



**Willibrord Lösing
Filtertechnik e. K.**

SEPAR · ARGO-HYTOS · HENGST · HYDAC
DONALDSON · PARKER · WIX-FILTER

Manual

Water separator / Fuel pre-filter SWK-2000

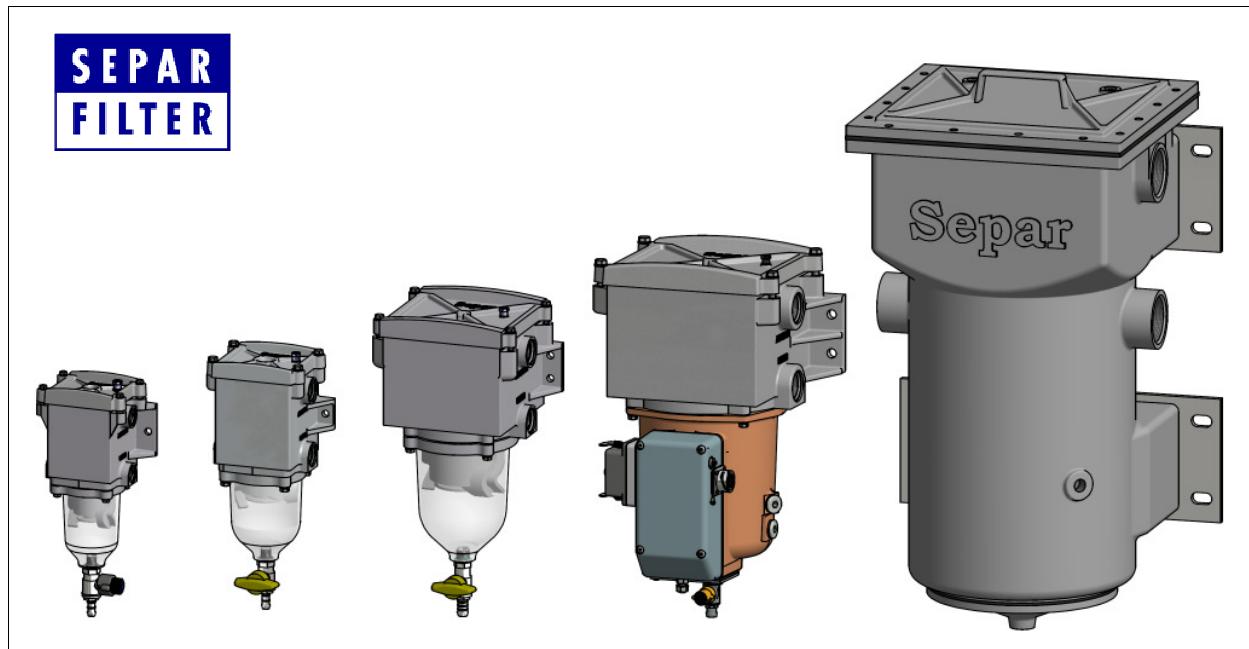




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1 Change register

Rev.	Date	Emp.	Change	Chap.	Page
00	05.04.2013	Texter/ Große	Dokumentenerstellung		
01	02.05.2013	Texter	Kleinere Fehlerkorrekturen		
02	05.08.2013	Texter	Kleinere Fehlerkorrekturen	7.1	21
03	16.08.2013	Texter	Korrektur der Leistungsmerkmale	5.3	12

2 General information

2.1 Disclaimer

The preparation of this document was made as carefully as possible. However, errors can not be excluded. Therefore, we do not take over any liability for errors or deficits in this document, nor for any consequential damages which may arise there from.

We reserve the right to make technical changes to this document or the product described herein without notice.

2.2 Symbols used

The following symbols are used in this document to visually emphasize important information and warnings:



Note on special tips and other helpful or important information.

Note



Note on special measures for protection of the environment / surroundings and disposal of the system or parts of the system.

Disposal



2.3 Safety instructions



Wear goggles



Wear protective gloves



Ventilate the work area



Refrain from smoking



No open fire



No food in the work area

Works on the system have to be performed by trained personal only and in compliance with the applicable work safety regulations. Generally operate on a cut-off, voltage-free system.

The filter may be under pressure. Therefore never open a filter in operation, otherwise fuel may leak into the environment and the engine draws air, which can cause damage to the engine.

When using duplex or switchable filters, the lever position indicates which filter is in operation. At this moment the other filter is isolated from the fuel circuit, but still could contain fuel.

