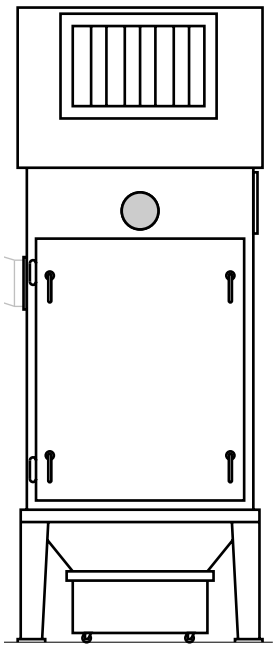
E

Operating Instructions

After Filter



Translation of the original operating instructions

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After Filter

Design, and operation

The **upper section** of the After Filter consists of a silencer hood with an integral radial fan. The radial fan is driven by an electric motor. Noise emission is reduced by built-in plate-type sound absorbers. The discharge of cleaned air is through an exhaust air grill.
The **mid-section** of the After Filter - the actual **filter housing** - consists of a rugged, welded structure. A horizontal "perforated plate" divides the filter housing into two sections, one above the other :
The lower section is the "raw air" space, the upper section is the "clean air" space.
The air flows through the filter elements from the outside inwards. Powder is retained on the surface of the PTFE (Polytetrafluorethylene) coated filter elements.
Fitted in the clean air space is a compressed air tank, and the distributor pipe system ("jet pipes") for the filter cleaning system, which is a jet pulse type. The distributor pipe system conveys the compressed air bursts from the compressed air tank into the interior of the filter elements. Pulses are produced by the quick-opening valves operating in rapid succession. The air pulses cause powder to be dislodged from the filter surface. A valve control unit controls the sequence, intensity, and time intervals of the cleaning pulses.
Convenient access to the quick-opening valves of the cleaning system, which are directly attached to the air tank, is through a cover plate.

The **lower section** of the After Filter consists of a powder collecting hopper.

Coated filter elements

The filter elements are made of sintered PE (Polyethylene), a porous, and rigid material and the airflow is from the outside inwards. The ribbed shape of the filter envelope provides a very large active filter area within minimum dimensions. Since the filter medium is self-supporting, the cleaning pulse produces neither friction nor flexing on the supporting cage, which substantially increases the service life of the filter.
For dry separation applications, the filter matrix is provided with a thin coating of PTFE so that surface filtration takes place on the outside of the filter. The high separation efficiency is due essentially to the micropore surface coating of PTFE which prevents particles from penetrating deep into the filter material. Cleaning of the filter elements is by pulsed air jets directed into the filter interior to loosen the powder layer adhering to the outer surface.

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Exhaust air system (recirculated air)

The fan of the exhaust system is located in the fan housing (**7**) of the After Filter. The fan draws air from inside the booth, first through the Multicyclone, and then through the After Filter, the clean air is then returned into the workshop. The fan housing is equipped with a silencer hood.
The suction capacity depends on the total area of the booth openings, and the permissible powder/air concentration. The required volume of air is adjustable with throttle vanes installed at the outlet of the fan housing.
The efficiency of the exhaust system depends on how severely the filter plates (**9**) are clogged. For this reason suction efficiency is determined by measuring the pressure difference between the suction chamber, and the exhaust side, and is indicated on the gauges of the pressure monitoring assembly.
Rising pressure indicates increasing contamination of the filter plates.

