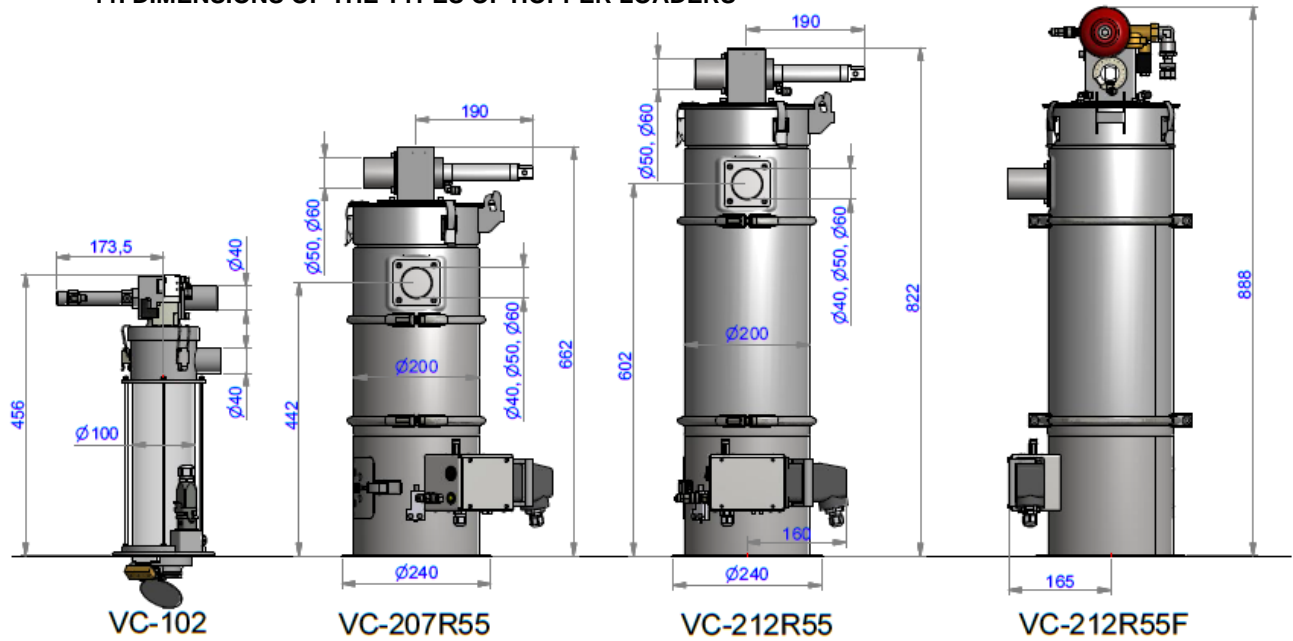


Depending on the dustiness of the material that is being sucked, the filter cloth of the inspection hatch no. 9 needs cleaning. When there has been a material exchange, the screen plate no.4 also needs cleaning. When the screen plate becomes clogged, airspeed will diminish and this will influence the capacity. The hopper loaders that have a filter bag instead of a screen plate, need to be cleaned manually on a regular basis. The material hose that is linked to the hopper loader, needs to be checked regularly for leakage. It is important that the hose contains a steel spiral. The steel spiral needs to be in contact with the hopper loader, so the static charge is able to flow away to earth.

The central filter contains a filter element that needs to be checked on a regular basis for dirt and damages. When the filter is dirty it should be cleaned manually using a compressed air gun by blowing clean, dry air from the inside out. When the filter is damaged, it should be replaced immediately in order to prevent damage to the pump. We advise to keep these filter elements on reserve. When dust is blown out of the exhaust of the pump, this is an indication that the filter element needs to be replaced. The bin at the bottom of the central filter needs to be cleaned every week. By pulling the handle on the central filter, the bin comes loose from the filter. When the bin

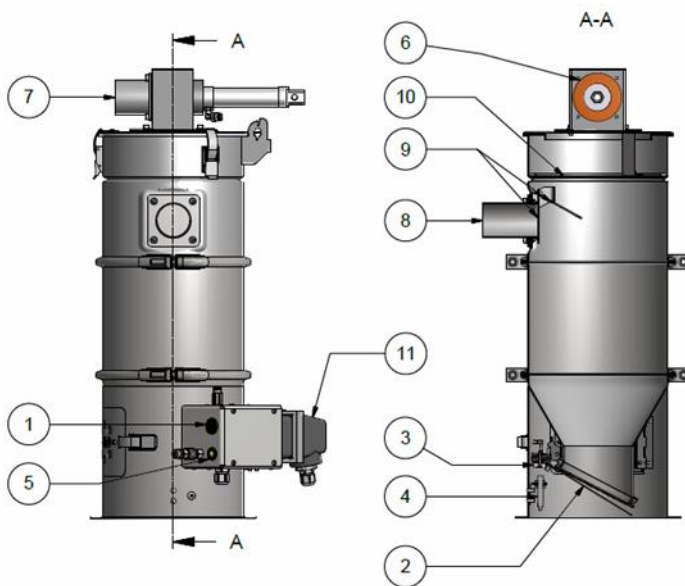
does not come loose, the central filter first needs to be brought back to atmospheric pressure by handling the pressure release valve.