Filters with fuel pre-heating systems may only be placed in operation when completely filled with fuel and primed of air. The electrical current of the heater must never be turned on without grounding and activated associated control system.

Remove spilled fuel immediately and dispose them in accordance with the applicable statutory provisions (s. cha. 12).

2.4 Intended use

The filter is intended for the filtration of diesel fuels and mineral oils with a dynamic viscosity < 10 mPas, flash point > 55 °C and boiling point > 160 °C and is designed for inlet operation in between fuel tank and fuel lift pump (suction side). The filter should never be installed on the pressure side, behind the fuel pump.



3 Introduction

3.1 Why Separ

In 1992, the generation SWK-2000 water separators / fuel filter was developed by the company W. Lösing Filtertechnik e. K. as an effective system for the separation of water and dirt particles which are contained in the fuel. Both water and dirt can lead to high wear and tear on engines as well as the injection systems and result in expensive, intensive repairs and equipment down time.

SWK-2000 offers:

- Smallest and most compact design
- High separation efficiency
- Low flow resistance
- Long life filter element
- Easy installation
- Simple maintenance
- Different flow rates
- Minimal maintenance effort
- Environment friendly

3.2 Function of the SWK-2000

The separation and purification process using a special patented system that is used throughout all of the different sizes, which stand out through most compact design in relation to the effective flow rate.

Generally, the SWK-2000 is installed on the vacuum side of the fuel system, i. e. between fuel tank and fuel pump.

The fuel enters the filter through one of the two inlet ports, the unused port must be sealed off with the attached plug.

Stage 1

From the inlet port, fuel flows into the filter and passes an interior vane system whereby the fuel is moved in an intensive circular motion.

Stage 2

The centrifugal gravity, resulting from the circular motion, forces the fuel to the outer wall of the bowl. The heavier water droplets and heavier particles collect on the wall of the bowl and settle due to natural gravity to the bottom of the bowl.

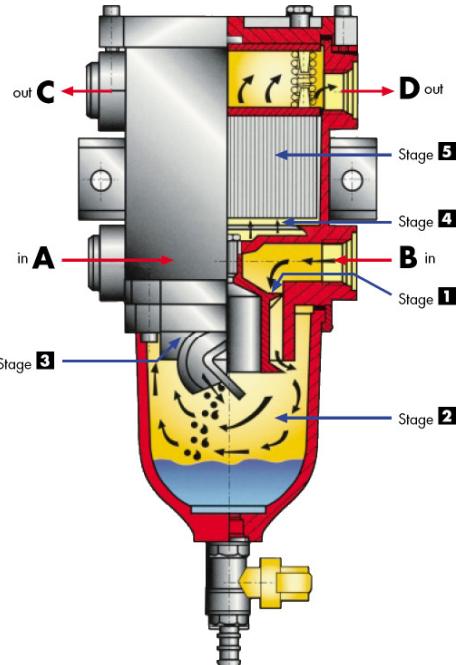


Stage 3

In the further flow the fuel passes the outer vane system. By the different length of the vanes and the twofold change in the fuel flow direction, smaller water droplets and fine dirt particles settle on the vanes, where they agglomerate and then decline, caused by gravity, down to the bottom of the bowl. Already at this point the major portion of any contaminates in the fuel have been separated.

Stage 4

Below the filter element, on the so-called dome, the flow cross-section is considerably increased, whereby a slow-down of the fuel occurs. This also allows smallest water droplets and dirt particles to settle. Through the previous pre-separation, the majority of the contamination (water and dirt) settles in the bowl and prolongs significantly the lifetime of the filter element.



Stage 5

The remaining suspended contaminates in the fuel, finest water droplets and smalles particulates are filtered by a replaceable filter element which is produced from a special cellulose paper or stainless steel mesh elements.

The clean fuel leaves the filter through one of the outlet ports (the port not required should be sealed off with the plug attached) and continues through the fuel system.

3.3 Fields of application of the filter

- Vehicle industry – trucks, busses, crane trucks, municipal vehicles, etc.
- Construction machinery, agricultural machinery, forklifts, compressors, etc.
- Ship propulsion motors, auxialiary units
- Stationary engines and generators, welding and pumping units
- Mining machinery, rail vehicles



There are also versions available for special applications.

Specifically for marine or prime power application duplex or switchable filters are offered. Thereby a filter can always be serviced, while the other filter is under flow without engine shut down.

For engines burning biodiesel appropriate versions are available.

For winter operation the SWK-2000 filter is available with pre-heating systems. For hot environments there are custom high-temperature variants available.