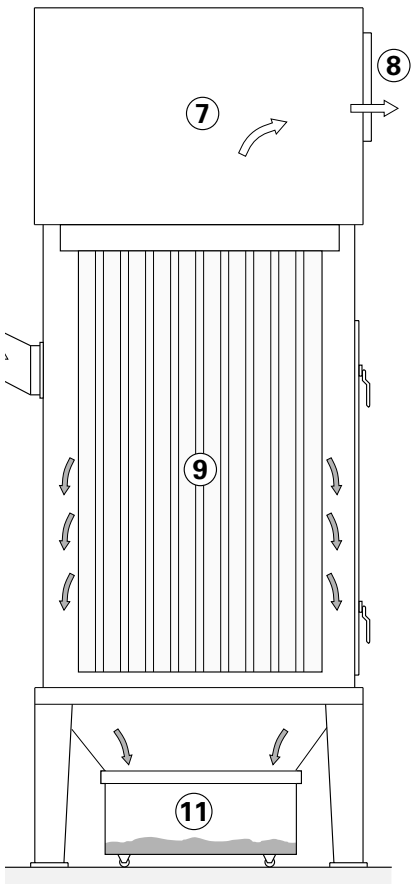

Figure 1

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Filter cleaning

(Bold numbers refer to Fig. 1, page 2)

The filter plates are cleaned periodically, in pairs, with short blasts of compressed air (jet pulse cleaning) in the opposite direction to filtration (from the inside of the filter outwards), while the booth is in operation. The powder dislodged from the filter plates falls into the collecting hopper (**11**). The cleaning procedure is initiated when the booth is started and remains enabled until the booth is switched off again.

The air for blasting off the filters is injected from a compressed air tank into the top of the filter plates through solenoid valves. The pressure tank, and the solenoid valves are integrated into the clean air housing in the middle section of the After Filter.

The duration of the cleaning blast, and the interval between the air blast for the next filter pair is monitored by an electronic control circuit. The blast time, and the interval time are preset at the factory. However, these settings can be changed if the warning - "Pressure rise" appears too frequently. The printed circuit board is found in the control cabinet.
The cleaning process can be initiated seperately for cleaning, and control purposes.

⚠ **CAUTION**

Good quality compressed air is a prerequisite for trouble-free operation (see Technical Data, page 5). Contamination by dirt, rust particles, oil residue or dampness lead to faults in the pneumatic components and influence the filtration performance of the filter plates.

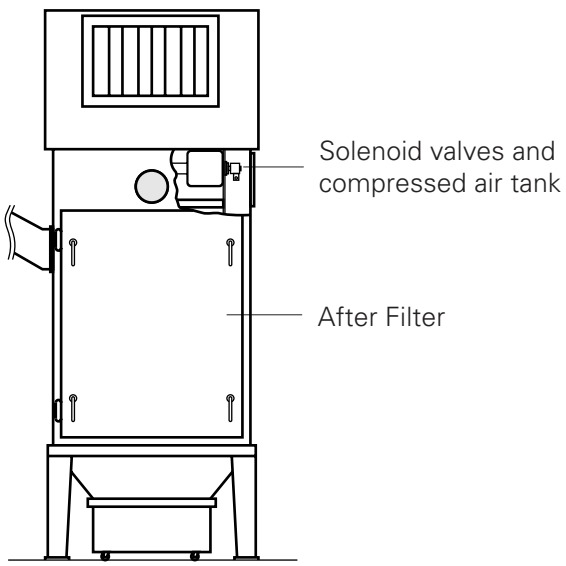

Figure 2

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Filter cleaning

The filter plates are cleaned automatically (by an air blast from the inside to the outside) at regular intervals during the coating operation. The cycle times are preset by the factory. If the maximum pressure difference is exceeded repeatedly (an alarm is triggered), the pressure must be reset.
The pressure difference is indicated on the pressure monitoring equipment :

- "Filter pressure monitoring" is indicated optically on the pressure gauge only.
- "Fan pressure monitoring" is indicated optically on the pressure gauge, and an optical, and accoustic alarm is released by two manostats (See Fig. 3).

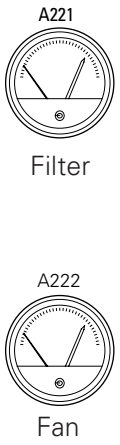

Figure 3

The upper limit, at which the alarm is released is specific to the individual plant and is set by Gema service personnel on assembly of the booth.

The setting of the cycle times must also only be set by trained personnel. The control printed citrcuit board is found in the control cabinet.