# 11. DIMENSIONS OF THE TYPES OF HOPPER LOADERS



Weight and volume of hopper loaders:			
VC-101	3,5	kg	1 dm <sup>3</sup>
VC-102	3,7	kg	2 dm <sup>3</sup>
VC-207	9,5	kg	7 dm <sup>3</sup>
VC-212	10	kg	12 dm <sup>3</sup>
VC-325	12,8	kg	25 dm <sup>3</sup>
VC-340	13,8	kg	40 dm <sup>3</sup>
Filter cleaning	+ 1,5	kg	

## 12. OPERATION



How to operate a hopper loader is explained with reference to the adjacent image. The connector (no. 11) needs to be connected to the PLC cabinet by a control cable. Without this connection, the hopper loader will not log on to the PLC controller and the vacuum valve (no. 6) will not be operated. Switch (no. 1) needs to be switched on, the red LED light on the switch will light up when the switch is turned on. When the hopper loader is empty, the bottom valve (no. 2) will close, causing the magnet (no. 3) to come close to the reed contact (no. 4). Reed contact now has been made and the LED light (no. 5) is switched on, indicating low level. Reed contact transmits a signal to the PLC. The PLC will then control the hopper loaders in order of demand.

As soon as the hopper loader is able to start sucking the material, the vacuum valve (no. 6) will be opened. The vacuum hose is connected to the vacuum valve at number 7. Because the hopper loader comes under vacuum, the bottom valve (no. 2) will be pulled to a gasket causing the airstream to only flow through the material input (no. 8). The material hose is attached to the material inlet pipe (no. 8), which has access to the material stock. The material is being sucked and the non-return valve (no. 9) is being pushed away by the material streaming in. The suction time is set for a particular time by the PLC. When the suction time has expired, the vacuum valve (no. 6) will close and the hopper loader will become atmospheric again, causing the material, due to gravity, to push open the bottom valve and flow out of the hopper loader. The bottom valve (no. 2) will remain open into the material, causing the reed contact (no. 4) not to detect the magnet (no. 3) and therefore sending no signal to the PLC. When the material level has dropped far enough, the bottom valve (no. 2) will close and the cycle will repeat itself.

