

Operating Manual PillAerator Turbo Compressor



7000 EN 02.2015 (EN) Original manual

Scope of application: PillAerators HP4000, MP6000, LP8000, HP9000, MP12000, LP14000

PillAerator GmbH reserves the right to make changes resulting from technical development!

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1. General information

1.1 Introduction

This operating manual contains basic instructions and safety information which must be complied with during transport, installation, commissioning, maintenance and repair work. For this reason, it is essential that the operating manual be read by both the service technician and the operator and user. The operating manual must be available in the PillAerator operating area at all times.

We retain the copyrights to this operating manual and its associated drawings, sketches and other documents. PillAerator GmbH shall assume no liability for damage caused during the warranty period by lack of maintenance, misuse, improper operation, incorrect installation and assembly, and incorrect or improper connection of the electrical and mechanical components. Unauthorized changes or non-compliance with the recommendations and the usage of accessories or spare parts which were not recommended or supplied by the manufacturer shall also result in an exclusion of liability for any resulting damages.



Safety instructions which, if not followed, could result in property damage and/or personal injury are highlighted by the general hazard symbol.



This safety symbol indicates the presence of dangerous electrical voltage.

CAUTION *Is posted for safety instructions which, if not followed, can damage the PillAerator or impair its function.*

NOTICE *Indicates important information.*

Numbers in brackets, e.g. [12], refer to the component numbers in the following illustration.

Item numbers for reordering individual components are given as ten-digit numbers, e.g. 5960342700.

Components to be provided by the customer are indicated in the text by "(Customer)". The optional scope of supply is not marked in this way.

1.2 General information

CAUTION *Always read the operating manual and follow its instructions before performing transport, installation, commissioning, operation, maintenance or repair work.*

CAUTION *Store the operating manual for later reference for the entire product service life.*

1.3 Intended Use

The PillAerator and its optional components are designed in accordance with the applicable safety regulations for the transport of air in such applications as the ventilation of activated sludge tanks in sewage treatment plants or the fermentation of yeast. They were developed, designed, constructed, tested and delivered for the design conditions specified in the order confirmation. The preset operating parameters must not be exceeded. Any usage differing from or extending beyond this, in particular the transport of other gases or under different suction conditions (e.g. excessively high or low pressure/temperature Section 4) is deemed misuse. The manufacturer shall assume no liability for damages resulting from such misuse. The risk shall be borne solely by the user. In cases of doubt, the intended use must be approved by PillAerator GmbH.

Intended use also includes compliance with the servicing and maintenance requirements specified by the manufacturer (see Section 9).

The PillAerator must be transported, installed, operated, serviced and repaired solely by persons familiar with this work who have been instructed about the hazards.

The applicable accident prevention regulations and the other generally recognized safety, occupational health and road traffic rules must always be complied with.

Modifications are prohibited and invalidate all liability of the manufacturer for any consequential damages.

The PillAerator must be shut down immediately when faults occur. The faults must be cleared without delay and the PillAerator GmbH customer service department notified if required.

1.4 Receipt of the PillAerator and inspection of its nameplate

The PillAerator and its packing materials must be checked immediately upon receipt.

CAUTION *Please ensure after removing the packaging that no foreign bodies or contaminants can get inside of the PillAerator since they result in damage.*

Please contact the shipper and notify your sales office immediately if damage to the PillAerator is discovered.

Inspect all of the packing materials for documents and small parts before they are disposed of.

Verify that the data on the nameplate attached to the PillAerator match those in the order specification. Please contact your sales office immediately if the information on the nameplate differs from the order details.

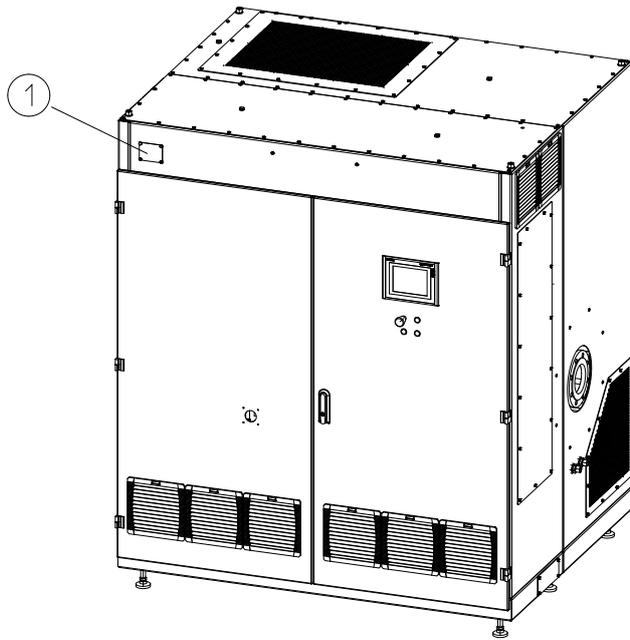


Figure 1: Position of the nameplate

PillAerator GmbH D - 37186 Moringen Made in Germany			
Type	PillAerator MP6000		
Diagram No.	5980700150	Weight	1780 kg
P	180 kVA	Year	2014
Phase/Freq.	3 / 50 Hz	I	260 A
U	400 V	Serial No.	8198278
		IP	21

Figure 2: Nameplate example

2. Safety

2.1 General information

Always read the operating manual and follow its instructions before performing transport, installation, commissioning, operation, maintenance or repair work.

Warning symbols and instructions are posted on the PillAerator. They indicate the hazard zones where increased caution is advised. Non-compliance can result in serious or fatal accidents.



Please ensure that the posted warning symbols and instructions are always well recognizable and legible.

2.2 Symbols

This operating manual includes symbols which must be particularly noted:



Calls attention to hazardous situations which can possibly result in personal injury and damage to the PillAerator.



Beware of electrical current. The intended work may only be performed by an electrician.



Reference to environmental protection.



Beware of hand injuries.



Beware of suspended loads.



Beware of hot surfaces.



Keep out!



MANDATORY - Follow the instructions!
The specified safety instructions must always be followed.



MANDATORY - Follow the instructions!
Wear hearing protection while working on the system.



MANDATORY - Wear safety shoes!
Wear safety shoes while working on the system.



MANDATORY - Wear gloves!
Wear suitable protective gloves while working on the system.



MANDATORY - Wear safety glasses!
Wear safety glasses while working on the system.



Nicht schalten!
Es wird
gearbeitet!
Datum _____
Entfernung des
Schildes nur
durch _____

DO NOT ACTIVATE following disconnection from the power supply.

The PillAerator must not be energized under any circumstances.
A prohibition sign with an adjacent symbol and instructional text must be posted on the control center of the PillAerator's mains cable and on the PillAerator itself for the entire duration of the work. The rotary drive for the door coupling must be secured by a lock.



Nicht in Betrieb
nehmen!
Es wird
gearbeitet!
Datum _____
Entfernung des
Schildes nur
durch _____

DO NOT OPERATE once the system is ready for operation!

The PillAerator may not be started up under any circumstances.
A prohibition sign with an adjacent symbol and instructional text must be posted on the PillAerator for the entire duration of the work. The rotary drive for the door coupling must be secured by a lock.

2.3 Special safety instructions

The PillAerator has been built in accordance with the state of the art and the recognized rules of safety. Nevertheless, its usage can still endanger the life and limb of the operator or a third party if the PillAerator is not used for its intended purpose and/or if this operating manual is not observed.

The PillAerator may only be used in a technically flawless condition and for its intended purpose with an awareness of safety and hazards while following the instructions in the operating manual.

Work on the PillAerator may only be performed by PillAerator GmbH employees (Exception: commissioning, inspection of and work on the electrical components and maintenance work).

The applicable national and international standards apply in each case for the connection of electrical components. Please ensure in this process that the regulations of the respective power company are complied with.

Read this manual and note its instructions precisely before carrying out the installation and commissioning. The machine may only be commissioned by qualified professionals whose technical training, experience and instruction has provided them with adequate knowledge of

- Safety regulations,
- Accident prevention regulations,
- Directives and the recognized rules of technology.

Only qualified electricians (in accordance with the Definition of trained professionals in DIN VDE 0105 and IEC 364) may inspect or work on the electrical equipment in compliance with the currently applicable

- National and international regulations
- Safety regulations,
- Accident prevention regulations.

Electricians are persons whose technical training, experience and instruction have provided them with adequate knowledge of applicable standards, requirements and accident prevention regulations. They must also be able to evaluate the work assigned to them and recognize possible hazards.

The electricians must be authorized by those responsible for the PillAerator to perform the required work and activities.



Electrical connections must be made by an electrician.



Internal PillAerator components become dangerously energized when the machine is connected to the network. Touching these components can lead to fatal electric shock.



The mains voltage must be shut off before installation and maintenance work is performed.



The capacitors still remain energized for prolonged periods of time following disconnection of the power supply. Ensure that no voltage is present before starting work on the PillAerator.



The PillAerator can cause high-frequency disturbances in residential environments which necessitate interference suppression measures.



The PillAerator is only designed for usage in a low voltage network which supplies solely industrial zones.



Start-up only when the discharge pipe is connected.



Seal the cable inlets with cable fittings (class IP54 or higher) to prevent dirt particles from penetrating the PillAerator.



Special tools and training are always required for work on the compressor unit (incl. motor, housing and impeller). A risk of injury otherwise exists.



The doors may only be opened when the PillAerator is idle and deenergized.



The inside of the PillAerator contains hot surfaces.



Wear safety shoes when working on the PillAerator

2.4 Trained personnel

Employ only reliable and trained personnel who are familiar with the machine. Clearly define the qualifications, roles and responsibilities of the personnel for commissioning, operation, maintenance and repair.

3. Scope of supply

Inspect the goods for completeness upon delivery. Please contact your sales office if the delivery is not complete.

PLEASE NOTE *Inspect the goods for damage. Damaged goods must not be installed since they could impair the PillAerator's functional capacity.*

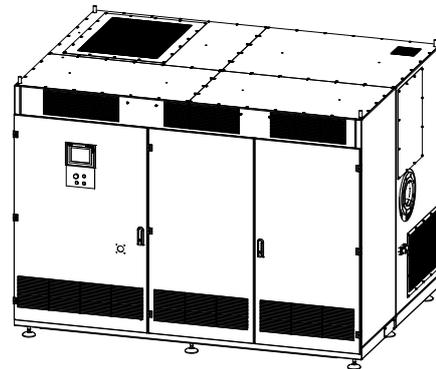
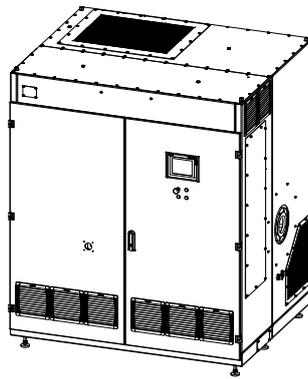
3.1 Standard

The standard scope of supply includes the following components:

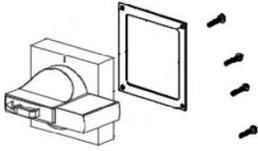
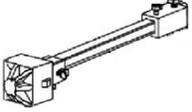
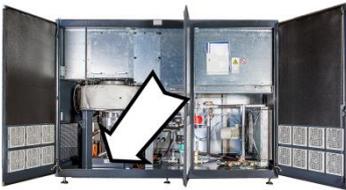
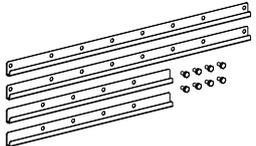
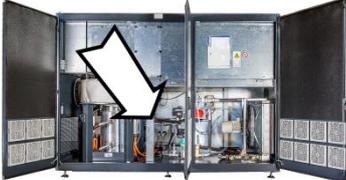
1 PillAerator

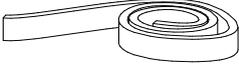
**HP4000 or MP6000
or LP8000**

HP9000 or MP12000 or LP14000



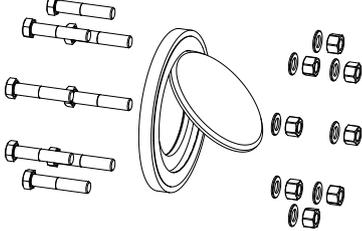
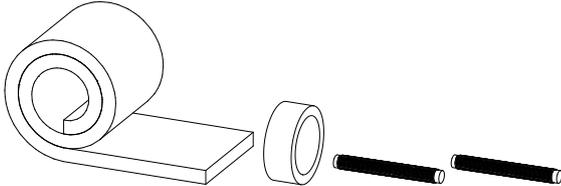
	HP4000, MP6000, LP8000	HP9000, MP12000, LP14000
including the following loose parts (located inside the PillAerator, packed in small bags or cartons)		
1 circuit diagram 		
1 operating manual 		
1 control cabinet key 	0047000704 	0047000704 

	HP4000, MP6000, LP8000	HP9000, MP12000, LP14000
including the following loose parts (located inside the PillAerator, packed in small bags or cartons)		
<p>1 door coupling rotary drive kit</p> 	<p>0047000228 including 1 rotary drive for door coupling 1 seal 4 screws</p> 	<p>0047000702</p> 
<p>1 rotary drive shaft for door coupling</p> <p>HP4000, MP6000, LP8000</p>  <p>HP9000, MP12000, LP14000</p> 	<p>0047000229 and 0047000228</p> 	<p>0047000517 and 0047000702</p> 
<p>4 ring nuts M24 DIN 582 C15E</p> 	<p>--</p>	<p>0032830006</p> 
<p>1 set of spacer brackets</p> 	<p>--</p>	<p>5961220013 including 2 spacer brackets 992 mm 6527001000 2 spacer brackets 671 mm 6527001001 8 screws M10x20 DIN 933 8.8</p> 

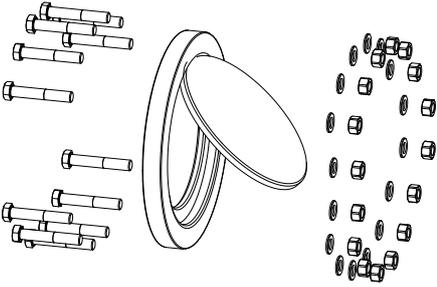
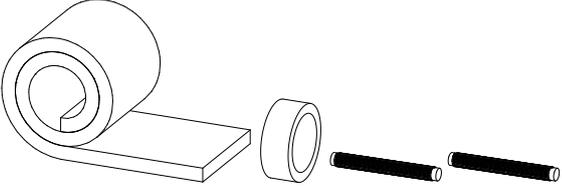
	HP4000, MP6000, LP8000	HP9000, MP12000, LP14000
including the following loose parts (located inside the PillAerator, packed in small bags or cartons)		
3.4 m sealing tape 8x2 EPDM 	--	0028500231 
12 bracket clips 	--	0047000297 

The standard scope of supply additionally includes the following components separately packed in cartons on a disposable pallet:

HP4000, MP6000, LP8000

1 complete check valve kit 0041131011 	including 1 check valve 0041131008 8 screws 8 washers 8 nuts	C22.8/1.4571/FPM M20x100 DIN 931 A4-70 A21 DIN 125 A4-70 M20 DIN 934 A4-70
6 m ² mineral fiber mat 50 mm thick 0041859256 	including 1 roll duct tape 2 rolls winding wire	

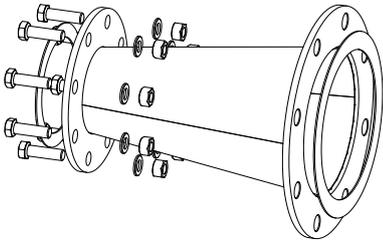
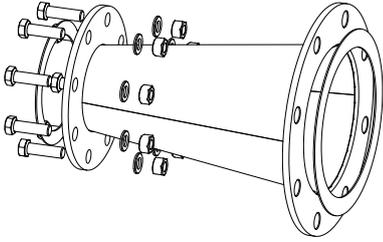
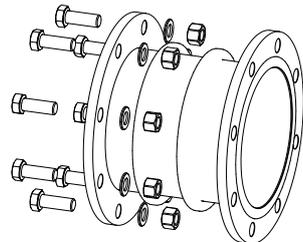
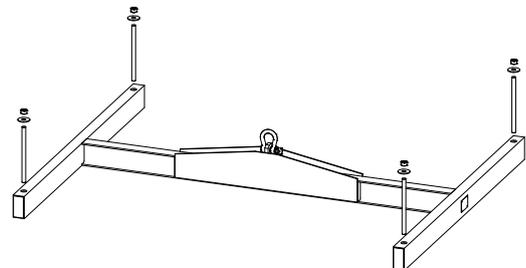
HP9000, MP12000, LP14000

<p>1 complete check valve kit 0041131012</p> 	<p>including</p> <ul style="list-style-type: none"> 1 check valve 0041131010 12 screws 16 washers 16 nuts 	<p>C22.8/FPM</p> <p>M24x140 DIN 931 A4-70 A25 DIN 125 A4-70 M24 DIN 934 A4-70</p>
<p>6 m² mineral fiber mat 50 mm thick 0041859256</p> 	<p>including</p> <ul style="list-style-type: none"> 1 roll duct tape 2 rolls winding wire 	

3.2 Optional

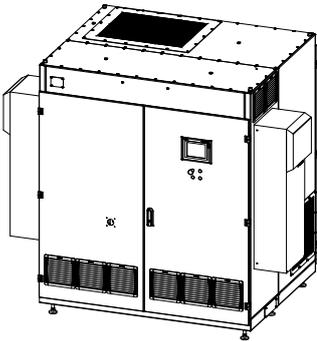
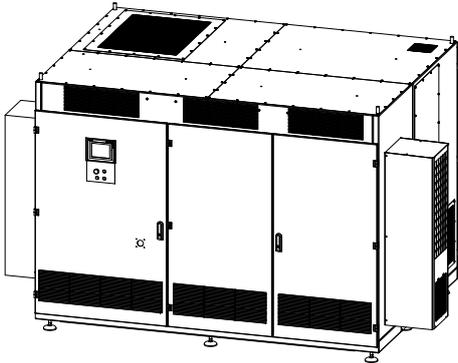
The optional scope of supply includes the following components separately screwed onto a disposable pallet or packed in cartons on the pallet if they have been ordered:

HP4000, MP6000, LP8000

<p>1 complete transition piece kit (HP4000, MP6000) 5928009993</p> 	<p>including</p> <ul style="list-style-type: none"> 1 transition piece 5928005116 1 small seal 0041191245 1 large seal 0041191246 8 screws 8 washers 8 nuts 	<ul style="list-style-type: none"> 1.4301 AFM-30 AFM-30 M16x55 DIN 933 A4-70 A17 DIN 125 A4-70 M16 DIN 934 A4-70
<p>1 complete transition piece kit (LP8000) 5928009992</p> 	<p>including</p> <ul style="list-style-type: none"> 1 transition piece 5928003740 1 small seal 0041191255 1 large seal 0041191246 8 screws 8 washers 8 nuts 	<ul style="list-style-type: none"> 1.4301 AFM-30 AFM-30 M16x55 DIN 933 A4-70 A17 DIN 125 A4-70 M16 DIN 934 A4-70
<p>1 complete capacitor kit 0043498003</p> 	<p>including</p> <ul style="list-style-type: none"> 1 capacitor 0043495351 8 screws 8 washers 8 nuts 	<ul style="list-style-type: none"> 1.4571/1.0038 M20x55 DIN 933 A4-70 A21 DIN 125 A4-70 M20 DIN 934 A4-70
<p>1 complete cross beam kit 5960342700</p> 	<p>including</p> <ul style="list-style-type: none"> 1 cross beam 1 shackle 4 threaded bolts 4 washers 4 nuts 	<ul style="list-style-type: none"> 1.0038 3,25 t M16x160 8.8 B17 DIN 9021 8 M16 DIN 934 St

3.2.1 External cooling system

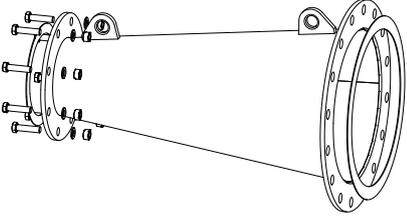
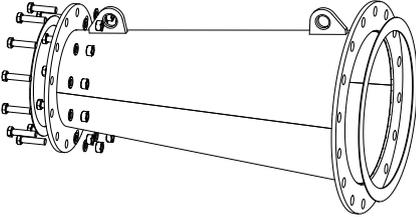
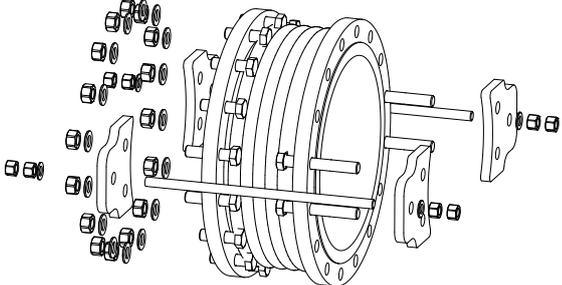
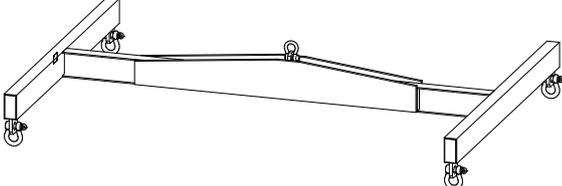
The optional scope of supply for the external cooling system includes the following components which are installed on or inside of the PillAerator at the factory:

	HP4000, MP6000, LP8000	HP9000, MP12000, LP14000
External cooling water see Figure 3 [1], [2] see Figure 78 [13] see Figure 79 [23]	Connections for cooling water inflow and return flow Water/water heat exchanger Ball valve with control actuator for external cooling water	Connections for cooling water inflow and return flow Water/water heat exchanger Ball valve with control actuator for external cooling water
1 cooling device kit	5960343934 	0045409548 and 0045409549 

NOTE *The optional cooling unit includes the external cooling water option.*

NOTE *The control cabinet fan is omitted when the optional cooling unit is included. The cooling air inlets [1] and cooling air outlets [4] (see Figure 19 and Figure 20) are sealed.*

HP9000, MP12000, LP14000

<p>1 complete transition piece kit (HP9000, MP12000) 5928009990</p> 	<p>including</p> <ul style="list-style-type: none"> 1 transition piece 5928005153 1 small seal 0041191246 1 large seal 0041191247 8 screws 8 washers 8 nuts 	<ul style="list-style-type: none"> 1.4301 AFM-30 AFM-30 M16x65 DIN 933 A4-70 A17 DIN 125 A4-70 M16 DIN 934 A4-70
<p>1 complete transition piece kit (LP14000) 5928009991</p> 	<p>including</p> <ul style="list-style-type: none"> 1 transition piece 5928005235 1 small seal 0041191264 1 large seal 0041191247 12 screws 12 washers 12 nuts 	<ul style="list-style-type: none"> 1.4301 AFM-30 AFM-30 M16x65 DIN 933 A4-70 A17 DIN 125 A4-70 M16 DIN 934 A4-70
<p>1 complete capacitor kit 0043498004</p> 	<p>including</p> <ul style="list-style-type: none"> 1 capacitor 0043497182 12 screws 4 screws 4 screws 4 washers 16 washers 8 nuts 16 nuts 4 end plates 2 threaded bolts 	<ul style="list-style-type: none"> 1.4541/1.0038 M24x80 DIN 931 A4-70 M24x100 DIN 931 A4-70 M24x160 DIN 931 A4-70 A21 DIN 125 A4-70 A25 DIN 125 A4-70 M20 DIN 934 A4-70 M24 DIN 934 A4-70 M20x500 A4-70
<p>1 complete cross beam kit 5960343401</p> 	<p>including</p> <ul style="list-style-type: none"> 1 cross beam 1 Shackle 4 Shackles 	<ul style="list-style-type: none"> 1.0038/1.0570 6.5 t 3.25 t

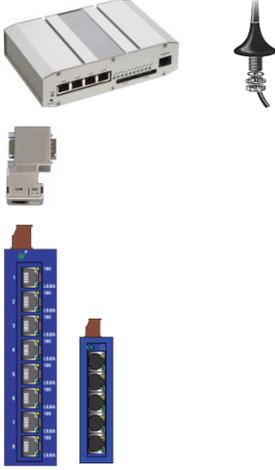
3.2.2 Remote maintenance

NOTE See Section 10 for detailed information on the topic of "remote maintenance".

The scope of supply for the remote maintenance option includes components which are installed in the PillAerator(s) at the factory (exception: roof antenna).

	HP4000, MP6000, LP8000	HP9000, MP12000, LP14000
including the following loose parts (located inside the PillAerator, packed in small bags)		
Roof antenna 		

Installed in the PillAerator(s) at the factory (exception: roof antenna).		
1 PillAerator	1 3G router with roof antenna 0046339013 1 Profibus/Ethernet Adapter 0046339011	
2 PillAerators	1 3G router with roof antenna 0046339013 2 Profibus/Ethernet Adapter 0046339011 1 Switch 8710051010	
3 to 5 PillAerators	1 3G router with roof antenna 0046339013 3 to 5 Profibus/Ethernet Adapters 0046339011 3 to 5 Switches 8710051010	

Installed in the PillAerator(s) at the factory (exception: roof antenna).		
6 to 8 PillAerators	1 3G router with roof antenna 0046339013 6 to 8 Profibus/Ethernet Adapters 0046339011 1 Switch (8 subscribers) 0046339016 6 to 7 Switches (5 subscribers) 8710051010	

NOTE Ethernet cables for the connection between the PillAerators must be provided by the customer.

3.3 Dimensions and weights

See the dimension sheets in Sections 14 and 15 for dimensional details, in particular edge and wall clearances and dimensions when the doors are open. Equipping the PillAerator with a cooling unit increases the weight by 126 kg (HP4000, MP6000, LP8000) or 155 kg (HP9000, MP12000, LP14000).

PillAerator	Dimensions in mm			Weight in kg		
	Width	Height	Depth	PillAerator without cross beam	Cross beam	PillAerator with cross beam
Standard HP4000, MP6000, LP8000	1800	2125	1525	1815	55	1870
North American design HP4000, MP6000, LP8000				1385		1440
Standard HP9000, MP12000, LP14000	2930	2155	2125	3785	305	4090
North American design HP9000, MP12000, LP14000				3355		3660

Table 1: Closed door dimensions and weights

4. Installation site

4.1 Installation conditions



The PillAerator is not suitable for outdoor installation.

CAUTION *The maximum permissible operating temperature (see Section 4.2) must never be exceeded.*

The unit may only be installed in a closed room without direct sunlight and with adequate air conditioning to ensure the specified operating environment temperature range.

If the PillAerator takes in process air from the installation area, then it must be ensured that this air is supplied in adequate amounts. The air quality must always be maintained and correspond to the standard atmosphere in accordance with Table 2 for both the process air and the ambient air.

The heat output of the drive components which must be discharged for PillAerators HP4000, MP6000 and LP8000 is routed through the installed air/water cooler to the outside (into the installation room). This heat output can be up to 10 kW (12 kW when the cooling unit is used) and reach ambient/cooling air inlet temperatures of around 35 °C. The heat output to be discharged for PillAerators HP9000, MP12000 and LP14000 is around 20 kW (24 kW when the cooling unit is used). It is routed through the air/water cooler at ambient/cooling air inlet temperatures reaching approximately 35°C, see Table 3 and Table 4.

This causes the installation room to heat up if **it is not equipped with an adequate air conditioning system**. External cooling water must be supplied if the specified cooling air inlet temperatures are exceeded, see Section 4.3.

4.2 Environmental conditions

Air quality	Standard atmosphere, see Table 2
Permissible ambient operating temperature	min. -10 °C, max. 35 °C (max. 40 °C see comment in Table 3 and Table 4) min. +0 °C, max. +55 °C (only with installed cooling unit)
Permissible ambient operating humidity	min. 15 %, max. 95 % non-condensing, no dripping water
Max. installation height	0 - 1000 m above sea level without performance reduction 1000 - 2000 m, at 1000 m or higher – 1% performance reduction per 100 m
Allowable process air intake temperature	min. -30 °C, max. +55 °C

Chemically active substance		Unit	Average value	Limit
Sulfur dioxide	SO ₂	[mg/m ³]	0.3	1.0
Hydrogen sulfide	H ₂ S	[mg/m ³]	0.1	0.5
Chlorine	Cl	[mg/m ³]	0.1	0.3
Hydrogen chloride	HCl	[mg/m ³]	0.1	0.5
Hydrogen fluoride	HF	[mg/m ³]	0.01	0.03
Ammonia	NH ₃	[mg/m ³]	1.0	3.0
Ozone	O ₃	[mg/m ³]	0.05	0.1
Nitrogen oxide (in values equivalent to nitrogen dioxide)	NO _x	[mg/m ³]	0.5	1.0
Dust content		[mg/m ³]	≤ 5	≤ 5

Table 2: Permissible loading of the process and ambient air with chemically active substances
as per DIN EN 60721-3-3

4.3 External cooling water

Cooling water which meets the following requirements must be supplied by the customer for ambient operating and cooling air temperatures of 35 °C or higher:

Water quality: Industrial, sea, river, brackish water

Cooling water pH value: 5 – 8.5

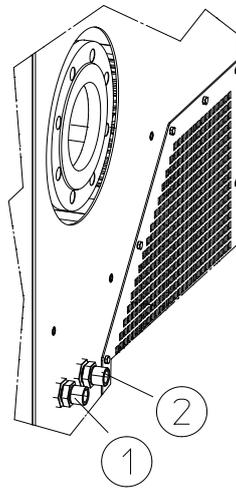
Connection pressure: min. 1 bar, max. 4 bar

The cooling water supply must be installed by the customer with a sieve having a mesh width of 0.5 mm.



If the external cooling water is not frost-proof, then the external water connection must be drained when the temperature drops below 3 °C to prevent damage to the external cooling water connections and the control valve.

CAUTION *Malfunctions can occur at high ambient temperatures if the water temperature is too high or the water quantity too low.*



1 Cooling water inflow

2 Cooling water return flow

Figure 3: Cooling water connections

HP4000, MP6000, LP8000

Inflow temperature: min. 5 °C, max. 35 °C (Cooling air temperature 40 °C, see Table 3)

Cooling water connection: 18L external thread

Inlet flow rate max. 25 l/min

HP9000, MP12000, LP14000

Inflow temperature: min. 5 °C, max. 30 °C (Cooling air temperature 40 °C, see Table 4)

Cooling water connection: 28L external thread

Inlet flow rate max. 50 l/min

4.3.1 Determination of the maximum permissible cooling air and water temperatures at full load

4.3.1.1 HP4000, MP6000, LP8000

Air/water cooler		
Dissipation loss	10	kW
Internal flow:	30	l/min
External air flow:	2.4	kg/s
P ₀₁ :	1.0	kW/K
Internal medium:	Water/glycol 77/23	
c _p (water) internal:	4.183	kJ/kg/K
c _p (glycol) internal:	2.4	kJ/kg/K
c _{p,res} internal:	3.94	kJ/kg/K
Inlet temperature:	40	°C
Δt (coolant)	5.08	K

Water/water cooler		
Dissipation loss	10	kW
Internal flow:	30	l/min
External cooling water:	25	l/min
P ₀₁ :	0.66	kW/K
External medium:	Water	
c _p (water) external:	4.183	kJ/kg/K

Full-load dissipation loss	Return flow temperature	A/W cooler dissipation loss	Air inlet temperature		Air outlet temperature		Water temperature downstream of A/W cooler	Cooling water inlet temperature		Cooling water outlet temperature		Temperature Inlet	
			External	Internal	External	Internal		External	Internal	External	Internal		
P _v (kW)	t _r (°C)	P _{v1} (kW)	t _{LE} (°C)	t _{LA} (°C)	t _z (°C)	P _{v2} (kW)	t _{KWE} (°C)	t _{KWA} (°C)	t _v (°C)				
10	45.1	10	35.1	39.2	40.0	0	40.0	40.0	40				
10	45.1	8	37.1	40.4	41.0	2	38.0	39.1	40				
10	45.1	6	39.1	41.6	42.0	4	36.0	38.3	40				
10	45.1	4	41.1	42.7	43.0	6	34.0	37.4	40				
10	45.1	2	43.1	43.9	44.1	8	31.9	36.5	40				
10	45.1	0	45.1	45.1	45.1	10	29.9	35.7	40				

Table 3: Maximum permissible cooling air and cooling water temperatures for HP4000, MP6000, LP8000

CAUTION *Ambient operating temperatures / cooling air temperature ≥ 40 °C (see Table 3, greyed out) require a cooling unit for the PillAerator if the cooling air is taken directly from the installation area.*

NOTE *Table 3 shows the maximum permissible cooling air and cooling water temperatures when the required cooling output is distributed between both coolers at full load.*

Example

At a cooling inlet temperature of around 41 °C, the air/water cooler achieves a cooling output of around 4 kW. The remaining 6 kW must be discharged by the water/water cooler. This can only be achieved if the cooling water inlet temperature does not exceed 34 °C.

4.3.1.2 HP9000, MP12000, LP14000

Air/water cooler		
Dissipation loss	20	kW
Internal flow:	76	l/min
External air flow:	2.7	kg/s
P ₀₁ :	1.47	kW/K
Internal medium:	Water/glycol 77/23	
c _p (water) internal:	4.183	kJ/kg/K
c _p (glycol) internal:	2.4	kJ/kg/K
c _p res internal:	3.94	kJ/kg/K
Inlet temperature:	40	°C
Δt (coolant)	4.4	K

Water/water cooler		
Dissipation loss	22	kW
Internal flow:	76	l/min
External cooling water:	50	l/min
P ₀₁ :	0.8	kW/K
External medium:	Water	Water
c _p (water) external:	4.183	kJ/kg/K

Full-load dissipation loss	Return flow temperature	A/W cooler dissipation loss	Air inlet temperature	Air outlet temperature	Water temperature downstream of A/W cooler	WW cooler dissipation loss	Cooling water inlet temperature	Cooling water outlet temperature	Temperature Inlet
	Internal		External	External			Internal	External	
P _v (kW)	t _R (°)	P _{v1} (kW)	t _{LE} (°C)	t _{LA} (°C)	t _Z (°C)	P _{v2} (kW)	t _{KWE} (°C)	t _{KWA} (°C)	t _V (°C)
20	44.0	20	34.9	39.1	40.0	0	40.0	40.0	40
20	44.0	16	36.7	40.1	40.8	4	36.6	37.7	40
20	44.0	12	38.6	41.1	41.6	8	33.2	35.5	40
20	44.0	8	40.4	42.0	42.4	12	29.8	33.2	40
20	44.0	4	42.2	43.0	43.2	16	26.4	31.0	40
20	44.0	0	44.0	44.0	44.0	20	23.0	28.7	40

Table 4: Maximum permissible cooling air and cooling water temperatures for HP9000, MP12000, LP14000

CAUTION Ambient operating temperatures / cooling air temperature ≥ 40 °C (see Table 4, greyed out) require a cooling unit for the PillAerator if the cooling air is taken directly from the installation area.

NOTE Table 4 shows the maximum permissible cooling air and cooling water temperatures when the required cooling output is distributed between both coolers at full load.

Example

At a cooling inlet temperature of around 38 °C, the air/water cooler achieves a cooling output of around 12 kW. The remaining 8 kW must be discharged by the water/water cooler. This can only be achieved if the cooling water inlet temperature does not exceed 33 °C.

4.4 Space requirements

Sufficient space must be provided around the PillAerator for its installation, maintenance and disassembly. See the dimension sheets in Sections 14 and 15 for dimensional details, in particular edge and wall clearances and dimensions when the doors are open.

CAUTION *No objects which interfere with the installation or maintenance work may be located near the PillAerator. The PillAerator can become damaged if its required cooling air cannot flow freely.*

NOTE *Please ensure sufficient space for the event that the PillAerator must be removed from its installation area.*

4.5 Noise emission values

The sound pressure level emitted by the PillAerator (as per ISO 45635), measured at a distance of 1 meter from the PillAerator, is below the free field conditions at < 80 dB(A). This value applies solely for professionally soundproofed pipelines (see Figure 15) and the usage of an intake duct.

The value can increase if several PillAerators are operated at the same time or if the noise is reflected from walls and ceilings.

4.6 Foundation

CAUTION *Ensure the stability of the foundation.*

NOTE *The height of the machine feet on the underside of the PillAerator is adjustable (see Sections 14 and 15).*

The foundation must be designed with a cable duct for the laying of the electrical connection cables if the height between the foundation and the access plates (see Figure 21 and Figure 23, [19]) is smaller than the minimum bending radius + outside cable diameter.

Machine feet height in mm	Height between the foundation and the access plates in mm
50	145
100	195

Table 5: Height between the foundation and the access plates

The PillAerator must be set up directly on the foundation. Install the PillAerator on a level surface. Flawless operation cannot be guaranteed if the PillAerator is tilted more than $\pm 2^\circ$ in any one direction. The flatness deviation of the installation points must not exceed 10 mm.

HP4000, MP6000, LP8000

The total weight is divided among 6 foot points with a loading of 3.1 kN per foot point.

HP9000, MP12000, LP14000

The total weight is divided among 8 foot points with a loading of 5.1 kN per foot point.

5. Storage and transportation

5.1 Storage

Comply with the following conditions if the PillAerator must be stored before installation:

Ambient temperature	min. -10 °C, max. +40 °C
Maximum relative humidity	min. 15 %, max. 95 % Non-condensing, no dripping water
Maximum storage time	6 months – if longer, please contact your regional sales office.
Covers	Cover all openings and grates with foil to prevent dirt particles and other foreign bodies from penetrating the machine.

5.2 Transportation



Use a forklift, lift truck or crane with cross beam to raise or transport the machine. The safety regulations of the crane system must be noted and complied with if the PillAerator is transported by crane. A suitable cross beam provided by PillAerator GmbH must be used for the PillAerator. The PillAerator must be lifted and transported in its upright position.



Follow all of the instructions regarding the lifting and transportation of the PillAerator. Failure to follow these instructions can result in personal injury or property damage.



The applicable accident prevention regulations and the generally recognized national and international rules of technology must be complied with for the lifting and transportation of the PillAerator.



Set the PillAerator down carefully to prevent damage to the system and its individual components.



Please note the total weight to be transported (see Table 1).



Secure the PillAerator against tipping and sliding if it is transported by forklift or lift truck.



The PillAerator must not be transported when the feet are loaded. Square timbers must be placed under the PillAerator to relieve the load on the machine feet.



Working and standing in the danger zone of a suspended load is prohibited.



CAUTION ***The PillAerator may only be lifted and transported when its doors are closed.***

5.2.1 Lift truck / fork lift

The maximum permissible load of the equipment used for lifting and transportation must be higher than the total weight of the PillAerator, see Table 1.

HP4000, MP6000, LP8000

Minimum fork length for cross transport: 1600 mm

Minimum fork length for longitudinal transport: 2000 mm

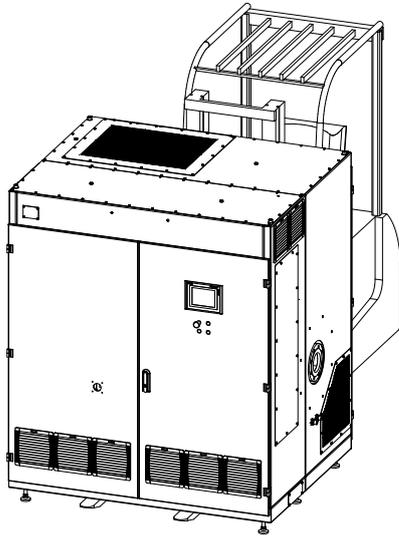


Figure 4: Cross transport
HP4000, MP6000, LP8000

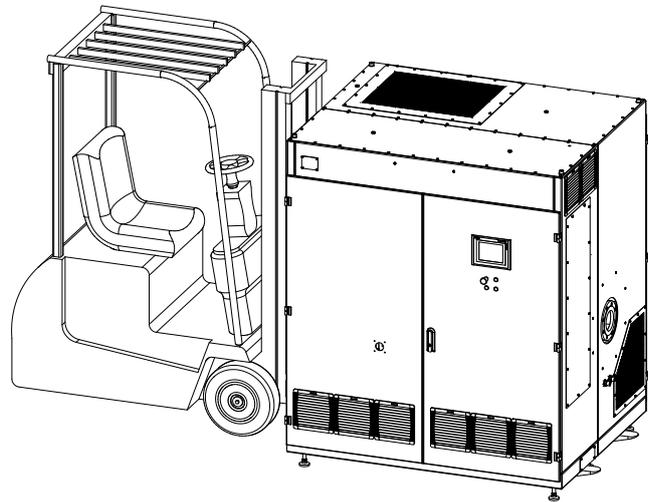


Figure 5: Longitudinal transport
HP4000, MP6000, LP8000

HP9000, MP12000, LP14000

Minimum fork length for cross transport: 1600 mm

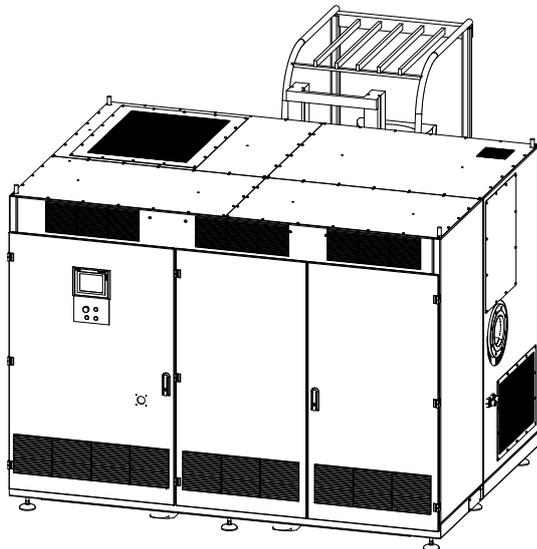


Figure 6: Cross transport
HP9000, MP12000, LP14000

CAUTION Longitudinal transport is prohibited.