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Technical Data

(subject to change)

Power requirements :

Voltage	:	3 x 380 V / 50 Hz *Other voltages, and frequencies on request*

After Filter fan performance :

with 12 filter plates or 8,000 m^3/h	:	15 kW
with 16 filter plates or 12,000 m^3/h, After Filter with silencer hood	:	22 kW

Fan pressure difference :

with 8,000 m^3/h	:	4.2 kPa
with 12,000 m^3/h	:	4.5 kPa

Compressed air connection :

Inlet pressure	:	min. 6 bar / max. 10 bar
Recommended inlet pressure	:	7 bar

Minimum quality compressed air requirement :

Water vapour content	:	max. 1.3 g/m^3
Max. oil content	:	max. 0.1 mg/kg (Oil/Air)

Compressed air consumption :

Rinsing air in the filter housing	:	max. 18 Nm^3/h

Filter cleaning interval settings

Valve control A56/A156:

Valve opening time	:	100-160 ms *(The cleaning pressure should sink by 2-2.5 bar)*.
Pause time	:	30-40 secs.

The time setting adjustment should only be done by trained personnel.
The control printed circuit is in the switch cabinet.

Fan pressure monitoring

Pressure condition	Pressure gauge	Switch
Under-pressure 1	A222	B30
Over-pressure 1	A222	B31
Under-pressure 2	A224	B32
Over-pressure 2	A224	B33

- Set the Alarm/Throttle Vane setting motors according to the fan curve diagram.
- Set the thermal control according to the electrical diagram.

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Booth settings - Overview

Pneumatic:

Input pressure	:	6 bar (Min.)
Filter cleaning pressure	:	5.5 bar
Sealing frame	:	2 bar

Instructions for starting/shutting down the After Filter

Safety instructions:

- The After Filter must only be started/shut down by authorized persons.
- The After Filter must ***never*** be put into operation without the interlocking safety devices provided.
- Make sure that the powder spraying equipment is ***never*** put into operation without the After Filter.

Recommended starting sequence :

- Compressed air supply - on
- Fan, and filter cleaning system - on
- Powder spraying equipment - on
- Powder discharge devices - on

Shut down is in the reverse order sequence.

- Establish a routine **starting sequence** of the plant components to suit particular applications and, if necessary, install any required **interlocks**.
  It is recommend to issue formal **operating instructions.**
- Note that the **starting sequence** of the plant components of the **powder spraying equipment** is such that the **process parameters** are maintained.

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Operation and Maintenance

Work to be carried out by the operating personnel

How often	Component	Work to be done
Hourly *(Operator)*		**Check the functioning of the suction.** - Accumulated powder (Overspray) must be sucked up so that as little powder as possible collects in the booth
Several times daily *(Operator)*		**Clear away the powder in the booth.**
Daily (*Operator)*	Cleaning filter	**Check :** - **Intensity** of the cleaning pulses. *These should all be roughly of the same intensity or loudness.* - **Pauses** between the cleaning pulses. *These should be of equal duration.* - **Pressure drop** reading of the pressure gauge of the filter regulator during the cleaning pulse. *This should be roughly the same for all pulses.* - Grounding connections - Pressure differences of the filter (Theoretical value). - Cleanliness of the air returned to the workshop. Make a visual check of the air at the exhaust outlet and/or check the clean air space as follows : 1. Remove the round, black rubber cover from the clean air space, with the After Filter switched off. 2. With the aid of a torch, check for powder deposits in the clean air space. (continued)

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Operation and Maintenance (continued)

Work to be carried out by the operating personnel

How often	Component	Work to be done
Daily (*Operator)*	Filter cleaning	Powder deposits point to a damaged filter element. 3. Close the inspection opening with the black rubber cover. 4. Check cleaning sequence
	Filter monitoring instruments (= optional)	Compare the readings with specified values. It is recommended to record the values.
	Jet pulse cleaning	Check performance : The intensity, and pauses between pulses should be equal.
	Filter regulator *(Operator or Specialist)*	Clean the automatic condensation trap
Weekly *(Operator)*	Clean air space	Check the **cleanliness** with the After Filter switched off, for this purpose : - remove the round, black rubber cover. - be sure to close the inspection opening again after checking ! Check the **cleanliness** of the filter pad on the exhaust outlet on the silencer hood, clean or replace, if neccessary
Weekly or more frequently where powder loading is high or according to operating instructions. *(Operator)*	Powder collecting hopper	**Empty** before : - *a **maximum** **filling level*** exceeds 75% of the hopper height
Monthly. *(Specialist)*	Differential pressure monitor.	- Clean the protective filters at the differential pressure measuring points. - Check the functioning of the differential pressure monitor.