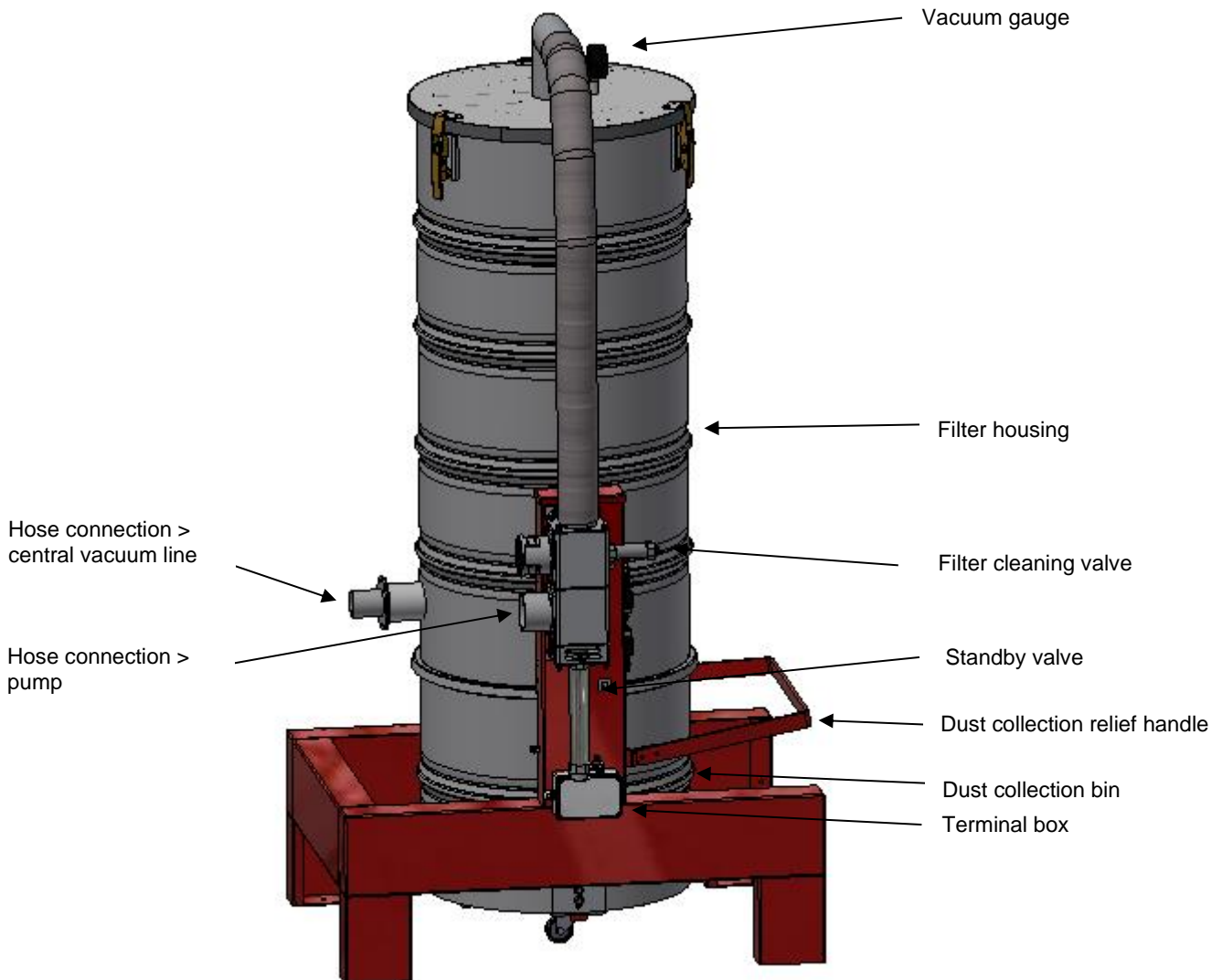
Instead of a suction time setting, the hopper loader can also be delivered with a high level sensor. As soon as the sensor detects material, the sucking of material will stop because the vacuum valve will be closed. How a hopper loader with a high level sensor precisely works, is described in the PLC control manual.

When the hopper loader is connected to a docking station or a central material guiding system the non-return valve (no. 9) has a dual function. As soon as another hopper loader, connected to the same piping, will suck material the non-return valve in the inactive hopper loader will be attracted and vacuum-tight sealed by using a sealing rubber (v-ring). When this will not happen or when the sealing is not tight or missing, there will be a vacuum leak on the other hopper loaders and the material transport will lose its capacity.

The function of the screen plate (no.10) is to separate the material from the air. The material is transported by using airflow. The airflow is created by a pump. In order to prevent the material to flow with the air into the pump a screen plate (no.10) is installed in the hopper loader, in order to make sure the material remains in the hopper loader. For this reason it is very important to always have a screen plate installed.