5.2.2 Crane

The cross beam must be installed on the top side of the PillAerator before it is transported by crane. The cross beam must be removed from the PillAerator following its transport because it otherwise covers the intake grille.

The maximum permissible crane load must be higher than the total weight of the PillAerator together with the cross beam, see Table 1.

HP4000, MP6000, LP8000

Installation of the cross beam as shown in Figure 7.

Components

Part	Designation	Dimension	Standard	Material
1	Bolts	M16x25	DIN 912	8.8
2	Threaded bolts	M16x160		8.8
3	Cross beam			1.0038
4	Washers	B17	DIN 9021	8
5	Nuts	M16	DIN 934	Pcs.
6	Shackle	3.25 t		

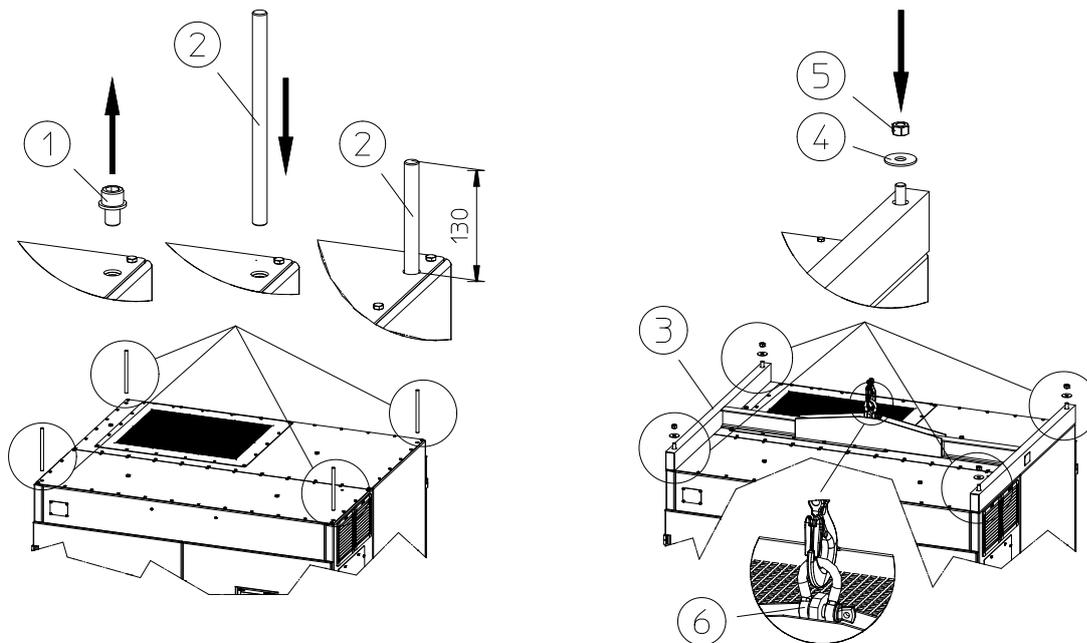


Figure 7: Installation of the cross beam HP4000, MP6000, LP8000

HP9000, MP12000, LP14000

CAUTION The lengthwise clearances (1530 mm and 1365 mm) of the center shackle of the cross beam to each of its outer shackles are different.

Installation of the cross beam as shown in Figure 8.

Components

Part	Designation	Dimension	Standard	Material
1	Ring nuts	M24	DIN 582	C15E
2	Threaded bolts	M24		Steel
3	Cross beam			1.0038/1.0570
4	Nameplate			
5	Shackle	3.25 t		
6	Shackle	6.5 t		

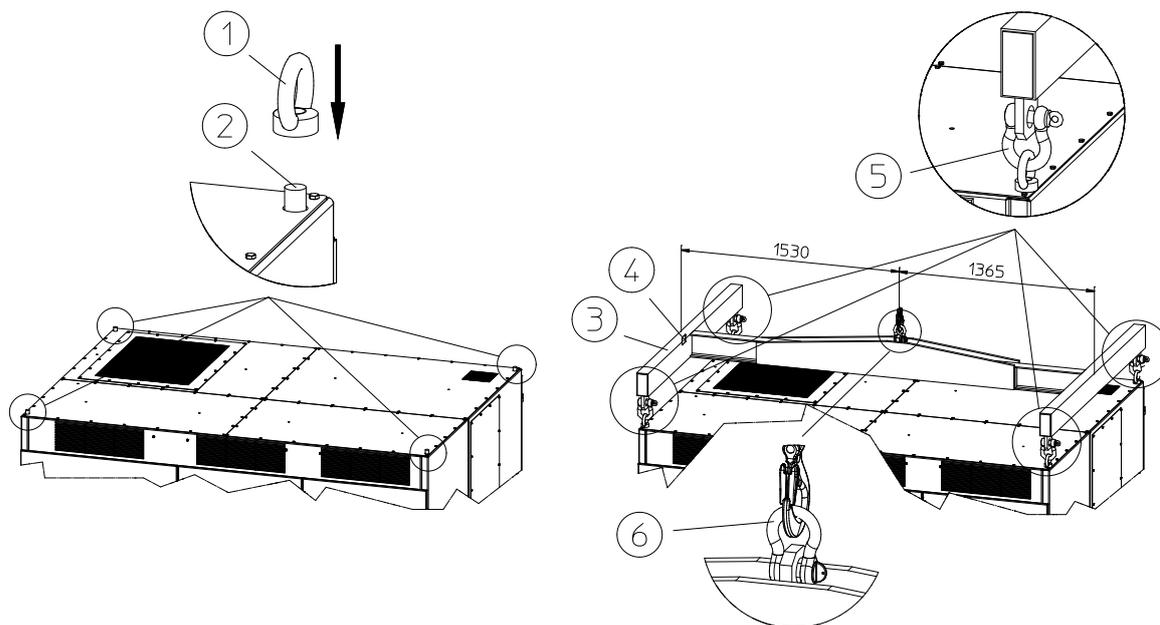


Figure 8: Installation of the cross beam HP9000, MP12000, LP14000

6. Connections

6.1 Pipeline connections



The rotary drive for the door coupling must be shut off and secured by a lock before installation or maintenance work is performed.



Start-up only when the discharge pipe is connected.



The doors may only be opened when the PillAerator is idle and deenergized.

Electricians are permitted to open the doors when the PillAerator is energized if the PillAerator is not operating.



The connections on the PillAerator and the connections linked to the PillAerator must never be welded since this can cause damage to the mechanical, electrical and electronic components.

Remove any dirt, moisture and foreign bodies from the system side of the pipeline and inlet channel before installing the system.

Align all of the pipeline flanges with the matching flanges on the PillAerator to prevent unnecessary loading of the PillAerator. See the dimension sheets in Sections 14 and 15 for the flange dimensions.

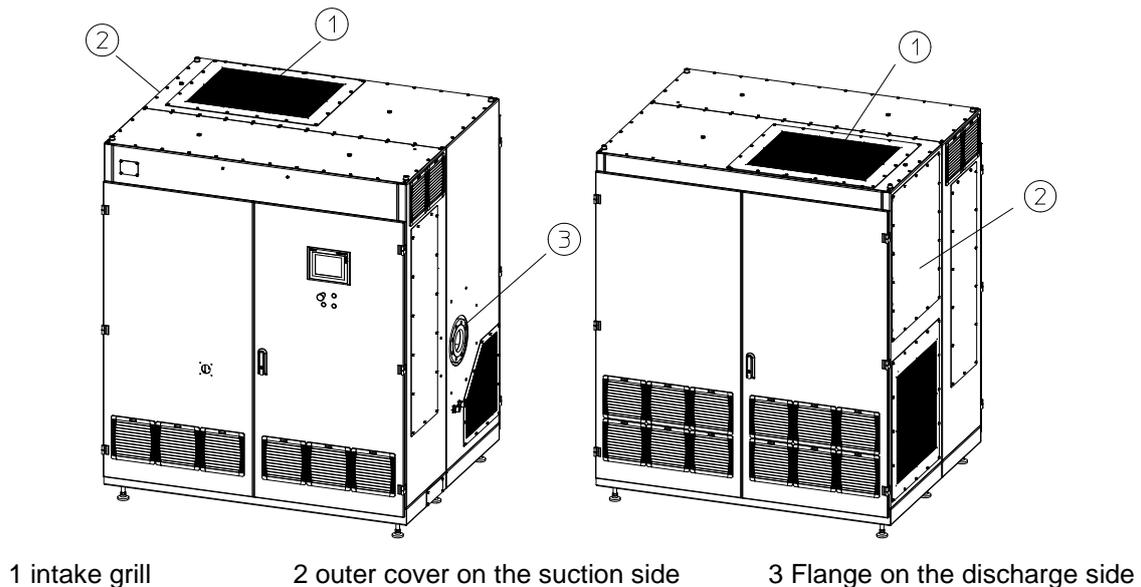


Figure 9: Position of the pipeline connections

6.1.1 Maximum forces and torques

The maximum forces and torques on the suction side of the flange and the discharge side of the capacitor must not be exceeded.

PillAerator	Force in N			Torque in Nm		
	Fx	Fy	Fz	Mx	My	Mz
HP4000, MP6000, LP8000	± 200	± 200	± 200	± 50	± 50	± 50
HP9000, MP12000, LP14000	± 400	± 400	± 400	± 100	± 100	± 100

Table 6: Maximum forces and torques

6.1.2 Suction side

One of four methods must be used to suck in the process air:

- open intake from above
- open intake from the side
- inlet channel (customer) from above
- inlet channel (customer) from the side

A combination of the methods is not permitted. In its delivered condition, the PillAerator is set up for the "open intake from above" method, see Section 0.

CAUTION Remove the protective foil from the intake grill before commissioning.

The intake can be optionally converted using the following components:

Components

Part	Designation	Dimension	Standard	Material
1	Intake grill			
2	Outer cover			
3	Inlet channel (customer)			
4	Sound absorber cover			
5	Bolts	M6x20	DIN 933	8.8
6	Bolts	M6x20	DIN 933	8.8
7	Bolts	M10x20	DIN 933	8.8
8	Bolts (customer)	M10x20	DIN 933	8.8
9	Spacer bracket	992 mm, 671 mm		
10	Bolts	M10x20	DIN 933	8.8
11	Sealing tape	8x2		EPDM

6.1.2.1 Conversion of open intake from the top to open intake from the side

HP4000, MP6000, LP8000

Conversion as shown in Figure 10.

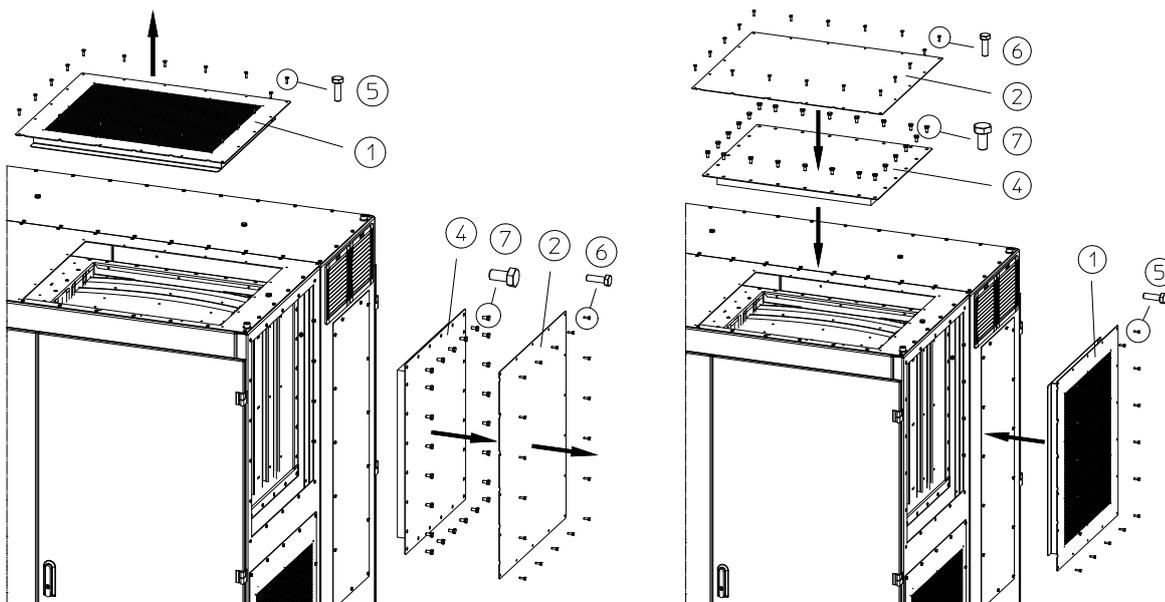


Figure 10: Conversion of open intake from the top to open intake from the side
HP4000, MP6000, LP8000

HP9000, MP12000, LP14000

Conversion as shown in Figure 11.

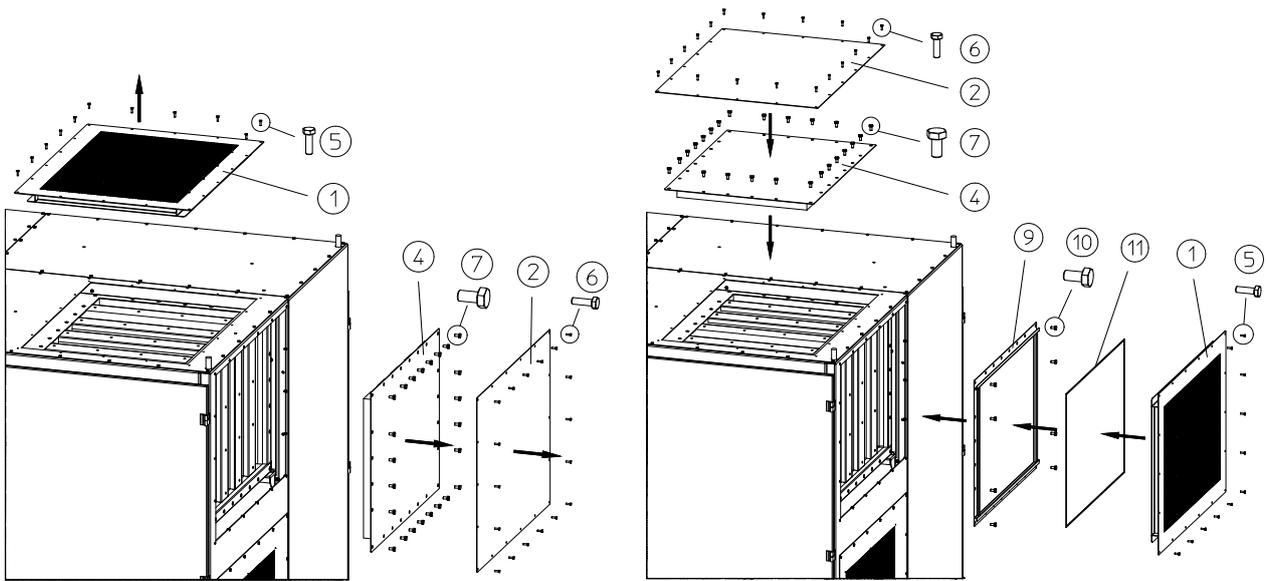


Figure 11: Conversion of open intake from the top to open intake from the side
HP9000, MP12000, 14000

6.1.2.2 Conversion of open intake from the top to channel inlet from the top

Conversion as shown in Figure 12.

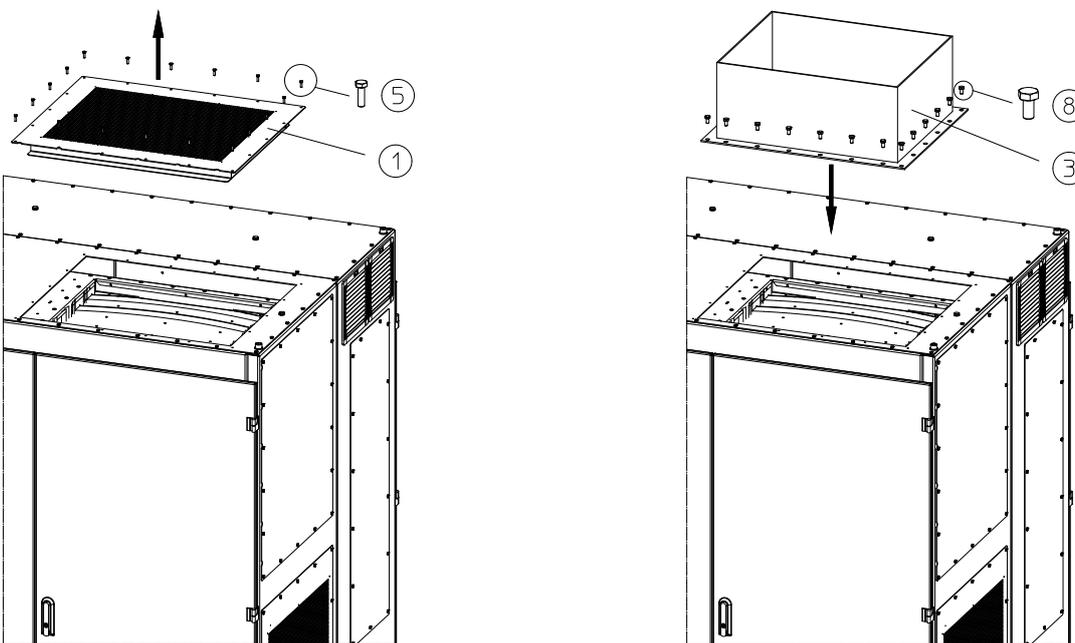


Figure 12: Conversion of open intake from the top to channel inlet from the top

6.1.2.3 Conversion of open intake from the top to channel inlet from the side

Conversion as shown in Figure 13.

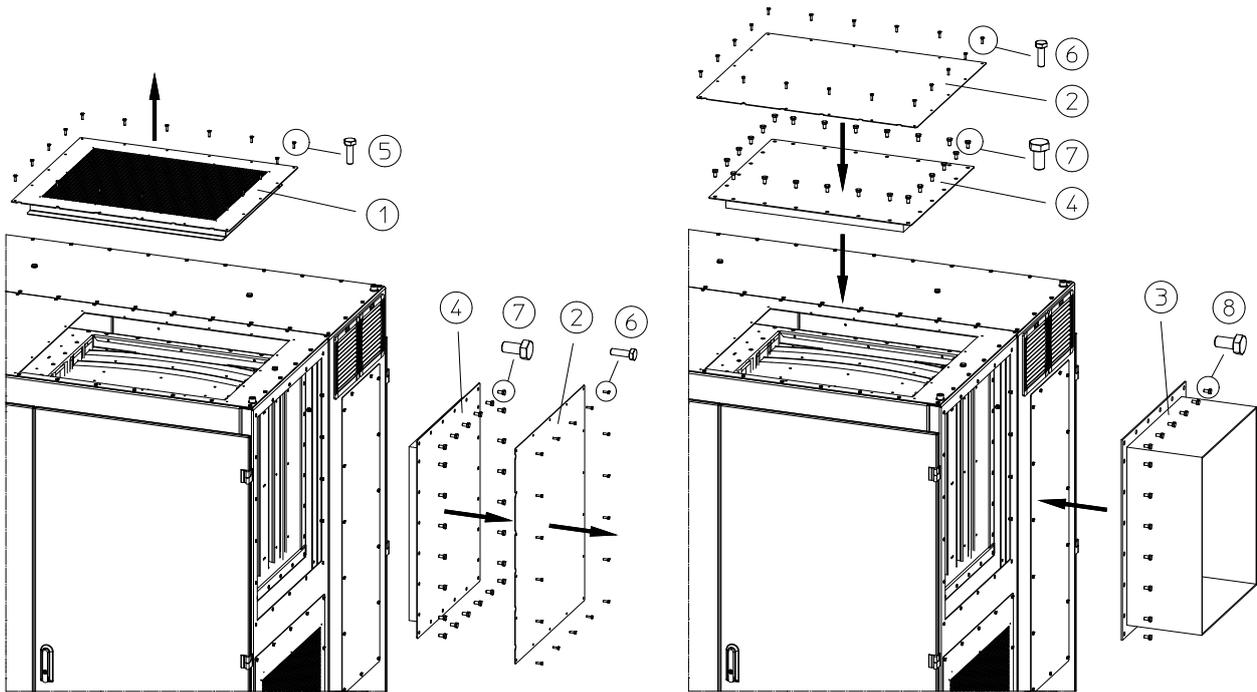


Figure 13: Conversion of open intake from the top to channel inlet from the side

6.1.3 Discharge side

CAUTION Remove the protective foil from the housing flange before performing the installation.

CAUTION The capacitor is designed with an internal guide tube. Note the direction of flow [2] when performing the installation.

CAUTION Note the opening direction of the check valve.

The process air on the discharge side must be routed from the housing flange [1] to the discharge line (customer) [7] by the diffuser (transition piece) [3], the capacitor [4] with internal tube [5] and the check valve [6]. The original PillAerator check valve must always be used.

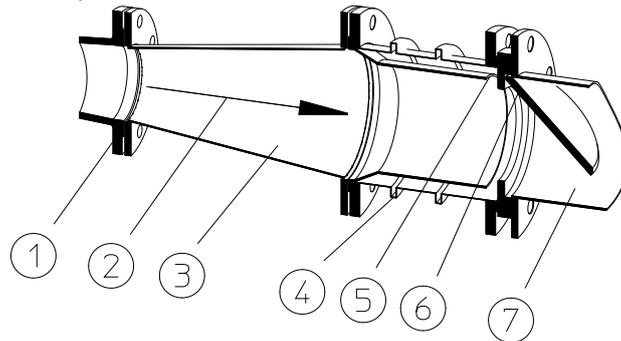


Figure 14: Discharge side of the pipeline connection

Tighten the screw connections on the discharge side of the pipeline to the tightening torques given in Table 7.

Material A4-70	
Inside thread diameter	Tightening torque in N
M16	109
M20	213
M24	368

Table 7: Tightening torques for screw connections

The maximum displacements on the capacitor as indicated in Table 8 must not be exceeded.

PillAerator	Maximum displacement Δ		
	lateral (l) in mm	axial (a) in mm	angular (a) in °
HP4000, MP6000, LP8000	± 2	± 20	± 2
HP9000, MP12000, LP14000	± 2.5	- 50	± 1.3

Table 8: Maximum displacements on the capacitor

CAUTION *The temperature of the process air on the discharge side can be extremely high. The customer must install protection against accidental contact.*

Protection against contact must be installed after the discharge side has been connected as shown in Figure 16 and Figure 17.

Cut the mineral fiber mat [1] to a length matching the scopes of the pipelines. Wrap the crosscut mineral fiber mat [1] around the discharge line [4]. Wrap winding wire [3] around the mineral fiber mat [1]. Use duct tape to mask the joints of the crosscut mineral fiber mat [1].

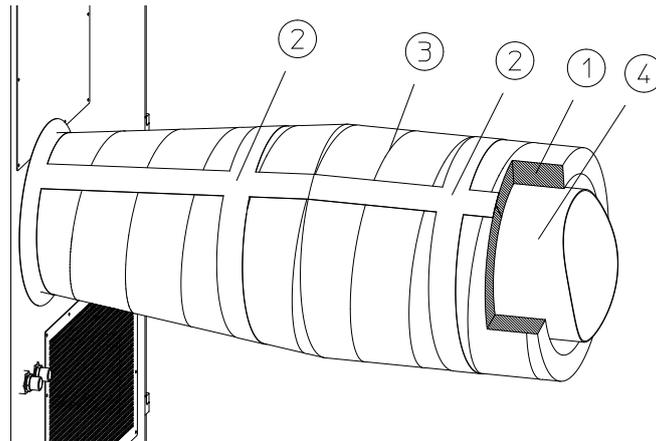


Figure 15: Contact protection of the pipeline discharge side

HP4000, MP6000, LP8000

The discharge side must be connected from left to right as shown in Figure 16 with the following components.

Components

Part	Designation	Dimension	Standard	Material
1	Bolts	M16x55	DIN 933	A4-70
2	Housing flange			G-AlSi 7 Mg
3	Small seal			AFM-30
4	Washers	A17	DIN 125	A4-70
5	Nuts	M16	DIN 934	A4-70
6	Transition piece			1.4301
7	Bolts	M20x55	DIN 933	A4-70
8	Large seal			AFM-30
9	Washers	A21	DIN 125	A4-70
10	Nuts	M20	DIN 934	A4-70
11	Capacitor			1.4571/1.0038
12	Bolts	M20x100	DIN 931	A4-70
13	Check valve			C22.8/1.4571/FPM
14	Washers	A21	DIN 125	A4-70
15	Nuts	M20	DIN 934	A4-70
16	Discharge line (customer)			

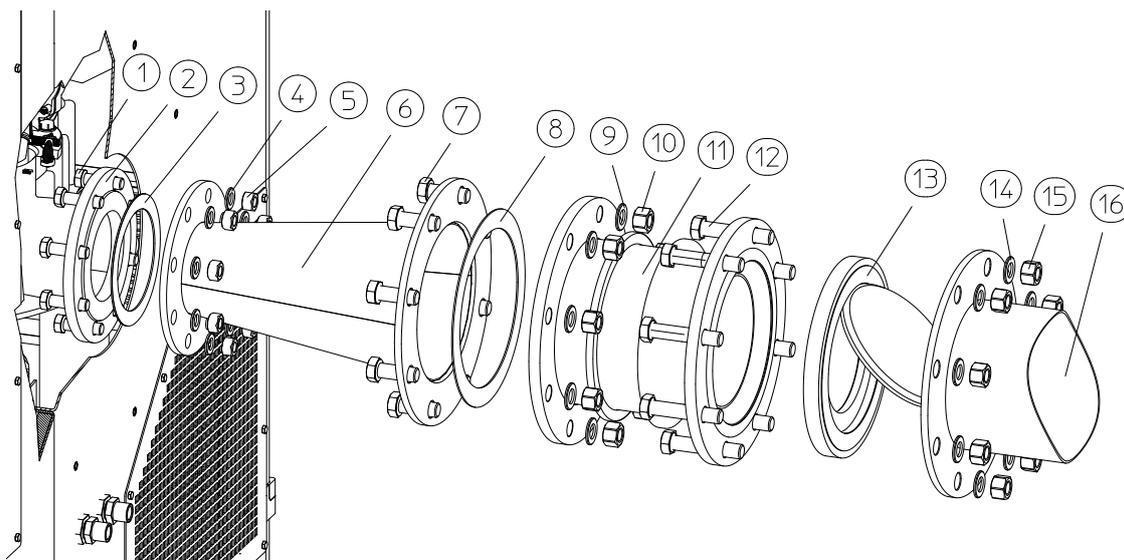


Figure 16: Connection of the discharge line HP4000, MP6000, LP8000

HP9000, MP12000, LP14000

The discharge side must be connected from left to right as shown in Figure 17 with the following components.

Components

Part	Designation	Dimension	Standard	Material
1	Bolts	M16x65	DIN 933	A4-70
2	Housing flange			G-AISI 7 Mg
3	Small seal			AFM-30
4	Washers	A17	DIN 125	A4-70
5	Nuts	M16	DIN 934	A4-70
6	Transition piece			1.4301
7	Nuts	M24	DIN 934	A4-70
8	Washers	A25	DIN 125	A4-70
9	Large seal			AFM-30
10	Bolts	M24x80	DIN 931	A4-70
11	Capacitor			1.4541/1.0038
12	Bolts	M24x140	DIN 931	A4-70
13	Check valve			C22.8/FPM
14	Washers	A25	DIN 125	A4-70
15	Nuts	M24	DIN 934	A4-70
16	Discharge line (customer)			
17	Nuts	M20	DIN 934	A4-70
18	Washers	A21	DIN 125	A4-70
19	End plates			1.4571
20	Bolts	M24x160	DIN 931	A4-70
21	Bolts	M24x100	DIN 931	A4-70
22	Threaded bolt	M20	DIN 934	A4-70

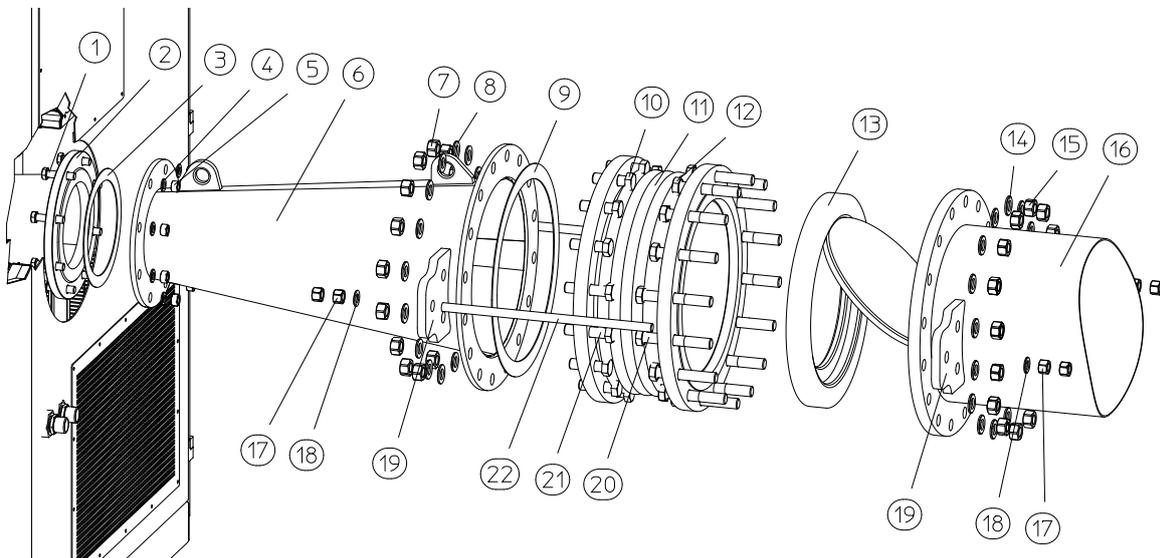


Figure 17: Connection on discharge side HP9000, MP12000, LP14000

CAUTION Do not exceed the dimension $338+t$ since the PillAerator can otherwise become damaged.

NOTE The lengths of the screws and threaded bolts for attaching the check valve to the capacitor and to the discharge line (customer) are suitable for a maximum flange thickness of $t = 28$ mm.

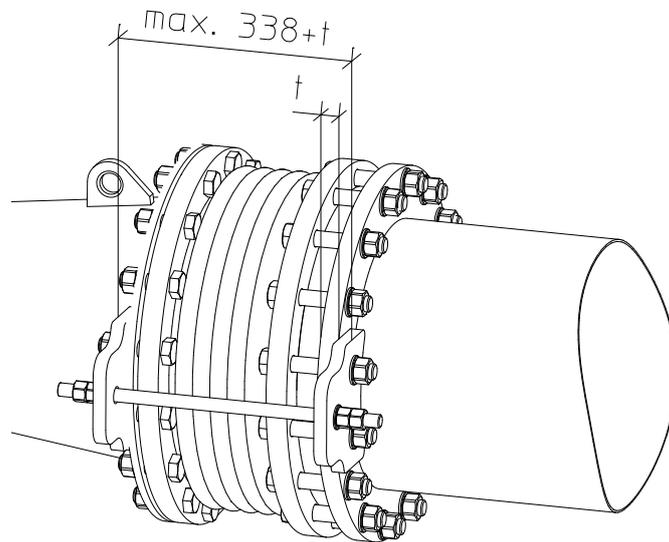


Figure 18: Maximum size $338+t$ HP9000, MP12000, LP14000

6.2 Cooling air

The electronics side is cooled by ambient air. The fans inside the control cabinet absorb the cooling air through the cooling air inlets [1] and return it to the surroundings through the cooling air outlets [4]. If the cooling air temperature is $\geq 40\text{ }^{\circ}\text{C}$, then cooling devices must be installed on [2] instead of the fans inside of the control cabinet. The cooling devices do not absorb any ambient air but rather cool the air on the electronics side.

The compressor side is cooled by the ambient air. An air/water cooler absorbs the cooling air through the cooling air inlet [5] and returns it to the surroundings through the cooling air outlet [3]. External cooling water is additionally required for cooling air temperatures of $35\text{ }^{\circ}\text{C}$ and higher (Section 4.2).

CAUTION Please ensure adequate air exchange in the installation area to guarantee the discharge of the heated air.

CAUTION The cooling air inlets and outlets must be kept free. The minimum wall clearances must be maintained, see the dimension sheets in Sections 14 and 15.

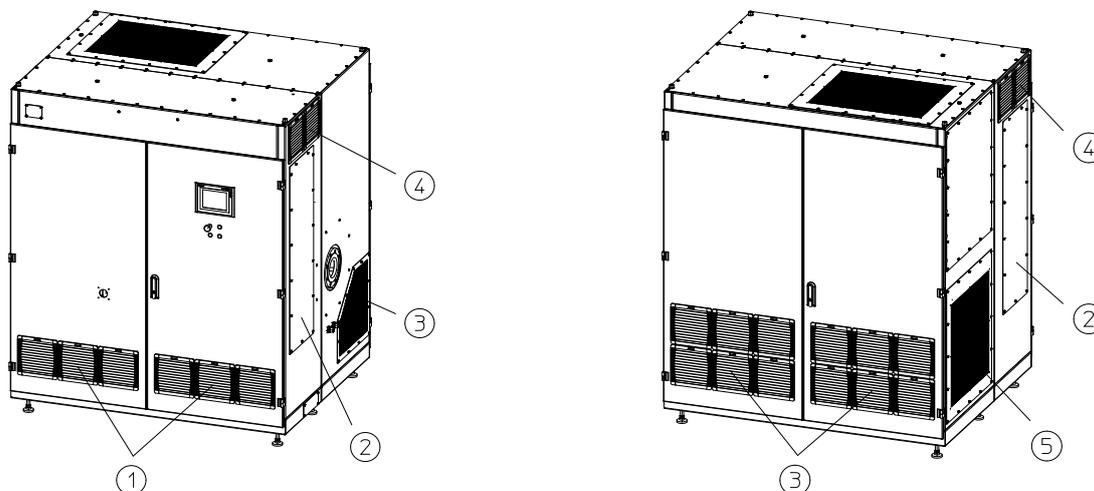


Figure 19: Cooling air connections HP4000, MP6000, LP8000

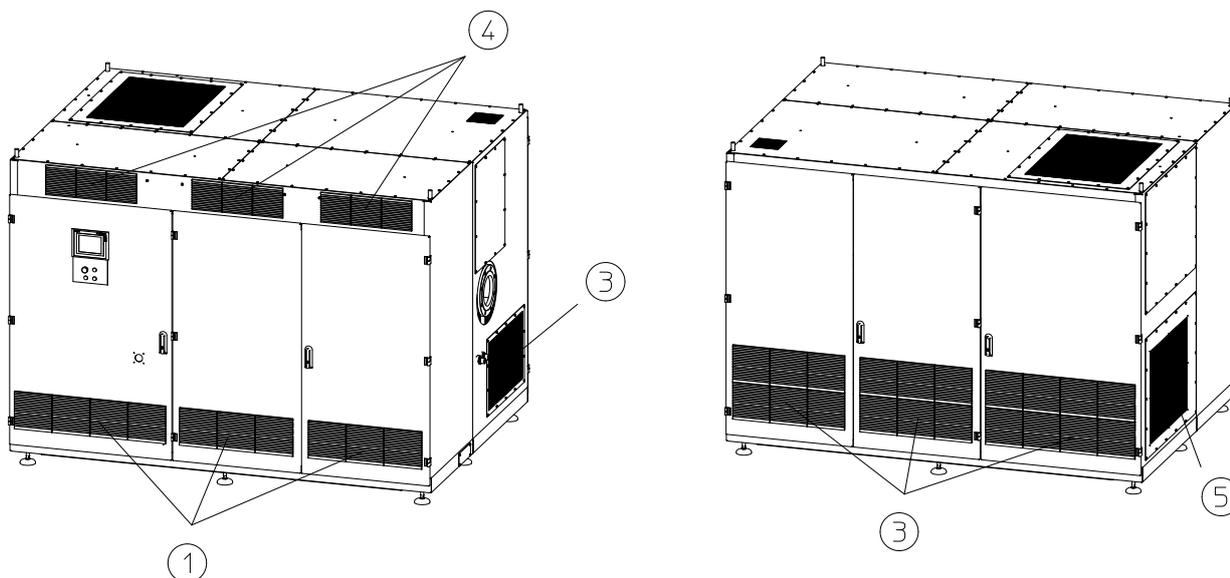


Figure 20: Cooling air connections HP9000, MP12000, LP14000

6.3 Electrical connections



Nicht schalten!
Es wird
gearbeitet!
Datum _____
Entfernung des
Schildes nur
durch _____

The mains voltage must be shut off before installation and maintenance work is performed. Ensure that no voltage is present before starting work on the PillAerator.



Electrical connections must be made by an electrician.



The PillAerator's internal components become dangerously energized when the machine is connected to the network and the main switch activated by turning the rotary drive for the door coupling. Touching these components can lead to fatal electric shock.



Cable ends must be professionally finished (e.g. with wire-end ferrules).



Seal the cable inlets with cable fittings (class IP54 or higher) to prevent dirt particles from penetrating the PillAerator.



The doors may only be opened when the PillAerator is idle and deenergized.

CAUTION *Verify that the mains voltage provided matches the voltage and frequency indicated on the nameplate before connecting the supply lines. The supply voltage must have a clockwise rotating field.*

CAUTION *Due to powerful ground leakage current, no fault-current circuit breakers may be used for PillAerators.*

CAUTION *Comply with the information in the circuit diagram.*

6.3.1 Malfunctions caused by the network and the surroundings



The connections on the PillAerator and the connections linked to the PillAerator must never be welded since this causes damage to the mechanical, electrical and electronic components.



Voltage peaks can shorten the service lives of electronic components installed in the PillAerator or even cause their destruction. The VDE (Association of German electrical engineers and electricians) permits voltage fluctuations of $\pm 10\%$.