(continued)

Operation and Maintenance (continued)

Work to be carried out by the operating personnel

How often	Component	Work to be done
3 years *(Specialist)*	Seals of filter elements	Renew seals.
3 years or 5 years. *(Specialist or Specialist firm)*	Electric motors	Change grease or bearings.

Report any abnormal conditions at once so that repairs can be initiated quickly and damage is minimized.
Fault finding, and remedial action must be carried by specialist personnel

- according to the instructions in the section Fault Finding.
- in observance of the rules for safety at work, and the prevention of accidents.

⚠ **NOTICE**

The intervals given above are recommended for single shift operation.
The intervals should be adapted to the the number of shifts, e.g. two or three shift operation.

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Fault finding on the After Filter

Safety precautions:
There is an *increased risk of accidents* when testing components for correct functioning. Only qualified specialist personnel should be employed for fault finding, and remedial action.

Before attempting repairs on plant components, depressurize, and switch off the unit.
If any problems are experienced in trying to remedy faults, contact a Gema Service Centre immediately.

The following information will be helpful in assisting with advice :
- Setting values (i.e. interval, valve opening time)
- Pressure drop across filter elements : Δp_{filter} - Pressure difference - Filter
  : Δp_{stat} - Pressure difference - Fan

Fault/Error/Problem	Remedy
Decrease in suction capacity:	
- The filter cleaning system fails to function or only insufficiently	- Check the filter cleaning system
- The ducting leaks or is clogged	- Seal or clean the ducting
- The direction of rotation of the fan is wrong, e.g. after work on the electrical system	- Change the direction of fan rotation
- The After Filter leaks, e.g. the rubber cover in the clean air space is missing, powder collecting hopper is not correctly clamped etc.	- Check the After Filter for air-tightness, e.g. rubber cover in the clean air space, the powder collecting hopper, the ducting
- The pressure drop in the filter elements is too high.	- Close the throttle damper on the After Filter, if this is not successful, **contact a Gema Service Centre.**
The After Filter stops running or fails to start:	
- The motor protection operates due to thermal overloading of the fan motor.	- Check the position of the throttle damper. - Check the After Filter for air-tightness, e.g. the rubber cover in the clean air space, the powder collecting bin, the ducting. - Check the power consumption of the fan motor. - Check the setting of the motor protection.
The powder in the clean air space or powder emitted from the outlet opening:	
- The filter seal has deteriorated, is crushed or cracked.	- Replace the filter seal.
- The filter element has mechanical damage.	- Replace the filter element.

(continued)

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Fault finding on After Filter (continued)

Fault/Error/Problem	Remedy
Filter cleaning system (jet pulse type) fails to function or insufficiently: - Compressed air supply not sufficient.	- Check the compressed air supply, if the amount, and quality is sufficient.
Electronic valve control unit : - Power supply failed. - Electronic valve control unit defective.	- Check the power supply of the solenoid valve unit (LEDs must light up). - Check the fine wire fuse of the solenoid valve unit. - Replace the solenoid valve control unit.
Individual quick-opening valves fail to open (recognizable when pauses between cleaning pulses are of different durations), increased powder depositing on individual filter plates.	- Check the power lead (connect the power lead to a quick-opening valve which works). - Clean or replace the diaphragm of the quick-opening valve (see section "Cleaning the quick-opening valves"). - Check the solenoid of the quick-opening valve (fit the solenoid to a quick-opening valve which works). - Check the control outputs of the quick-opening valve.
Air escaping from the safety valve of the compressed air tank (hissing noise).	- Correct the pressure in the compressed air tank. ⚠ **CAUTION** ***No repairs* to the safety valve** ***Replace the safety valve.***
Too much powder in the waste container	- Multicyclone leaking - Too little exhaust air - Powder transport from Multicyclone not switched on
Filter pressure too high	- Filter cleaning pressure too low - Cleaning sequence set too long - Too much exhaust air - Exhaust air ducting leaking