### 13. CENTRAL FILTER



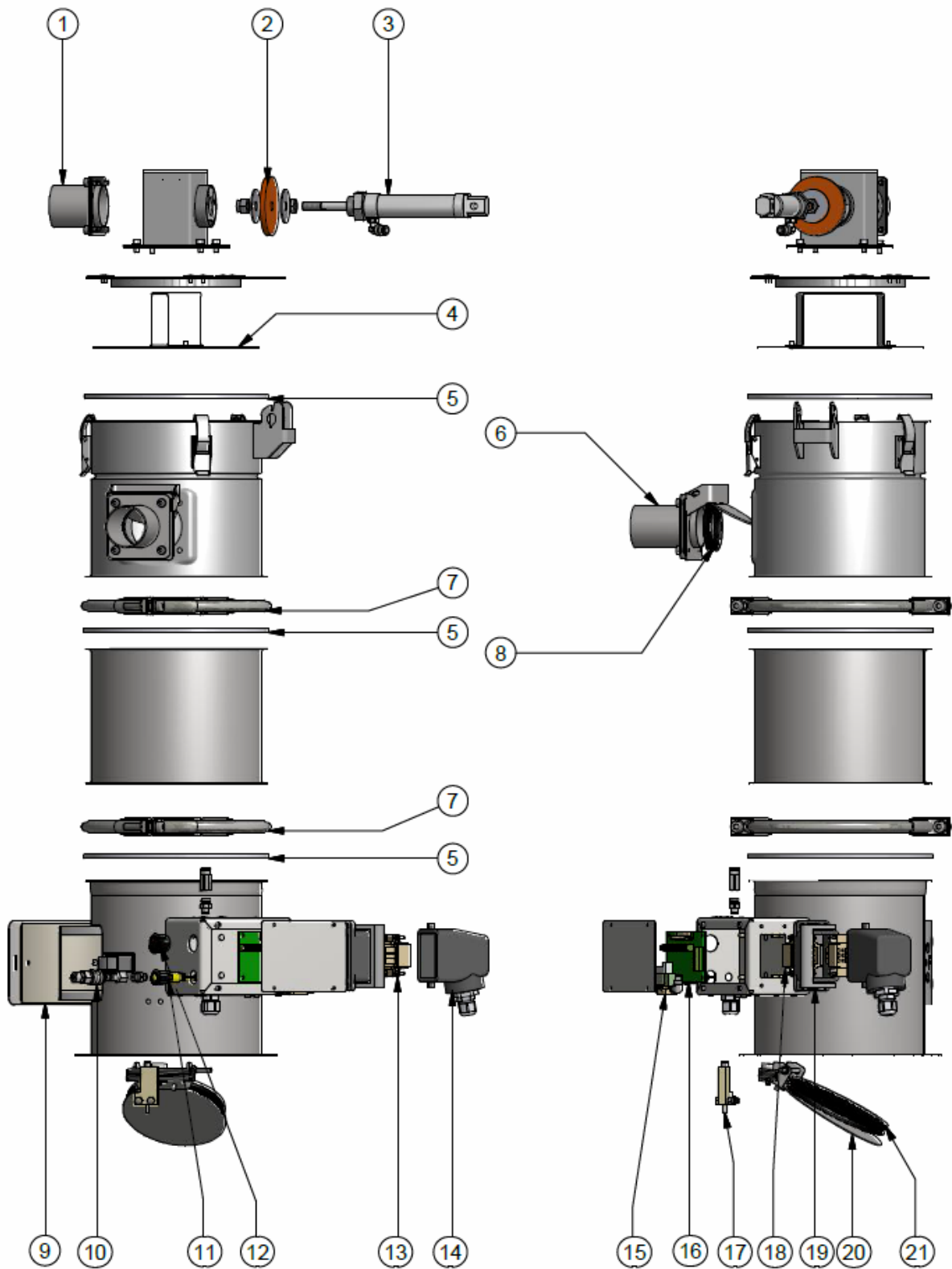
The central filter is used to protect the pump against (dusty) material on systems with more than 1 hopper loader and also with pumps from 3kW and up. When installing the central filter, hoses will need to be connected. In the picture you can see where each hose should be connected. The standby valve and filter cleaning should be operated with 24VDC. The connections are in the terminal box.



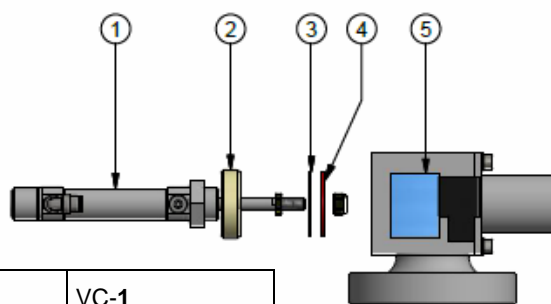
- 1 = + standby valve
- 2 = -
- 3 = + filtercleaning