6.3.2 Components on the electronics side

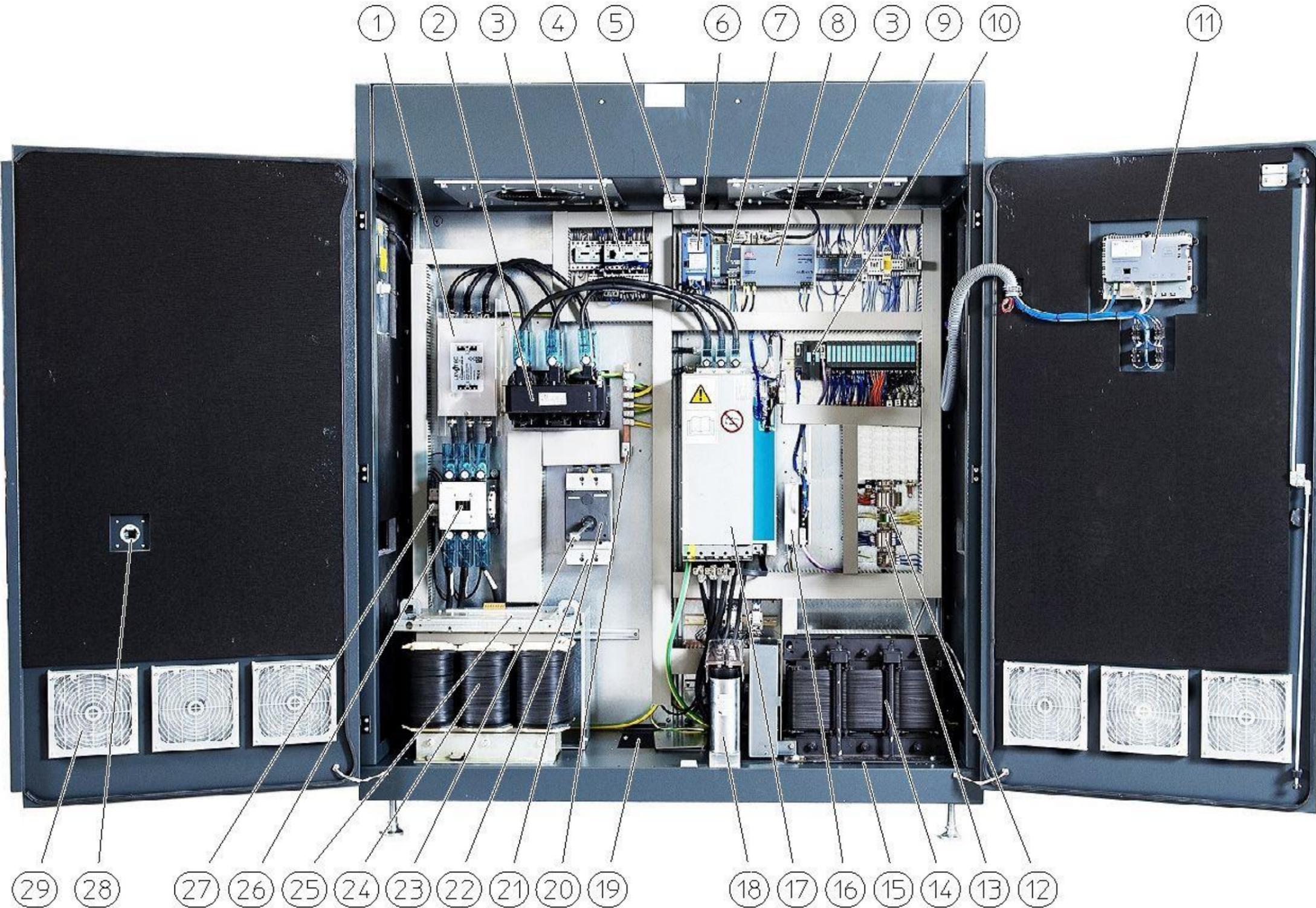


Figure 21: Components on the electronics side HP4000, MP6000, LP8000

Components HP4000, MP6000, LP8000

Part	Designation	Item
1	Line filter	0047000656
2	Commutating reactor	0047000658
3	Control cabinet fans	0044895110
4	Motor protection circuit breaker and fuses for Main contactor Control voltage Fans inside the control cabinet Coolant pump Air/water cooler	0047000373 0047000065 0047000219 0047000487 0047000221
5	Control cabinet temperature sensor	0041641189
6	Frequency converter for air/water cooler	0048920271
7	Power supply for PLC and 24 V control voltage	0047000703
8	Power supply for magnetic bearing electronics	0047000030
9	Circuit breaker for control circuit	0047000619
10	PLC	0047000705
11	Touch panel and SD card	0047000081 and 0047000188
12	Control cable connections	
13	Emergency-Stop circuit connections	
14	Sinusoidal filter	0047000655
15	Access plate for control cables (behind the sinusoidal filter)	
16	Magnetic bearing controller	0047000654
17	Drive controller for motor	0047000651
18	Capacitors for intermediate circuit	0047000659
19	Access plate for supply lines and protective earth	
20	Connection for protective earth	
21	Main switch	0047000225
22	Supply line connections	
23	Rotary drive shaft for the door coupling	0047000229 and 0047000228
24	Transformer	0047000144
25	Transformer protective grill	
26	Main contactor	0047000062
27	Line circuit breaker for protecting the auxiliary consumers (control cabinet fans, motor cooling pump, frequency converter for air/water cooler, PLC and 24 V control voltage, control cable for main contactor)	0047000509
28	Rotary drive for door coupling	0047000228
29	Cooling air inlet grid with Filter mat	0041859246 0041859151

PLC components [10] HP4000, MP6000, LP8000

Part	Designation	Item
10.1	CPU	0047000416
10.2	Micro Memory Card	0047000098
10.3	DP master interface	0047000093
10.4	Power module	0047000092
10.5	Card for digital input signals	0047000086
10.6	Card for digital output signals	0047000087
10.7	Card for digital output signals, relays	0047000088
10.8	Card for analog input signals	0047000089
10.9	Card for analog input signals	0047000189
10.10	Card for analog input signals	0047000190
10.11	Card for analog output signals	0047000091
10.12	Terminal module	0047000096
10.13	Terminal module	0047000095
10.14	Terminal module	0047000097

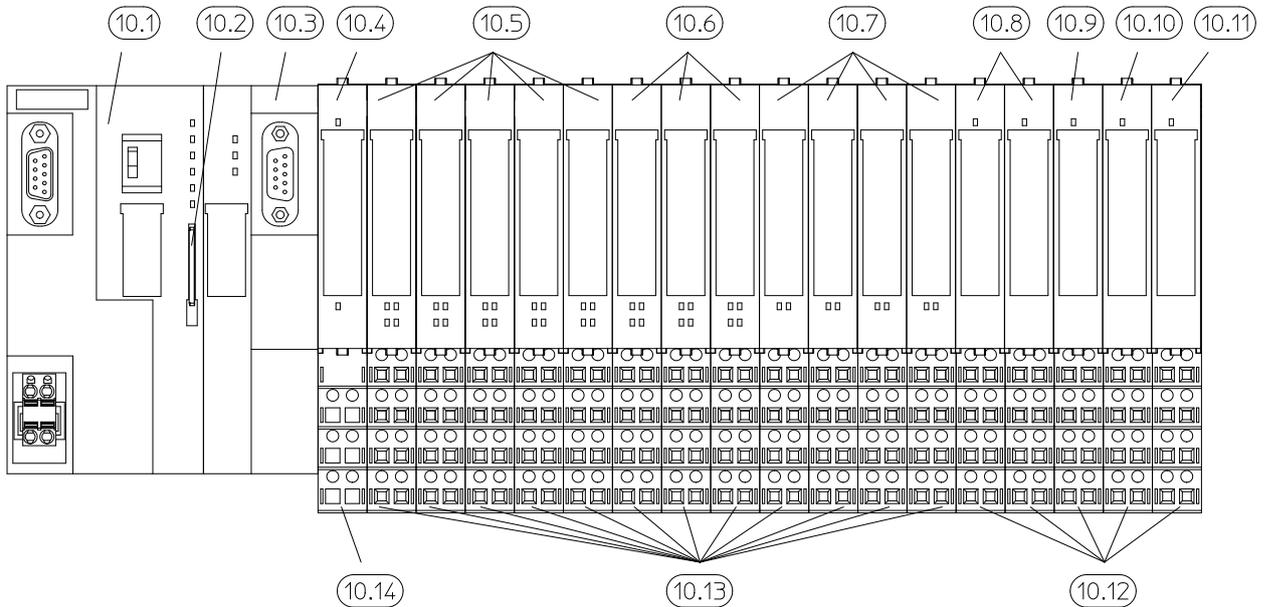


Figure 22: PLC Components HP4000, MP6000, LP8000

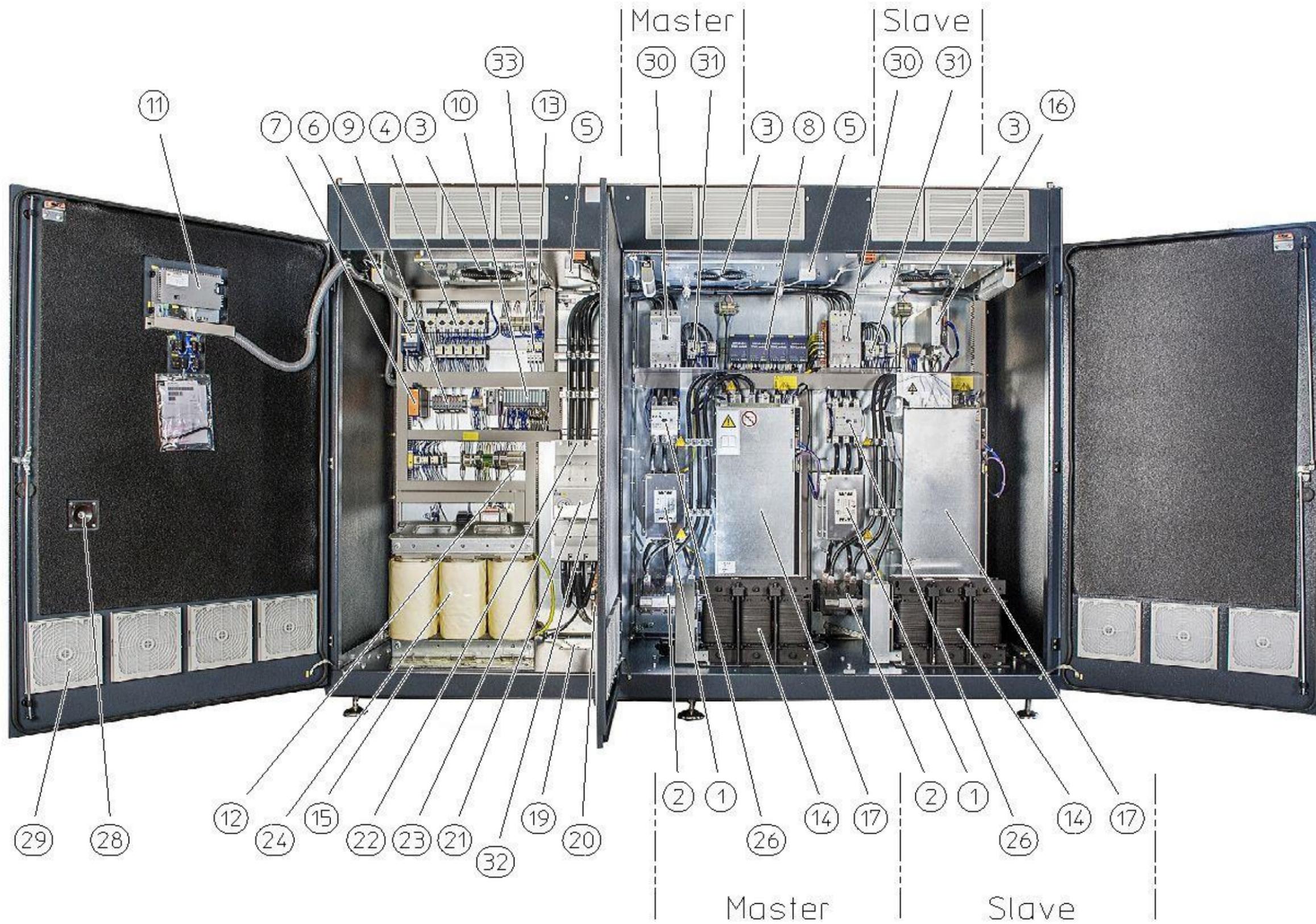


Figure 23: Components on electronics side HP9000, MP12000, LP14000

Components HP9000, MP12000, LP14000

Part	Designation	Item
1	Line filter	0047000656
2	Commutating choke	0047000672
3	Control cabinet fans	0044895110
4	Motor protection circuit breaker and miniature circuit breaker Control cabinet air conditioning coolant pump Air/water cooler	0047000689 0047000431 0047000690
5	Control cabinet temperature sensor	0041641189
6	Frequency converter for air/water cooler	0048920378
7	Power supply for PLC and 24 V control voltage	0047000499
8	Power supplies for magnetic bearing electronics	1x 0047000674 3x 0047000675
9	Circuit breaker for control circuit	0047000085
10	PLC	0048920407
11	Touch panel and SD card	0047000081 and 0047000188
12	Control cable connections	
13	Emergency-Stop circuit connections	
14	Sinusoidal filter	0047000655
15	Access plate for control cables (behind the transformer)	
16	Magnetic bearing controller	0047000673
17	Drive controller for motor	0047000671
19	Access plate for supply lines and protective earth	
20	Connection for protective earth	
21	Main switch	0047000693
22	Supply line connections	
23	Rotary drive shaft for the door coupling	0047000517 and 0047000702
24	Transformer	0047000158
26	Main contactor	0047000531
28	Rotary drive for door coupling	0047000702
29	Cooling air inlet grid with Filter mat	0041859246 0041859151
30	Circuit breaker for frequency converter	0047000690
31	Circuit breaker Standard design North American design	0047000570 0047000536
32	Cable catch rails	
33	Fuses Control voltage power pack Main contactor	0047000717 0047000685

PLC components [10] HP9000, MP12000, LP14000

Part	Designation	Item
10.1	CPU	0047000416
10.2	Micro Memory Card	0047000098
10.3	DP master interface	0047000093
10.4	Power module	0047000092
10.5	Card for digital input signals	0047000697
10.6	Card for digital output signals	0047000696
10.7	Card for analog input signals	0047000089
10.8	Card for analog input signals	0047000190
10.9	Card for analog output signals	0047000091
10.10	Terminal module	0047000096
10.11	Terminal module	0047000698

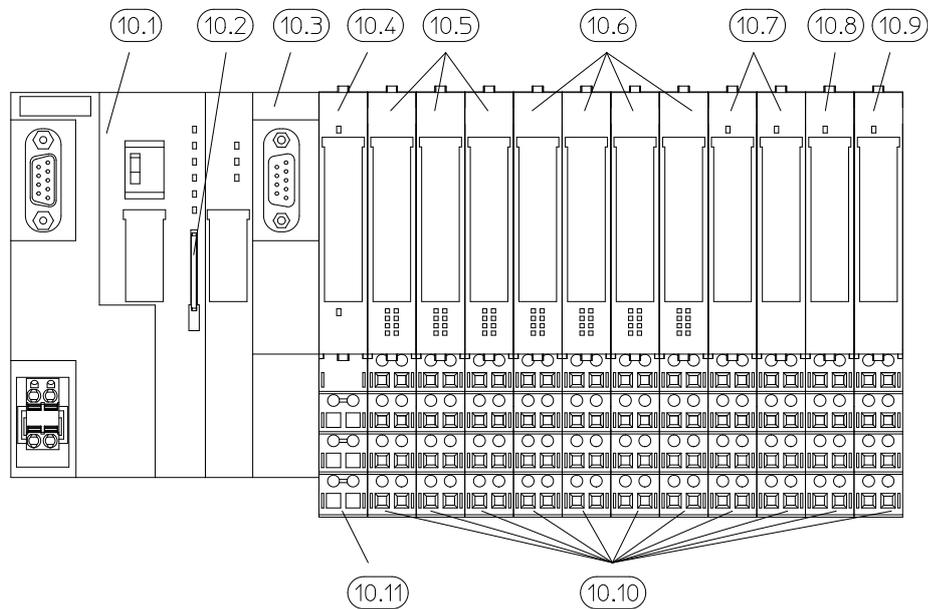


Figure 24: PLC components HP9000, MP12000, LP14000

6.3.3 Connection of the cables (U, V, W, PE)



The cable screw connections (customer) used on the system serve to relieve tension on the cable and to seal and protect it from mechanical damage. They must be selected to match the selected cable diameters and must be installed in accordance with the manufacturer's specifications.

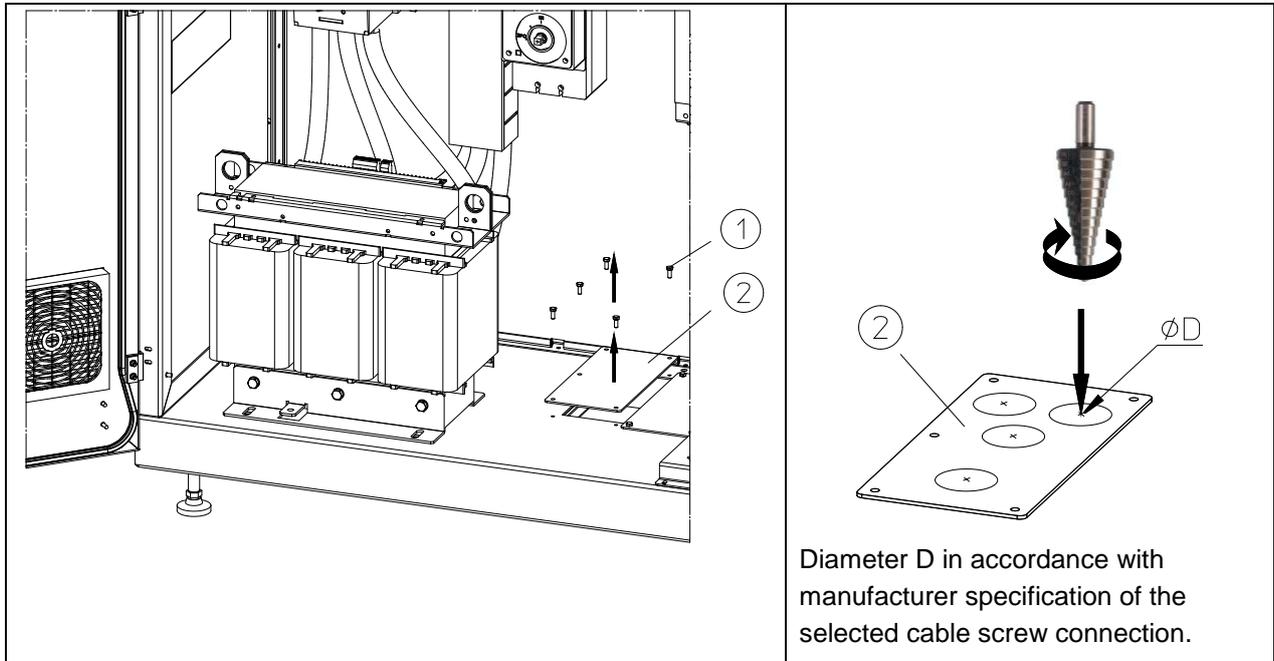
6.3.3.1 Laying the cables (U, V, W, PE)

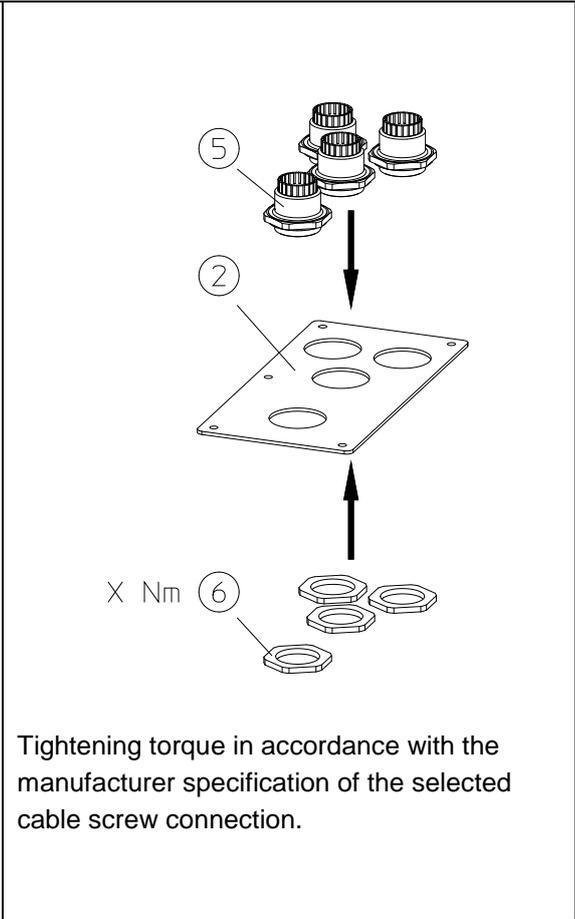
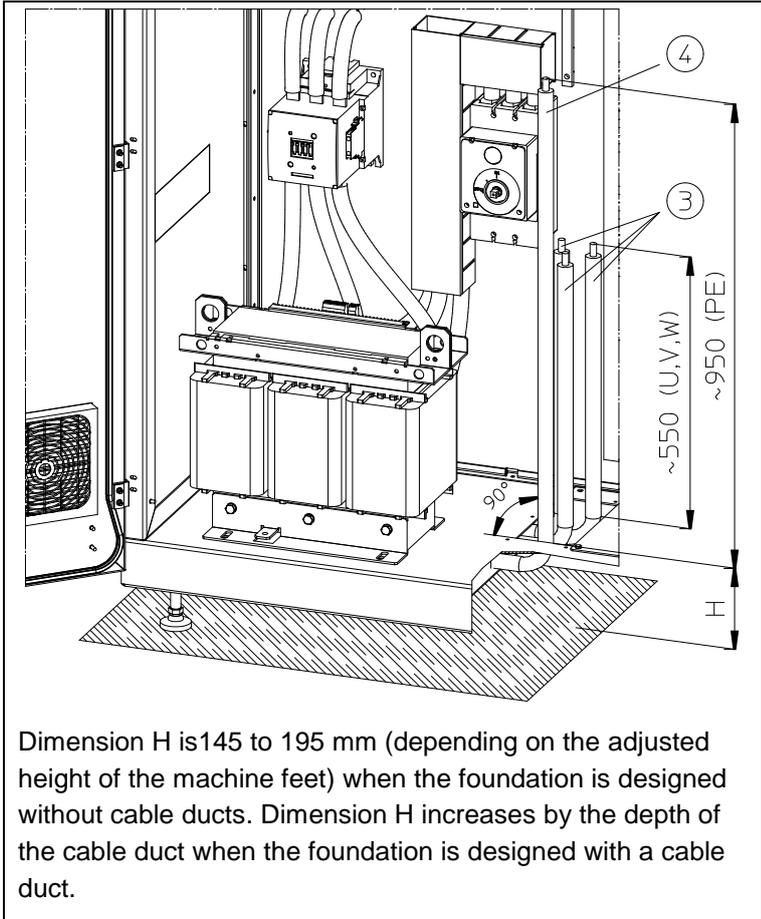
The cables are laid as shown in the diagrams in this section.

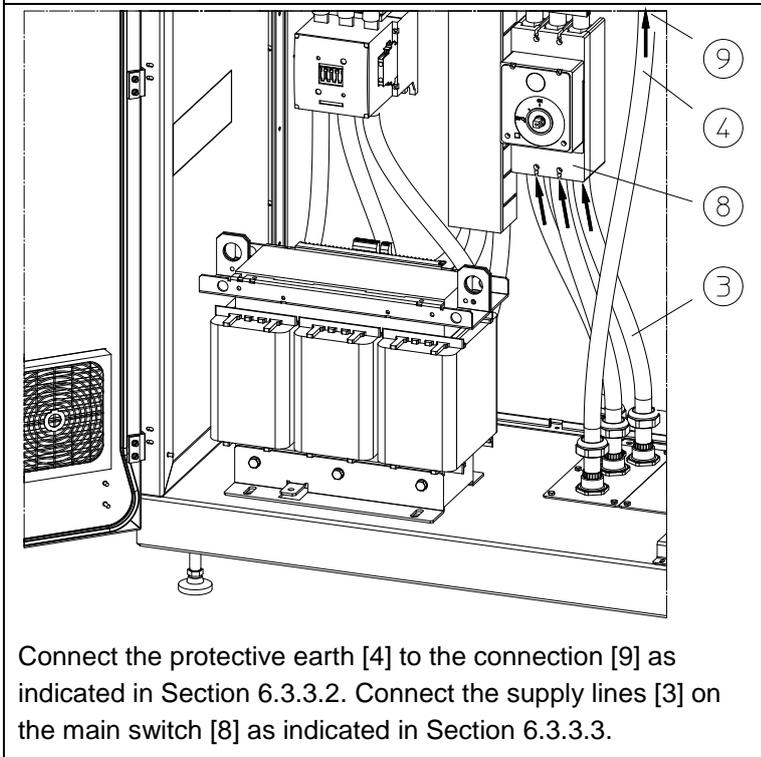
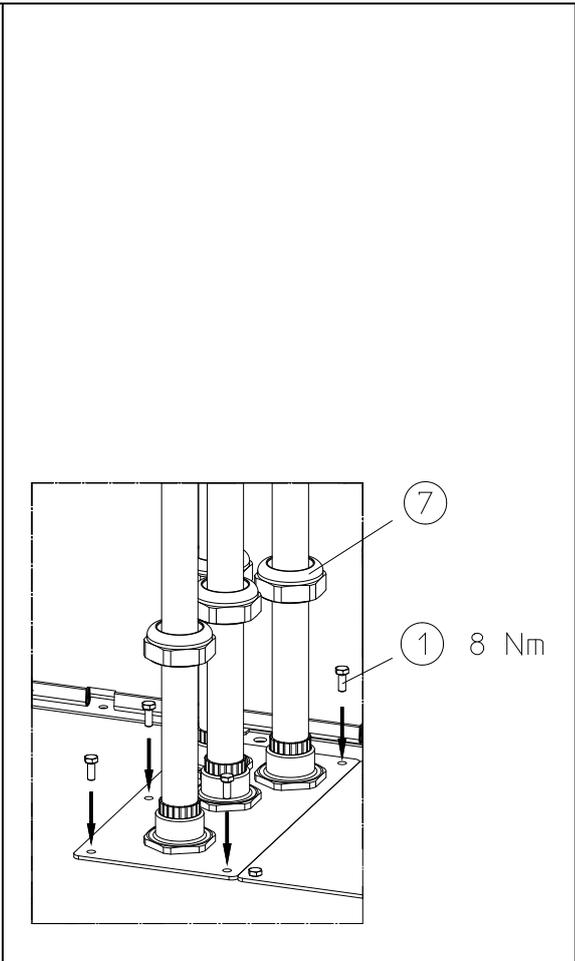
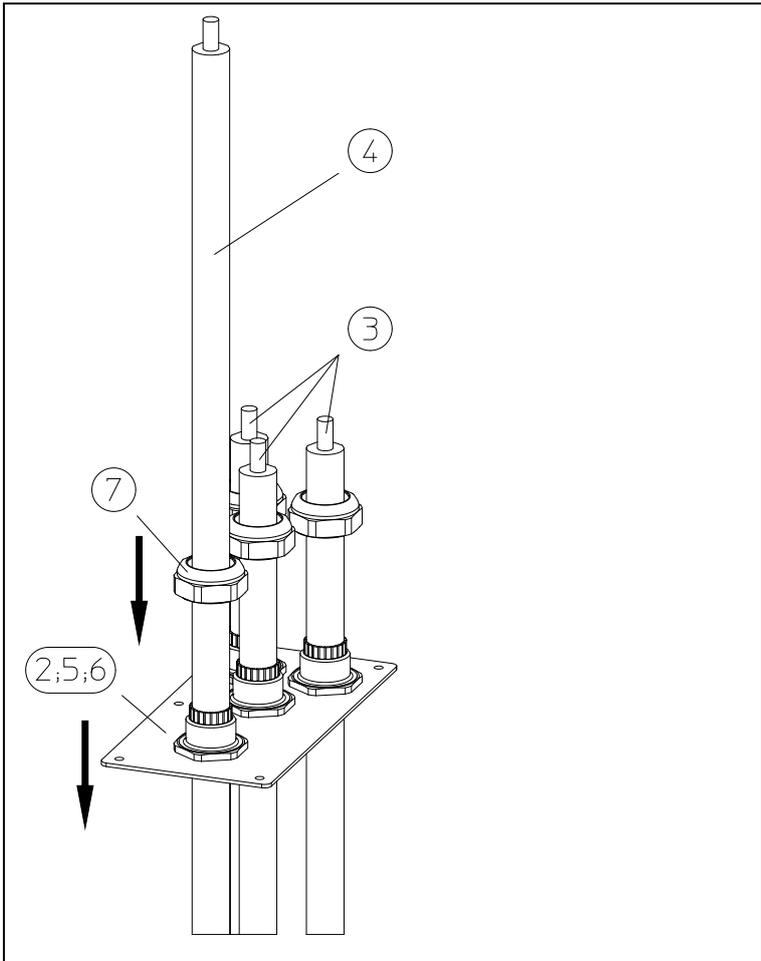
HP4000, MP6000, LP8000

Components

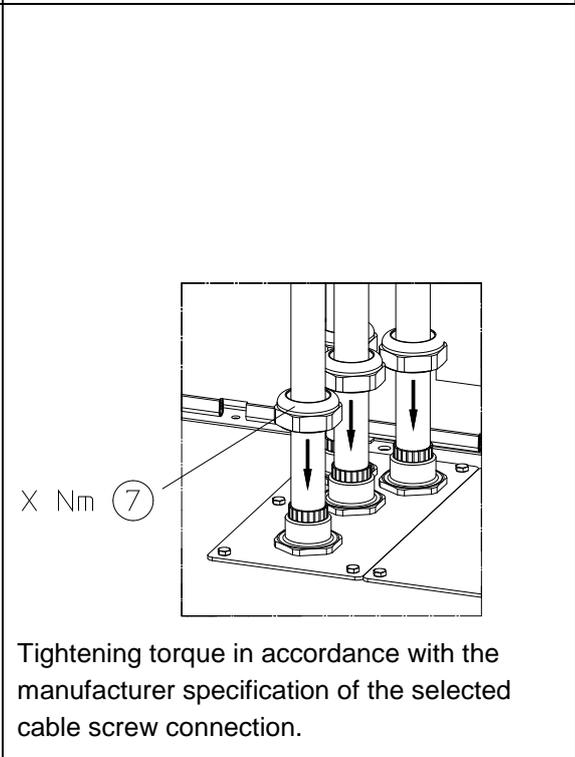
Part	Designation	Dimension	Standard	Material
1	Bolts	M6x16	DIN 933	8.8
2	Access plate for supply lines and protective earth			
3	Supply lines (customer)			
4	Protective earth (customer)			
5	Cable screw connections (customer)			
6	Counternuts for cable screw connection (customer)			
7	Cap nuts for cable screw connection (customer)			
8	Main switch			
9	Connection for protective earth			







Connect the protective earth [4] to the connection [9] as indicated in Section 6.3.3.2. Connect the supply lines [3] on the main switch [8] as indicated in Section 6.3.3.3.

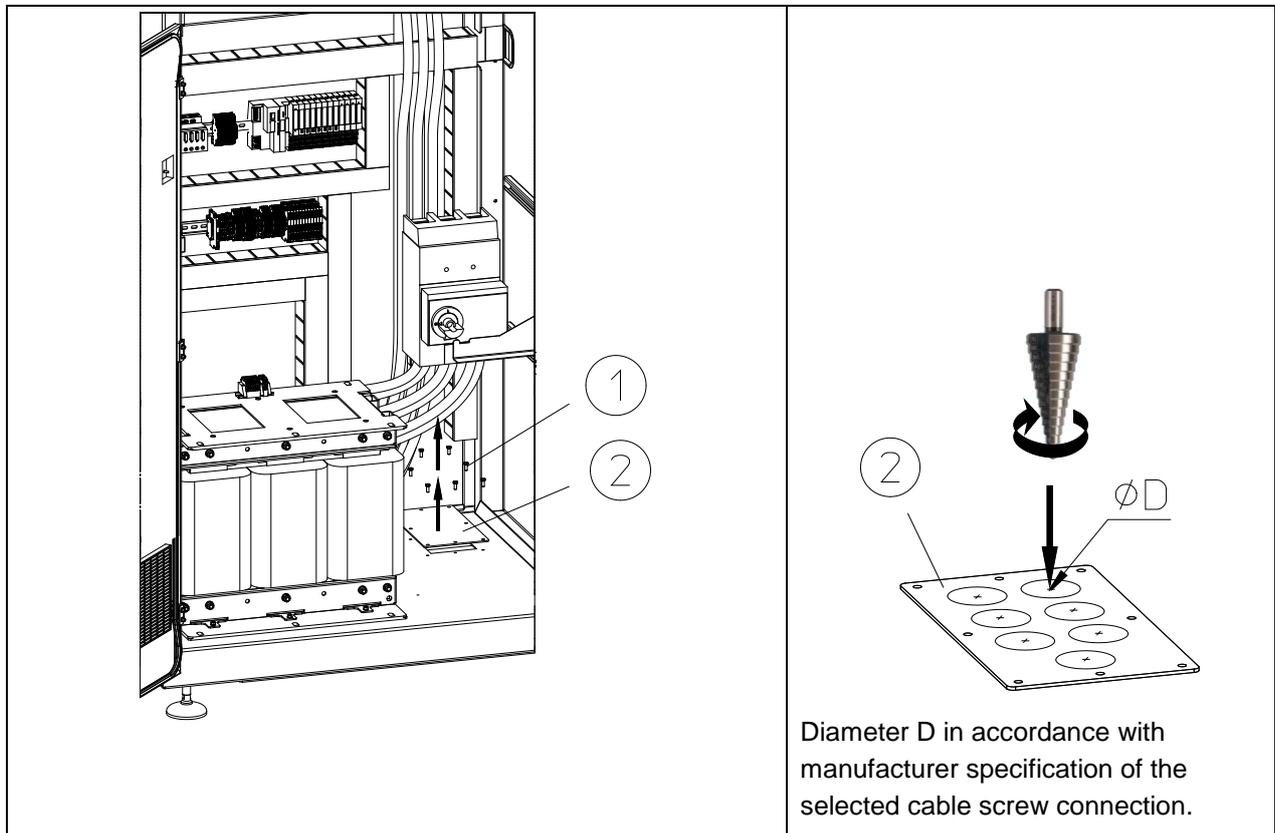


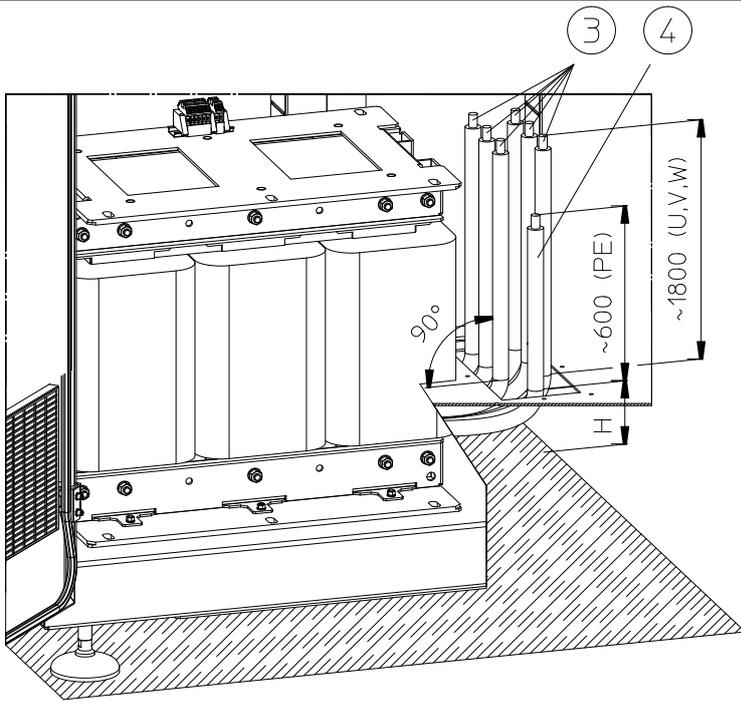
Tightening torque in accordance with the manufacturer specification of the selected cable screw connection.

HP9000, MP12000, LP14000

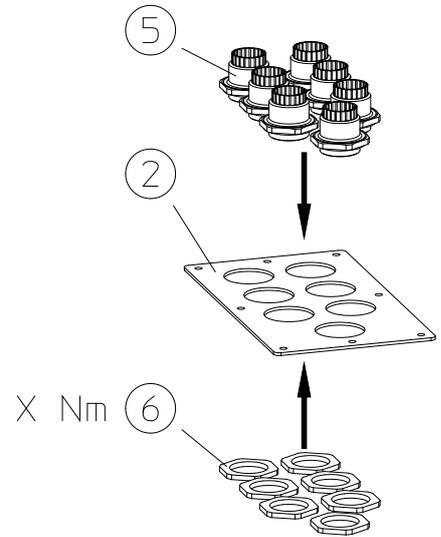
Components

Part	Designation	Dimension	Standard	Material
1	Bolts	M6x16	DIN 933	8.8
2	Access plate for supply lines and protective earth			
3	Supply lines (customer)			
4	Protective earth (customer)			
5	Cable screw connection (customer)			
6	Counternut for cable screw connection (customer)			
7	Cap nut for cable screw connection (customer)			
8	Main switch			
9	Connection for protective earth			
10	Bracket clip			

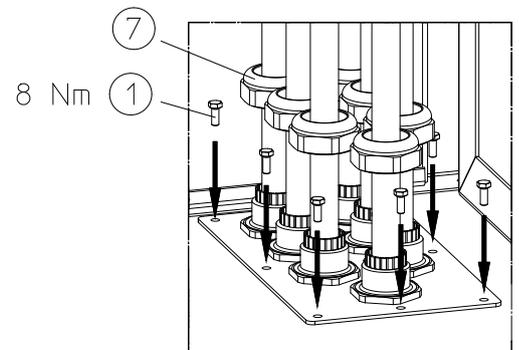
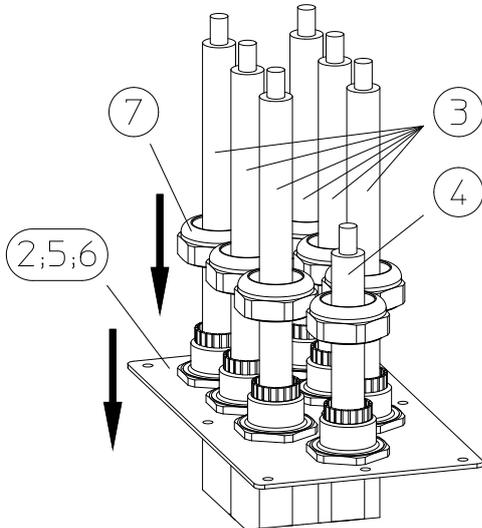


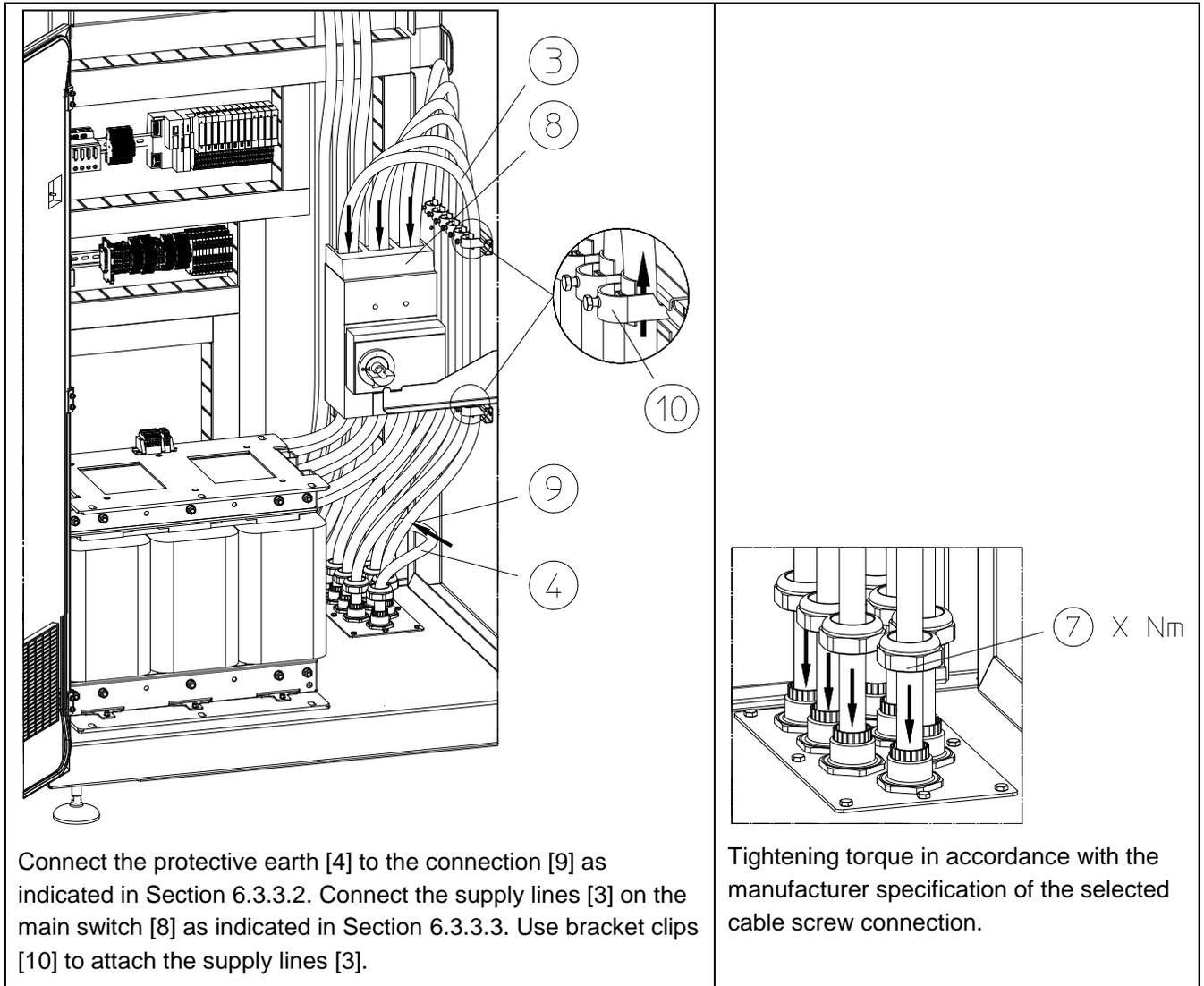


Dimension H is 145 to 195 mm (depending on the adjusted height of the machine feet) when the foundation is designed without cable ducts. Dimension H increases by the depth of the cable duct when the foundation is designed with a cable duct.



Tightening torque in accordance with the manufacturer specification of the selected cable screw connection.





6.3.3.2 Connection of protective earth (PE)

If the protective earth is laid separately, please ensure that its cross-section is at least as large as that of the supply line's outer conductor (single phases). This means that a protective earth with a diameter of at least 60 mm² must be used if the supply line diameter is 120 mm².

A protocol for testing the electrical safety of the PillAerator's control system is prepared by the manufacturer in accordance with DIN VDE 0113 / EN 60204-1 / IEC 204. The test includes the following points:

- Agreement of the electrical equipment with the technical documentation
- Continuous connection of the protective earth system
- Function tests

The PillAerator meets the requirements of the specified safety directives in all points.

HP4000, MP6000, LP8000

Maximum cable cross-section: fine-stranded 300 mm²
multi-stranded with ferrule: 240 mm²

HP9000, MP12000, LP14000

Maximum cable cross-section: 120 mm²

Properly connect the protective earth as shown in Figure 21 and Figure 23. Tighten the terminal clamp [20] to 20 Nm (HP4000, MP6000, LP8000) or 15 Nm (HP9000, MP12000, LP14000).

6.3.3.3 Connection of the supply line (U, V, W)



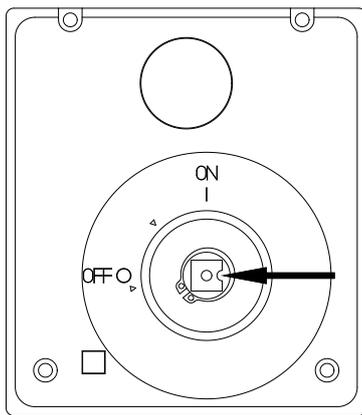
DIN EN 60204 requires that the supply line be equipped with an overcurrent protection device (e.g. circuit breaker, fuse).



The main switch must be shut off (OFF/0) before you connect the supply line (Figure 25 and Figure 26).