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Cleaning coated filter elements

Safety precautions:
Acquire information about the type of powder on the filter elements, and the regulations to be observed in respect at safety at work, and environmental protection.

Note : ***Cleaning the filter elements is not necessary as part of the maintenance program.***
Should cleaning become necessary, as a consequence of a failure, it is recommended that cleaning is done by the built-in filter cleaning system.

Optimum procedure :
Allow the After Filter to run without powder loading, if possible with the throttle damper (in the silencer hood housing) *closed*.
The filter cleaning system will clean the filter elements within 30-60 minutes.

Approved procedures in consultation with a Gema Service Centre :
- Clean with a suitable industrial vacuum cleaner with a soft suction brush head.

***Never* use any of the following procedures :**
- Rough mechanical cleaning, e.g. with wire brushes.
- Steam cleaning equipment or a high-pressure cleaners.
- Cleaning with solvents or detergents.
- Operating the plant with *wet* filter elements.
- Unauthorized repairs of any damage.
- Avoid anything that will permit powder to penetrate into the interior of the filter elements.

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Cleaning/Replacing the solenoid valve for cleaning the filter plates

The solenoid valves for jet pulse cleaning are located in the clean air chamber in the fan housing (see the Fig. 4 below) and are accessible by opening the side panel. If a solenoid valve is faulty, it is usually only necessary to clean the upper part of the solenoid housing of the diaphragm. If the fault is not corrected with this operation the solenoid must be replaced completely.

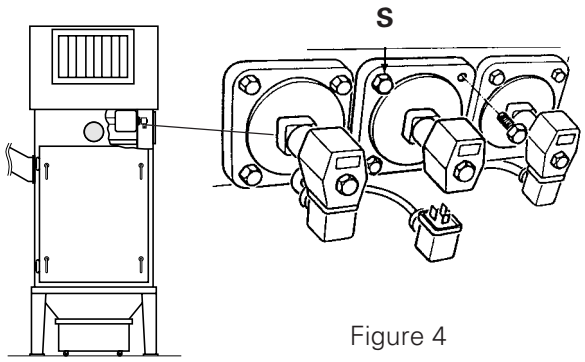


Figure 4

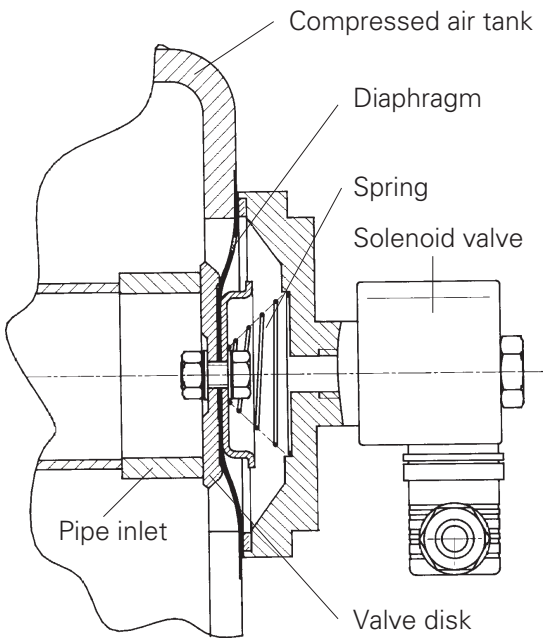
Procedure :