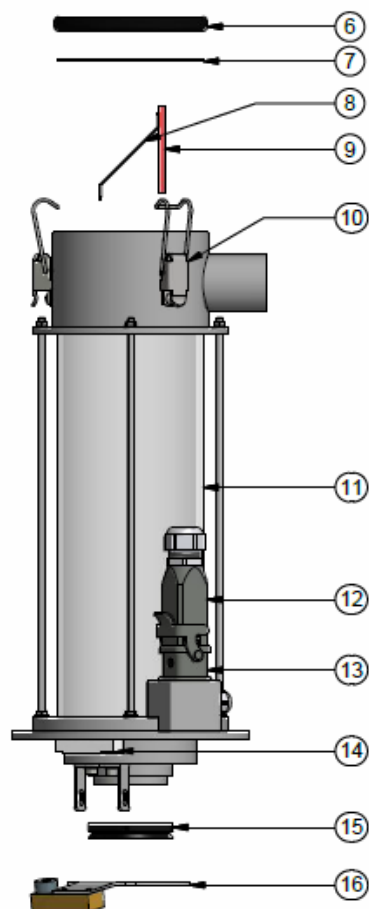
## 14. SPARE PARTS

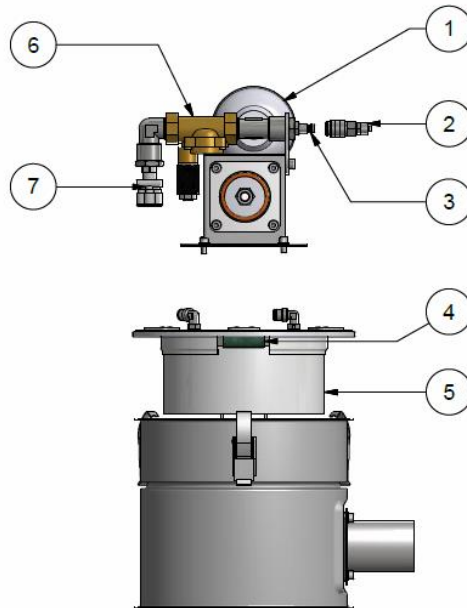


Pos.	Description	VC-2_R	VC-3_R
1	Vacuum connection ø50 mm incl. gasket	04M89.VV050	04M89.VV050
1	Vacuum connection ø60 mm incl. gasket	04M89.VV060	04M89.VV060
2	PU disk	04M01.MO245	04M01.MO245
3	Cylinder	04M89.C2530	04M89.C2530
4	Screenplate	04M89.ZEEF2	04M89.ZEEF3
5	Sealing rubber (EPDM)	04M89.EPDM2	04M89.EPDM3
6	Material inlet ø40mm complete with gasket and non-return valve and V-ring (nr.8)	04M89.VM040	04M89.VM040
6	Material inlet ø50mm complete with gasket and non-return valve and V-ring (nr.8)	04M89.VM050	04M89.VM050
6	Material inlet ø60mm complete with gasket and non-return valve and V-ring (nr.8)	04M89.VM060	04M89.VM060
7	Clamp ring	04M89.200VZ	04M89.300VZ
8	Material inlet gasket V-ring ø40mm	04M16.0VA40	04M16.0VA40
8	Material inlet gasket V-ring ø50mm	04M16.0VA50	04M16.0VA50
8	Material inlet gasket V-ring ø60mm	04M16.0VA60	04M16.0VA60
9	Filter cloth inspection hatch	04M89.FILT9	04M89.FILT9
10	Pneumatic quick coupling	01P68.05464	01P68.05464
11	LED for low level detection	01E40.71352	01E40.71352
12	On/off switch	01E33.66781	01E33.66781
13	Inside 9-pin connector female	04E1P.DSF09	04E1P.DSF09
14	Connector housing with swivel	04E1P.06L25	04E1P.06L25
15	Pneumatic 3/2 valve incl. 24VDC coil	04P69.V114A	04P69.V114A
16	Connection circuit board	04E1Q.00001	04E1Q.00001
17	Reed contact	04E43.FMMA6	04E43.FMMA6
18	Inside 9-pin chassis male	04E1P.DSM09	04E1P.DSM09
19	Chassis housing	04E1P.HI06L	04E1P.HI06L
20	Bottom valve complete with counter weight and magnet	04M89.99BOD	04M89.99BOD
21	Bottom valve gasket V-ring	04M16.VA110	04M16.VA110