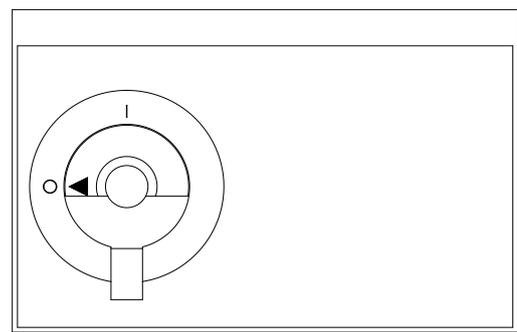
CAUTION: *Due to powerful ground leakage current, no fault-current circuit breakers may be used.*

NOTE *Position of the main switch as shown in Figure 21 and Figure 23.*



Main switch in the deactivated position (OFF), groove position on the right

Figure 25: Main switch
HP4000, MP6000, LP8000



Main switch in the deactivated position (0)

Figure 26: Main switch
HP9000, MP12000, LP14000

A power supply with the following values is required for operating the PillAerator

Connection voltage

- Standard: 3 x 400 V AC / 50 Hz, PEN, clockwise rotary field
- North American design: 3 x 480 V AC / 60 Hz, PEN, clockwise rotary field

NOTE *Please contact your regional sales office if you have different connection voltages.*

HP4000, MP6000, LP8000

- Connected load: 180 kW
- Standard rated current: 260 A
- Rated current – North American design: 220 A
- maximum cable cross-section per phase: 300 mm²

HP9000, MP12000, LP14000

Connected load	360 kW
Standard rated current:	520 A
Rated current – North American design:	440 A
maximum cable cross-section per phase:	240 mm ²

HP4000, MP6000, LP8000

Loosen and remove the screws [21.1]. Remove the cover [21.2] from the main switch [21]. Loosen the screws [22.1]. Properly insert the supply lines [22.2] into their connections. Tighten the screws [22.1]. Attach the touch protection device [22.3]. Attach the cover [21.2]. Tighten the screws [21.1].

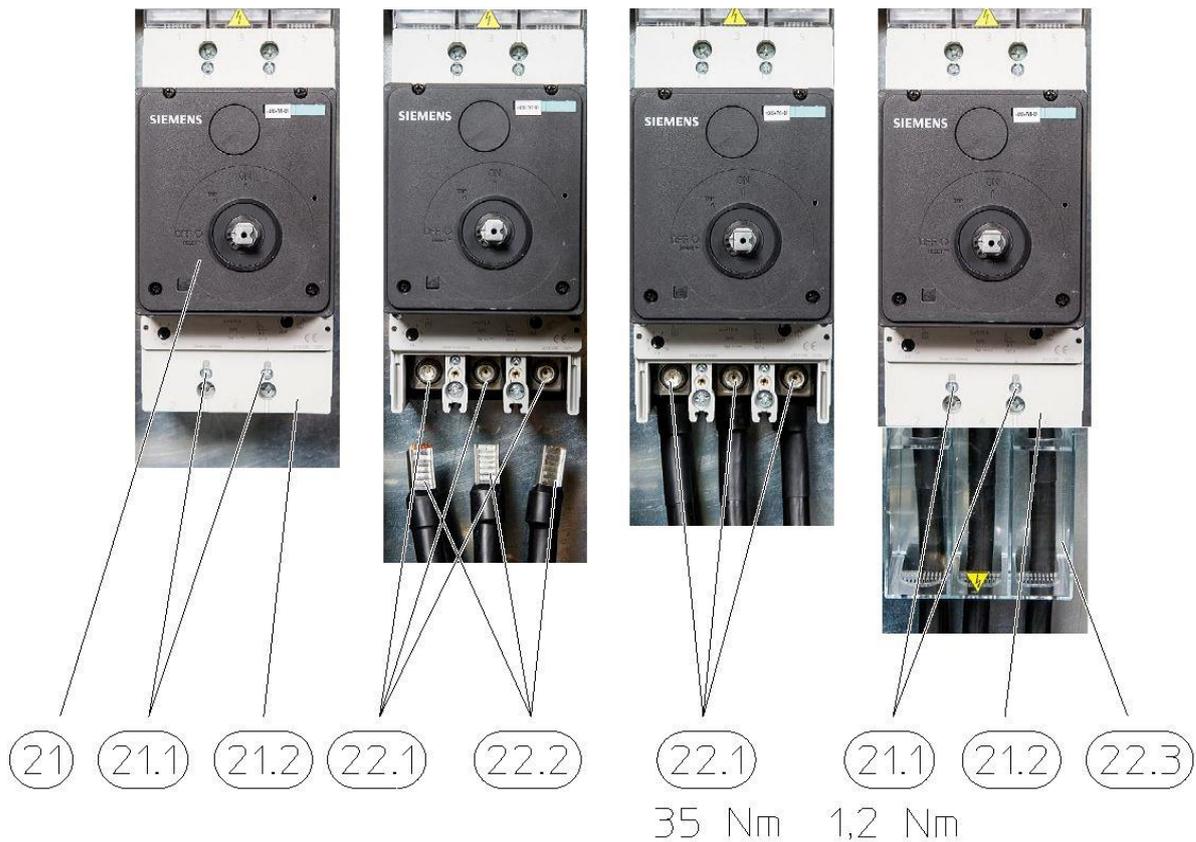


Figure 27: Connection of the supply line HP4000, MP6000, LP8000

HP9000, MP12000, LP14000

Loosen and remove the screws [21.1, 21.2]. Remove the cover [21.3] from the main switch [21]. Use bracket clips [32.1] to attach the supply lines [22.2] to the cable catch rails [32]. Loosen the screws [22.1]. Properly insert the supply lines [22.2] into their connections for supply lines [22]. Tighten the screws [22.1]. Attach the cover [21.2]. Tighten the screws [21.1, 21.2].

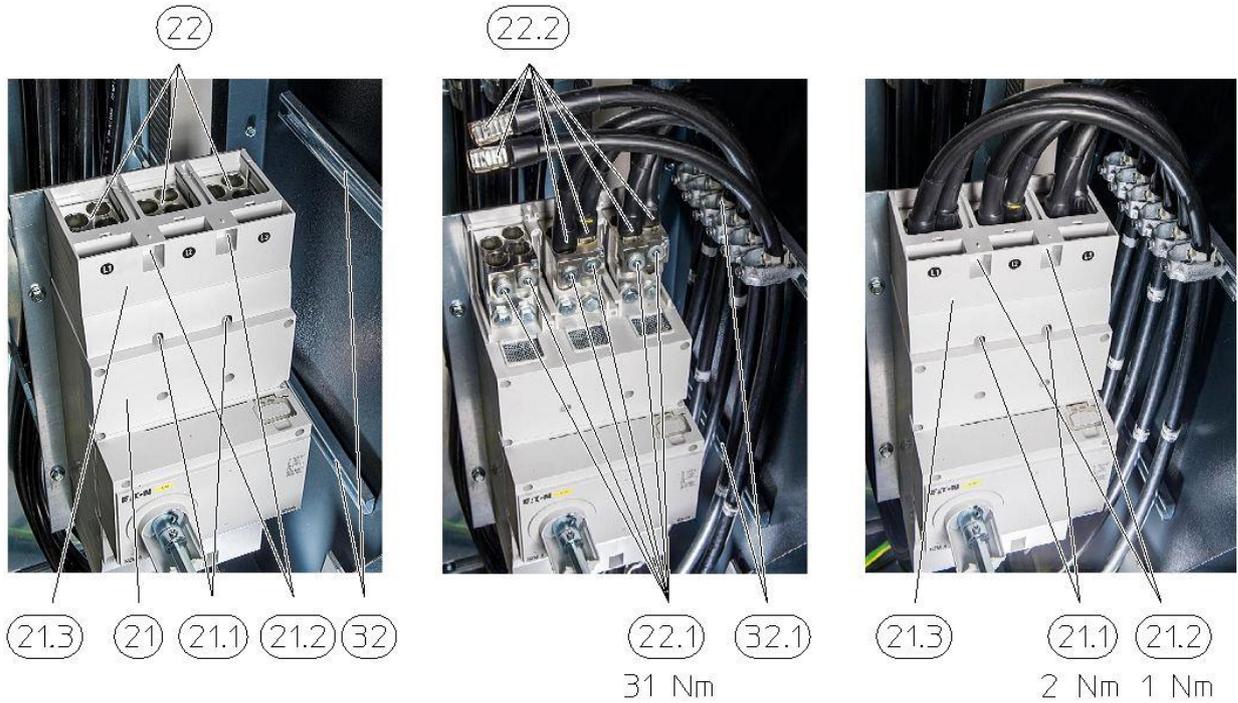


Figure 28: Connection of the supply line HP9000, MP12000, LP14000

6.3.4 Installation of the rotary drive and rotary drive shaft for the door coupler

NOTE Position as shown in Figure 21 and Figure 23.

Remove the protective foil from the control cabinet door [28.2]. Use screws [28.3] to fasten the door coupler's rotary drive [28] and seal [28.1] to the control cabinet door in the recess [28.2] provided for this purpose.

1,3 Nm (HP4000, MP6000, LP8000)

1 Nm (HP9000, MP12000, LP14000)

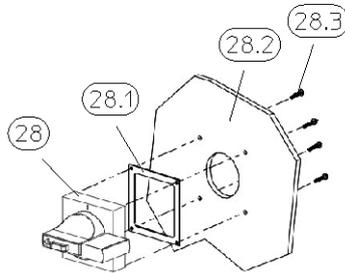
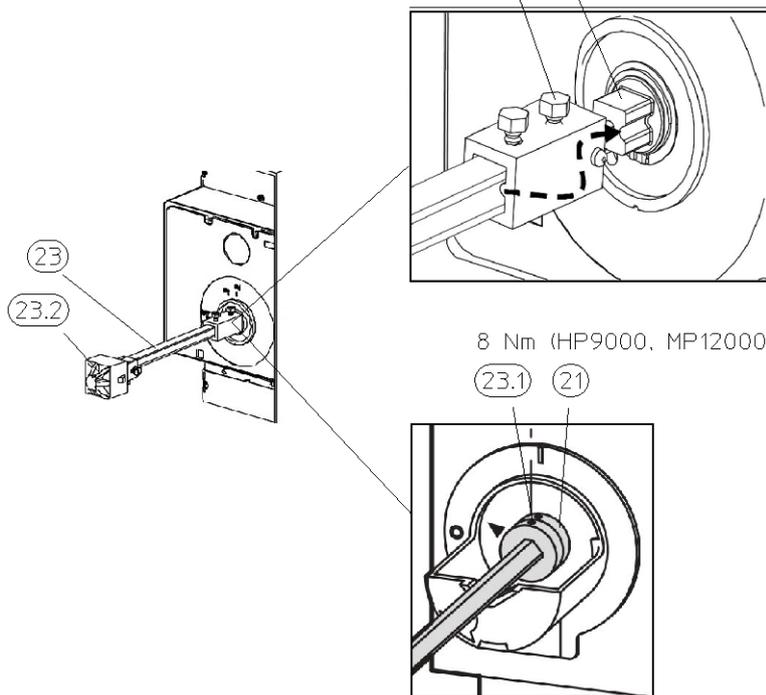


Figure 29: Installation of the rotary drive for the door coupler

Slide the door coupler's rotary drive shaft [23] 15 mm onto/into the main switch [21] and fasten with the screw [23.1].

6 Nm (HP4000, MP6000, LP8000)

(23.1) (21)



8 Nm (HP9000, MP12000, LP14000)

(23.1) (21)

Figure 30: Installation of the rotary drive shaft for the door coupler

6.3.4.1 Function test of the main switch / door coupler rotary drive shaft



The function test may only be performed when the PillAerator is idle and deenergized.

It is possible due to the production-related building tolerances that the star-shaped endpiece [23.2] of the rotary drive shaft for the door coupling [23] does not project completely or projects too far into the door coupling drive [28]. In this case, the rotary movement of the door coupling drive [28] is not transferred to the main switch [21] by the door coupling's rotary drive shaft [23], making it impossible to switch on the PillAerator.

Close the control cabinet doors at the start of the function test. Apply **moderate** force to turn the door coupling drive [28] to position "1". A pronounced clicking sound can be heard when the rotary motion of the door coupling drive [28] has been correctly transferred through the door coupling's rotary drive shaft [23] to the main switch and the function test is successful. Conclude the function test by applying moderate force to turn the door coupling drive [28] to position "0".

If you can turn the door coupling drive [28] without applying force, then turn the door position actuator to position "0" and open the control cabinet door [28]. Loosen the screw [23.1] and pull the door coupling's rotary drive shaft [23] a maximum of 5 mm out of the main switch. Tighten the screw [23.1] (Tightening torque as per Figure 30). Perform the function test again.

If you cannot turn the door coupling drive [28] to position "1" even when applying **moderate** force, then turn the door position actuator [28] to position "0" and open the control cabinet door. Loosen the screw [23.1] and slide the door coupling's rotary drive shaft [23], reduced by a few millimeters, back onto the main switch [21]. Tighten the screw [23.1] (Tightening torque as per Figure 30). Perform the function test again.

6.4 Integration of the PillAerator in a plant control system provided by the customer

The standard PillAerator is delivered with an analog and a Profibus DP interface for control and monitoring. The desired interface is activated on the touch panel.

NOTE *The interface specified in the order is activated in the delivery state.*

NOTE *Simultaneous integration using both interfaces is not possible.*

6.4.1 Analog interface

Table 9 shows the scope of signals, the terminal assignment and the type of signal of the analog interface. The touch panel on the PillAerator can be used to assign and scale the target value specification to each required controller (pressure, volumetric flow rate or external actual value) or to a simple speed controller.

No.	Signal designation	Terminal		Signal type
		HP4000, MP6000, LP8000	HP9000, MP 12000, LP14000	
1	Start	X5.1, X5.2	X5.1, X5.2	DI, 24 VDC
2	Target value	X6.1, X6.2	X5.4, X5.5, X5.6, X5.7	AI, 4..20 mA
3	Actual value	X6.3, X6.4	X5.9, X5.10, X5.11, X5.12	AI, 4..20 mA
4	System ready to operate	X5.3, X5.4	X5-40: 3/4	DO, floating DC24..120V / 5A o. AC24..230V /5A
5	System in operation	X5.11, X5.12	X5-44: 3/4	DO, floating DC24..120V / 5A o. AC24..230V /5A
6	Collective warning	X5.5, X5.6	X5-41: 3/4	DO, floating DC24..120V / 5A o. AC24..230V /5A
7	Collective fault	X5.7, X5.8	X5-42: 3/4	DO, floating DC24..120V / 5A o. AC24..230V /5A
8	Warning of power limit	X5.9, X5.10	X5-43: 3/4	DO, floating DC24..120V / 5A o. AC24..230V /5A
9	Surge line fault	X5.13, X5.14	X5-45: 3/4	DO, floating DC24..120V / 5A o. AC24..230V /5A
10	Inlet temperature fault	X5.15, X5.16	X5-46: 3/4	DO, floating DC24..120V / 5A o. AC24..230V /5A

No.	Signal designation	Terminal		Signal type
		HP4000, MP6000, LP8000	HP9000, MP 12000, LP14000	
11	Emergency-Stop button channel 1 from external device	X2.6, X2.7	0A-X2: 1/4	24 VDC
12	Emergency-Stop button channel 2 from external device	X2.10, X2.11	0A-X2: 2/3	24 VDC
13	Emergency-Stop: external switching device enabled on channel 1	X2.5, X2.8	0A-X2: 5/6	24 VDC
14	Emergency-Stop: external switching device enabled on channel 2	X2.9, X2.12	0A-X2: 7/8	24 VDC
15	Acknowledge Emergency-Stop from external device	X2.13, X2.16	0A-X2: 9/10	24 VDC
16	Acknowledge Emergency-Stop, transfer button to external device	X2.14, X2.15	0A-X2: 11/12	24 VDC

Table 9: Scope of signals, terminal assignment and signal types of the analog interface

CAUTION *Comply with the terminal assignment in the circuit diagram.*

NOTE *Signal Nos. 4 - 10 are provided with Logic 1 in the standard design. This means that the corresponding floating outlet relay is activated when the event occurs.*

NOTE *Additional signals cannot be provided by the analog interface. An expanded scope of signals is only possible by using Profibus to integrate the Brain Box.*

NOTE

Position of the analog interface [12] and connections for Emergency-Stop circuit [13] as shown in Figure 21 and Figure 23. Screw connections (customer) are used to feed the cable through the access plate [15] (see Section 6.3.3.1).

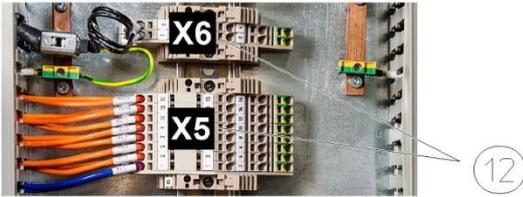


Figure 31: Analog interface connections
HP4000, MP6000, LP8000

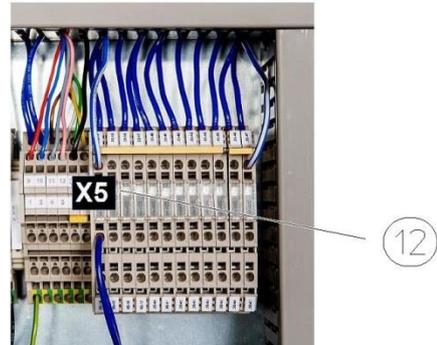


Figure 32: Emergency-Stop circuit connections
HP4000, MP6000, LP8000



Figure 33: Analog interface connections
HP9000, MP12000, LP14000

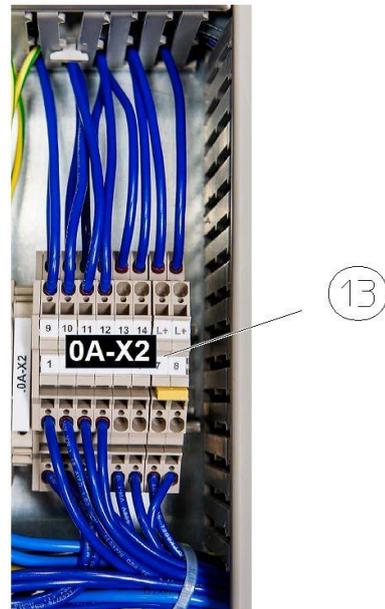


Figure 34: Emergency-Stop circuit connections
HP9000, MP12000, LP14000

6.4.2 Profibus DP integration

The control unit is configured as a slave with the Profibus DP address 11 in the standard configuration. If multiple PillAerators are delivered with a single order, then the DP addresses for the additional PillAerators are each increased by one (12, 13, 14, ...). The assigned **DP address is indicated on the CPU (K1) label.**

Table 10 and Table 11 summarize the addresses and data read (input) and written (output) by the Profibus by default. **It must be noted that the input and output area of the PillAerator control unit begins with the address 1000.**

Table 10 shows the input addresses and data which are read by the PillAerator's (slave's) Profibus. It should be noted here that the target value corresponding to the selection made on the touch panel (speed, pressure, volumetric flow rate or external actual value control) is provided by the customer's master under the address 1002. The address 1006 is used to read the external actual value from the master when "external actual value control" mode is activated.

Profibus PillAerator - Standard				
Address of the Profibus interface: 11				
Block	I/O	Size	Consistency	Local PB address
1	Output	32 Bytes	Total	1000
2	Output	8 Bytes	Total	1032 Reserved for internal usage
3	Output	10 Bytes	Total	1040
4	Output	16 Bytes	Total	1056
Block	I/O	Size	Consistency	Local PB address
5	Input	14 Bytes	Total	1000
6	Input	8 Bytes	Total	1032 Reserved for internal usage
Local PB address	Type	Description		Block
1000.0	BOOL	Start If TRUE, then enabling of PillAerator controller		1
1000.1	BOOL	Reset If TRUE, then reset current error		1
1001.7	BOOL	Live bit (0.5 Hz) The live bit toggles between TRUE and FALSE at a cycle rate of 0.5 Hz. Operation by Profibus is not possible without the live bit.		1
1002	REAL	Target value [0 - 100 %] Target value corresponding to the selection on the user interface (Speed, pressure, volumetric flow rate or external actual value)		1
1006	REAL	Actual value [0 - 100 %] This value is used for the control unit if the "external actual value" mode is selected on the user interface.		1

Table 10: Profibus Input Addresses and Data

Table 11 shows the output addresses and data which are provided to the PillAerator's (slave's) Profibus in the standard configuration.

Please note here that

- The live bit is received under the address 1000.7. The Profibus connection is considered interrupted if the status of the live bit does not change within 2 seconds. In this case the PLC generates a fault message and all of the PillAerators are shut off. The fault message must be acknowledged when the Profibus connection is restored.
- The PillAerator's exact-to-the-second operating time is sent under the address 1028.
- The warnings are transmitted with **bit-by-bit coding** under the address 1040, also see Section 8 and the BrainBox operating manual.
- The malfunctions are transmitted with **bit-by-bit coding** under the address 1042-1048, also see Section 8 and the BrainBox operating manual.

Profibus PillAerator - Standard				
Address of the Profibus interface: 11				
Block	I/O	Size	Consistency	Local PB address
1	Output	32 Bytes	All	1000
2	Output	8 Bytes	All	1032 Reserved for internal usage
3	Output	10 Bytes	All	1040
4	Output	16 Bytes	All	1056
Block	I/O	Size	Consistency	Local PB address
5	Input	14 Bytes	All	1000
6	Input	8 Bytes	All	1032 Reserved for internal usage
Local PB address	Type	Description		Block
1000.0	BOOL	On TRUE when the PillAerator is operating.		1
1000.1	BOOL	Ready to operate TRUE when the system is ready to operate FALSE when an error is pending or when the PillAerator has started		1
1000.2	BOOL	Collective warning TRUE when one of the warnings is pending.		1
1000.3	BOOL	Collective fault TRUE when one of the malfunctions is pending.		1
1000.6	BOOL	Bypass closed TRUE when the bypass valve is closed.		1
1000.7	BOOL	External enabling TRUE when external enabling (digital input) is selected on the touch panel.		1
1001.0	BOOL	Warning - Power limit reached TRUE when the power limit is reached		1
1001.1	BOOL	Malfunction - Power limit reached TRUE when the power fault limit is reached		1
1001.2	BOOL	Malfunction - Surge line reached TRUE when the actual volumetric flow rate falls below the one defined by the surge line.		1
1001.3	BOOL	Malfunction - inlet temperature too high TRUE when the fault limit of the inlet temperature is exceeded.		1
1001.5	BOOL	DP_On Start/Stop via Profibus TRUE when Start/stop via Profibus is selected on the touch panel.		1
1001.6	BOOL	DP Target value via Profibus TRUE when Target value via Profibus is selected on the touch panel.		1
1001.7	BOOL	Live bit (0.5 Hz) The live bit toggles between TRUE and FALSE at a cycle rate of 0.5 Hz.		1
1002	REAL	External target value [0 - 100 %] Shows the external target value pending on the Profibus..		1
1006	REAL	Speed [RPM] Current speed of the PillAerator.		1
1010	REAL	Motor current [A] current from the servo drive controller		1
1014	REAL	Motor output [kW] Current motor output from the servo drive controller		1
1018	REAL	Pressure [bar] Measured pressure difference at the outlet		1
1022	REAL	Volumetric flow [m³/s] Calculated volumetric flow at the outlet		1
1026	INT	Density [kg/m³] Calculated density at the inlet		1
1028	DINT	Operating hours [s] Operating hours (down to the second)		1
1040	WORD	Warnings Warning messages (Listed in the operating manual)		3
1042	WORD	Faults 1 Fault messages (Listed in the operating manual)		3
1044	WORD	Faults 2 Fault messages (Listed in the operating manual)		3
1046	WORD	Faults 3 Fault messages (Listed in the operating manual)		3
1048	WORD	Faults 4 Fault messages (Listed in the operating manual)		3
1058	REAL	Filter clogging [%] Degree of filter clogging in %. 100 % corresponds to the warning threshold.		4
1062	REAL	Inlet temperature [°C] Temperature on the compressor inlet		4

Table 11: Profibus output addresses and data

6.4.3 Connection of the Profibus cable



The quality of the Profibus communication and the usable cable lengths depend very strongly on the correct wiring of the plug connectors and the settings of the terminal resistors.

The PillAerator must be linked to the customer's control system when it is connected by Profibus DP. A Profibus cable (UNITRONIC® BUS L2/FIP 105) and a Profibus connector (e.g. Type: PHOENIX CONTACT SUBCON-PLUS-PROFIB/SC2) must be used for the coupling. The cable [5] must be laid on short routes in a line, i.e. from the customer's control unit [4] to the first PillAerator [1], from there to the second PillAerator [2] and if applicable, from there to the next PillAerator [3] (see Figure 35).

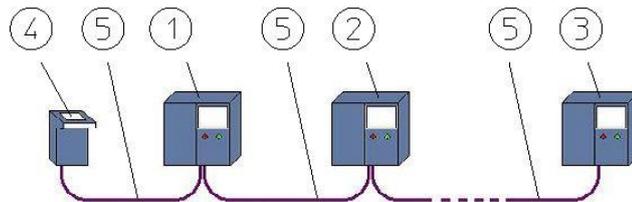


Figure 35: Line structure for laying the Profibus DP cable

The baud rate for the Profibus is set to 1.5 MBit by default and can only be changed by a PillAerator GmbH technician.

Baud rate	max. total cable length in m
9.6 bis 187.5 KBit	1000
500 KBit	400
1.5 MBit	200
3 to 12 MBit	100

Table 12: Maximum Profibus cable length

Strip the ends of the Profibus cables as shown in Figure 36.

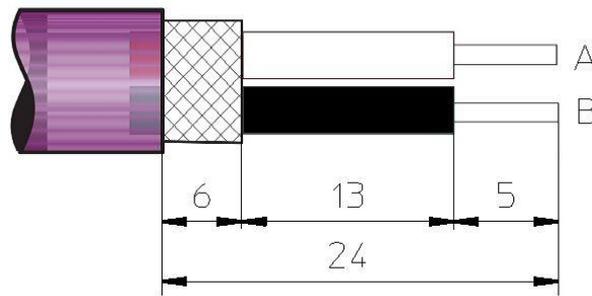


Figure 36: Stripping the Profibus cables, dimension data apply for the sample connector PHOENIX CONTACT SUBCON-PLUS-PROFIB/SC2)

Connect the Profibus cables [1] and [2] for all of the PillAerators to the jack (customer) as shown in Figure 37 (except for the PillAerator at the end of the Profibus connection). Connect the cables from the PillAerator or the customer's control unit [1] to terminals A1 and B1 in the jack on the left. Connect the cable for the next PillAerator [2] to terminals A2 and B2 in the jack on the right. Insert the wires into the screw terminal block [3] for this (A = green, B = red), press the cable sheath between the two terminal strips [4], and tighten the screw terminals [5] to 0.4 Nm. Place the bare cable shield [6] onto the metal guide [7]. Set the switch position [8] of the terminal resistor on the connector to "OFF".

Connect the PillAerator's Profibus cable [1] to the end of the Profibus link in accordance with the above description. Set the switch position [8] of the terminal resistor on the connector to "ON".

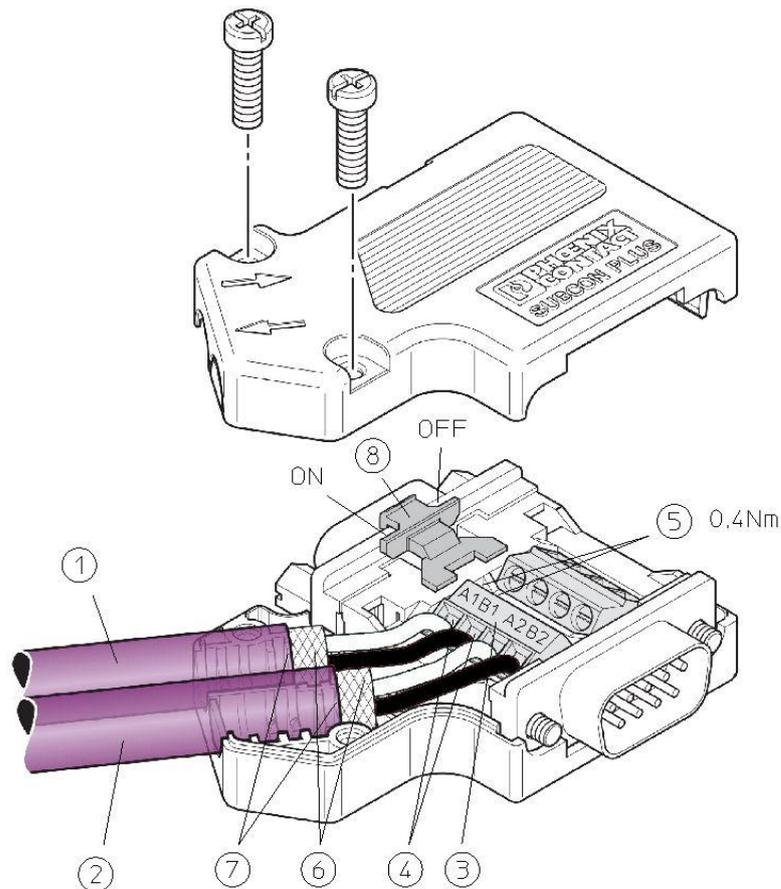


Figure 37: Profibus connector, example PHOENIX CONTACT SUBCON-PLUS-PROFIB/SC2

NOTE Position of the PLC as shown in Figure 21 and Figure 23.

The Profibus cable connector must be connected to the interface module [10.1] of the PLC [10].

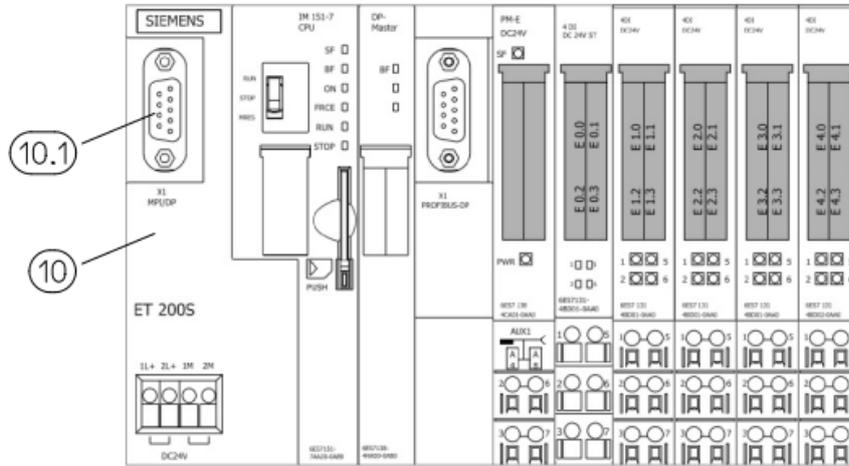


Figure 38: Profibus connection to the PLC

6.4.4 Integration in the Emergency-Stop circuit

The PillAerator or PillAerators can be integrated in an Emergency-Stop circuit supplied by the customer (Table 13). The integration enables the Emergency-Stop to be triggered from the customer control unit for each and every PillAerator. See Section 7.6.1 for unlocking the Emergency-Stop.

CAUTION *Comply with the information in the circuit diagram.*

NOTE *Position of the connections for Emergency-Stop circuit [13] as shown in Figure 21 and Figure 23. Screw connections (customer) are used to feed the cable through the access plate [15] (see Section 6.3.3.1).*

NOTE *No. 3 in Table 13 is optional. No. 4 must also be implemented if option no. 3 is selected.*

No.	Purpose Description	HP4000, MP6000, LP8000	HP9000, MP12000, LP14000
1	Disconnect the Emergency-Stop button (2xNC) from the PillAerator circuit and integrate it in the Emergency-Stop circuit supplied by the customer. Remove the wire jumpers and connect the cable to the customer control unit.	Terminal pair X2:6/7 Terminal pair X2:10/11	Terminal pair 0A-X2:1/4 Terminal pair 0A-X2:3/4
2	The Emergency-Stop circuit supplied by the customer interrupts the PillAerator's Emergency-Stop circuit. The make contacts of the customer's switchgear interrupt the channels of the PillAerator's safety relay. Remove the wire jumpers and connect the cable to the customer control unit.	Terminal pair X2:5/8 Terminal pair X2:9/12	Terminal pair 0A-X2:5/6 Terminal pair 0A-X2:7/8
3	The Emergency-Stop acknowledgment button (NO) can be disconnected from the PillAerator's Emergency-Stop circuit and integrated in the customer's Emergency-Stop circuit. The "Acknowledge" signal must be switched in this case by a make contact in the customer's Emergency-Stop circuit. Remove the wire jumpers and connect the cable to the customer control unit.	Terminal pair X2:13/16	Terminal pair 0A-X2:9/10
4	Transfer the PillAerator's Emergency-Stop acknowledgment button to the customer's control unit in order to switch the "acknowledge" signal there. Remove the wire jumpers and connect the cable to the customer control unit.	Terminal pair X2:14/15	Terminal pair 0A-X2:11/12

Table 13: Integration in the Emergency-Stop circuit

7. Commissioning and operation

The Commissioning Checklist (Section 7.9) must be filled out and archived.

7.1 Installation and mechanical connections

Install and connect the PillAerator as shown in Sections 4, 6.1 and 6.2.

The discharge and suction sides of the pipeline must be connected in a way that prevents the forces permitted on the nozzles from being exceeded (see data sheet in Sections 14 and 15). The capacitor together with its stops must be installed for the HP9000, MP12000 and LP14000. Set the stops so that they fit closely when the pipeline is cold and limit the expansion of the capacitor.

7.2 Hydraulic connections

The cooling water must already be supplied and tested before the commissioning takes place. For this purpose, we recommend covering the air inlet of the air/water cooler with cardboard or a similar material. This makes conventional cooling by the ambient air no longer sufficient and causes the external cooling to be additionally switched on.

Check the pressure in the cooling circuit on the manometer [12] before commissioning (Figure 78 and Figure 79). The pressure must be 0.8 bar when the PillAerator is deactivated. Coolant must be added if the pressure is below 0.8 bar (see Section 9.2)

7.3 Electrical connections

The rotary drive and rotary drive shaft of the door coupling were dismantled for the PillAerator's transport. They must be installed as described in Section 6.3.4.

All of the PillAerator's screw connections must be inspected following its transport.

Transformer connections:



① 15 Nm

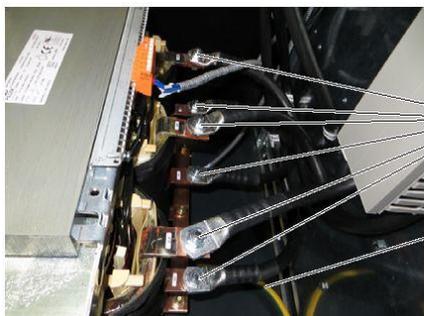
Loosen and remove the M8 screws [1].

③

Loosen and remove the M6 screws [2].

② 10 Nm

Remove the protective grating [3].



④ 30 Nm

Use a torque wrench to check the six M10 screws [4] (inlet and outlet).

⑤ 30 Nm

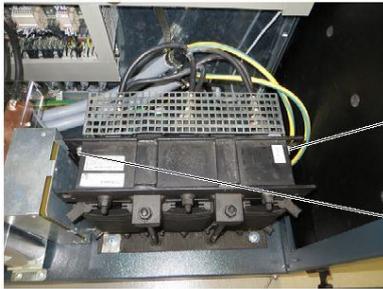
Use a torque wrench to check one M10 screw [5] (PE, cannot be seen here because it is covered).

Attach the protective grating [3] and use the M8 screws [1] and M6 screws [2] to tighten it (note the torque).

NOTE

Counter the screw with a second wrench to check the torque.

Sinusoidal filter connections:

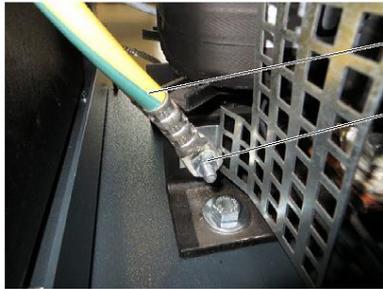


② 15 Nm

① 15 Nm

Loosen and remove the screw and M8 nut [1].

Loosen and remove the screw and M8 nut [2].

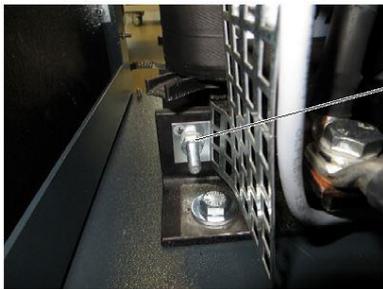


③.2

③.1 20 Nm

Remove the M8 nut [3.1].

Remove the two PE cables [3.2].



③.3 20 Nm

Loosen the M8 nut [3.3].



④

Press the right-hand side of the protective grating [4] upwards and then forwards.



⑤ 54 Nm

Use a torque wrench to check the six M10 screws [5] (inlet and outlet).

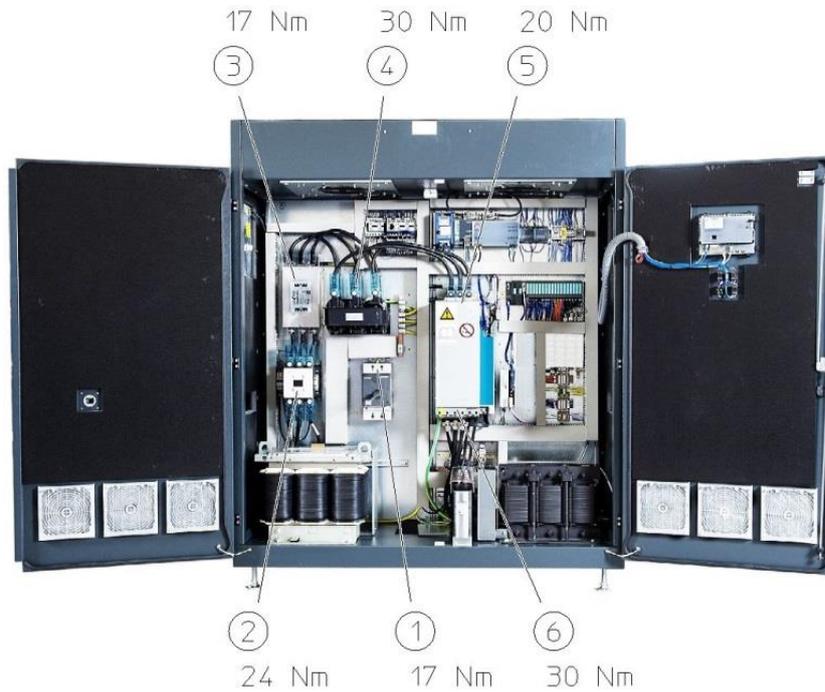
Press the right-hand side of the protective grating [4] backwards and then downwards.

Use the nut and the M8 screw to fasten the protective grating.

Use the M8 nut [3.1] to attach the PE cable (note the torque).

Complete the M8 screw connection [1] and [2] (note the torque).

Additional cable connections of the power branch HP4000, MP6000, LP8000:



Check the torques for the following screw connections:

- [1] Main switch outlet
- [2] Main contactor inlet and outlet
- [3] Network filter inlet and outlet
- [4] Commutating choke inlet and outlet
- [5] Servo drive controller inlet
- [6] Servo drive controller outlet

NOTE: The cover and the contact protection on the TOP of the main switch must first be removed for [1] (see Section 6.3.3.3).

NOTE: The covers on the cable screw connections must first be removed for [2], [4] and [5].



Remove the cover for [2], [4] and [5]:

Use a 1.2 x 6.5 slotted screwdriver to loosen and remove the screws [2].

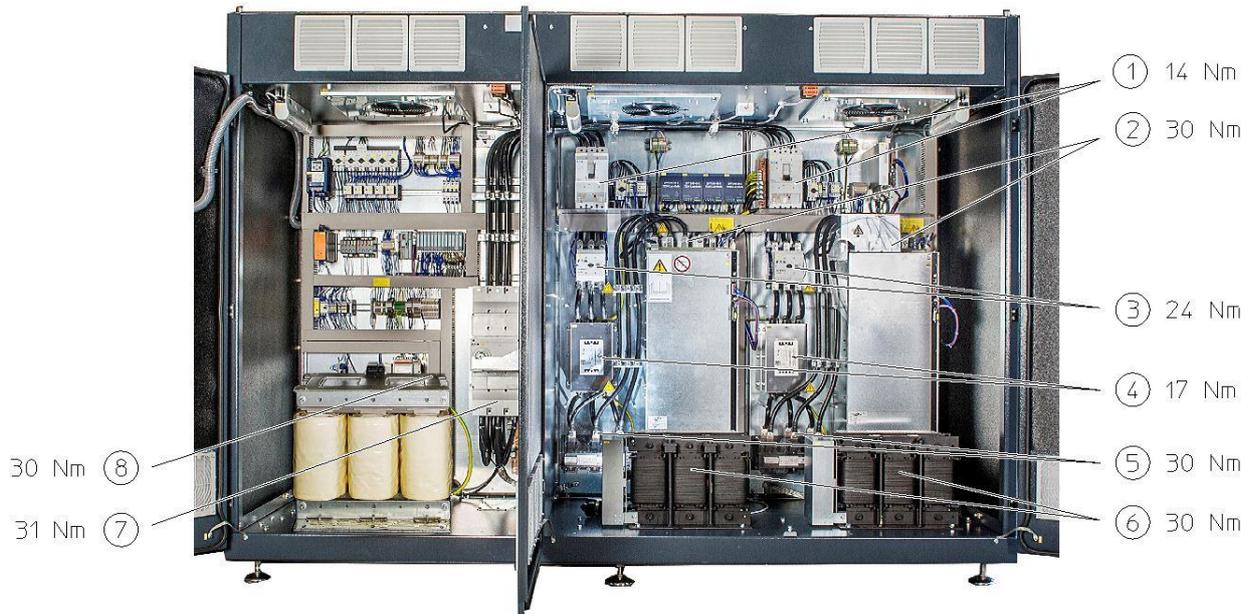
Remove the cover [1].