1. Close down the compressed air supply, and depressurize the system..
   Secure the compressed air supply to prevent unintentional opening!
   Do not change the preset cleaning pressure of the filter regulator.
2. Let the booth operate until all the compressed air in the pressure tank in the fan housing has been consumed.
   The pressure gauge of the pressure tank (on the booth) should stand at 0 (zero).
3. Switch off the booth and disconnect the power supply.
4. Open the side panel in the filter housing, the solenoid valves are now accessible.
5. Unplug the control cable of the defect solenoid valve.
6. Unscrew the screws (**S** - Fig. 4) from the compressed air tank.
7. Remove the valve plate, spring, and diaphragm of the quick-opening valve.
   Check if :
   - *the diaphragm is cracked or swollen*
   - *the sealing surfaces of the tube or the diaphragm are dirty*
   - *the vent hole (brass rivet) of the d diaphragm is clogged*
   - *the spring is broken*
8. Assemble in the reverse order.
   Apply thread sealant to the screws before installation.
9. Tighten the M8 screws (diagonally) .

⚠ CAUTION

Care should be taken when retightening the screws - S (Aluminium housing !!). Torque : M = 14 Nm

10. Connect the power supply.
11. Open the compressed air supply and check its function.



Quick-opening valve

Figure 5

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Replacing the filter plates in the After Filter

Note:
Before removing the filters, be sure to order :

- **Gaskets,** and **seals,** so as to be able to replace any defective gaskets or seals right away,
- **Coated screws**. The coating of the thread sealant will have worn off after the filter elements have been removed/reinstalled 5 times.

⚠ CAUTION

Before starting repair, and maintenance work switch off, and depressurize the systems. *Lock the main compressed air supply.*

Run the booth and the cleaning systems until the pressure in the compressed air tank has dropped to zero. Turn the main switch on the switch cabinet to the 0 (Off) position. Check the pressure gauge display again to be sure there is no pressure in the tank.
There is a considerable risk of injury if the tank is not empty!!

Replacing filter elements

*It only takes one defective filter element to cause the destruction of a **complete** filter set because leakage will result in internal fouling of all the filter elements.*

1. Open the After Filter door (Fig. 6)
2. Unscrew the screw on the side of the door and turn the comb bar downwards.
3. Unscrew the fixing screw (**1** - Fig. 8, page 16) only so much that the sealing strip is not compressed.
4. Release the other side of the filter plate, remove the screw (**1** - Fig. 8, page 16), the washer (**2** - Fig. 8, page 16, and spacer (**3** - Fig. 8, page 16).
5. Number the filter plates, then remove to check their condition. If necessary clean or replace.
6. Check the condition, and seating of the sealing strip. If necessary replace (see Replacing the sealing strip).
   - *Store the filter elements horizontally on suitable supports with packing (cardboard strips) placed between them.*
7. Repeat these operations until all defect filter plates are replaced.

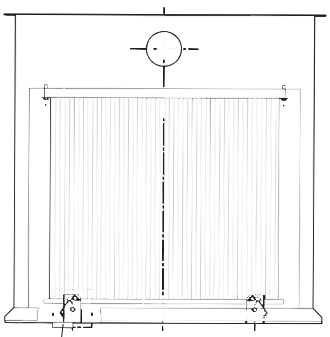
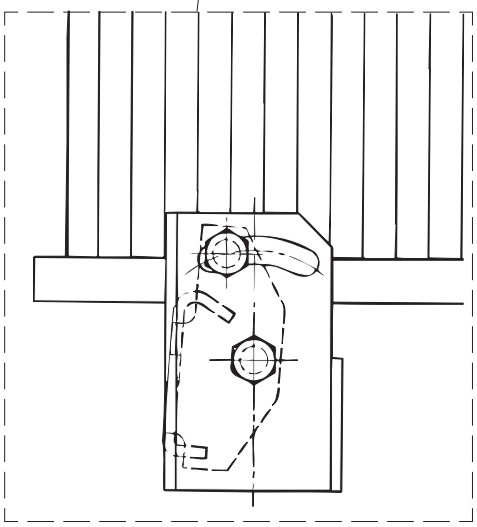


Figure 6



Insert : "Filter element locating bar"

Filter housing with built-in filter elements

Figure 7

Fitting a filter plate

1. Coat the front end of the screw (**1** - Fig. 8) with sealing compound. If the screw coating is worn it must be replaced.
2. Place the washer (**2** - Fig. 8), and spacer (**3** - Fig. 8) on the screw shank.
3 Align the filter element approximately under the perforated .plate.
4. Insert the screw, washer, and spacer through the oblong hole in the filter bracket and screw into the tapped hole in the perforated plate, without tightening.
5. Screw the other side of the filter plate to the perforated plate, also without tightening.
6. Tighten both screws with a torque spanner.