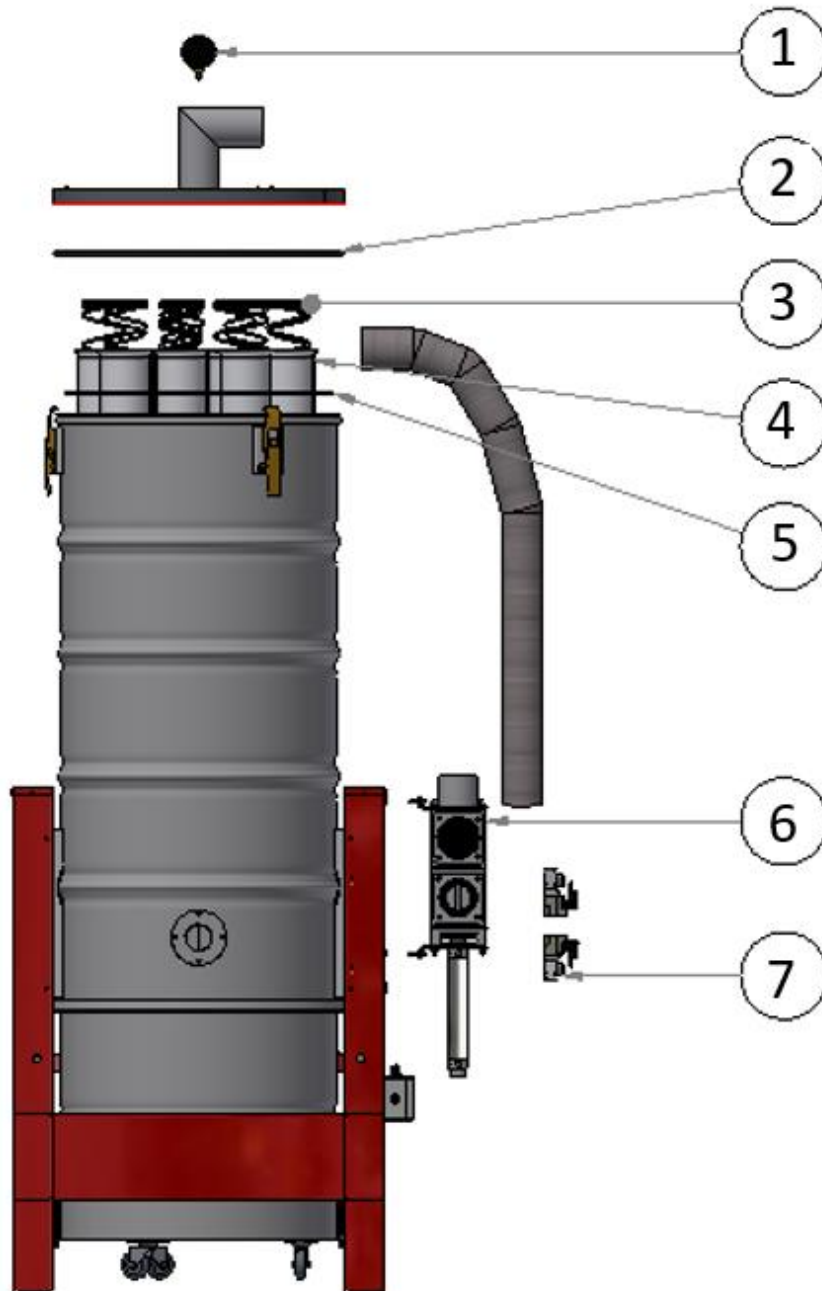


Pos.	Description	VC-1_ _
1	Cylinder	01P69.N2040
2	Sealing ring	04M01.MO925
3	Support disk	04M01.MO921
4	Linatex-disk	01M99.70103
5	4/2 pneumatic valve incl. 24VDC coil	01P67.05685
6	Screen mesh sealing rubber	04M01.0060B
7	Screen mesh	04M01.LK014
8	Material conductor	04M01.MO916
9	Non-return valve	04M01.MO924
10	Fastener	04M76.2MSZN
11	Acrylic pipe L=150mm	01M78.10018
11	Acrylic pipe L=280mm	01M78.10017
12	Connector housing	01E31.14265
12	4-pin connector female inside	01E31.14210
12	6-pin connector female inside	01E31.14861
13	Chassis housing	01E31.14225
13	4-pin chassis male inside	01E31.14200
13	6-pin chassis male inside	01E31.14881
14	Reed contact	01E35.44290
15	Bottom valve sealing V-ring	04M16.0VA50
16	Bottom valve complete with counter weight and magnet	04M01.99913