Use the torque wrench to check the torques of the screw connections.

Install the cover and contact protection for [1].

Remove the covers for [2], [4] and [5]:

Additional cable connections of the power branch HP9000, MP12000, LP14000:

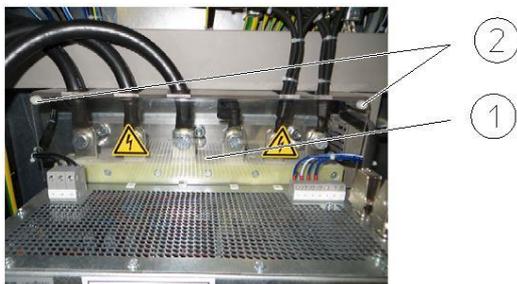


Check the torques for the following screw connections:

- [1] Inlet and outlet of the circuit breaker for the servo drive controller
- [2] Servo drive controller inlet
- [3] Main contactor inlet and outlet
- [4] Network filter inlet and outlet
- [5] Commutating choke inlet and outlet
- [6] Servo drive controller outlet
- [7] Main switch outlet
- [8] Transformer inlet and outlet

NOTE: The plastic covers on the cable screw connections must first be removed for [2], [3], [4] and [5].

NOTE: The cover on the BOTTOM of the main switch must first be removed for [7] (see Section 6.3.3.3).



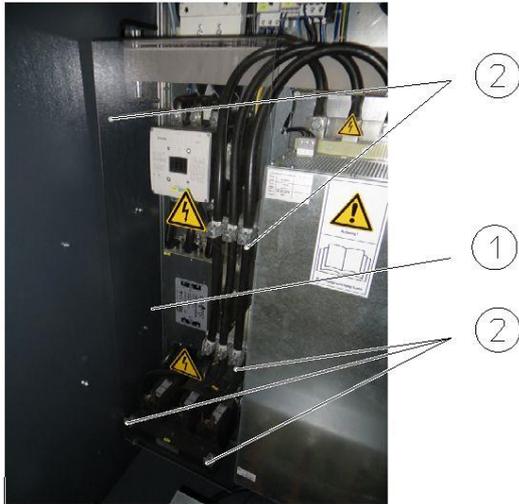
Remove the cover for [2].

Use a 1.2 x 6.5 slotted screwdriver to loosen and remove the screws [2].

Remove the cover [1].

Use the torque wrench to check the torques of the screw connections.

Install the cover [1].



Remove the cover for [3], [4] and [5]:

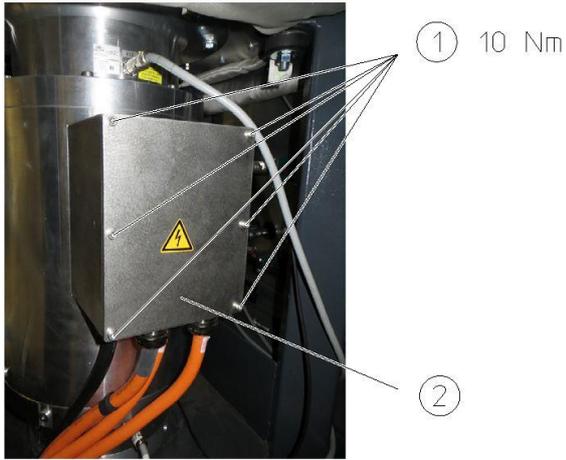
Use a 1.2 x 6.5 slotted screwdriver to loosen and remove the screws [2].

Remove the cover [1].

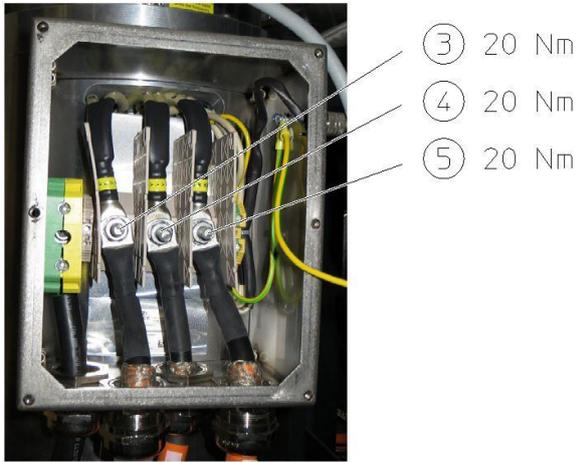
Use the torque wrench to check the torques of the screw connections.

Install the cover [1].

Inspecting the motor cable:



Use a No. 6 Allen key to remove the 6 screws [1].
Remove the cover [2].



Use a torque wrench to check the torques of the nuts [3], [4], [5].
Install the cover (note the torque).

Connect the PillAerator's supply lines and the grounding cable as described in Section 6.3.3. Be sure to check the rotary field. A clockwise rotary field is required to operate the PillAerator.

Please ensure that the cable screw connections are also correctly installed. (Section 6.3.3)

7.4 Communication connections

The wiring for the communication with a customer control unit or the control center must be installed as described in Section 6.4.

Ethernet cables must be laid and connected as described in Section 10.4 when multiple PillAerators are operated by remote control.

7.5 Circuit breakers and power switches

NOTE Position of the circuit breakers and power switches as shown in Figure 21 and Figure 23.

All circuit breakers and power switches are activated before commissioning. This is achieved by tipping or turning the switches to the switch positions in accordance with the following illustrations.

7.5.1 Circuit breakers and power switches HP4000, MP6000, LP8000



Figure 39: Circuit breakers HP4000, MP6000, LP8000

- [4.1] Fuse for main contactor
- [4.2] Circuit breaker for control voltage power pack
- [4.3] Motor protection circuit breaker for coolant pump
- [4.4] Motor protection circuit breaker for recooling system fans
- [4.5] Motor protection circuit breaker for cabinet fan1
- [4.6] Motor protection circuit breaker for cabinet fan 2

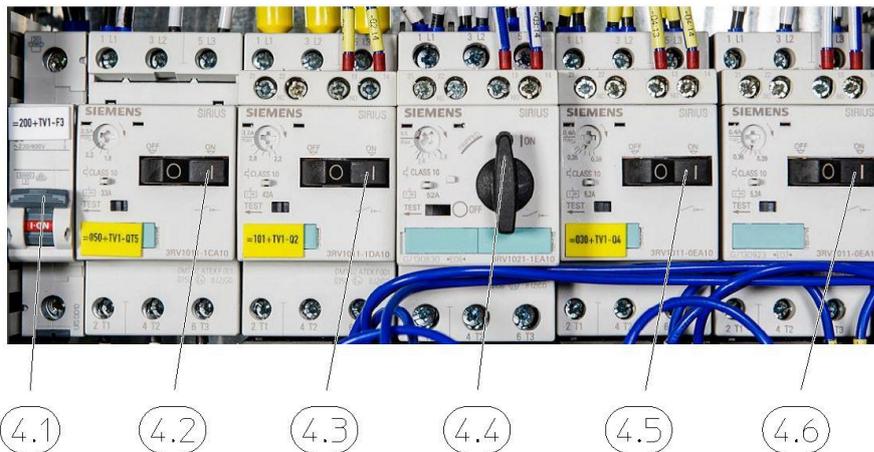


Figure 40: Motor protection circuit breaker HP4000, MP6000, LP8000

NOTE *The status of the 24 V circuit breakers can only be checked in the energized state (main switch on).*

NOTE *If the LED is not flashing green, then press the associated button repeatedly until the LED flashes green.*

- [9.1] Circuit breaker of the 24 V control circuit for control voltage
- [9.2] Circuit breaker of the 24 V control circuit for response of the proportional valve
- [9.3] Circuit breaker of the 24 V control circuit for power module PLC
- [9.4] Circuit breaker of the 24 V control circuit for PLC supply
- [9.5] Circuit breaker of the 24 V control circuit for supply of the bypass and proportional valve
- [9.6] Circuit breaker of the 24 V control circuit for supply of the remote control
- [9.7] Circuit breaker of the 24 V control circuit for supply of the Profibus module
- [9.8] Free
- [9.9] Circuit breaker for 24 V supply of the servo drive controller

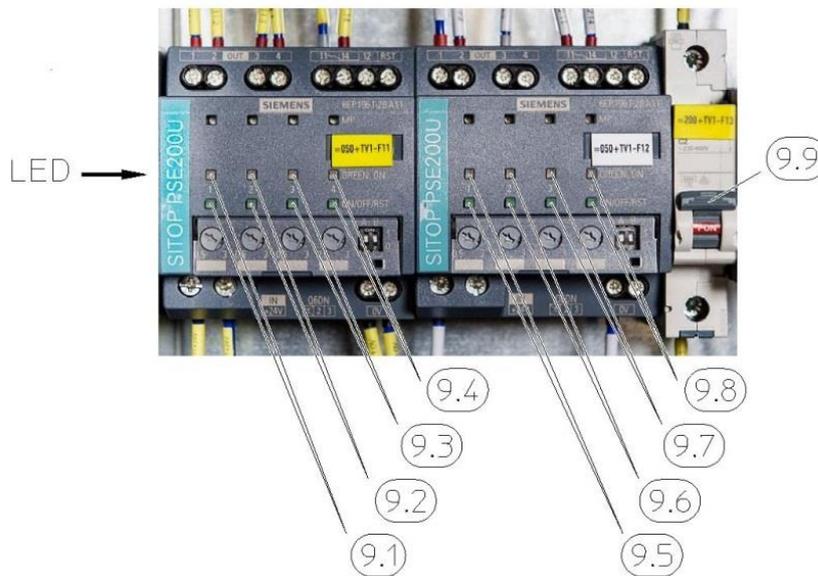


Figure 41: Circuit breaker for control circuit HP4000, MP6000, LP8000

7.5.2 Circuit breakers and power switches HP9000, MP12000, LP14000

- [33.1] Fuse for main contactor
- [33.2] Fuse for inside lighting of control cabinet
- [33.3] Fuse for control current power pack



Figure 42: Fuses for control current, lighting, main contactor HP9000, MP12000, LP14000

- [4.3] Motor protection circuit breaker for coolant pump
- [4.4] Motor protection circuit breaker for recooling system fans
- [4.5] Motor protection circuit breaker for control cabinet fan 1
- [4.6] Motor protection circuit breaker for control cabinet fan 2
- [4.7] Motor protection circuit breaker for control cabinet fan 3
- [4.8] Motor protection circuit breaker for control voltage power pack

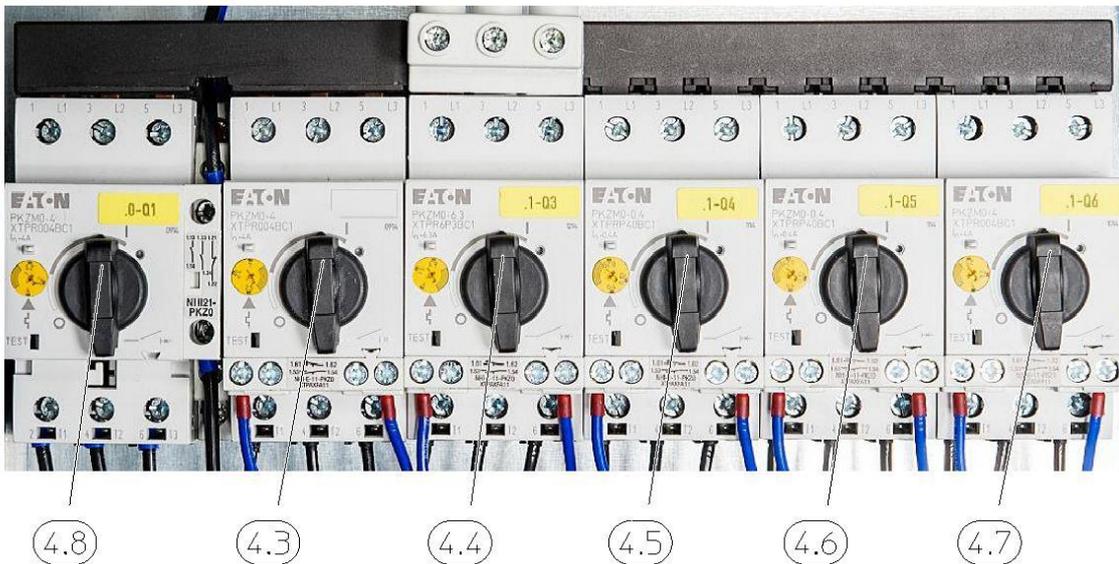


Figure 43: Motor protection switches HP9000, MP12000, LP14000

[30.1] Circuit breaker for main power supply of the master and slave

[31.1] Circuit breaker for precharging resistor of the servo drive controller for the master and slave.



Figure 44: Circuit breakers HP9000, MP12000, LP14000

NOTE The status of the 24 V circuit breakers can only be checked in the energized state (main switch on).

NOTE Press the reset button [9.9] if the LED does not flash green.

- [9.1] Circuit breaker of the 24 V control circuit for control voltage
- [9.2] Circuit breaker of the 24 V control circuit for response of the proportional valve
- [9.3] Circuit breaker of the 24 V control circuit for power module PLC
- [9.4] Circuit breaker of the 24 V control circuit for touch panel supply
- [9.5] Circuit breaker of the 24 V control circuit for supply of the bypass and proportional valve
- [9.6] Circuit breaker of the 24 V control circuit for supply of the remote control
- [9.7] Circuit breaker of the 24 V control circuit for supply of the Profibus module
- [9.8] Free
- [9.9] Free

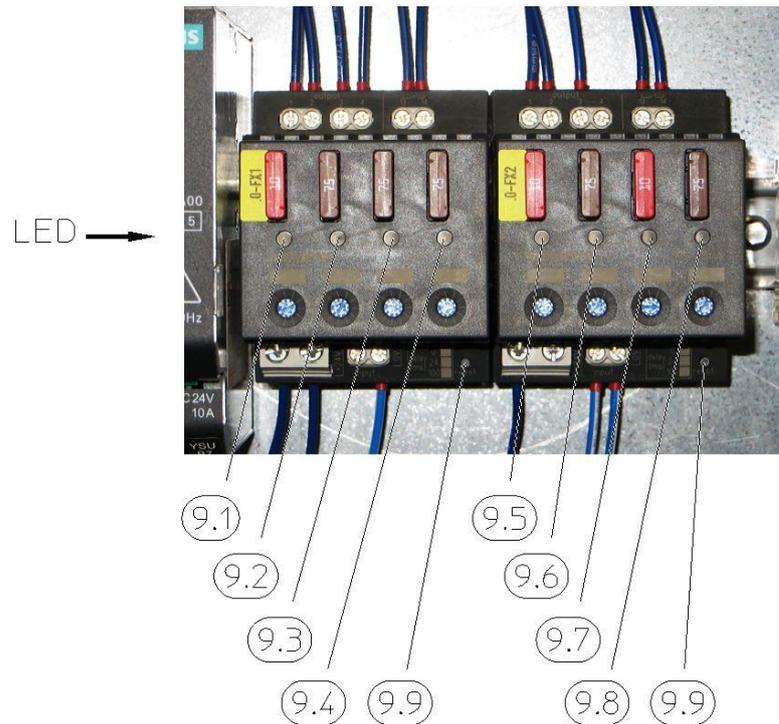


Figure 45: Circuit breaker for control circuit HP9000, MP12000, LP14000

7.6 Operating the PillAerator

7.6.1 Emergency-Stop

NOTE *The Emergency-Stop switch [1] is activated in the delivery state.*

The PillAerator is designed with an Emergency-Stop switch [6]. Pressing the Emergency-Stop switch [6] deactivates all of the components except for the 24 V consumers (e.g. PLC) and the compressor motor is braked to 0 rpm within 10 seconds.



The PillAerator is now deenergized. The compressor cabinet may not be opened.

The following fault message appears on the touch panel: Malfunction: EMERGENCY-STOP (M52.0)

The fault message cannot be acknowledged until the Emergency-Stop switch is unlocked.

If the Emergency-Stop switch [6] is pressed, then it must first be unlocked by turning it when the PillAerator needs to be switched on.

Press the "Plant On" button [2].

 The "Acknowledge Emergency-Stop" button [5] flashes red.

Wait 10 seconds.

Press the "Acknowledge Emergency-Stop" button [5].

 The "Acknowledge Emergency-Stop" button [5] stops flashing.

 The "Plant On" button [2] flashes green.

The PillAerator is ready to operate when the "System On" button [2] stops blinking and flashes continuously green instead.

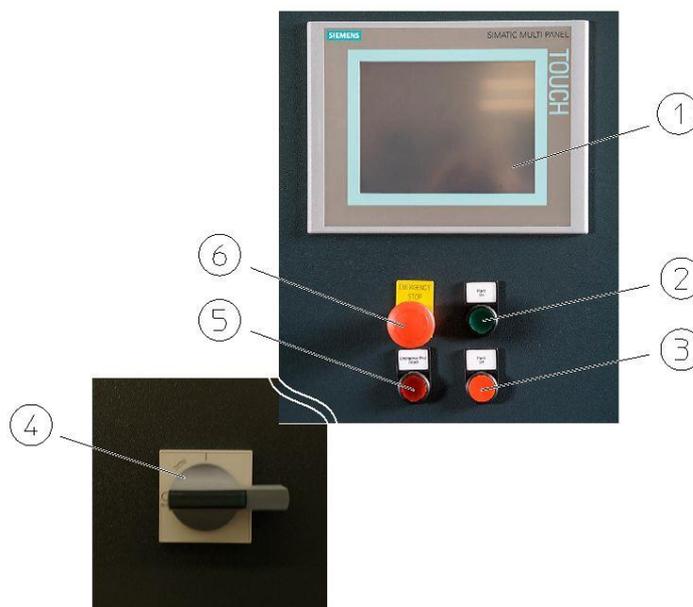


Figure 46: Touch panel, button, and rotary drive for door coupling

7.6.2 Switching on

NOTE If the work steps described in Section 7.6.1 have already been completed, then the work steps described in Section 7.6.2 can be eliminated because the PillAerator is already operational.

Energize the PillAerator by turning the rotary drive for the door coupling [4] to position "1".

The software starts.

Wait until the software is completely loaded. Display in the touch panel [1] as shown in Figure 47.

Press the "Plant On" button [2].

The "Acknowledge Emergency-Stop" button [5] flashes red.

Wait 10 seconds.

Press the "Acknowledge Emergency-Stop" button [5].

The "Acknowledge Emergency-Stop" button [5] stops flashing.

The "Plant On" button [2] flashes green.

The PillAerator is ready to operate when the "Plant On" button [2] stops blinking and flashes continuously green instead.

		0:		PillAerator		
		10/04/2015	12:40:40	Mustername		
main menu turbo compressor						
	set value	actual value	min. value	max. value	item	
turbo compressor (=200-T1)	0	0	28908	30040	1/min	
bypass valve(=10-Y1)		open				
water/water cooler(=20-Y2)	0.0	0.9	0.8	100.0	%	
air/water cooler (=100-T3)	0.0	0.0	0.0	60.6	%	
volume flow		0.0	10.0	6372.0	m³/h	
differential pressure outlet		0.00	10.00	1280.00	mbar	
differential pressure inlet		0.000	41.597	69.340	mbar	
differential pressure suction filter		0.022	0.687	2.351	mbar	
pressure cooling circuit		1965.9	854.7	2914.9	mbar	
temperature compressor inlet		19.1	15.9	28.4	°C	
temperature coolant		20.5	18.9	40.7	°C	
temperature switch cabinet		21.4	20.4	27.1	°C	

Figure 47: Main menu

7.6.3 Switching off

Press the "Plant Off" button [3].

The "Plant On" button [2] stops flashing.

The internal 480 V supply voltage is shut off. Only the transformer and the PLC are supplied with power.



The PillAerator is not deenergized in this state.

Turn the rotary drive for the door coupling [4] to position "0".

The PillAerator is now completely shut off.



The drive controller and the intermediate circuit capacitors can also remain under dangerously high voltages for a certain amount of time after the PillAerator has been shut off. Always check the inlets and outlets of the converter and especially the connections of the internal and external intermediate circuit capacitors to ensure that they are not energized!

7.6.4 Operating and display functions

7.6.4.1 Screen setup

The touch panel screen (Figure 48) is divided into a static part [1], a variable image area [2], the navigation bar [3] and an information area with process values [4].

The static part contains the following information:

0 :	Current user profile
01.08.2014	Current date
16:43:32	Current time
Mustername	Installation site
main menu turbo compressor	Menu heading

The appearance of the navigation bar [3] depends on the menu.

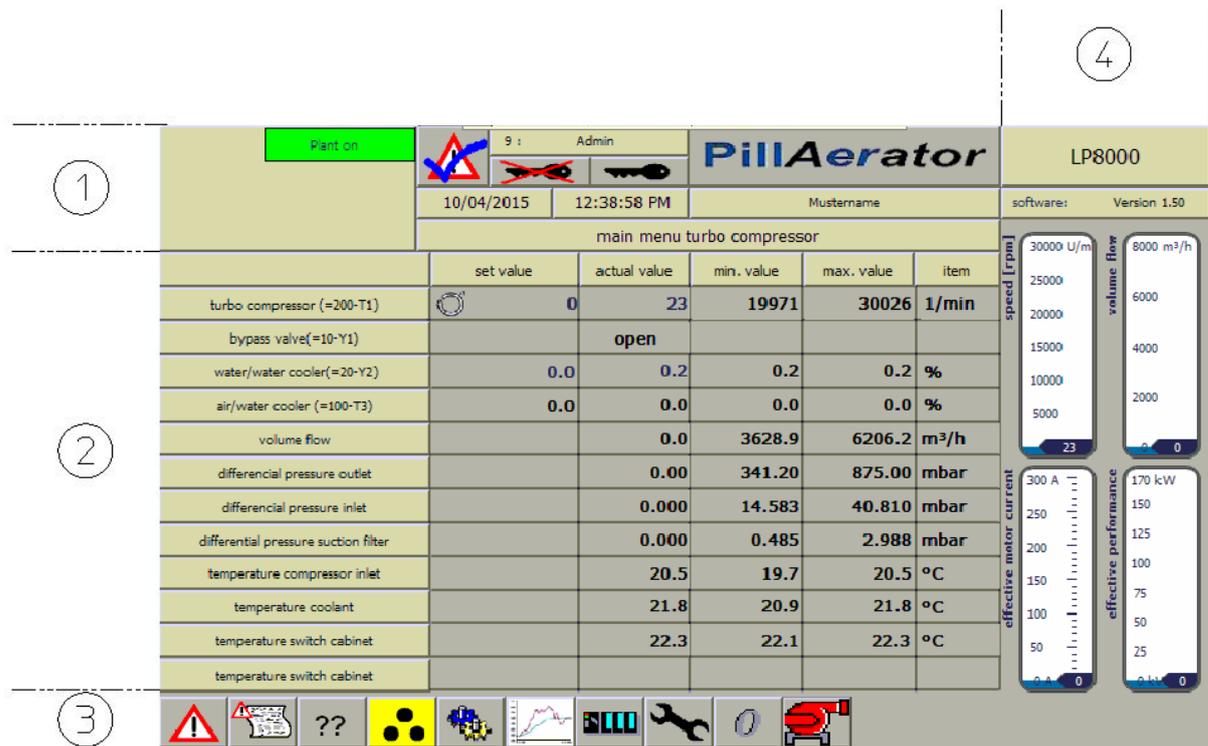
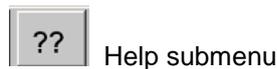


Figure 48: Screen setup



7.6.4.2 Help

The functions of all of the buttons are explained in the "Help" menu (Figure 49).

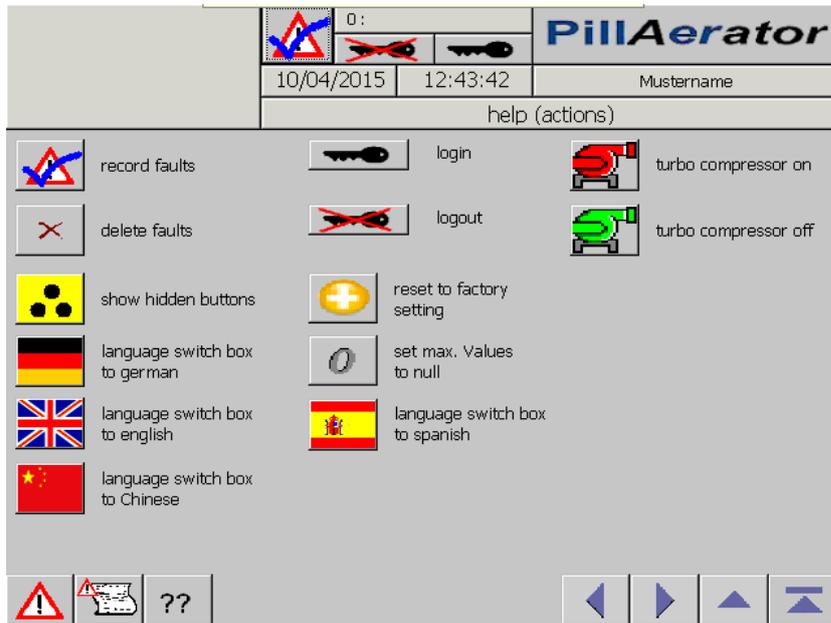


Figure 49: Help



Browse the pages of the menu



Switch to the higher-level menu



Switch to the main menu

7.6.4.3 Logging the user on and off

The PillAerator starts with the standard user profile "0", which only permits the input of target values, the selection of the control type, and the resetting of fault messages. Beyond this, it is a pure observer profile. The "Administrator" user profile (Password: admin) is required to change parameters and other settings. The log-in dialog is accessed by the log-in button in the static part of the display or an automatic log-in request is issued whenever a password-protected value is selected. (Figure 50).



Log-in button

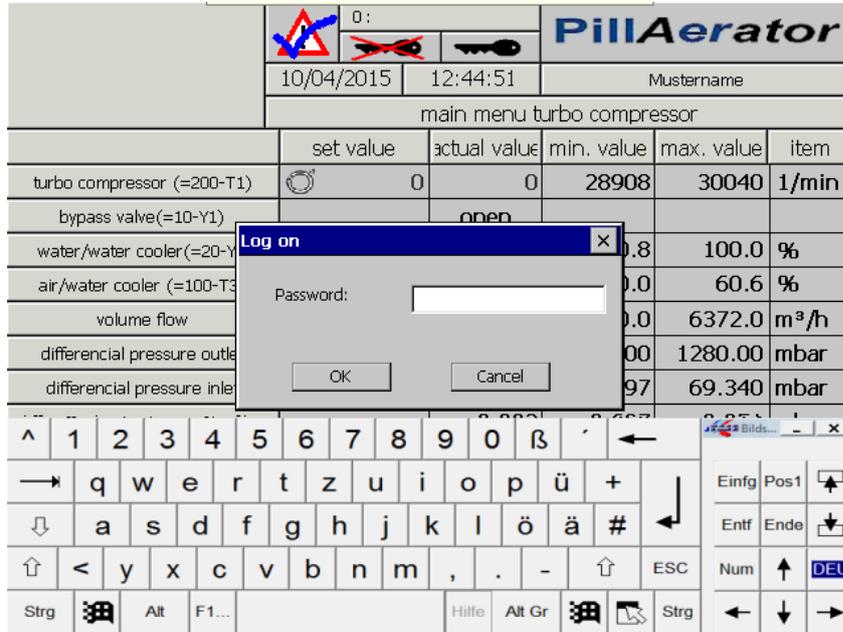
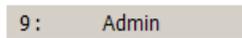


Figure 50: User log-in

The password is entered by the screen keyboard and by pressing the "OK" button. The user "9: Admin" is displayed as the current user profile when the log-in is successful.



Adjusting the system parameters can cause the PillAerator to malfunction!



Log-out button

The standard user profile is automatically activated if an hour passes with no input being made by the touch panel.

7.6.4.4 Message indicator and message window

The message indicator [1] appears in the top left corner of the screen when warnings and/or malfunctions occur during operation, (Figure 51). The number in the message indicator is the number of unacknowledged warnings and malfunctions. The associated messages are shown in the message window [2] at the same time. The message indicator can be activated to fade the message window in and out. The message window can alternatively be faded out by clicking the "X" in its header.



Acknowledging warnings and malfunctions

See Section 7.6.4.9 for detailed information on the "acknowledge" topic..

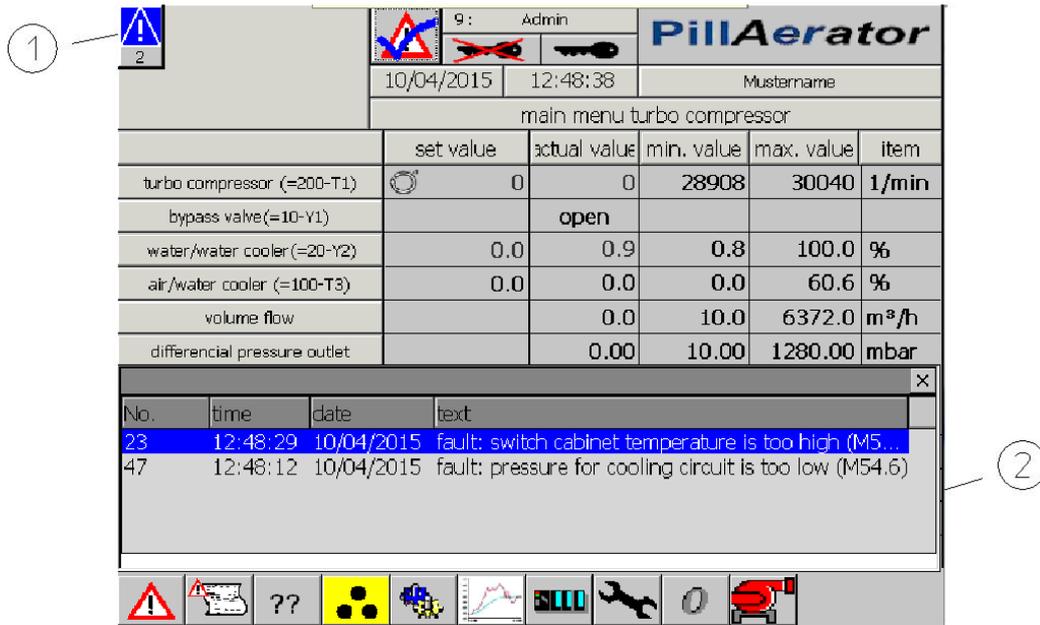


Figure 51: Online message display

7.6.4.5 Invisible buttons

The visualization button is faded into all of the menus where "invisible buttons" are present. "Invisible buttons" are buttons in the variable image area which cannot be directly recognized as such. Pressing the visualization button causes the "invisible buttons" to be highlighted in turquoise (Figure 52).

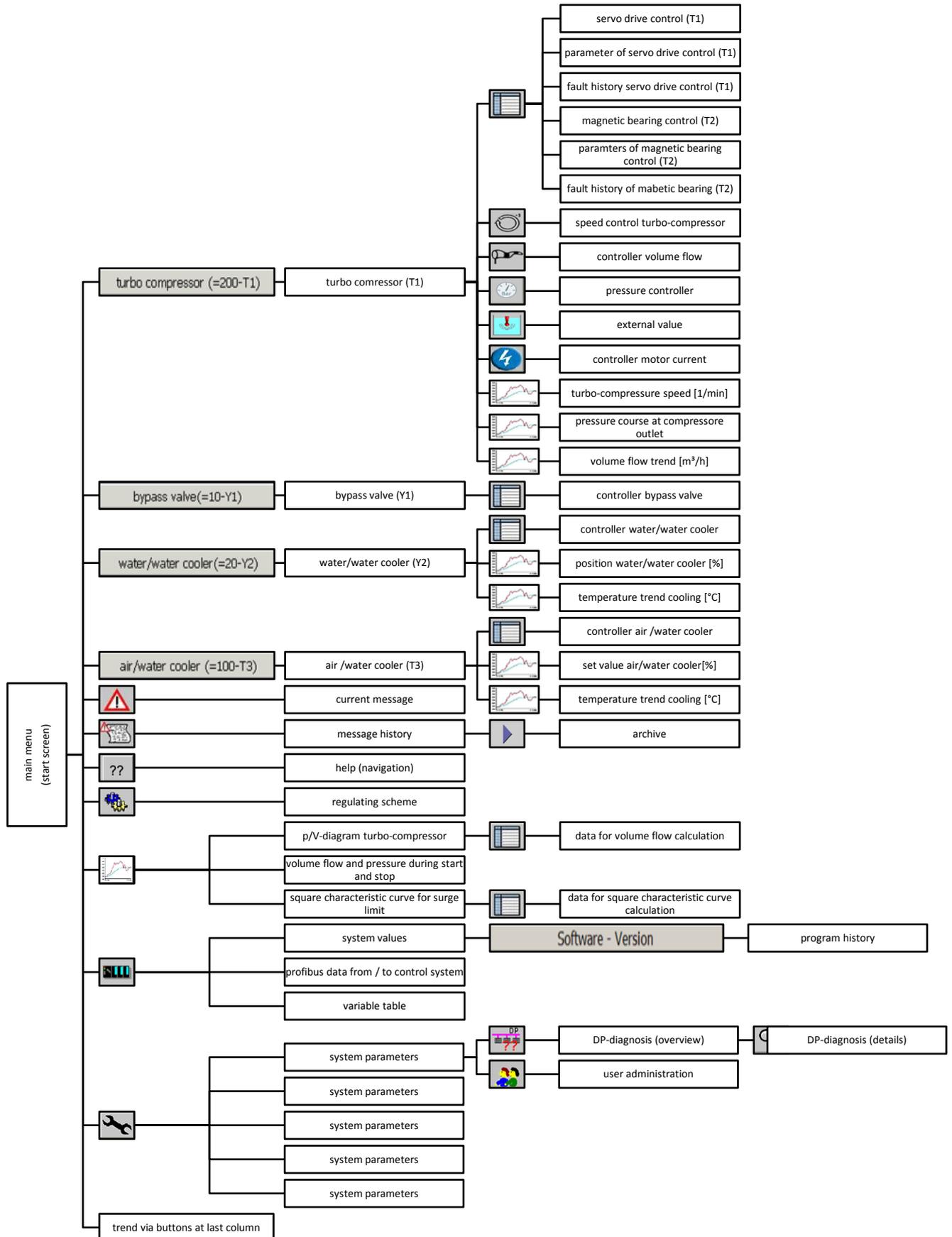
		0:		PillAerator	
		10/04/2015	12:46:17	Mustername	
main menu turbo compressor					
	set value	actual value	min. value	max. value	item
	0	0			
		open			
	0.0	0.9			
	0.0	0.0			
		0.0			
		0.00			
differential pressure inlet		0.000			
differential pressure suction filter		0.017			
pressure cooling circuit		1965.3			
temperature compressor inlet		19.2			
temperature coolant		20.8			
temperature switch cabinet		21.7			

Figure 52: Display of the main menu with highlighted "invisible buttons".



Visualization button

7.6.4.6 Menu structure



7.6.4.7 Main menu turbo compressor

The "main menu turbo compressor" appears on the touch panel once the PillAerator has been made operational. The current PillAerator data are displayed as target and actual values. The maximum and minimum values are additionally displayed for certain measurement and system values (Figure 53).

					
10/04/2015 12:40:40 Mustername					
main menu turbo compressor					
	set value	actual value	min. value	max. value	item
turbo compressor (=200-T1)		0	0	28908	30040 1/min
bypass valve(=10-Y1)		open			
water/water cooler(=20-Y2)		0.0	0.9	0.8	100.0 %
air/water cooler (=100-T3)		0.0	0.0	0.0	60.6 %
volume flow		0.0	10.0	6372.0	m³/h
differential pressure outlet		0.00	10.00	1280.00	mbar
differential pressure inlet		0.000	41.597	69.340	mbar
differential pressure suction filter		0.022	0.687	2.351	mbar
pressure cooling circuit		1965.9	854.7	2914.9	mbar
temperature compressor inlet		19.1	15.9	28.4	°C
temperature coolant		20.5	18.9	40.7	°C
temperature switch cabinet		21.4	20.4	27.1	°C

Figure 53: main menu turbo compressor

turbo compressor (=200-T1)	Turbocompressor submenu (=200-T1)
bypass valve(=10-Y1)	Bypass valve submenu (=10-Y1)
water/water cooler(=20-Y2)	Water/water cooler submenu (=20-Y2)
air/water cooler (=100-T3)	Air/water cooler submenu (=100-Y3)

The "Max. value" column contains "Invisible buttons" which can be used to display the associated values as a graphical trend.

The following operating mode symbols are faded into the "set value" column (Figure 54) if they were previously activated in the corresponding submenu (e.g. turbo compressor (=200-T1)).

	set value	actual value	min. value	max. value	item
turbo compressor (=200-T1)		0	0	28908	30040 1/min
bypass valve(=10-Y1)		open			
water/water cooler(=20-Y2)		0.0	0.9	0.8	100.0 %
air/water cooler (=100-T3)		0.0	0.0	0.0	60.6 %
volume flow		0.0	10.0	6372.0	m³/h

Figure 54: Display of the operating modes

Turbo compressor (=200-T1)

-  Speed control active
-  Volumetric flow rate control active
-  Pressure control active
-  Actual value control active

Bypass valve (=10-Y1)



Manual mode active

No symbol appears when normal mode is active.

Water/water cooler (=20-Y2)



Manual mode active. Target value can also be entered as an opening angle in percent.

No symbol appears when normal mode is active.

Air/water cooler (=100-Y3)



Manual mode active. Target value can also be entered as a speed specification in percent.

No symbol appears when normal mode is active.

7.6.4.8 Turbo compressor (=200-T1)

The "Turbo compressor" menu (Figure 55) can be accessed from the "Turbocompressor main menu" by pressing the



button. A choice can be made among speed control, pressure control, volumetric flow rate control or external actual value control and the corresponding target values specified unless they are meant to be taken over by an external control system.

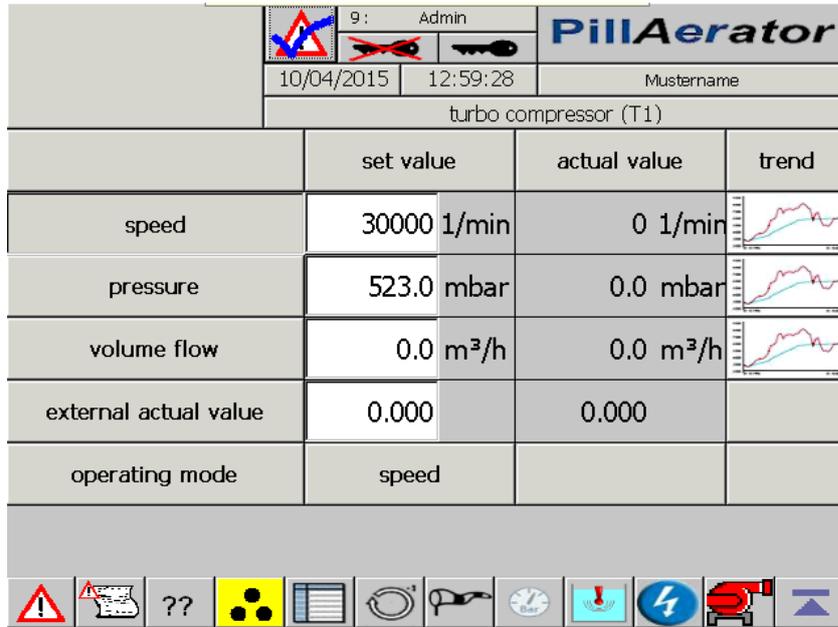


Figure 55: Turbo compressor (=200-T1)

The following buttons are used to select the operating mode.

- Speed control selection
- Pressure control selection
- Volumetric flow rate control selection
- External actual value control selection

The selected operating mode can then be recognized by the sunken button. Typing on the target value field produces an on-screen keypad (Figure 56) which can be used to enter the target value on the touch panel. The input is concluded by pressing the return key.



Figure 56: Inputting the target value for the PillAerator

Once the operating mode has been selected, it is displayed in the "Turbo compressor main menu" with the corresponding symbol [1], [2], [3] or [4] on the right-hand side next to the turbo compressor field (=200-T1).



Buttons display (submenus)



Switch to the "Servo drive controller (=200-T1)" menu



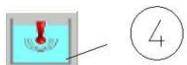
Switch to the "Turbo compressor speed control" menu



Switch to the "Volumetric flow rate" menu



Switch to the "Pressure control" menu



Switch to the "External actual value control" menu



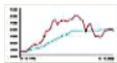
Switch to the "Motor current control" menu



Activation of the PillAerator, when it is not enabled by an external signal.



Deactivation of the PillAerator, when it is not enabled by an external signal.



Switch to the trend menu for measurements

7.6.4.9 Acknowledge current messages and warning/malfunction

The "current messages" menu (Figure 57) can be accessed from the other menus by pressing the



button in the navigation bar. The currently pending warnings and malfunctions are displayed with date and time. The meaning of the message texts and the actions required for eliminating the warnings and malfunctions are described in Section 8.

No.	time	date	text
23	13:29:06	10/04/2015	Fault: switch cabinet temperature is too high (M53.6)
47	13:28:56	10/04/2015	Fault: pressure for cooling circuit is too low (M54.6)

Figure 57: Current messages



Acknowledging warnings and malfunctions

Warnings do not need to be acknowledged. They disappear automatically from the current message display when the corresponding condition is no longer met. Malfunctions **must be acknowledged**.