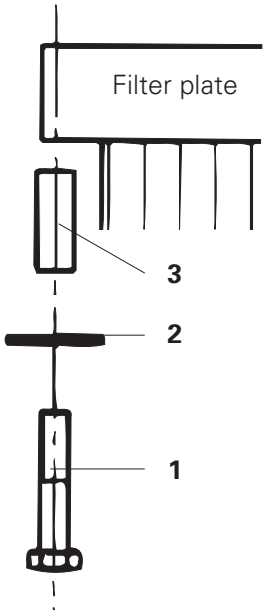


Figure 8

⚠ **CAUTION** ***Prescribed torque : Mt = 40 Nm.***

7. After installing the first filter element, turn up the locating bars far enough to permit the lower filter bar to seat about 5 mm (Fig. 9) into the recess of the locating bar.
8. Repeat Steps 1-6 until all defect filter plates are replaced.
9. Turn up both locating bars to a point where the filter bars seat about 15 mm into the recess (see Fig. 10), and then tighten the clamping screws. After all filter plates have been installed; turn up the comb bar and secure with a screw on the side of the door.

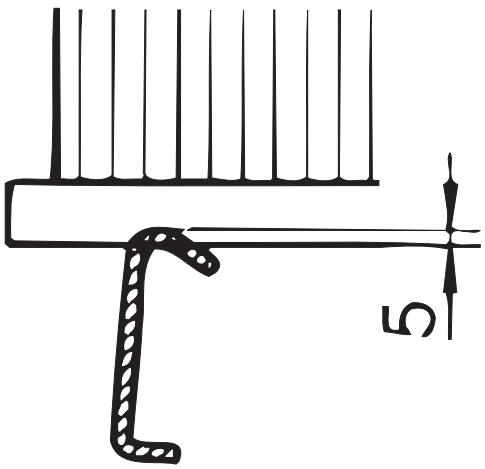


Figure 9

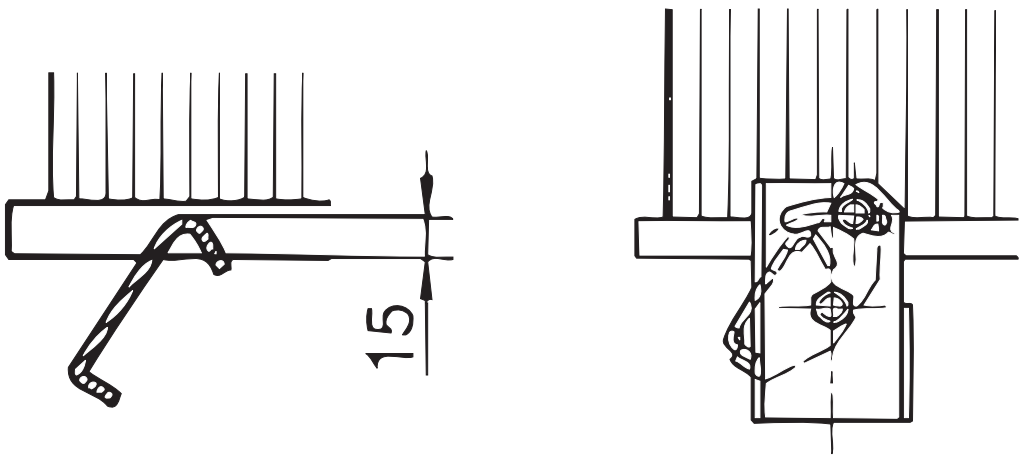


Figure 10

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Replacing the sealing strip

Aged, inelastic or porous rubber sealing strips must be replaced *without exception.*

1. Carefully remove the faulty sealing strip (Fig. 11).
2. Thoroughly clean the top of the filter (contact surface of the sealing strip) and the groove.
3. Inject sealing compound (e.g. sealing compound for car windscreens) into the groove at the end of the radius over a length of 2 cm (Fig. 13).
4. Fit a new sealing strip.