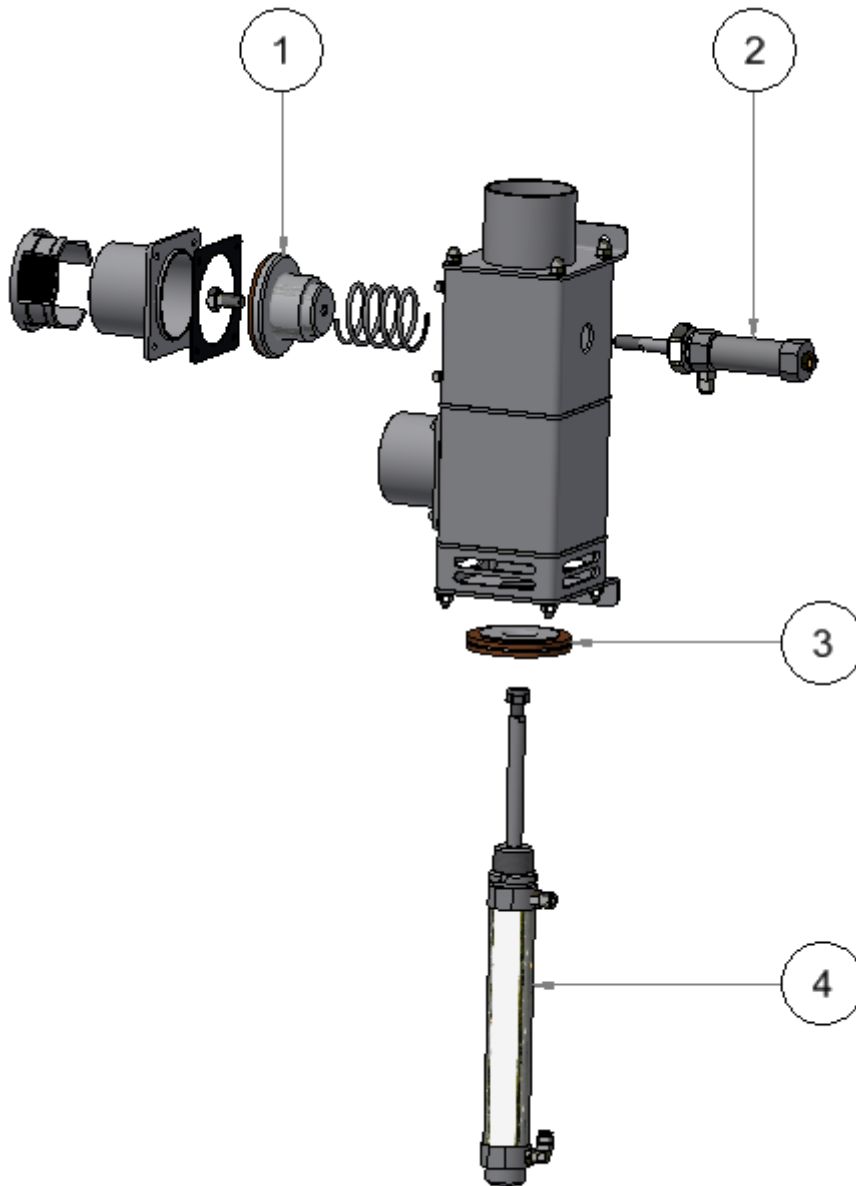


Pos.	Description	VC-2_R_F	VC-3_R_F
1	Compressed air tank	04M01.SBCV2	04M01.SBCV2
2	Pneumatic quick coupling	01P68.05464	01P68.05464
3	Pneumatic coupling column	01P68.15018	01P68.15018
4	Filter bag clamp	02M82.60561	02M82.60566
5	Filter bag	04M11.95572	04M11.95571
6	3/2 Valve incl. coil 24VDC	04M68.24NW1	04M68.24NW1
7	Manifold hose connection	01P68.75726	01P68.75726



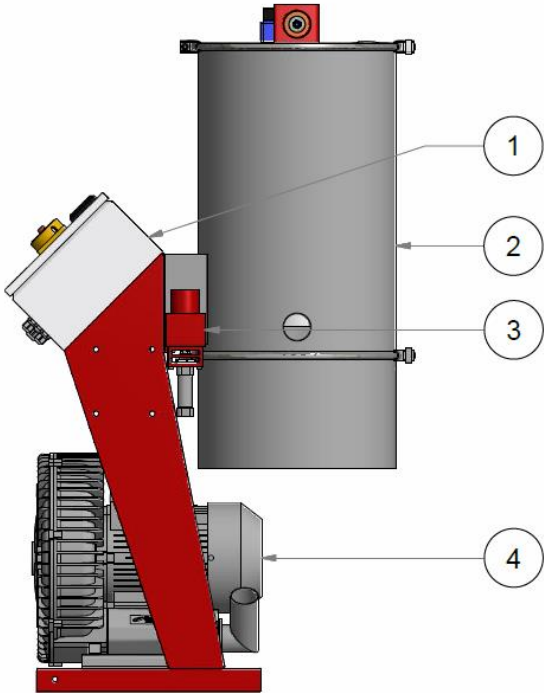
Pos.	Description	Article code
1	Manometer	04M82.40090
2	Rubber sealing for filter plate	04M99.0F813
3	Spring in filter	04M1A.682RV
4	Filter bag	04M11.25001
5	Filter plate	04M89.06061
6	Complete stand-by and filter cleaning valve	04M01.99222
7	Pneumatic valve	04P69.YOC6Q