CAUTION *Make certain that the cause has been eliminated before acknowledging the malfunction.*

Messages with a number greater than 1000 contain system malfunctions. Report system malfunctions to the regional sales office immediately.

7.6.4.10 Message history

Accessing:

The "Message history" menu (Figure 58) can be accessed from the other menus by pressing the



button in the navigation bar. This historical sequence of warning, malfunction and system messages is displayed with time and date. A maximum of 500 messages is displayed before the oldest message is overwritten by each new message. The meanings of the message texts of warnings and malfunctions are described in Section 8.

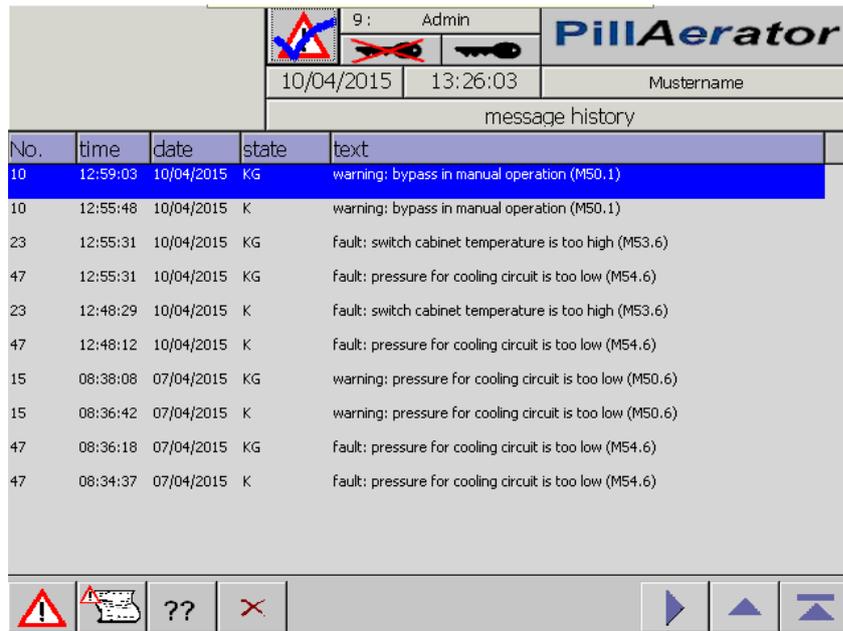


Figure 58: Message history



Delete the message history. A log-in as "9: Admin" is required.



Switch to the "Archive" menu

7.6.4.11 Control diagram

The simplified P&I diagram (Figure 59) can be accessed from the "Turbo compressor main menu" by pressing the



button in the navigation bar. All of the PillAerator's essential components are displayed along with the sensors and their latest measurements.

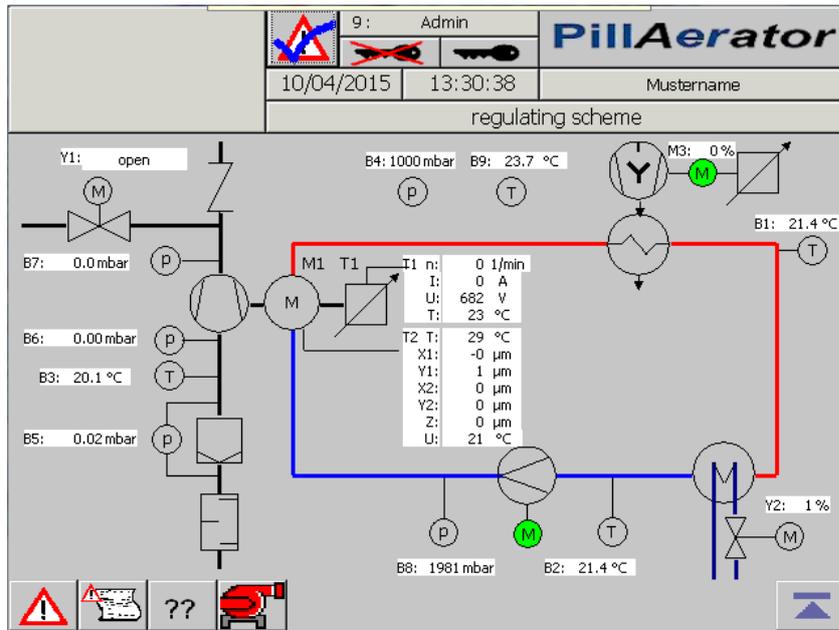


Figure 59: regulating scheme

NOTE

The specified measurements are required for the most diverse standard processes within the PillAerator control unit. They may not be used as evidence of guaranteed performance and characteristic diagram values. Solely those performance values determined on a standardized test bed can be used for this purpose.



Activation of the PillAerator, when it is not enabled by an external signal.



Deactivation of the PillAerator, when it is not enabled by an external signal.

Displayed sensors (measuring range):

- B1 ¹: Temperature [°C] in the cooling circuit downstream of the air/water cooler (-50 – 150 °C)
- B2: Temperature [°C] in the cooling circuit downstream of the water/water cooler (-50 – 150 °C)
- B3: Temperature [°C] at the compressor inlet (-50 -150 °C)
- B4: Ambient air pressure [mbar] (0 – 1600 mbar)
- B5: Differential pressure [mbar] over the suction filter (-80 – 0 mbar)
- B6: Pressure [mbar] at the compressor inlet (-170 – 0 mbar)
- B7: Pressure [mbar] at the compressor outlet (0 – 1.6 mbar)

¹ HP4000, MP6000, LP8000 Not applicable for serial number 8198337 and higher

- B8²: Pressure [mbar] in the cooling circuit (0 – 4000 mbar)
- B9: Temperature [°C] in the control cabinet (0 – 150 °C)
- M3: Speed [%] of the air fan on the air/water cooler (0 – 100 %)
- T1: Frequency converter
 - n: Speed [rpm] of the compressor motor
 - I: Motor current [A]
 - U: Intermediate circuit voltage [V]
 - T: FU cooling body temperature [°C]
- T2: Magnetic bearing control unit
 - T: Magnetic bearing temperature [°C]
 - X1: Orbit [µm] level X1
 - Y1: Orbit [µm] level Y1
 - X2: Orbit [µm] level X2
 - Y2: Orbit [µm] level Y2
 - Z: Orbit [µm] level Z
 - KTY: Motor temperature [°C]
- Y1: Bypass valve status (open, closed)
- Y2: Position [%] of the proportional valve on the water/water cooler (0 – 100 %)
(0 % = closed, 100 % = open)

² HP4000, MP6000, LP8000 Replaced by pressure switch for serial numbers 8198337 and higher.

7.6.4.12 p/V diagram of the turbo-compressor

The " p/V diagram turbo-compressor " menu (Figure 60) can be accessed from the "Turbo compressor main menu" by pressing the



button in the navigation bar. The PillAerator's currently measured operating point (red cross) and its standardized operating point (green cross) are displayed by symbolic crosses. The values for the pressure increase and the volumetric flow rate are displayed on the axes of the graphs in the output fields. The p/V diagram additionally includes graphical information about the PillAerator's surge line (red characteristic curve).

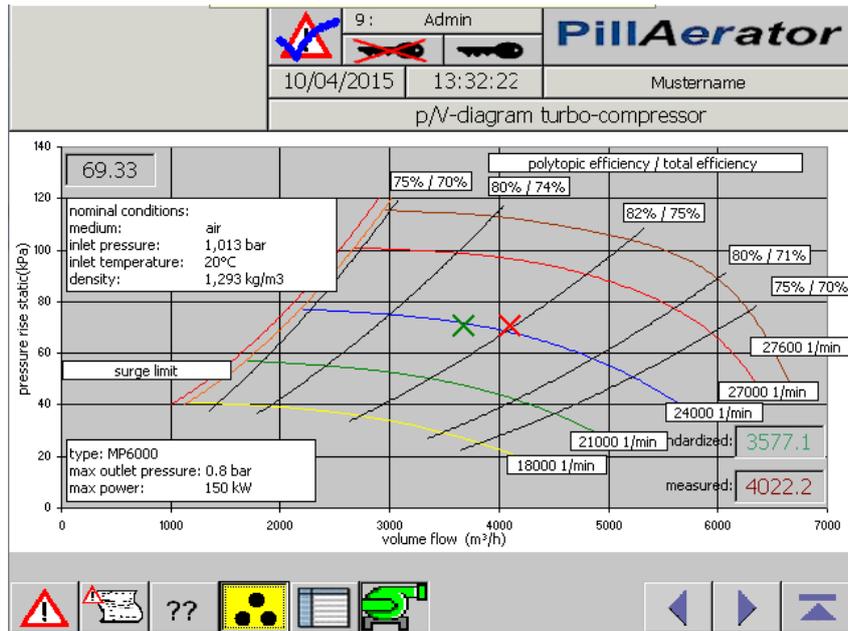


Figure 60: p/V-Diagram turbo-compressor



Display of the efficiency and speed information



Switches to the "Data for calculating the volumetric flow rate" menu.

NOTE

The volumetric flow rate computed from the measurements is accurate to a tolerance of +/- 5 %. The tolerance value is based on a volumetric flow rate measurement in accordance with ISO 5167.

7.6.4.13 System values

The "System data" menu (Figure 61) can be accessed from the "Turbo compressor main menu" by pressing the



button in the navigation bar.

The menu contains the following system data:

- Installation site *(can be changed with administrator rights)*
- PillAerator GmbH order number *(can be changed with administrator rights)*
- Drawing number of the wiring diagram
- Software version
- License number for the remote maintenance software
- System operating hours (system switched on)
- PillAerator operating hours *(PillAerator switched on)*
- Air volume transported by the turbo compressor
- Consumed electrical energy
- Current PLC cycle time
- Minimum PLC cycle time
- Minimum PLC cycle time

description		value	item
place of installation		Mustername	
order number		41500109.040	
machine number		8198335	
software version		Version 1.35	
Sm@rtService licence no.		00411000211081806236	
operating hours system		0 0 1 11 26	y-m-d-h-m
operating hours turbo compressor		0 0 0 19 3	y-m-d-h-m
discharged air quantity		94.418,183 m³	
total power input		2.543,074 kWh	
cycle time (min, cur, max)		4 6 13	ms

Figure 61: System values

7.6.4.14 System parameters

The "System parameters" menu (Figure 62) can be accessed from the "Turbo compressor main menu" by pressing the



button in the navigation bar.

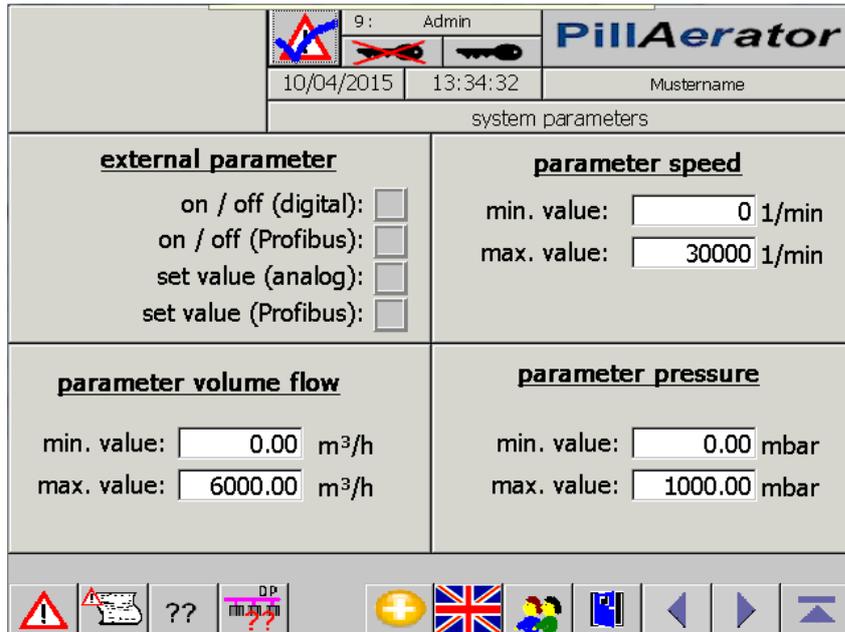


Figure 62: System parameters



Switch to the "DP diagnostics (overview)" menu



The current touch panel language is German. Language switching to English, Chinese, French, Spanish, Russian, Hebrew and German.



Restore default setting (Administrator profile required)



Switch to the "User administration" menu

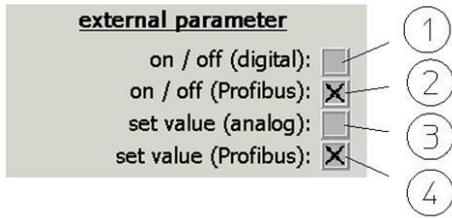


End the program (Administrator profile required)



Browse the pages of the menu

The following system parameters must be set depending on the operating mode.



The function can be activated by selection.

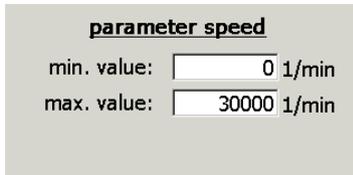
- [1] activated: Enabling by external "hard wired" signal
- deactivated: Enabling from the touch panel (red compressor symbol)
- [2] activated: Enabling by Profibus or "hard wired" (or link)
- deactivated: Enabling from the touch panel

Figure 63: external parameter

deactivated:

- [3] activated: Target value via analog signal (for terminal, see Table 9)
- deactivated: Target value via touch panel

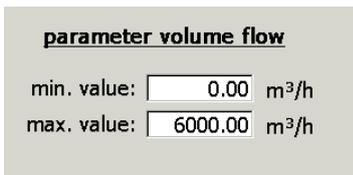
- [4] activated: Target value via Profibus
- deactivated: Target value via touch panel



Scaling of the external "speed" target value for speed control.

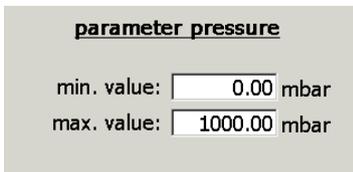
Figure 64: parameter speed

If the "Speed control" mode (Figure 55) and the "analog" or "Profibus" target value specification type (Figure 63) have been selected, then the "Speed specification" target value (Figure 64) must be scaled. The minimum and maximum speed values must be assigned to the analog signal (4-20 mA) or the Profibus signal (0-100%). The corresponding scaling must also be assigned for the "Volumetric flow rate specification" and the "Pressure specification".



Scaling of the external "Volumetric flow rate" target value for volumetric flow rate control.

Figure 65: parameter volume flow



Scaling of the external "Pressure" target value for volumetric flow rate control.

Figure 66: parameter pressure

external set point

min. value:

max. value:

Figure 67: external set point

Scaling of the external target value for the external actual value control.

external actual value

min. value:

max. value:

Figure 68: external actual value

Scaling of the external actual value for the external actual value control.

compressor speed

warning limit: 1/min

disturbance limit: 1/min

shut-down speed: 1/min

run-up speed: 1/min

Figure 69: compressor speed

Specification for the shut-off and start-up speed.

Shut-off speed: Is the speed at which the PillAerator brakes with its standard ramp before it reaches a complete standstill with an emergency stop ramp. If the shut-off speed is specified as '0', then the emergency stop is only executed when a fault occurs and not for a normal shutdown.

Start-up speed: Is the speed at which the PillAerator operates immediately after starting in order to achieve the pressure increase required by the system.



The speed's "warning limit" and "fault limit" parameters may only be changed by PillAerator service technicians.

start-up delay and shut-down delay

bypass valve closed ms

bypass valve open ms

Figure 70: start-up and shut-down delay

Specification of the lead time and stopping time for the bypass valve

Bypass valve closed: The time following the startup of the PillAerator before the bypass valve closes.

Bypass valve open: The time for which the PillAerator continues to operate with an open bypass before it reduces the speed following a loss of the enabling signal (shut-off).



The other system parameters may only be changed by PillAerator service technicians.

7.6.4.15 Profibus data from/to the control system

The "Profibus data from/to the control system" menu (Figure 71) can be accessed from the "System data" menu (Figure 61) by

pressing the 

button. The individual control and status bits which the PillAerator uses to communicate with a customer control system through the PROFIBUS-DP are displayed. The target value and three actual values are also displayed.

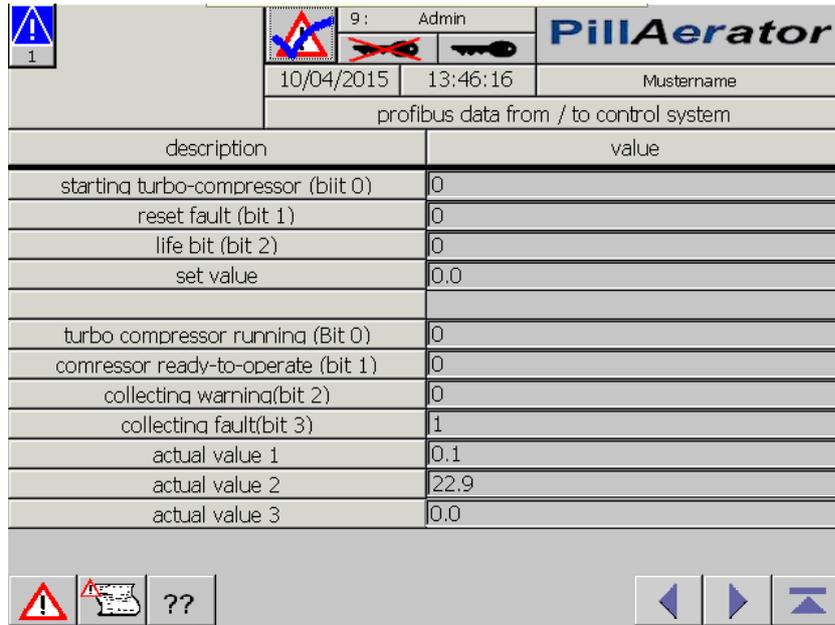


Figure 71: Profibus data from/to the control system

The meaning of the target value depends on the selected PillAerator operating mode.

Operating mode	Meaning of the target value
Speed control	Speed
Volumetric flow rate control	Volumetric flow rate
Pressure control	Pressure increase
External actual value control	External actual values

This menu can assist in checking the Profibus communication of the PillAerator with the system. The signals to and from the control system are described in Table 14.

Signal path	Designation	BP address	Signals	Meaning
Signal from the control system to the PillAerator	Enabling of turbo compressor (Bit 0)	1000.0	0	Not enabled (PillAerator stops).
			1	Enabled (PillAerator starts).
	Reset error (Bit 1)	1000.1	0	Not activated, error is not reset.
			1	Activated, error is reset.
	Live bit (Bit 15)	1001.7	0	The live bit must be switched on (1) and off (0) with clocking at 0.5 Hz. If the control unit does not detect any change in the live bit for at least 2 seconds, then the PillAerator is stopped and a fault message generated.
			1	
Target value	1002	Real number	Depends on the mode selected or the target value specified by the control system.	
Signal from the PillAerator to the control system	Turbo compressor is operating (Bit 0)	1000.0	0	PillAerator is not running (the motor is stopped).
			1	PillAerator is running (the motor is rotating).
	Turbo compressor operational (Bit 1)	1000.1	0	PillAerator is not operational (when Bit 0 = 0) or is running (when Bit 0 = 1).
			1	PillAerator operational (ready to start).
	Collective warning (Bit 2)	1000.2	0	No warning is pending.
			1	At least one warning is pending.
	Collective fault (Bit 3)	1000.3	0	No fault is pending.
			1	At least one fault is pending.
	Actual value 1	1002	Real number	External target value
	Actual value 2	1006	Real number	Speed
Actual value 3	1010	Real number	Motor current	

Table 14: Profibus data from/to the control system

Description of the signals:

Digital input and output signals are provided in parallel with the control and status bits for the PROFIBUS-DP communication.

If the external "On/Off (Profibus)" [2] specification has been selected in the "System parameters" menu (Figure 63), then the live bit of the PROFIBUS-DP communication is used to enable the PillAerator. In contrast, the floating digital input for switching the PillAerator on and off is used when "On/Off (digital)" [1] is selected.

In order to specify the target value, the user must specify either the analog input [3] or the PROFIBUS [4] in the menu mentioned above. If neither analog nor PROFIBUS is selected, then the touch panel target value is used to control the PillAerator.

7.6.5 Surge line protection

The PillAerator is equipped with various protective devices to prevent operation in prohibited ranges of its characteristic diagram (surge line).

Control characteristic curve:

A control characteristic curve based on the type is stored in the PillAerator's control unit (volumetric flow rate as a function of pressure). When this line is fallen short of, the currently pending target value is ignored and the current actual value adopted as the target value instead. A further reduction in the target value is therefore no longer possible. The PillAerator doesn't react again to the entered target value until it is greater than the "frozen" target value.

Surge line characteristic curve:

A surge line characteristic curve based on the type is stored in the PillAerator's control unit (volumetric flow rate as a function of pressure). When this line is fallen short of, the PillAerator is shut off before it can start to pump. The "Fault: Surge line reached (M54.4)" message is output in the touch panel.

Orbit monitoring:

The PLC cycle times may cause a delay in the shutdown (M54.4) when the surge line curve is fallen short of very quickly. The "surging" phenomena causes collisions with the impeller and the shaft. These cause very minimal position changes in the shaft which are recorded by the sensors of the magnetic bearing electronics. The PillAerator is shut off when the position limits are exceeded. The "Fault: Magnetic bearing =200-T2, Warning: Orbit exceeded (M52.3)" is output in the touch panel.

7.7 Configuration

The system-specific parameters must be set on the touch panel before the PillAerator is operated for the first time (See the parameter list in Section 18, system-specific parameters are highlighted in gray).

The system-specific parameters are input in the "System parameters" menu (see Section 7.6.4.14).

Depending on how the PillAerator is to be controlled, the target value and/or actual value must first be scaled. The scaling can only be foregone when the PillAerator is operated in manual mode or with pressure control using a fixed target value. The minimum and maximum values for the target value must be specified when the machine is operated with speed control, volumetric flow rate control or pressure control using an external target value

Scaling of the external actual value is only required when this value is used for system control. The principle is identical to that used for specifying the target value.

The "External specification" menu item (Figure 63) is used to activate the control with an external target value. The corresponding function must be activated, depending on whether the value is analog or provided by Profibus. The compressor can only be operated in manual mode by the input on the touch panel when no function is activated for the external target value.

Parameters which have been entered incorrectly can be restored to the default setting by pressing the



button (see Section 7.6.4.14).

7.8 The first test run

Open all of the valves in the suction and discharge lines.



A closed pipeline on the suction or discharge side can cause damage to the PillAerator.

NOTE The first test run should always be performed in manual mode.

External specifications (Figure 72): Deactivate all menus

external parameter

on / off (digital):

on / off (Profibus):

set value (analog):

set value (Profibus):

Figure 72: External parameter

Start-up speed (Figure 73): 0

Shut-off speed (Figure 73): 0

compressor speed

warning limit: 1/min

disturbance limit: 1/min

shut-down speed: 1/min

run-up speed: 1/min

Figure 73: Compressor speed

Bypass valve target value mode (Figure 74): Manual

Bypass valve target value position (Figure 74): Open

bypass valve(Y1)			
	set value	actual value	trend
position	open	open	
operating mode	hand		

No.	time	date	text
10	13:49:18	10/04/2015	warning: bypass in manual operation (M50.1)

Figure 74: Bypass in hand mode

Operating mode (Figure 75): Speed control

Speed target value (Figure 75): 5000 rpm

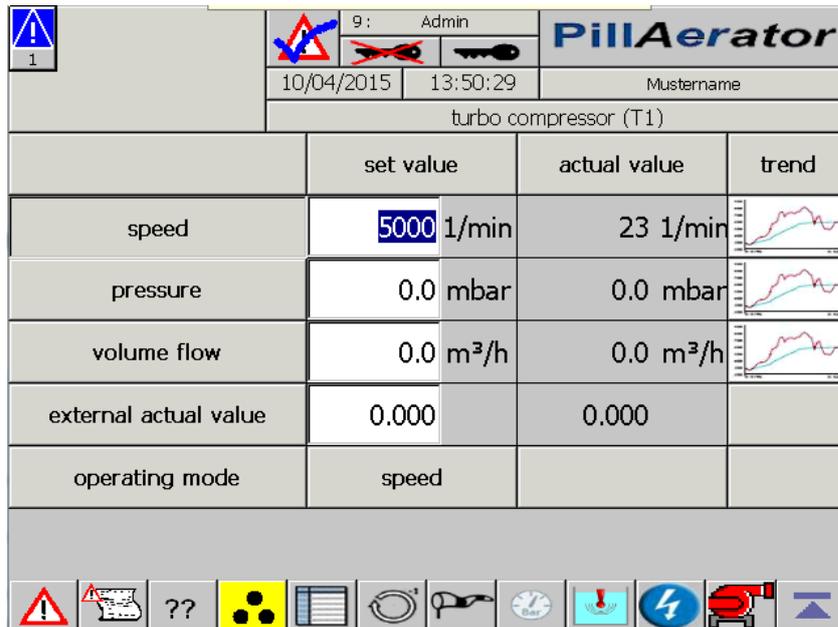


Figure 75: Speed control

Press the red compressor symbol to start the PillAerator.



The PillAerator starts up and increases its speed to 5000 rpm.

If a static initial pressure must be overcome in the pipeline, then the PillAerator is probably not yet feeding the pipeline. The conveyed volumetric flow will simply be blown out through the bypass valve until the PillAerator achieves the system's static initial pressure. The current operating point can be tracked in the "p/V Diagram turbo-compressor" menu.

Now increase the speed until the pressure barely continues to rise. The primary result of a continued speed increase should now be an increase in the volumetric flow rate.

NOTE *With types HP4000, MP6000 and LP8000, the intake temperature can increase so greatly in prolonged bypass mode that a fault occurs (Fault message: Temperature in the compressor inlet too high (M54.7)). In this case, the test must be interrupted until the temperature limit for the fault is again fallen short of.*

This indicates that the PillAerator has overcome the system's static initial pressure and is now feeding into the system. This reveals the pressure level which must be overcome to ensure reliable conveyance to the system. The pressure can be read in the "p/V Diagram turbo-compressor" menu.

Press the green compressor symbol to stop the PillAerator.



The first test run is now completed.

The start-up speed can now be specified. A value must be selected which ensures that the system's static initial pressure will be reliably overcome without the PillAerator reaching its power limit. Round up the determined pressure increase to the next tenth (unit is kPa). The start-up speed must be determined in accordance with Table 15.

Pressure increase [kPa]	Start-up speed				
	HP4000	MP6000	LP8000	HP9000, MP12000	LP14000
30	15650	17120	17900	11130	11650
40	17460	19210	20660	12710	13360
50	19270	21220	23010	14040	14800
60	21120	22870	25110	15260	16000
70	22770	24400	27060	16330	17120
80	24240	25820	28960	17330	18090
90	25490	27153		18240	19040
100	26710	27980		19120	19900
110	28020	28800		19870	20700
120	29510			20720	

Table 15: Start-up speed

Enter the specified start-up speed in the "Startup speed" field (Figure 73).

This causes the control unit to initially run at the start-up speed when the PillAerator is activated before it switches over to the normal control mode.

Bypass valve: convert to automatic (Figure 74)

We recommend starting the PillAerator one more time with speed control to check whether the start-up speed has been correctly selected. A high target value for the speed must now still be selected from the very beginning to ensure that the PillAerator does not travel to the surge line when the start-up speed is reached with a closed bypass. Select the same value as for the start-up speed.

The bypass valve closes automatically when the corresponding volumetric flow rate has been reached.

Once the test run is completed, the PillAerator can be integrated in the system control unit and operated in the desired mode.

7.9 Commissioning checklist

Customer:

Date:

PillAerator type:

Serial number:

No.	Description	Completed	Not completed	Does not apply
Before commissioning				
1.	Check for transport damage (feet, Emergency-Stop switch, panel, paint damage).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Compressor cabinet stands straight (Doors are straight, maximum deviation from the horizontal 2%, housing flange does not touch the compressor cabinet, all feet are loaded)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	The mains voltage is shut off. Zero voltage ensured.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Main switch installed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Suction channel installed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Discharge side of the pipeline connected	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	Transition piece, capacitor and check valve installed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	Transition piece, capacitor and check valve insulated	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9.	Supply and return flow for external cooling water connected	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.	Mains connection established	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.	Protective earth connected	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12.	Cable conduit for mains connection and control line installed with cable screw connections	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13.	Analog data link established	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14.	Data link via Profibus established	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15.	Ethernet connection established between the PillAerators	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.	Emergency-Stop wiring established	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17.	Cable conduit covers intact	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

No.	Description	Completed	Not completed	Does not apply
Before commissioning				
18.	Torques checked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19.	Mains voltage checked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20.	Clockwise rotary field checked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21.	Fuses and motor protection circuit breakers switched on	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22.	Cooling circuit pressure 0.8 bar (when the system is off)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23.	Check the parameters (see parameter list)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24.	Target and actual values scaled	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25.	Check the contact with the control center / customer control unit (target value, actual value, enabling,...)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26.	Checked whether all desired information arrived at the control center	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27.	Checked whether all of the valves in the system are open	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28.	Customer-specific parameters (start-up speed, controller settings) adapted	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29.	Remote control set	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30.	Connection to PillAerator GmbH checked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Table 16: Commissioning checklist

8. Faults / Fault clearance

8.1 General warning and fault messages

Code	Message	Fault clearing actions
M50.0	Warning: Function venting coolant is active (M50.0)	The function must be shut off again on the touch panel.
M50.1	Warning: Bypass in manual operation (M50.1)	Switch the bypass valve control back to control mode on the touch panel.
M50.2	Warning: Compressor at the speed limit (M50.2)	Reduce target value or don't increase it further.
M50.3	Warning: Compressor at the power limit (M50.2)	Do not further increase the target value.
M50.5	Warning: Differential pressure at suction filter is too high (M50.5)	Check the suction filter for contamination and replace if necessary (Section 0). The message goes out when the differential pressure falls below the warning value.
M50.6	Warning: Pressure for cooling circuit is too low (M50.6)	Check the cooling circuit for leaks. Increase the pressure in the cooling circuit (Section 9.2). The message goes out when the pressure rises above the warning value.
M50.7	Warning: compressor inlet temperature is too high (M50.7)	Check the inlet conditions (Section 4.2). The warning may also occur after the compressor has been stopped and can then be ignored. The message goes out when the temperature falls below the warning value.
M51.0	Warning: coolant temperature is too high (M51.0)	Check the intake grill of the air/water heat exchanger for clogging. Check the ambient temperature (Section 4.2). Provide external cooling water (Section 4.3). The message goes out when the temperature falls below the warning value.
M51.1	Warning: cabinet temperature is too high (M51.1)	Check the temperature in the control cabinet. Check the ambient temperature (Section 4.2). The message goes out when the temperature falls below the warning value.

Code	Message	Fault clearing actions
M51.2	Warning: nominal value for compressor reduced (M51.2)	The PillAerator is running at the power limit. Check the target value for the current operating mode. The message goes out when the motor current falls below the warning value.
M51.3	Warning: sinus filter temperature is above 120°C (M51.3)	Replace the filter in the cooling air inlet grille (Section 9.3.1). The message goes out when the temperature falls below the warning value.
M51.4	Warning: differential pressure at outlet is too high (M51.4)	Check the system (valves, piping) or parameters. The message goes out when the pressure falls below the warning value.
M51.5	Warning: redundant safety bearings partially damaged (M51.5)	The safety bearings must be replaced. Please contact your regional sales office immediately. Additional crashing of the shaft in the safety bearing can cause damage to the motor and invalidate the warranty.
M51.6	Warning: Cabinet fan = 030-M4 (M51.6)	Arrange for a PillAerator service technician to determine and eliminate the causes of the fault message. The cause can be either the Q4 switch-on contact or the Motor's M4 thermal contact. The message must be acknowledged by the operator on the touch panel.
M51.7	Warning: Cabinet fan = 030-M5 (M51.7)	Arrange for a PillAerator service technician to determine and eliminate the causes of the fault message. The cause can be either the Q5 switch-on contact or the Motor's M5 thermal contact. The message must be acknowledged by the operator on the touch panel.
M52.0	Fault: emergency stop (M52.0)	Check whether the reason for the Emergency-Stop has been eliminated and whether the Emergency-Stop switch was then unlocked. Press the "Acknowledge Emergency-Stop" button to reset the fault (Section 7.6.2).
M52.1	Fault: 24V fuse =050-F11 + F12 (M52.1)	Arrange for a PillAerator service technician to determine why the fuses have tripped and to eliminate the causes. The message must be acknowledged by the operator on the touch panel.
M52.2	Fault: Servo drive control =200-T1	Frequency converter error (Sections 8.3 and 8.4).

Code	Message	Fault clearing actions
M52.3	Fault: Magnetic bearing =200-T2...	Error in the magnetic bearing electronics (See Section 8.5).
M52.4	Fault: Frequency converter =100-T3 (M52.4)	The causes of the errors can be read from the converter's own display. Arrange for a PillAerator service technician to determine and eliminate the causes of the fault message. The message must be acknowledged by the operator on the touch panel.
M52.5	Fault: transformer =010-T9 (M52.5)	The transformer's temperature monitoring triggered this message. Replace the filter in the cooling air inlet grille (Section 9.3.1). Arrange for a PillAerator service technician to determine and eliminate the cause. The message must be acknowledged by the operator on the touch panel.
M52.6	Fault: Turbo compressor =200-M1 (M52.6)	Arrange for a PillAerator service technician to determine and eliminate the causes of the fault message. The message must be acknowledged by the operator on the touch panel.
M52.7	Fault: Coolant pump =101-M2 (M52.7)	Arrange for a PillAerator service technician to determine and eliminate the causes of the fault message. The message must be acknowledged by the operator on the touch panel.
M53.0	Fault: Air/water cooler =100-M3 (M53.0)	Arrange for a PillAerator service technician to determine and eliminate the causes of the fault message. The message must be acknowledged by the operator on the touch panel.
M53.4	Fault: Water/water cooler =20-Y2 (M53.4)	Arrange for a PillAerator service technician to determine and eliminate the causes of the fault message. The message must be acknowledged by the operator on the touch panel.
M53.6	Fault: switch cabinet temperature is too high (M53.6)	Determine and eliminate the cause of the high control cabinet temperature. The message must be acknowledged by the operator on the touch panel.
M53.7	Fault: sinus filter temperature is above 140°C (M53.7)	Arrange for a PillAerator service technician to determine and eliminate the cause. The message must be acknowledged by the operator on the touch panel.

Code	Message	Fault clearing actions
M54.0	Warning: Cabinet fan = 030-M5 (M54.0)	Arrange for a PillAerator service technician to determine and eliminate the causes of the fault message. The cause can be either the Q5 switch-on contact or the Motor's M5 thermal contact. The message must be acknowledged by the operator on the touch panel.
M54.1	Fault: fault in control (M54.1)	Arrange for a PillAerator service technician to determine and eliminate the cause. The message must be acknowledged by the operator on the touch panel.
M54.2	Fault: Compressor at the speed limit (M54.2)	Restart the compressor at a lower speed. Reduce the warning limit for speed monitoring by 100 rpm. The message must be acknowledged by the operator on the touch panel.
M54.3	Fault: Compressor at the power limit (M54.3)	Restart the compressor at a lower speed. Decrease the warning limit for the power limit by 2 %. The message must be acknowledged by the operator on the touch panel.
M54.4	Fault: Surge line reached (M54.4)	Increase the system's minimum valve position. Check the target value scaling (increase the minimum). The message must be acknowledged by the operator on the touch panel.
M54.5	Fault: Differential pressure at the suction filter is too high (M54.5)	Inspect and clean the suction filter (Section 9.3.3). The message must be acknowledged by the operator on the touch panel.
M54.6	Fault: Pressure for cooling circuit is too low (M54.6)	Inspect the cooling circuit. Increase the pressure in the cooling circuit (Section 9.2). The message must be acknowledged by the operator on the touch panel

Code	Message	Fault clearing actions
M54.7	Fault: compressor inlet temperature is too high (M54.7)	The PillAerator is running too long through the bypass valve. The message can be acknowledged when the PillAerator is standing and the temperature has dropped. Starting the PillAerator several times in succession without reducing the temperature can cause its mechanical destruction.
M55.0	Fault: coolant temperature is too high (M55.0)	Check the PillAerator's water cooling system. The message must be acknowledged by the operator on the touch panel.
M55.4	Fault: differential pressure at outlet is too high (M55.4)	Check the system (valves, piping) or parameters. The message must be acknowledged by the operator on the touch panel.
M55.5	Fault: lost connection to servo drive control (M55.5)	Look for and clear the fault in the Profibus communication. The message is automatically reset after the fault has been cleared.
M55.6	Fault: lost connection to magnetic bearings (M55.6)	Look for and clear the fault in the Profibus communication. The message is automatically reset after the fault has been cleared.
M55.7	Fault: interrupted connection to control system (M55.7)	The control system does not detect any signal change in the live bit during the specified monitoring time. Inspect the Profibus cable and connector to the system
M56.0	Fault: temperature sensor at outlet air/water cooler =50-B1 (M56.0)	Check the temperature sensor and the connector cable. The message must be acknowledged by the operator on the touch panel.
M56.1	Fault: temperature sensor at outlet water/water cooler =50-B2 (M56.1)	Check the temperature sensor and the connector cable. The message must be acknowledged by the operator on the touch panel.
M56.2	Fault: temperature sensor at compressor inlet =50-B3 (M56.2)	Check the temperature sensor and the connector cable. The message must be acknowledged by the operator on the touch panel.
M56.3	Fault: pressure sensor for ambient pressure =50-B4 (M56.3)	Check the pressure sensor and the connector cable. The message must be acknowledged by the operator on the touch panel.

Code	Message	Fault clearing actions
M56.4	Fault: differential pressure sensor at suction filter =50-B5 (M56.4)	Check the differential pressure sensor and the connector cable. The message must be acknowledged by the operator on the touch panel.
M56.5	Fault: differential pressure sensor at compressor inlet =50-B6 (M56.5)	Check the differential pressure sensor and the connector cable. The message must be acknowledged by the operator on the touch panel.
M56.6	Fault: differential pressure sensor at compressor outlet =50-B7 (M56.6)	Check the differential pressure sensor and the connector cable. The message must be acknowledged by the operator on the touch panel.
M56.7	Fault: pressure sensor water circuit =50-B8 (M56.7)	Check the pressure sensor and the connector cable. The message must be acknowledged by the operator on the touch panel.
M57.0	Fault: temperature sensor in switch cabinet =50-B9 (M57.0)	Check the temperature sensor and the connector cable. The message must be acknowledged by the operator on the touch panel.
M57.1	Fault: record positioning proportional valve water/water cooler =20-Y2 (M57.1)	Check the valve and the connector cable. The message must be acknowledged by the operator on the touch panel.
M57.2	Fault: external director =50-G1 (M57.2)	Check the wiring. The message must be acknowledged by the operator on the touch panel.
M57.3	Fault: external director =50-G2 (M57.3)	Check the wiring. The message must be acknowledged by the operator on the touch panel.

Table 17: General warning and fault messages

NOTE *Always include the error code in your queries. In addition to this, always include the error number and error location for error codes M52.2 and M52.3. (See Section 8.2)*

8.2 Accessing the error history of the frequency converter and the magnetic bearing electronics.

Not all of the faults in the magnetic bearing electronics and the frequency converter are displayed by the on-line message display (Section 7.6.4.4). The last 4 errors in the magnetic bearing electronics and the frequency converter can be displayed. Proceed as follows for this:

Press the



button in the "turbo compressor" menu (Section 7.6.4.8) to switch to the operating data menu.

Press and hold down the



or



button

until the "fault history servo drive control (T1)" (Figure 76) or "fault history magnetic bearing (T2)" (Figure 77) menu is displayed.

 9 : Admin  PillAerator			
10/04/2015		13:51:53	
Mustername			
fault history servo drive control (T1)			
parameter	fault number	fault location	before(operating hours)
95-ERR1	13	1	1
	13 - E-EXT - external fault message		
96-ERR2	16	172	2
	16 - E-OP2 - fault in module at optional slot 2		
97-ERR2	13	1	8
	13 - E-EXT - external fault message		
98-ERR4	13	1	8
	13 - E-EXT - external fault message		

Figure 76: "fault history servo drive control" menu

The servo drive controller and the magnetic bearing electronics store the last 4 errors in 4 parameters with a time stamp. These parameters are prepared and displayed in the "fault history servo drive control (T1)" and the "fault history magnetic bearing (T2)" operating data menus.

		9 : Admin		PillAerator	
10/04/2015		13:52:45		Mustername	
fault history magnetic bearing (T2)					
parameter	fault number	fault location	before(operating hours)		
95-ERR1	27	0	0		
27 - E-POS - fault at automatic sensor reconciliation					
96-ERR2	0	0	0		
0 no fault					
97-ERR2	0	0	0		
0 no fault					
98-ERR4	0	0	0		
0 no fault					
   					

Figure 77: "fault history magnetic bearing (T2)" menu

NOTE

Always indicate the error number and location of the last 4 errors when making queries or service requests.