⚠ CAUTION

The vent holes in the sealing strip must face inward (Fig. 11).

5 . The joint of the sealing strip should be located on the long side of the filter element (Fig. 12).
6. Make sure that the sealing strip sits uniformly in the groove. Carefully tap into place with a rubber hammer.

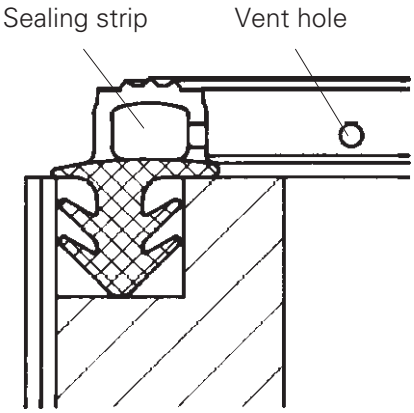

Figure 11

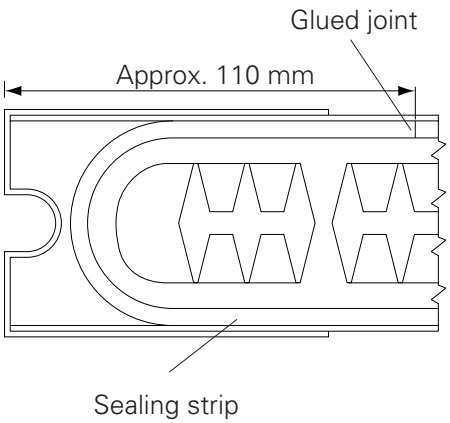

Figure 12

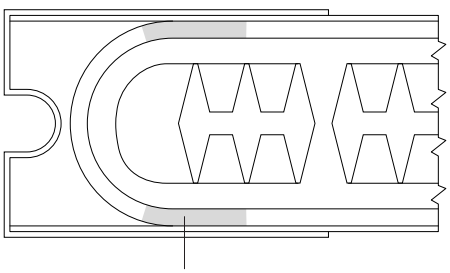

Figure 13

Checking the direction of rotation of the fan

Safety precautions :

⚠ CAUTION

During checks, there is an *increased risk* of accidents due to the rotating fan wheel!

Never *reach into the inspection hole while the fanwheel is rotating!*
Due to their high flywheel mass, fanwheels will continue to ***rotate*** for about *5 minutes* ***after*** the fan has been switched off!
There may be a strong air draught at the inspection opening.
Take care to prevent any objects being drawn into the opening!

Note:
A fan running in the **wrong** *direction of rotation* will have a **low suction capacity,** but it will **not** cause air to be **blown** from the intake ducting!
Therefore, **check** the *direction of rotation* of the fan during **initial commissioning,** and whenever work has been done on **the drive** or its **power lines!**

Checking the direction of rotation :

- Depending on the type of After Filter, there is an inspection opening above the casing door or one inspection opening each on the two side panels. Only remove the black rubber cover in the inspection opening with the After Filter shut down.
- Start the fan for a short period.
  The fan need not run up to its rated speed.
- Be sure to prevent the After Filter from being switched on unintentionally!
- Use a lamp to inspect the clean air space while observing the above-mentioned safety precautions.

⚠ CAUTION

Rotating fan wheel!
Air draught!

- Check the direction of rotation of the fan; *note* the arrow on the intake nozzle, and the marking on the fanwheel.
- If necessary, have a specialist change the direction of rotation.
- After the check, reinstall the rubber cover.

An uncovered inspection opening will greatly reduce the suction capacity!

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Documentation After Filter

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