Spare parts standby and filter cleaning valve article code 04M01.99222



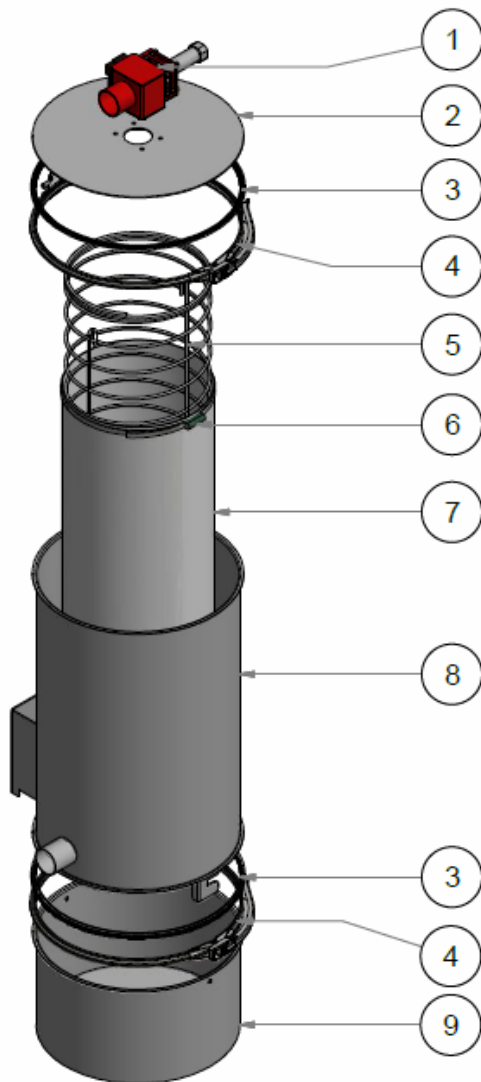
Pos.	Description	Article code
1	Filter cleaning valve set	04M01.99010
2	Cylinder (double-acting) $\varnothing 25$ stroke 25	01P69.Y2525
4	Standby valve set	04M01.99011
5	Cylinder (double-acting) $\varnothing 32$ stroke 100	01P69.10622

Pump and filter on frame MO-MxxF4



- 1 = Control box (see type plate)
- 2 = F4 Filter, article code 04M89.000F4
- 3 = Idle valve, article code 04M01.99NLK
- 4 = Pump (see type plate pump)

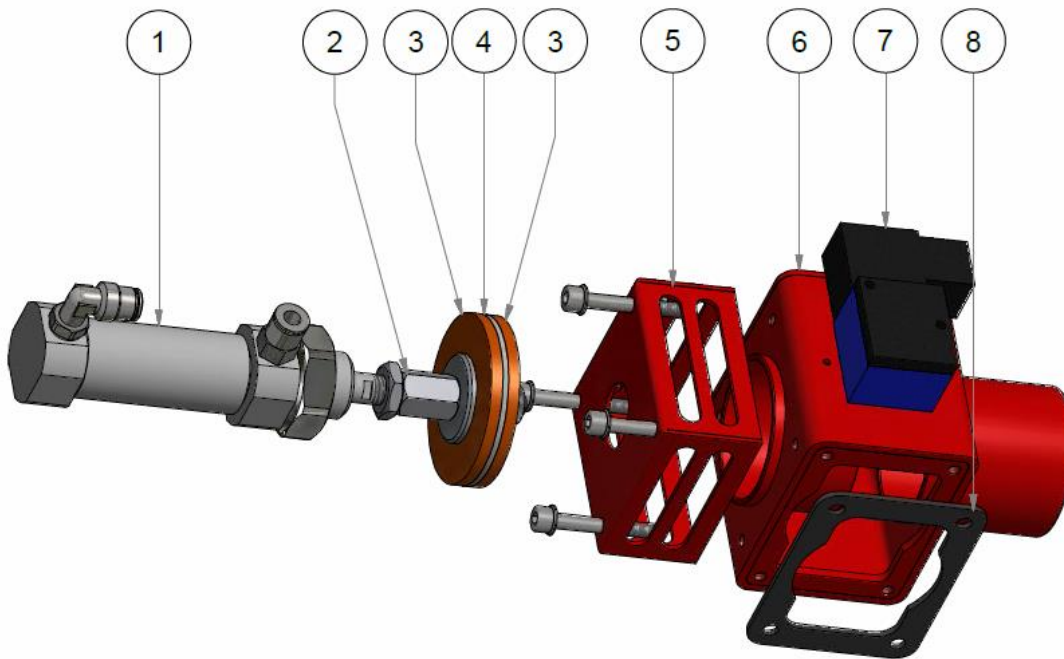
Spare parts F4 filter article code 04M89.000F4



Positie	Description	Article code
1	Idle valve	04M01.99NLK
2	Top plate	04M89.LTF41
3	Sealing ring	04m1s.95159
4	Quick-coupling	04M89.350VZ
5	Bearing spring	01M1G.F3010
6	Hose clamp	02M82.60566
7	Filter bag	04M11.02000
8	Filter housing	04M89.LTF42
9	Container	04M89.LTF43



Spare parts idle valve article code 04M01.99NLK



Positie	Description	Article code
1	Cylinder	01P69.Y2525
2	Shaft extension	04M01.LK032
3	PU disk	04M01.10633
4	Support disk	04M01.LK028
5	Cylinder support	04M01.LK031
6	Housing	04M01.K020A
7	Pneumatic valve	01P67.05685
8	Gasket	04M22.LK027

For the spare parts of the PLC control unit, we refer to the attached electrical drawings

## 15. ELECTRICAL DRAWINGS