8.3 Fault messages of the frequency converter HP4000, MP6000, LP8000

No.	DM/KP	Error location no.	Meaning
0			No error
1	E-CPU		Collective fault message
2	E-OFF	1	Undervoltage in the intermediate circuit
3	E-OC	19	Max. allowable output current exceeded (software shutdown).
3	E-OC	34	Overvoltage shutdown of the servo by the software.
3	E-OC	35	A short circuit was detected during the self test.
3	E-OC	41	Max. allowable output current exceeded (hardware shutdown).
4	E-OV	1	Overvoltage in the intermediate circuit
5	E-OLM	1	Overvoltage shutdown lxlxt monitoring of the motor as a function of parameter MOI2T
6	E-OLI	1	Overvoltage shutdown lxt monitoring of the servo converter
7	E-OTM	1	Excess motor temperature
8	E-OTI	31	Excess temperature of the servo's cooling element
8	E-OTI	32	Excess temperature of the servo's interior
9	E-PLS		Plausibility check detected invalid parameters or program sequence.
10	E-PAR	7	Value range violation of a parameter setting detected. Parameter ERPAR contains the number of the incorrect parameter.
10	E-PAR	8	An invalid parameter value was found after the new initialization of the parameter list in the device's start-up phase. Parameter ERPAR contains this parameter's number.
10	E-PAR	9	Error in the initialization of a parameter with its read-only memory value. Parameter ERPAR contains the parameter's number.
10	E-PAR	13	The combination of the settings of the function selectors for one of the analog inputs and target value selectors is contradictory.
10	E-PAR	16	Error in the initialization of the factors for the analog output on the digital outputs.
10	E-PAR	101	Not possible to set the resolver pole pair number.
11	E-FLT		General error in the floating point computation
12	E-PWR	6	No or unknown power output stage: no valid power output stage detected.
12	E-PWR	8	No or unknown power output stage: no valid power output stage detected.
13	E-EXT	1	Error message of an external device is pending.
14	E-USR	1	Error in the execution of a customer-specific function.

No.	DM/KP	Error location no.	Meaning
15	E-OP1		Error in the option module on slot 1 (X8)
16	E-OP2		Error in the option module on slot 2 (X9)
18	E-SIO	11	SIO Watchdog triggered (LustBus).
19	E-EEP		Error while accessing EEPROM.
	E-SC	20-23	Auto-tuning error
	E-HWE	47	Hardware limit switch interchanged
26	E-OL5		Overvoltage shutdown lxt monitoring of the servo motor at a speed less than 5 Hz
30	E-ENC	1	Rotary encoder wire breakage detection
31	E-TIM		Runtime monitoring error
32	E-FLW	1	Tracking error
33	E-WDG		Error in the SIO communication
34	E-VEC		Initialization error
35	E-BRK	1	Monitoring device for brake output (OSD03) reports error.
36	E-POS		Error in the positioning software
37	E-FLH		Error in the data flash memory
38	E-END		Hardware limit switch responded.
40	E-WRN	59	Torque limit (TCMMX) has been automatically restricted.
40	E-WRN	60	Cycle time of the status message via field bus too small
40	E-WRN	62	Speed limit (SCSMX) has been automatically restricted.
40	E-WRN	255	Permissible load exceeded
41	E-EX1	1	Error message of an external device is pending.
42	E-EX2	1	Error message of an external device is pending.
43	E-EX3	1	Error message of an external device is pending.
44	E-SPM	84	Time until "Target value reached" exceeded
44	E-SPM	85	Shortfall of minimum speed limit
45	E-PFS	1	Speed monitoring during network standby mode.

Table 18: Fault messages of the frequency converter of types HP4000, MP6000, LP8000

The first action taken for clearing the fault should be the deactivation and reactivation of the PillAerator. Shut off the door coupling rotary drive for this. Then wait one minute before switching the PillAerator on again (See Section 7.6.2).

Please contact your regional sales office if the error occurs repeatedly (Section 12).

NOTE *Always indicate the error number and location of the last 4 errors when making queries or service requests (Section 8.2).*

8.4 Fault messages of the frequency converters HP9000, MP12000, LP14000

DM/KP	Fault designation	Meaning
E00001-1...4	E1-Runtime	Runtime error
E00002-1...9	E2-ParaList	Error in the parameter initialization
E00003-1	E3-OFF	Undervoltage
E00004-1	E4-Overvoltage	Overvoltage
E00005-1...7	E5-Overcurrent	Electrical current overload
E00006-1...4	E6-Overheating	Excess motor temperature
E00007-1	E7-Heat sink overheating	Excess cooling element temperature
E00008-1	E8-Interior overheating	Excess temperature of the interior
E00009-1	E9-I ² t motor	I ² t Shutdown to protect the motor
E00010-1	W10 Power stage monitoring	I ² t Shutdown to protect the motor
E00011-1	E11-External error	Error in the magnetic bearing electronics
E00012-1...7	E12-CAN	Error in CAN Option
E00013-1...14	E13-SERCOS	Error in SERCOS Option
E00014-1...3	E14-EtherCad	Error in Ethercat Option
E00015-1...14	E15-Parameter	Parameter error
E00016-1...2	E16-Speed tracking error	Speed tracking error
E00017-1	E16 -Position tracking error	Position tracking error
E00018-1...13	E18-Motion profile	Position tracking error
E00019-1...9	E19-Fatal error	Fatal error (Flash, Memory, CPU)
E00020-1...3	E20-Hardware limit switches	Limit switch interchanged
E00021-1...2	E21-Encoder initialization	Error in the encoder initialization
E00022-1...43	E22-Encoder channel 1 initialization	Error in the encoder initialization
E00023-1...3	E22-Encoder channel 2 initialization	Error in the encoder initialization
E00024-1...50	E24-Encoder channel 3 initialization	Error in the encoder initialization
E00025-1...2	E25-EncoderCycl	Error in the encoder initialization
E00026-1...3	E26-EncC1Cycl	Error in the encoder initialization
E00027-1	E27-EncC2Cycl	Error in the encoder initialization
E00028-1	E28-EncC3Cycl	Error in the encoder initialization
E00029-1...4	E29-TriCore	TriCore error
E00030-1...4	E30-InitCon	Error in the initialization
E00031-1	E31-PLC	Error in the control unit
E00032-1	E32-Profibus	Error in Profibus option
E00033-1...2	E33-Timing	Error in the control unit

DM/KP	Fault designation	Meaning
E00034-1	E34-PowerFail	Error in the power supply
E00035-1...4	E35-EncObs	Encoder cable break
E00036-1...2	E36-VARAN	Error in the control unit
E00037-1	E37-Synchronization controller	The relationships between interpolation, synchronization and/or speed control time are not synchronized.
E00038-1	E38-Braker chopper monitoring	Braker chopper overloaded
E00039-1...2	E39-TwinWindow	Error in the speed and torque monitoring.
E00040-1...4	E40-TwinSyncModule	TECH-Option communication fault
E00041-1	E41-Fast discharge exceeded	Maximum time for fast discharge exceeded
E00042-1	E42-EtherCat master implementation	EtherCad master error
E00043-1	E43-Ethernet port	Error in the Ethernet configuration
E00044-1	E44-Wire break detected	Cable break detected
E00045-1...2	E45-LockViolate	Movement requested which was limited by directional block, limit switches or target value restriction.
E00046-1...3	E46-PositionLimit	Negative software limit switch approached
E00047-1...7	E47-Functional safety	Error message from the Safety System
E00048-1...14	E48-Safety-System	Error message from the Safety System
E00049-1	E49-NmtStateChange	NMT Status change while the drive is in controller mode.
E00050-1	E50-TimeOut detected	Permitted controller time exceeded.
E00051-1...2	E51-EncStatus	Warning or error bits in the digital encoder record
E00052-1	E52-Analog inputs	Cable break detection in analog inputs
E00053-1	E53-Motor failure	At least one motor phase is missing.
E00054-1	E54-Power grid failure	Missing network phase
E00055-1...2	E55-Speed guarding error	Maximum speed deviation detected.

Table 19: Fault messages of the frequency converters of types HP9000, MP12000, LP14000

The first action taken for clearing the fault should be the deactivation and reactivation of the PillAerator. Shut off the door coupling rotary drive for this. Then wait one minute before switching the PillAerator on again (Section 7.6.2).

Please contact your regional sales office if the error occurs repeatedly (Section 12).

NOTE *Always indicate the error number and location of the last 4 errors when making queries or service requests (Section 8.2).*

8.5 Fault messages of the magnetic bearing electronics

No.	DM/KP	Meaning
0		No error
1	E-CPU	CPU hardware or software error
2	E-OFF	Network failure
3	E-OC1	Overcurrent shutdown in channels 0 to 3
4	E-OV	Overvoltage shutdown
5	E-OLA	I ² t actuator shutdown
6	E-OLD	Ixt shutdown of device
7	E-OTA	Excess actuator temperature
8	E-OTD	Excess device temperature
9	E-PLS	Plausibility error during device startup
10	E-PAR	Incorrect configuration
11	E-FLT	Floating point error
12	E-HW	Error in the hardware detection
13	E-EXT	Error in an external device (input)
14	E-OP1	Error in the optional connector slot
15	E-CAN	Error in the internal CAN bus
16	E-EEP	Error when accessing the internal EEPROM
17	E-HWE	Output stage was interchanged
18	E-ENC	Error in the rotary encoder evaluation
19	E-TIM	Runtime error of a task
20	E-FLI	Internal flash error
21	E-FLE	External flash error
22	E-I2C	Internal I ² C-Bus error
23	E-ORB	Error: Permissible orbit exceeded
24	E-WDG	SIO Watchdog error
25	E-OLS	Position sensor excitation overload
26	E-OC2	Overcurrent shutdown in channels 4 and 5
27	E-POS	Error in the automatic sensor alignment
28	E-BEAR	Safety bearing error
40	W-WRN	General warning
41	W-ORB	Warning: Orbit exceeded
42	W-OTA	Warning: Actuator temperature exceeded
43	W-OTD	Warning: Internal device temperature exceeded
	E-TCP	TCP-IP module error
	E--30	Error in the internal option module

Table 20: Fault messages of the magnetic bearing electronics

The first action taken for clearing the fault should be the deactivation and reactivation of the PillAerator. Shut off the door coupling rotary drive for this. Then wait one minute before switching the PillAerator on again (Section 7.6.2).

Please contact your regional sales office if the error occurs repeatedly (Section 12).

NOTE ***Always indicate the error number and location of the last 4 errors when making queries or service requests (see Section 8.2).***

9. Maintenance

9.1 Components on the compressor side

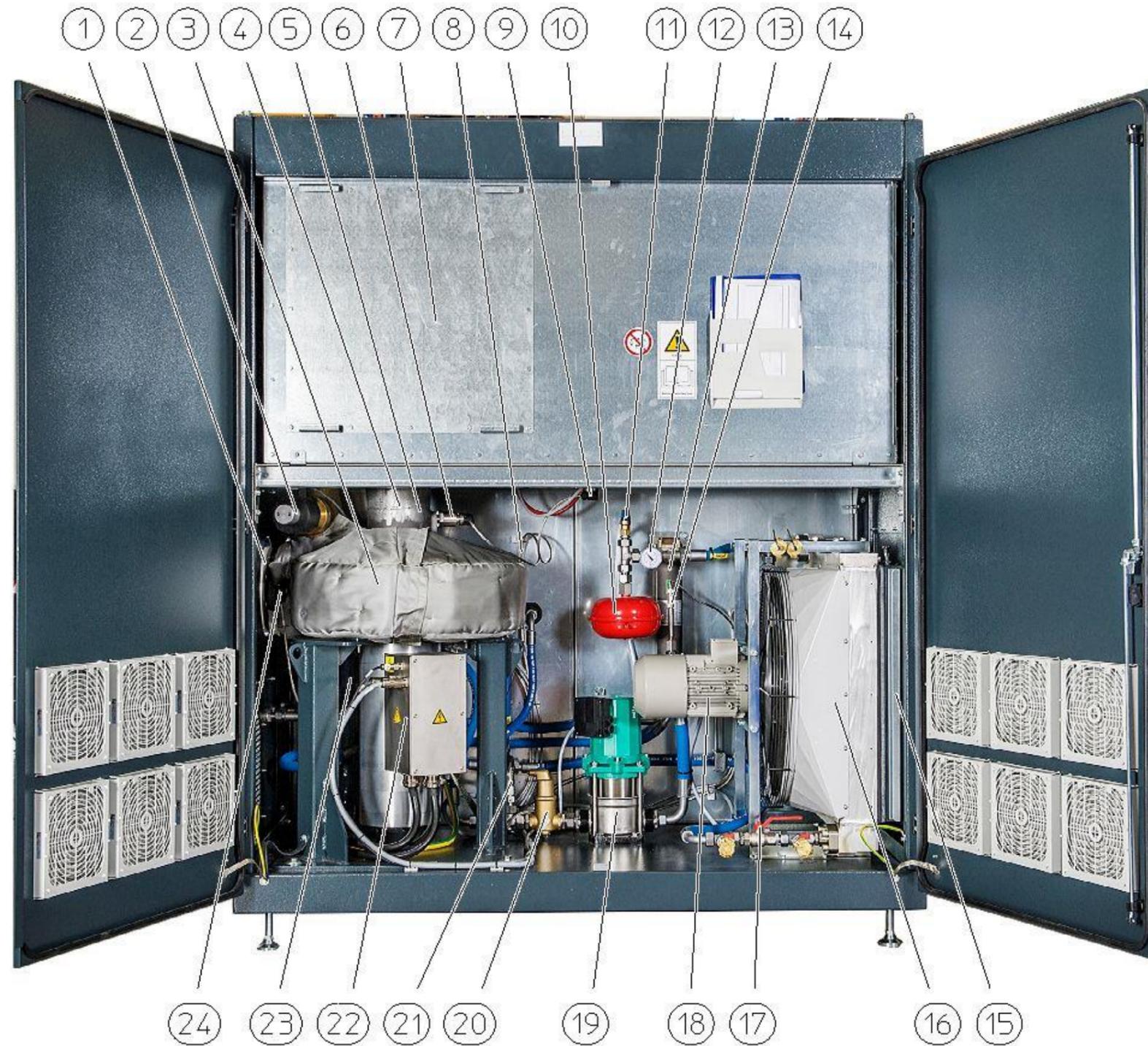


Figure 78: Components on the compressor side HP4000, MP6000, LP8000

Components HP4000, MP6000, LP8000

Part	Designation	Item
1	Housing flange	
2	Bypass valve	0048930161
3	Insulating mat	0024151906 (HP4000, MP6000) 0024151909 (LP8000)
4	Suction nozzles	5932700735 (HP4000, MP6000) 5932706804 (LP8000)
5	Compressor inlet temperature sensor (behind the suction nozzles)	0047000009
6	Compressor inlet pressure sensor	0041641225 (HP4000) 0041641226 (MP6000, LP8000)
7	Suction filter cover	
8	Ambient pressure sensor	0041641188
9	Suction filter differential pressure sensor	0041641184
10	Pressure expansion tank	0048930137
11	Overpressure valve	0047010162
12	Cooling circuit manometer	0047010021
13	Water/water heat exchanger	0044890142
14	Cooling circuit temperature sensor	0047000010
15	Air/water cooler filter	0041859228
16	Air/water heat exchanger	0045409081
17	Filling valve	
18	Air/water cooler motor	0040033996
19	Coolant pump	0045409409 0045409098 (North American design)
20	Air vent	0047000395
21 ³	Cooling circuit pressure sensor Cooling circuit pressure switch	0041641187 0041641222
22	Compressor motor	0047000680
23	Ball valve with control actuator for external cooling water (behind compressor motor)	0042530362
24	Compressor outlet pressure sensor	0041641186

³ Pressure sensor replaced by pressure switch for serial numbers 8198337 and higher.

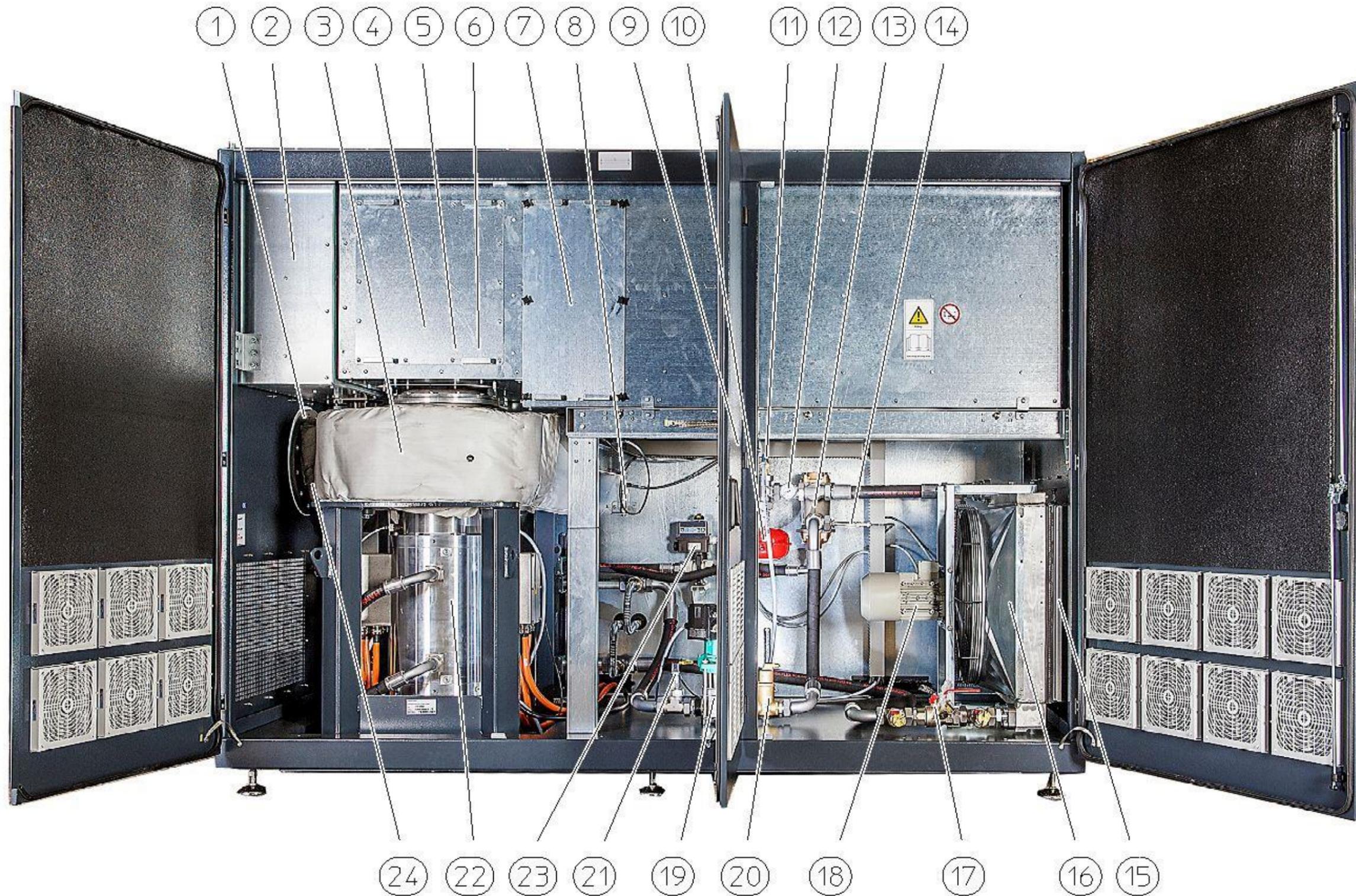


Figure 79: Components on compressor side HP9000, MP12000, LP14000

Components HP9000, MP12000, LP14000

Part	Designation	Item
1	Housing flange	
2	Bypass valve (in the bypass sound absorber)	5960343805
3	Insulating mat	0024151908 (HP9000, MP12000) 0024151910 (LP14000)
4	Suction nozzles (behind the suction nozzle cover)	5932701176
5	Compressor inlet temperature sensor (behind the suction nozzle cover)	0047000009
6	Compressor inlet pressure sensor (behind the suction nozzle cover)	0041641225
7	Suction filter cover	
8	Ambient pressure sensor	0041641188
9	Suction filter differential pressure sensor (behind the door)	0041641184
10	Pressure expansion tank	0048930137
11	Overpressure valve	0047010162
12	Cooling circuit manometer	0047010188
13	Water/water heat exchanger	0044890150
14	Cooling circuit temperature sensor	0047000010
15	Air/water cooler filter	0041859227
16	Air/water heat exchanger	0045409099
17	Filling valve	0040034666
18	Air/water cooler motor	0040034666
19	Coolant pump	0045409409 0045409098 (North American design)
20	Air vent	0047000478
21	Cooling circuit pressure sensor	0041641187
22	Compressor motor	0047000681
23	Ball valve with control actuator for external cooling water	0042530287
24	Compressor outlet pressure sensor	0041641186
25	Suction nozzle cover	
26	Bypass sound absorber	

9.2 Cooling system



The rotary drive for the door coupling must be shut off when work is performed on the cooling system.

NOTE Position of the cooling system as shown in Figure 78 and Figure 79.

The PillAerator cooling system consists of a closed circuit filled with a water-glycol mixture. The system is overpressurized to around 0.8 bar. The PillAerator first sends a warning signal if the cooling circuit pressure drops too greatly and then a fault message via the touch panel if the pressure continues to drop.

M50.6 Warning: Pressure for cooling circuit too low (M50.6)

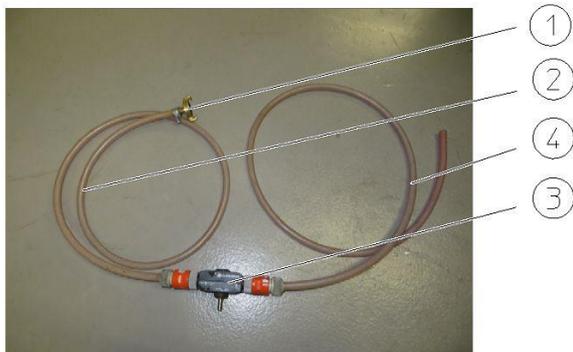
M54.6 Malfunction: Pressure for cooling circuit too low (M54.6)

The cooling system must be replenished when they occur.

9.2.1 Refilling

The following tools are required for refilling:

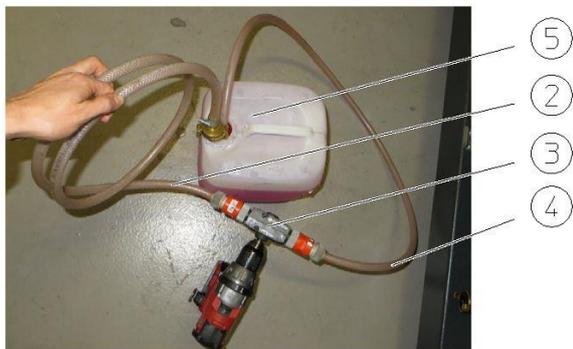
- 1 pump with a discharge head > 15 m
- 2 hoses, ½ inch (each 1.5 m)
- 1 bucket, 10 l
- 1 quick coupler (included with the PillAerator on the air/water cooler)
- Water-glycol mixture blended for -15 °C



Attach the quick coupler [1] to the hose [2].

Fasten the hose [2] to the pressure side of the pump [3].

Fasten the hose [4] to the suction side of the pump [3].

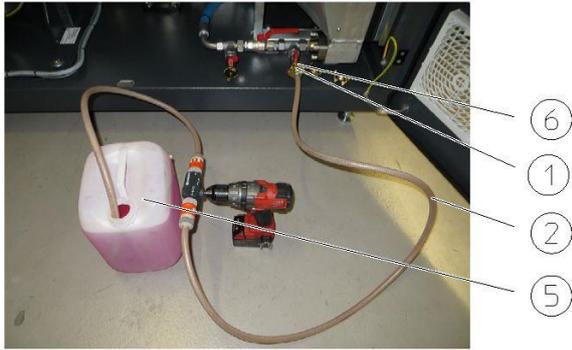


Fill the container [5] with the glycol-water mixture (blended for frost protection up to -15 °C).

Immerse hose [2] and hose [4] in the container [5].

Switch on the pump [3] and completely bleed hose [2] and hose [4].

Switch off the pump [3].



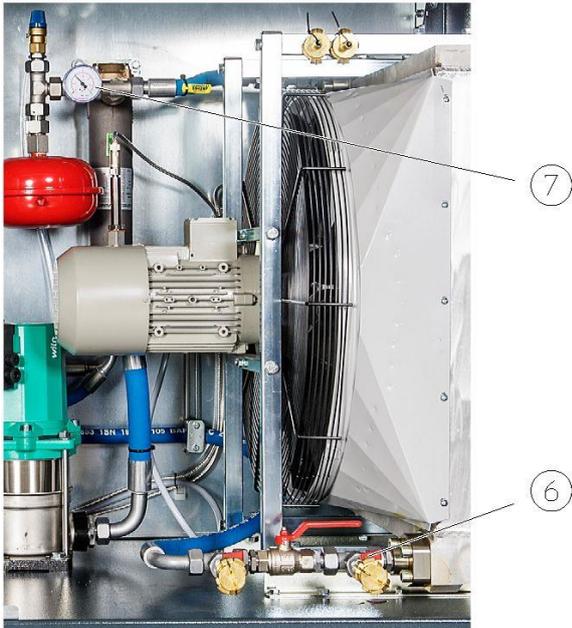
Pull the hose [2] with the quick coupler [1] out of the container [5] and attach a shut-off valve [6].

Note:

The hose [2] must remain filled with the glycol-water-mixture to prevent air from entering the cooling system.

Switch on the pump [3].

Open the shut-off valve [6].



Close the shut-off valve [6] when a pressure of 0.8 bar is reached on the manometer [6].



Switch off the pump [3].

NOTE

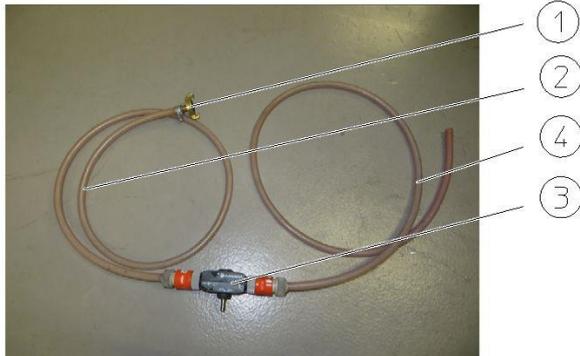
The air trapped in the cooling system escapes through a bleed valve in the time following. The pressure in the cooling system drops. The refilling process must be repeated if this causes the warning or malfunction to reoccur.

The cooling system must be completely refilled when one of its components needs to be replaced.

9.2.2 Completely refilling

You need the following tools for complete refilling:

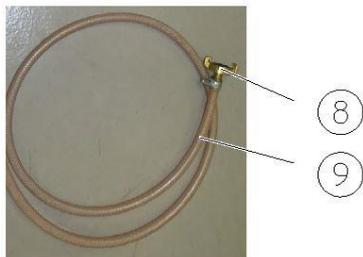
- 1 pump with a discharge head > 15 m
- 3 hoses, ½ inch (each 1.5 m)
- 1 bucket, 10 l
- 2 quick couplers (included with the PillAerator on the air/water cooler)
- Water-glycol mixture blended for -15 °C



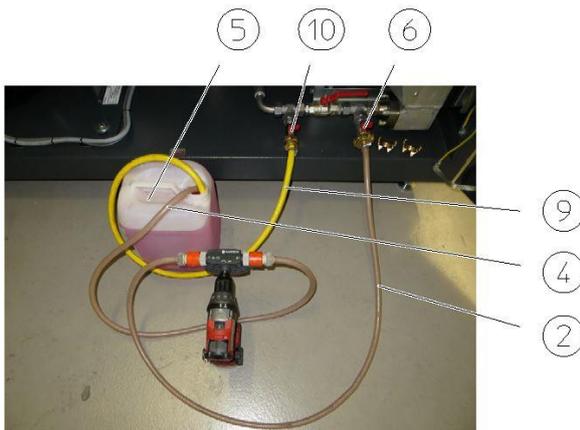
Attach the quick coupler [1] to the house [2].

Fasten the hose [2] to the pressure side of the pump [3].

Fasten the hose [4] to the suction side of the pump [3].



Attach the quick coupler [8] to the house [9].



Fill the container [5] with the glycol-water mixture (blended for frost protection up to -15 °C).

Use the quick coupler [1] to attach the hose [2] to the shut-off valve [6].

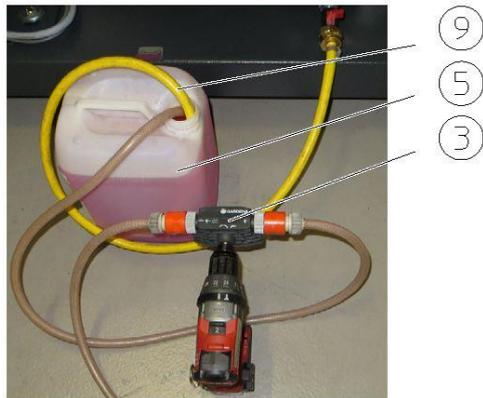
Immerse the hose [4] in the container [5].

Use the quick coupler [8] to attach the hose [9] to the shut-off valve [10] and immerse the other end of the hose [9] in the container [5].



Open shut-off valve [6] and shut-off valve [10].

Close the shut-off valve [11].

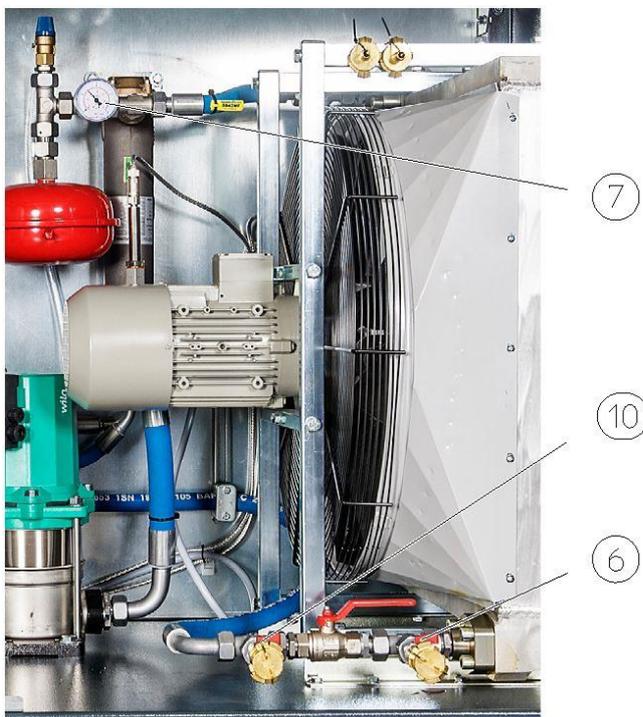


Switch on the pump [3].

Monitoring until the air output from the hose [9] is completed.

Note:

Replenish the glycol-water mixture in the container [5] as needed.



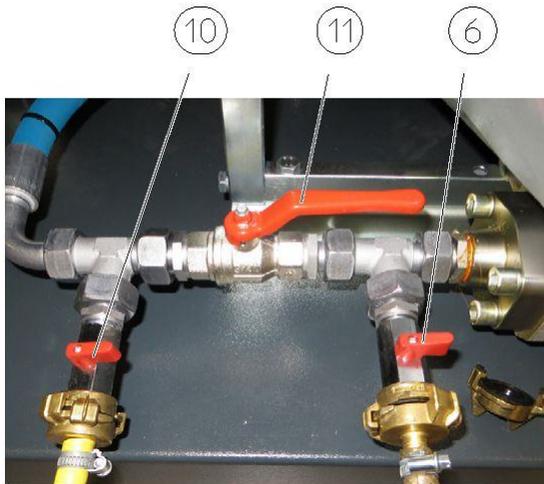
Close the shut-off valve [10].



Close the shut-off valve [6] when a pressure of 0.8 bar is reached on the manometer [6].



Switch off the pump [3].



Open the shut-off valve [11].



The shut-off valve [11] must always remain open during operation.

9.3 Filter change



The rotary drive for the door coupling must be shut off when work is performed on the cooling system.

The PillAerator is equipped with 3 different filters. They must be replaced at regular intervals. The time intervals are based on the surrounding conditions at the installation site. However, the filters must be inspected at least every three months.

9.3.1 Filter replacement on the electronics side

NOTE *Position of the Filters as shown in Figure 21 and Figure 23.*

NOTE *The grates in the doors are closed when cooling devices are used for cooling. In this case, no filters need to be changed on the electronics side.*

The filters for the control cabinet ventilation are located in the door grates on the electronic side. Tilt the grates and replace the filter mat. (Figure 80)



Figure 80: Filter replacement on the electronics side

9.3.2 Filter replacement in the cooling circuit

NOTE Position of the filter as shown in Figure 78 and Figure 79.

The filter for the cooling circuit is located on the compressor side on the air inlet of the air/water cooler.

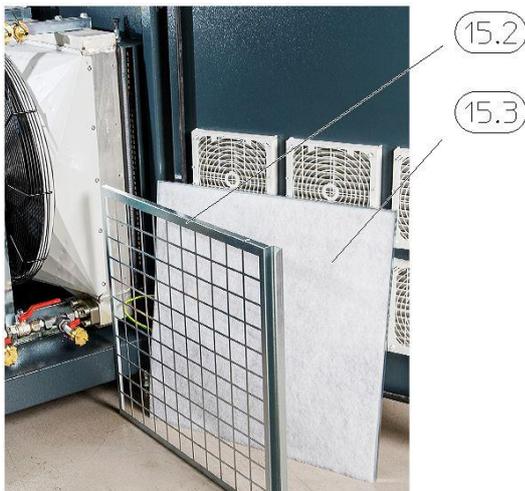


Unlock the safety bolts [15.1] by pulling them up.

Lock the safety bolts [15.1] by slightly rotating them.



Remove the filter cartridge [15] from the bracket.



Separate the two parts of the filter cartridge [15.2] and replace the filter mat [15.3].

Filter mat [15.3] for

HP4000,MP6000,LP8000: 0041859228

HP9000,MP12000,LP14000: 0041859227

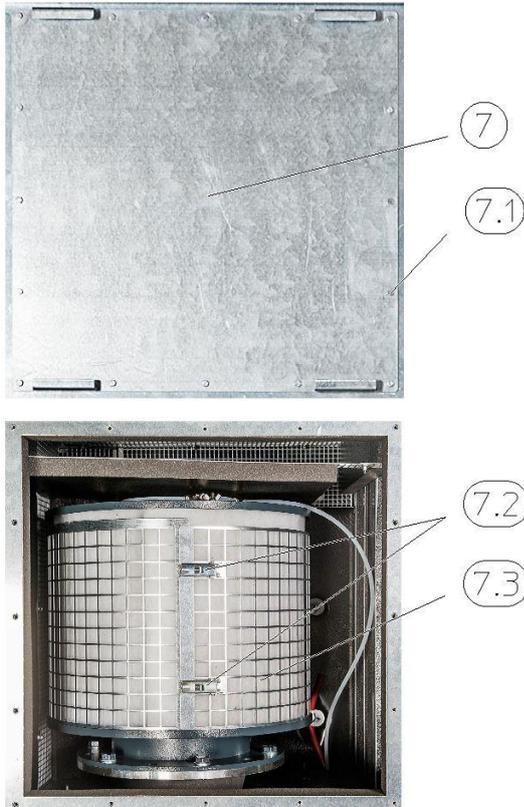
Slide the filter cartridge [15.2] into the bracket.

Lock the safety bolts [15.1].

9.3.3 Suction filter

NOTE *Position of the suction filter as shown in Figure 78 and Figure 79.*

HP4000, MP6000 and LP8000



Loosen and remove the screws [7.1].

Remove the cover [7].

Open the suction filter's locking mechanism [7.2].

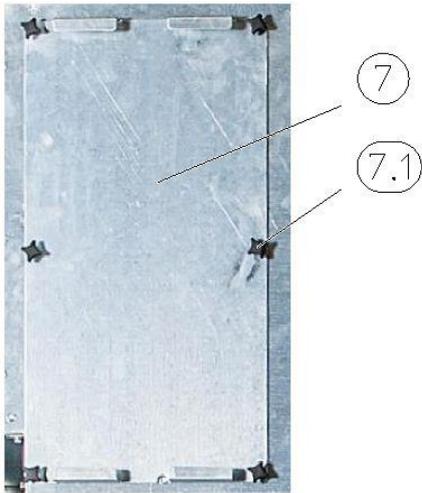
Remove the filter [7.3].

Insert a new filter mat [7.3] (0041859231).

Close the locking mechanism [7.2].

Use screws [7.1] to attach the cover [7].

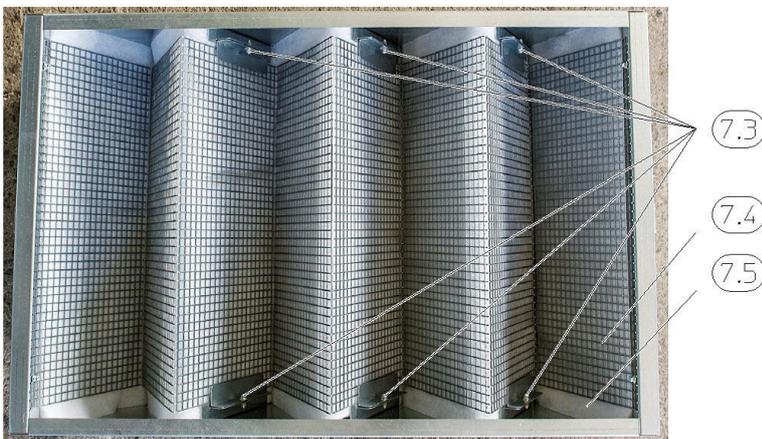
HP9000, MP12000 and LP14000:



Loosen and remove the screws [7.1].
Remove the cover [7].



Remove the filter cartridge [7.2].



Loosen and remove the screws [7.3].
Remove the mounting bracket [7.3].
Carefully lift the top grid [7.4] and remove it from the filter cartridge [7.2].
Replace the filter mat [7.5] (0041859226).
Place the top grid [7.4] in the filter cartridge [7.2].
Use screws [7.3] to attach the mounting bracket [7.3].
Insert the filter cartridge [7.2].
Use screws [7.1] to attach the cover [7].

10. Remote maintenance Option

The PillAerator can be optionally equipped (at the customer's request) with a 3G router [1] and/or switch [2] (Figure 81 and Figure 82). A SIM card to be provided by the customer is required to use the router and thus the remote access.

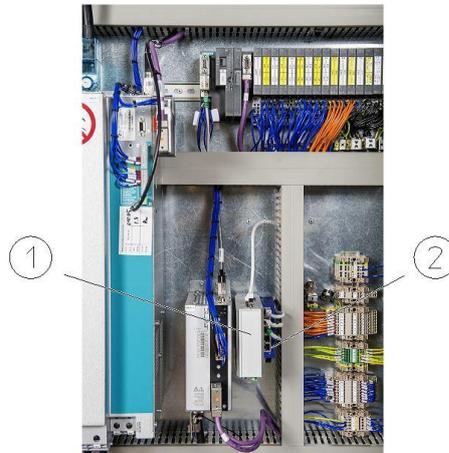


Figure 81: Router HP4000, MP6000, LP8000



Figure 82: Router HP9000, MP12000, LP14000

The router uses the mobile radio network (GPRS, EDGE, UMTS) to create a remote connection to the PillAerator. The service technician can thus use a server and a switch to create a remote connection to the touch panel and to access information for servicing purposes. A switch and a corresponding network cable can be used to create a connection to additional PillAerators.

The alternative option also exists of using the router's WAN connection to create a wired connection. The condition for this is that an Internet-compatible network connection be provided by the customer.

The remote maintenance can be used to assist the customer with commissioning the PillAerator by making selective adjustments or analyzing warnings and error messages.

The remote maintenance hardware includes a router and an Ethernet switch depending on the number of PillAerators involved.

10.1 SIM card

The SIM card required for remote maintenance and the mobile phone contract must meet the following criteria:

- Card type: Mini-SIM (or also UICC in accordance with ISO/IEC 7810:2003, ID-000)
- Connection speed: at least GRPS
- Data volume: at least 200 MB

The following provider information is also required. The information can be found in the SIM card documents or requested from the provider.

- PIN for the SIM card (if the SIM card is protected by a PIN)
- The provider's APN (Access Point Name)
- The provider's User Name
- The provider's password

10.2 Use of the SIM card and the configuration of the 3G-Router



Read Section 10.2 before inserting the SIM card into the Router. Mistakes in the procedure can cause irreparable damage to the SIM card or router.

The Router settings are made by the Ethernet interface (Figure 83 [4]).

The following data are required for access and changes in the configuration.

- Router IP address (<https://10.10.10.10>)
- Router network mask (Example: 255.255.0.0)
- Router user name: piller
- Router password: 31415

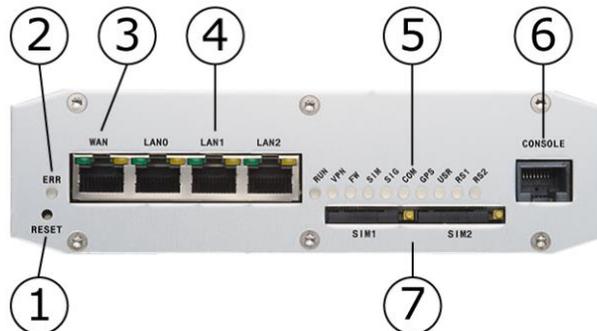


Figure 83: 3G-Router (top)

1. Use the switch [4] to shut off the router (switch position OFF).

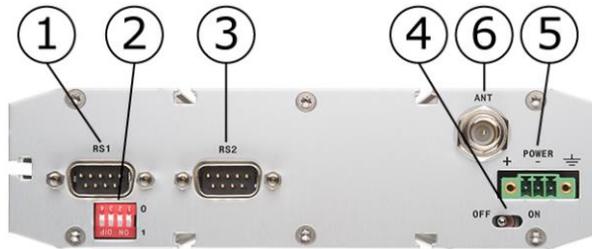


Figure 84: 3G-Router (bottom)

2. Press down the locking mechanism [1] (e.g. with a slotted screwdriver [2] size 0.4x2.5). Pull out the SIM card holder [3].



Figure 85: SIM card slot



Do not insert the new SIM card yet!

3. Use the switch [4] (Figure 84) to switch on the router (switch position ON).
4. Connect the Ethernet cable to the router (Figure 83 [4]: the connections LAN0, LAN1 or LAN2).
5. Connect the Ethernet cable to the PC.
6. Change the PC's IP address and network mask.

Use the following settings:

- IP address: 10.10.10.2
- Network mask: 255.255.0.0

7. Open the browser and enter <https://10.10.10.10> as the address
8. Log in to the Router with:
 - User name: piller
 - Password 31415

9. Click on the Mobile WAN (3G) [1] menu item in the left image area. Enter the provider data (APN [2], user name [3] and password [4])
10. Save the settings by pressing the "Submit" button [5].

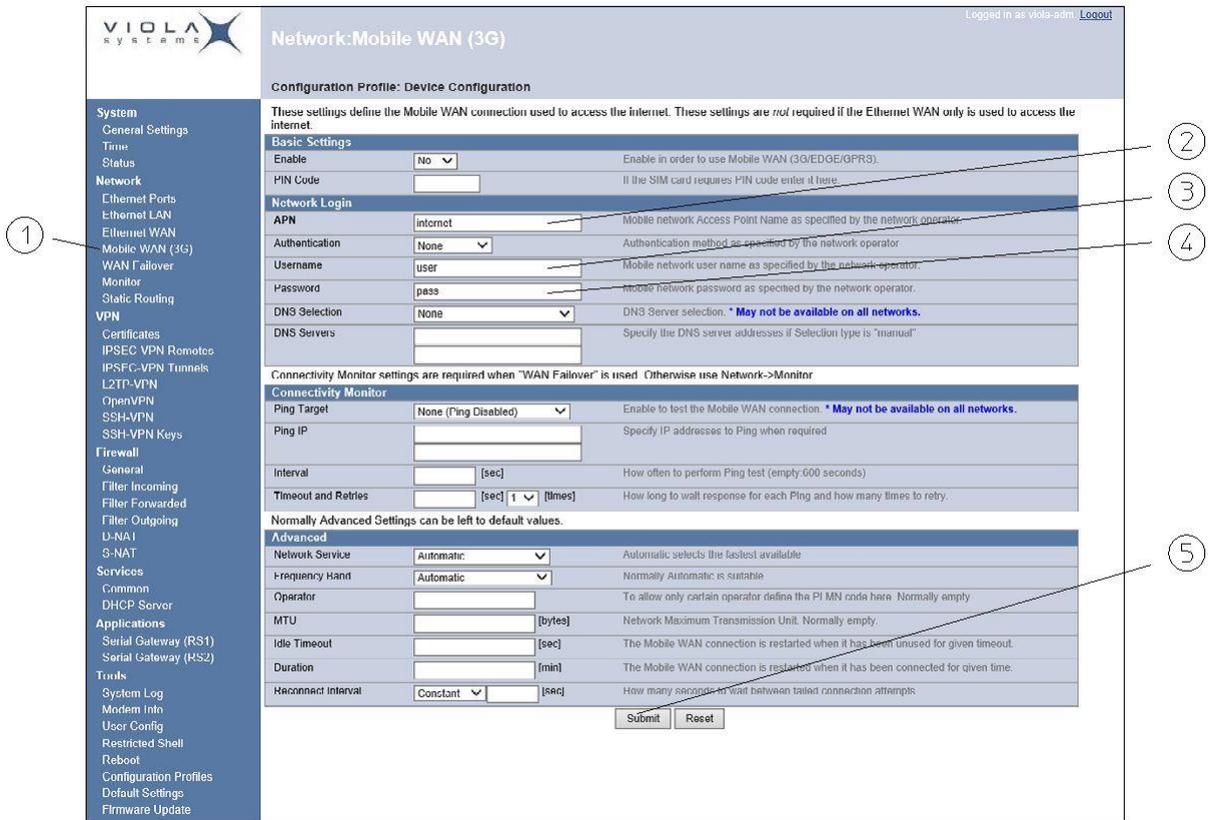


Figure 86: 3G Router start screen

11. Use the switch [4] (Figure 84) to shut off the router (switch position OFF).
12. Insert the SIM card [4] into the recess of the card holder [3].



Figure 87: SIM card and card holder

13. Slide the card holder [3] into the card slot [1].



Figure 88: Insert the card holder

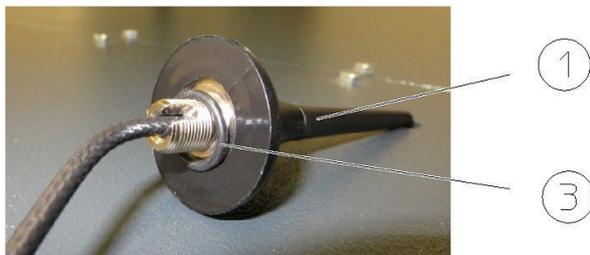
14. Use the switch [4] (Figure 84) to switch on the router (switch position ON).

10.3 Installing the antenna

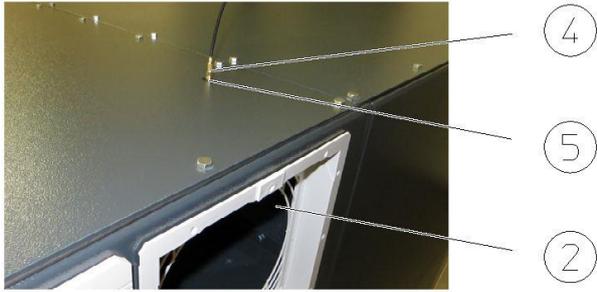
To prevent damage to the antenna during transport, it may only be installed during commissioning at its intended operating site.



The antenna [1] is mounted on the compressor cabinet in the hole intended for this above the air outlet grate [2].

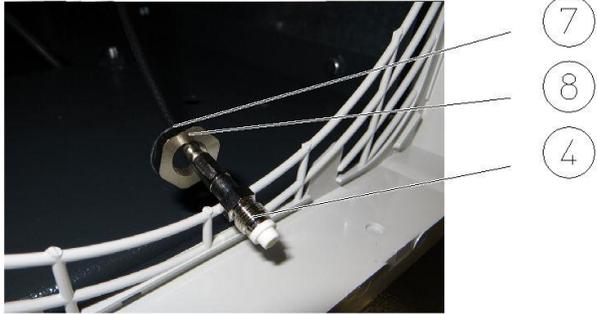


Thread the O-ring [3] over the cable [1] up to the antenna's threading.



Remove the air outlet grate [2].

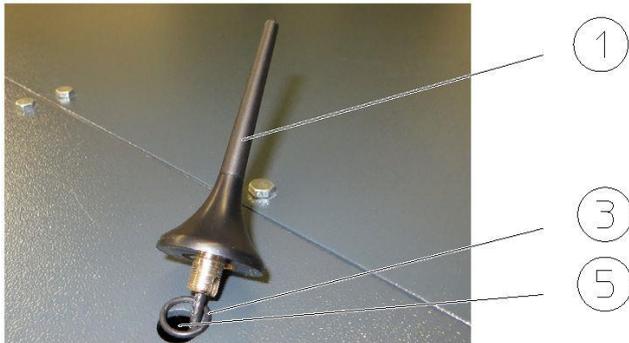
Insert the antenna's [1] connector [4] into the hole [5].



Slide the lock washer [7] and nut [8] over the connector [4].



Insert the antenna's [1] connector [4] into the hole [6].



Insert the antenna's cable [1] further through the two holes.

Slide the O-ring [3] over the antenna threading [1] and insert the threading through the hole [5].



5

7

8 5 Nm

Screw the nut [8] together with the lock washer [7] onto the threading.



9

10

11

In the marked cable ducts [10], lay the antenna's cable [1] from the hole [9] up to the router's antenna connection [11].



11

4

Manually screw the connector [4] into the Router's antenna connection [11].

10.4 Remote maintenance networking

NOTE *The Ethernet cables between the PillAerators are not included in the PillAerator's scope of supply.*

Figure 89 to Figure 91 schematically show how the PillAerators are networked together. The required hardware can differ, depending on the number of PillAerators involved. If remote maintenance was also ordered, then the required hardware is already installed in the PillAerators. It can be retrofitted at any time however.

When just one PillAerator is used, then the router is installed solely in this one. A second PillAerator can be directly connected to the router. A switch is required in the second PillAerator to connect the touch panel (HMI) and NetLink adapter to the network (Figure 89).

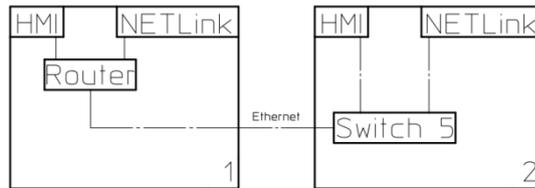


Figure 89: 2 PillAerators with remote maintenance (without Brain Box)

When more than 2 PillAerators are used, then the network is set up in a star configuration from the PillAerator containing the router. Either a 5-fold switch (Figure 90) or an 8-fold switch (Figure 91) is used depending on the number of PillAerators involved.

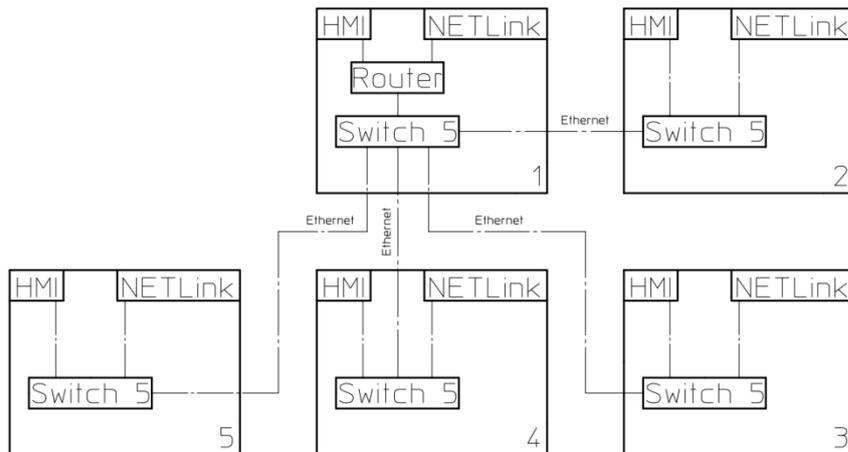


Figure 90: 3 to 5 PillAerators with remote maintenance (without Brain Box)

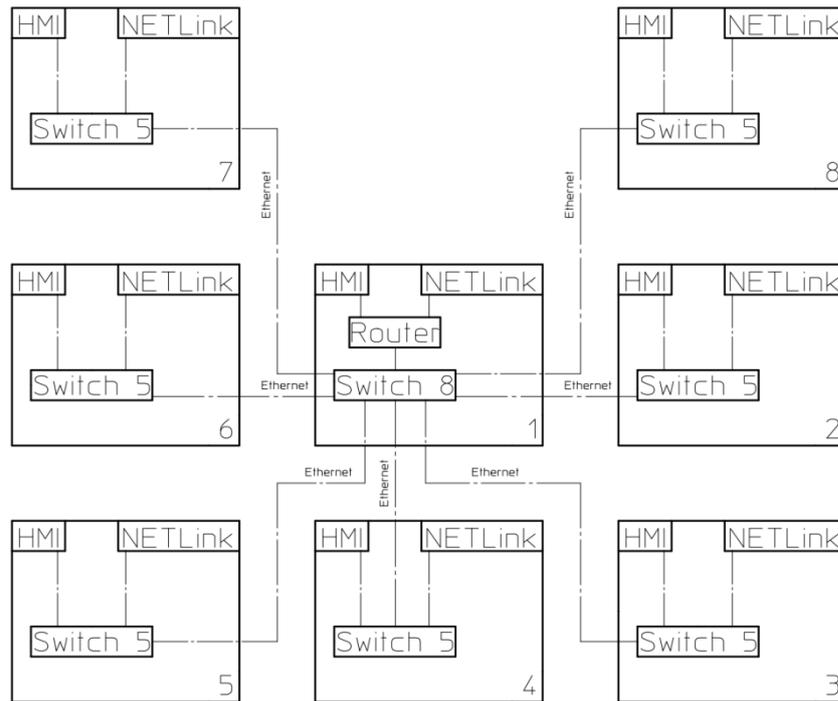


Figure 91: 6 to 8 PillAerators with remote maintenance (without Brain Box)

The router is deenergized when its host PillAerator is shut off (Door coupling rotary drive off). In this case, no remote maintenance connections can be made to any of the PillAerators. This does not affect the operation of the other PillAerators. The remote maintenance is not mandatory for operating the PillAerators.

10.5 Function test of the 3G Router

The status of the router can be monitored by the LEDs shortly after it is switched on (Table 21).

LED	LED Name	LED Status	Description	Actions for clearing the fault
1	Error	On	The router starts Should go out after 30 seconds.	Switch off the router and then switch it on again. Check the router configuration Have a PillAerator service technician investigate the cause.
		Flashes	The power supply is possibly malfunctioning.	Switch off the router and then switch it on again. Check the router configuration Have a PillAerator service technician investigate the cause.
		Off	Everything okay	
2	RUN	Flashes	The device is functioning normally	
		Off	No error is present and the device with restart shortly.	
3	VPN	On	VPN connection is established.	
		Flashes	VPN connection is being established.	
		Off	VPN connection is deactivated.	Check the router configuration
4	FW		Reserve	
5	SIM	On	SIM card found and ready for usage.	
		Flashes	SIM card is being initialized.	
		Off	SIM is not being used.	Check the router configuration
6	SIG	On	Signal strength is normal or good (better than -95 dBm).	
		Flashes	Signal strength is weak (between -110 dBm and -95 dBm).	Check the connection of the antenna to the router. Change the antenna's position. Use the antenna with an amplifier.
		Off	No signal (under -110 dBm)	Check the connection of the antenna to the router. Change the antenna's position. Use the antenna with an amplifier.
7	COM	On	3G connection is established.	
		Flashes	3G connection is being started.	
		Off	3G connection is deactivated.	Check the router configuration
8	GPS		Reserve	
9	USR		Reserve	
10	RS1		Reserve	
11	RS2		Reserve	

Table 21: Router status (Fault clearing for usage of the mobile network)

11. Disassembly

Disassembly defines the dismantling of the PillAerator for transport to a different installation site or for scrapping. We recommend contracting the PillAerator GmbH installation personnel for professional disassembly.

Proceed as follows:

1. Disconnect the PillAerator from the power supply.
2. Disconnect the PillAerator from the pipeline and, if applicable, from the suction channel.
3. Disconnect the PillAerator from the customer's control unit/station.
4. If recommissioning is intended, then protect the entire system from moisture.
5. The PillAerator must be covered by a tarp to protect it against dust and dirt.



Follow the commissioning instructions for the new start-up.

12. Queries, spare parts orders and service calls

We request the following information for queries, spare parts orders and service calls:

- The PillAerator's serial number
- The exact address of the plant
- The name of the person in charge to be contacted by our installer.
- Explain the malfunctions and your observations as well as possible since the more precisely you explain the information, the better and faster we can help you. Information by fax or email is the most suitable.

Please contact:

PillAerator GmbH
Nienhagener Str. 6
D-37186 Moringen (Germany)
Tel.: +49 5554/201-0
Fax: +49 5554/201-271
Email: info@pillaerator.com
Web: <http://www.pillaerator.com>

13. Appendix 1: Original EU Declaration of Conformity

PillAerator

Original EU-Declaration of Conformity

Hereby we,
PillAerator GmbH, Nienhagener Straße 6, 37186 Moringen,

declare that the following products

Products: Turbo Compressor, Master Control
Types: **PillAerator HP4000**
PillAerator MP6000
PillAerator LP8000
PillAerator HP9000
PillAerator MP12000
PillAerator LP14000
PillAerator BrainBox

are in conformity with the following EU Directives:

EU Machinery Directive 2006/42/EG
EU Low Voltage Directive 2006/95/EG
EU Electromagnetic Compatibility 2004/108/EG

References of standard and/or technical specifications applied for this declaration of conformity or parts thereof:

DIN EN 60034-1:2013-10
DIN EN 60204-1:2007-06
DIN EN 61000-6-2:2011-06
DIN EN 61558-2-1:2007, 61558-2-4:2009, 61558-2-6:2010, 61558-2-20:2011
DIN EN 61800-3:2004 + A1:2012, 61800-5-1:2007
DIN EN 60939:2011

Authorised Representative for the Technical Documentation:

PillAerator GmbH
Daniel Nagel
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37186 Moringen
Germany

E-Mail: nagel@pillaerator.com

Moringen, 29.08.2014



Daniel Nagel, Head of Quality Management and Service

Moringen, 29.08.2014



Dipl.-Oec. Nils Englund, Managing Director

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www.pillaerator.com

Geschäftsführung:
Dipl.-Oec. Nils Englund

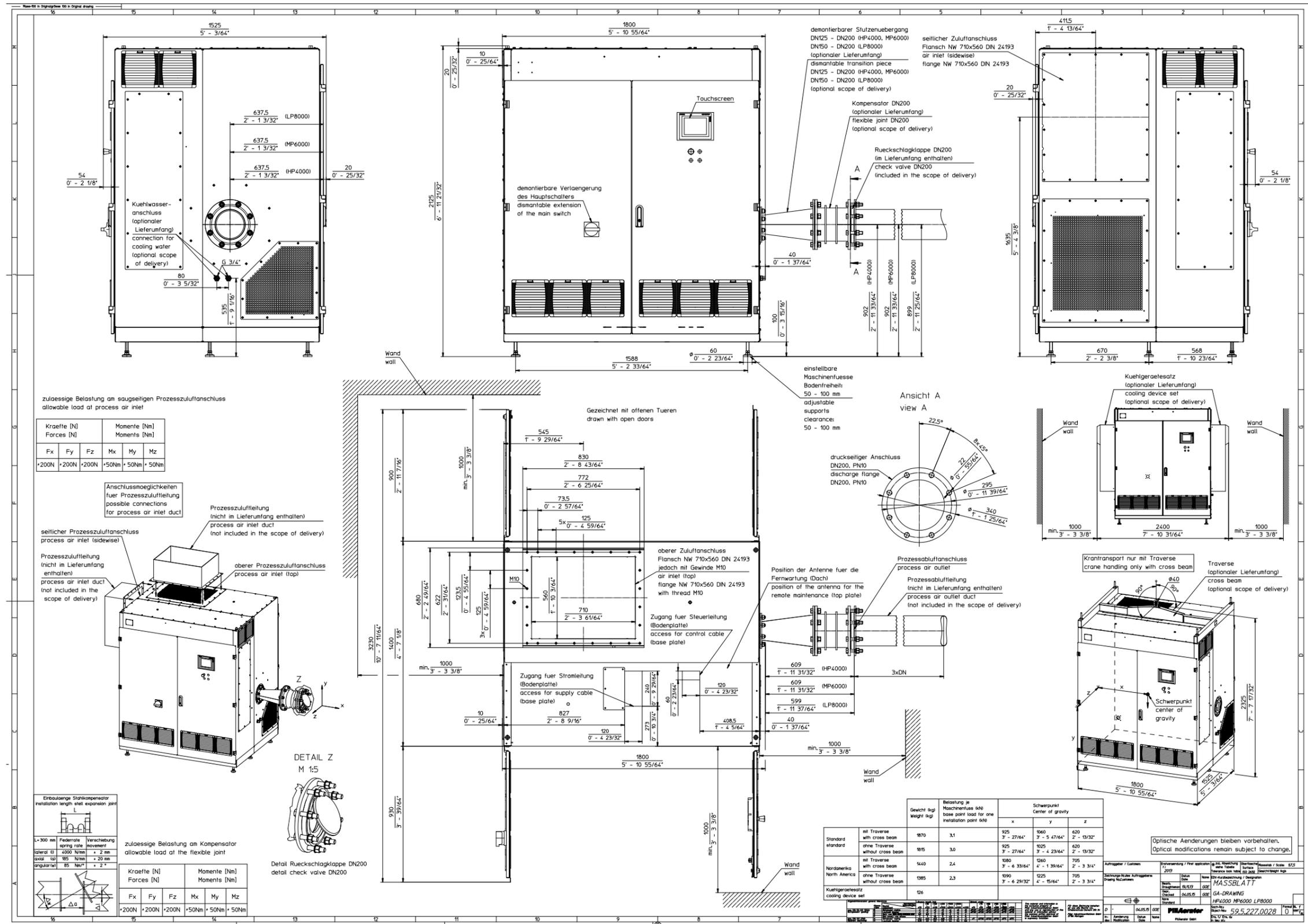
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Ust.-Id.-Nr. DE 284730507

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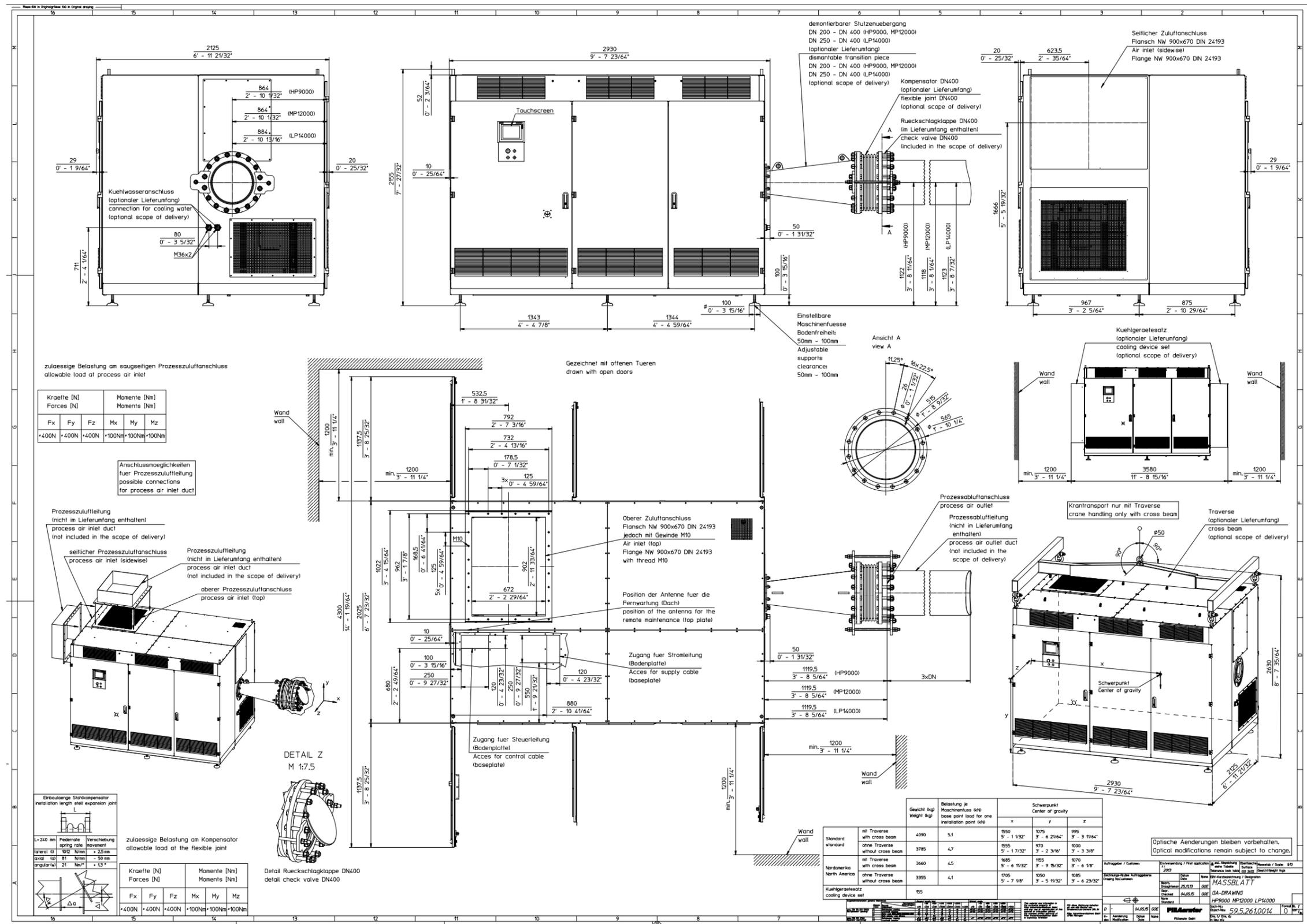
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Figure 92: Original EU Declaration of Conformity

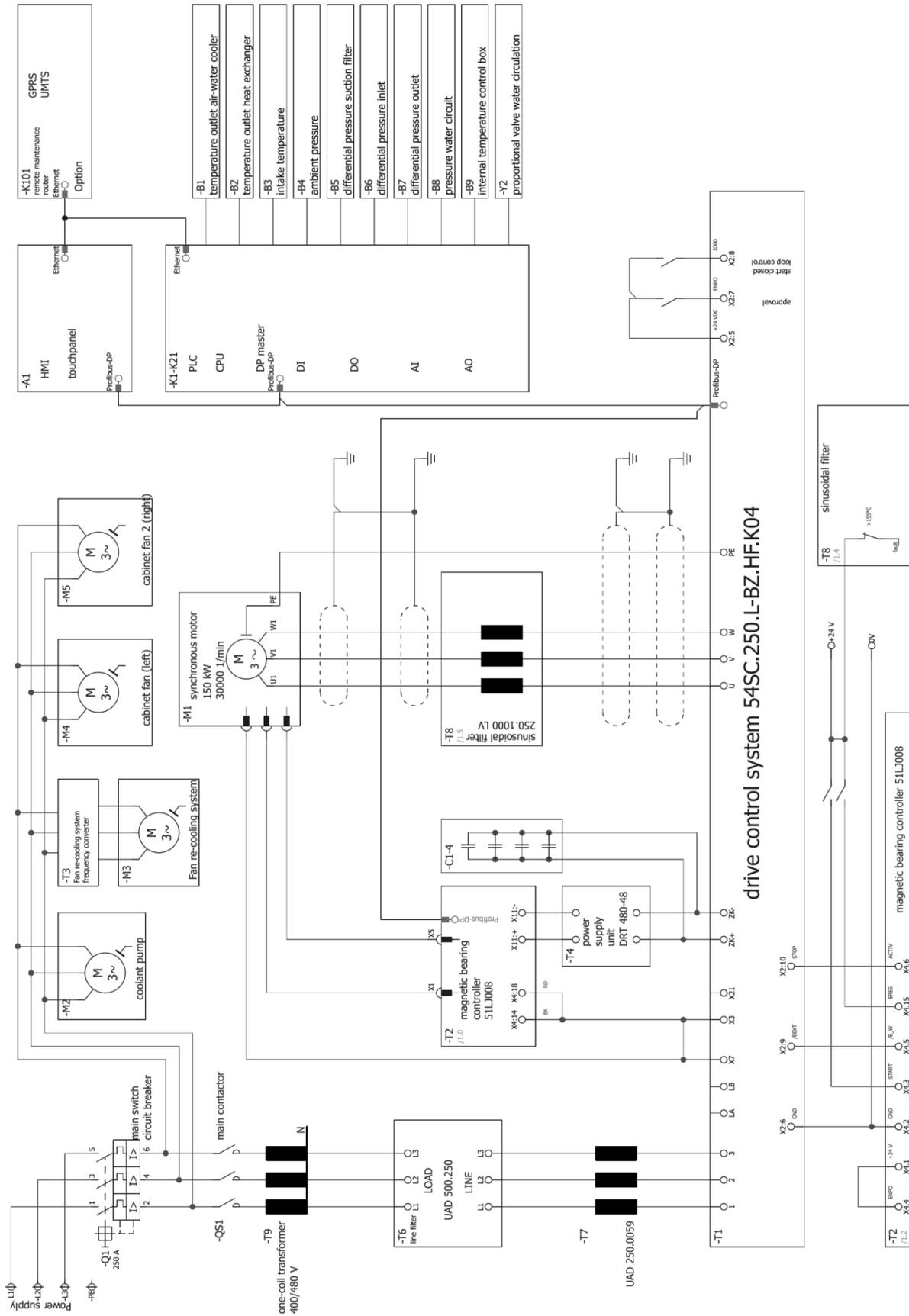
14. Appendix 2: Dimension sheet HP4000, MP6000, LP8000



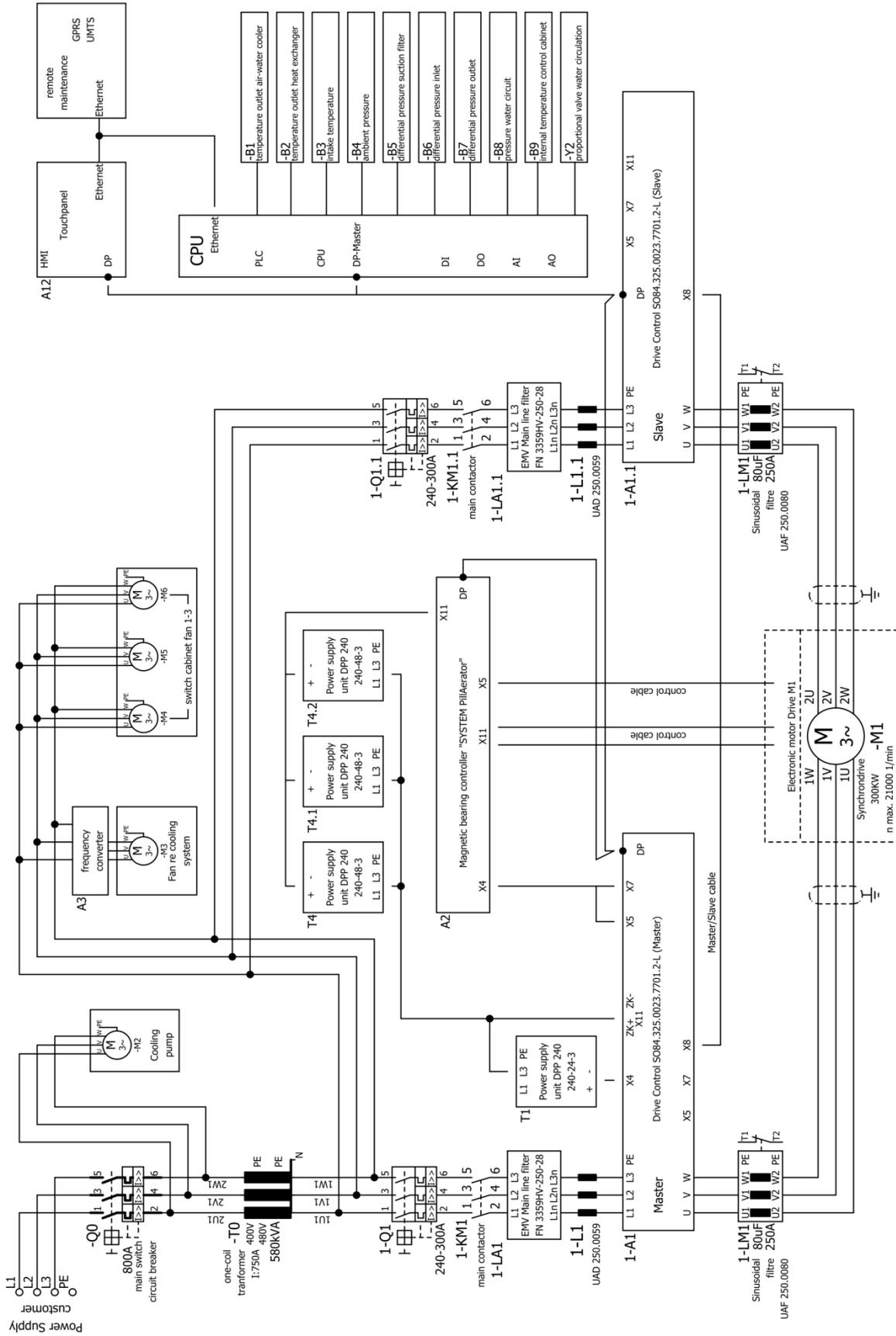
15. Appendix 3: Dimension sheet HP9000, MP12000, LP14000



16. Appendix 4: Overview diagram HP4000, MP6000, LP8000



17. Appendix 5: Overview diagram HP9000, MP12000, LP14000



18. Appendix 6: Parameter list

The parameters highlighted in gray must be adapted to the type of control system during commissioning.

	HP4000	MP6000	LP8000	HP9000	MP12000	LP14000	
Parameter name	Parameter value						Unit
Parameter speed: min. value	0.0	0.0	0.0	0.0	0.0	0.0	rpm
Parameter speed: max. value	30000	30000	30000	21000	21000	21000	rpm
Parameter volume flow: min. value	0.0	0.0	0.0	0.0	0.0	0.0	m ³ /h
Parameter volume flow: max. value	4000	6000	8000	9000	12000	14000	m ³ /h
Parameter pressure: min. value	0.0	0.0	0.0	0.0	0.0	0.0	mbar
Parameter pressure: max. value	1200	1000	800	1200	1000	800	mbar
External set value: min. value	0.00	0.00	0.00	0.00	0.00	0.00	
External set value: max. value	1.00	1.00	1.00	1.00	1.00	1.00	
External actual value: min. value	0.00	0.00	0.00	0.00	0.00	0.00	
External actual value: max. value	1.00	1.00	1.00	1.00	1.00	1.00	
Bypass valve closed	0.0	0.0	0.0	0.0	0.0	0.0	ms
Bypass valve open	100	100	100	100	100	100	ms
Fan off	60000	60000	60000	60000	60000	60000	ms
Compressor speed: Warning limit	30050	30050	30050	21050	21050	21050	rpm
Compressor speed: Disturbance limit	30100	30100	30100	21100	21100	21100	rpm
Compressor speed: Shut-down speed	0.0	0.0	0.0	0.0	0.0	0.0	rpm
Compressor speed: Start-up speed	0.0	0.0	0.0	0.0	0.0	0.0	rpm
Motor current compressor: Warning limit	255	255	255	253	253	253	A
Motor current compressor: Disturbance limit	260	260	260	260	260	260	A
Differential pressure suction filter: Zeta (warning)	355	355	355	65	65	65	
Differential pressure suction filter: Zeta (disturbance)	474	474	474	87	87	87	
* Pressure cooling circuit: Warning limit	600	600	600	1000	1000	1000	mbar
* Pressure cooling circuit: Disturbance limit	300	300	300	600	600	600	mbar
Temperature compressor inlet: Warning limit	50.0	50.0	50.0	50.0	50.0	50.0	°C
Temperature compressor inlet: Disturbance limit	65.0	65.0	65.0	65.0	65.0	65.0	°C
Temperature coolant: Warning limit	42.0	42.0	42.0	42.0	42.0	42.0	°C
Temperature coolant: Disturbance limit	50.0	50.0	50.0	50.0	50.0	50.0	°C
Temperature switch cabinet: Fan on	25.0	25.0	25.0	25.0	25.0	25.0	°C
Temperature switch cabinet: Warning limit	42.0	42.0	42.0	42.0	42.0	42.0	°C
Temperature switch cabinet: Disturbance limit	45.0	45.0	45.0	45.0	45.0	45.0	°C
Venting coolant: Time on	15	15	15	15	15	15	s
Vent the cooling water: Time off	5	5	5	5	5	5	s
Remoute maintenance	0	0	0	0	0	0	ms
System time	Current	Current	Current	Current	Current	Current	
System parameters: Air inlet diameter	150	150	170	250	250	250	mm
System parameters: Spinner diameter	0.0	0.0	0.0	0.0	0.0	0.0	mm
System parameters: Factor for volume flow calculation	1.0	1.0	1.0	1.0	1.0	1.0	
System parameters: Correction factor a	0.09	0.13	0.1	0.18	0.16	0.17	
System parameters: Correction factor b	-0.03	-0.07	-0.03	-0.14	-0.11	-0.18	
System parameters: Differential pressure offset at the inlet	0.0	0.0	0.0	0.0	0.0	0.0	
Quad. factor for bypass closing characteristic curve	45	60	17	1	9	10	s/m ³
Linear factor for bypass closing characteristic curve	60	65	95	116	50	70	
Constant bypass closing characteristic curve	0	-20	-29	-165	-60	-120	m ³ /s
Quad. factor for control characteristic curve	265	60	17	1	12	17	s/m ³
Linear factor for control characteristic curve	60	96	100	116	50	70	
Constant control characteristic curve	10	3	-1	-42	-7	-68	m ³ /s
Quad. factor for surge line	280	60	17	1	13	18	s/m ³
Linear factor for surge line	60	100	100	116	50	70	
Constant surge line	15	10	5	-30	2	-55	m ³ /s
Controller volume flow: P-part	20.0	20.0	20.0	100.0	100.0	100.0	
Controller volume flow: I-part	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	
Controller volume flow: Min. limit	0.0	0.0	0.0	0.0	0.0	0.0	rpm
Controller volume flow: Max. limit	30000	30000	30000	21000	21000	21000	rpm
Pressure controller: P-part	5.0	5.0	5.0	100.0	100.0	100.0	
Pressure controller: I-part	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	

* HP4000, MP6000, LP8000: Not applicable for serial number 8198337 and higher

	HP4000	MP6000	LP8000	HP9000	MP12000	LP14000	
Parameter name	Parameter value						Unit
Pressure controller: Min. limit	0.0	0.0	0.0	0.0	0.0	0.0	rpm
Pressure control: Max. limit	30000	30000	30000	21000	21000	21000	rpm
External value: P-part	5.0	5.0	5.0	5.0	5.0	5.0	
External value: I-part	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	
External value: Min. limit	0.0	0.0	0.0	0.0	0.0	0.0	rpm
External value: Max. limit	30000	30000	30000	21000	21000	21000	rpm
Controller motor current: P- part	-2.0	-2.0	-2.0	-2.0	-2.0	-2.0	
Controller motor current: I- part	500.0	500.0	500.0	500.0	500.0	500.0	
Controller motor current: Min. limit	0.0	0.0	0.0	0.0	0.0	0.0	rpm
Controller motor current: Max. limit	300	300	300	300	300	300	rpm
Controller water/water cooler: P- part	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	
Controller water/water cooler: I- part	1000.0	1000.0	1000.0	1000.0	1000.0	1000.0	
Controller water/water cooler: Min. limit	0.0	0.0	0.0	0.0	0.0	0.0	%
Controller water/water cooler: Max. limit	100	100	100	100	100	100	%
Controller air/water cooler: P- part	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	
Controller air/water cooler: I- part	2500.0	2500.0	2500.0	2500.0	2500.0	2500.0	
Controller air/water cooler: Min. limit	0.0	0.0	0.0	0.0	0.0	0.0	%
Controller air/water cooler: Max. limit	100	100	100	100	100	100	%
Controller bypass valve: minimum volume flow	720	720	720	1000	1000	1000	m³/h
* Temperature according to air/water cooler: min. value	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	°C
* Temperature according to air/water cooler: max. value	150.0	150.0	150.0	150.0	150.0	150.0	°C
* Temperature according to water/water cooler: min. value	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	°C
* Temperature according to water/water cooler: max. value	150.0	150.0	150.0	150.0	150.0	150.0	°C
Temperature compressor inlet: min. value	-50.0	-50.0	-50.0	-50.0	-50.0	-50.0	°C
Temperature compressor inlet: max. value	150.0	150.0	150.0	150.0	150.0	150.0	°C
Ambient pressure: min. value	0.00	0.00	0.00	0.00	0.00	0.00	mbar
Ambient pressure: max. value	1600.0	1600.0	1600.0	1600.0	1600.0	1600.0	mbar
Differential pressure suction filter: min. value	0.00	0.00	0.00	0.00	0.00	0.00	mbar
Differential pressure suction filter: max. value	50.0	50.0	50.0	50.0	50.0	50.0	mbar
Differential pressure compressor inlet: min. value	-60.0	-80.0	-80.0	-60.0	-60.0	-60.0	mbar
Differential pressure compressor inlet: max. value	0.00	0.00	0.00	0.00	0.00	0.00	mbar
Differential pressure compressor outlet: min. value	0.00	0.00	0.00	0.00	0.00	0.00	bar
Differential pressure compressor outlet: max. value	1.60	1.60	1.60	1.60	1.60	1.60	bar
* Output pressure coolant pump: min. value	0.00	0.00	0.00	0.00	0.00	0.00	mbar
* Output pressure coolant pump: max. value	4000	4000	4000	4000	4000	4000	mbar
Temperature switch cabinet: min. value	0.0	0.0	0.0	0.0	0.0	0.0	°C
Temperature switch cabinet: max. value	150.0	150.0	150.0	150.0	150.0	150.0	°C
* Temperature switch cabinet power section: min. value	-	-	-	0.0	0.0	0.0	°C
* Temperature switch cabinet power section: max. value	-	-	-	150.0	150.0	150.0	°C
Actual position of water/water cooler: min. value	0.00	0.00	0.00	0.00	0.00	0.00	%
Actual position of water/water cooler: max. value	100.0	100.0	100.0	100.0	100.0	100.0	%
Nominal value blower: min. value	0.00	0.00	0.00	0.00	0.00	0.00	%
Nominal value blower: max. value	100.0	100.0	100.0	100.0	100.0	100.0	%
Nominal position water/water cooler: min. value	0.00	0.00	0.00	0.00	0.00	0.00	%
Nominal position water/water cooler: max. value	100.0	100.0	100.0	100.0	100.0	100.0	%

Table 22: Parameter list

* HP4000, MP6000, LP8000: Not applicable for serial number 8198337 and higher