3.4 Tests and Certificates

The SWK-2000 has various approvals and certificates. Copies can be provided on request. Below is a list of organizations that have carried out these tests.

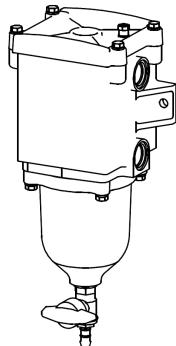
- Rheinisch-Westfälischer TÜV
- KBA - Kraftfahrt-Bundesamt Flensburg
- German Technical Department for Army Ship and Marine Weapons
- GL - Germanischer Lloyd Type Approval Certificate
- Bureau Veritas Type Approval Certificate
- RINA – Registro Italiano Navale
- ABS – American Board of Shipping
- LR – Lloyds Registry London
- Gost Standard
- Fire Resistance Test by MPA – Materialprüfungsamt Nordrhein-Westfalen



4 Delivery

4.1 Scope of delivery

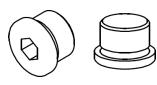
Check if you have the following accessories:



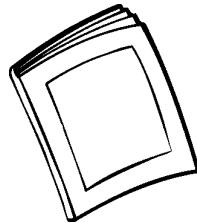
Filter assembly
(s. chap. Fehler!)



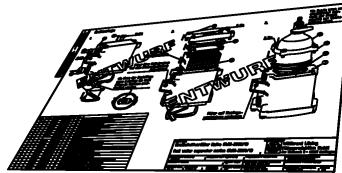
Filter element
(already installed)



2 plugs



Operating instruction



specific drawings
(upon request)

4.2 Unpacking

Before opening check the delivery for outer damage. Report any damage to carrier.



DISPOSAL

Please follow the environmental guidelines and laws of your country. Make sure the the packaging material is disposed according to applicable regulations.

4.3 Storage

The filter and its accessories must be kept dry and in compliance with the maximum permitted temperature ranges (s. chap. 5.8).

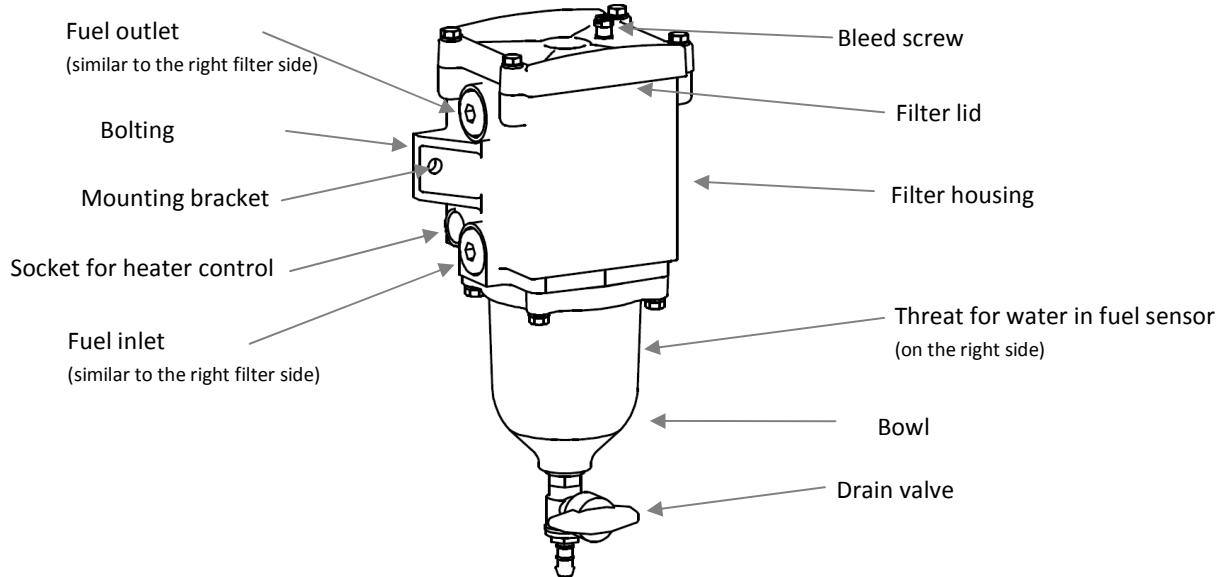
During a long storage period you should close all openings on the filter in order to protect the interior and the filter element from unnecessary pollution. All filters out of the factory have all ports sealed with plastic plugs.



5 Technical description

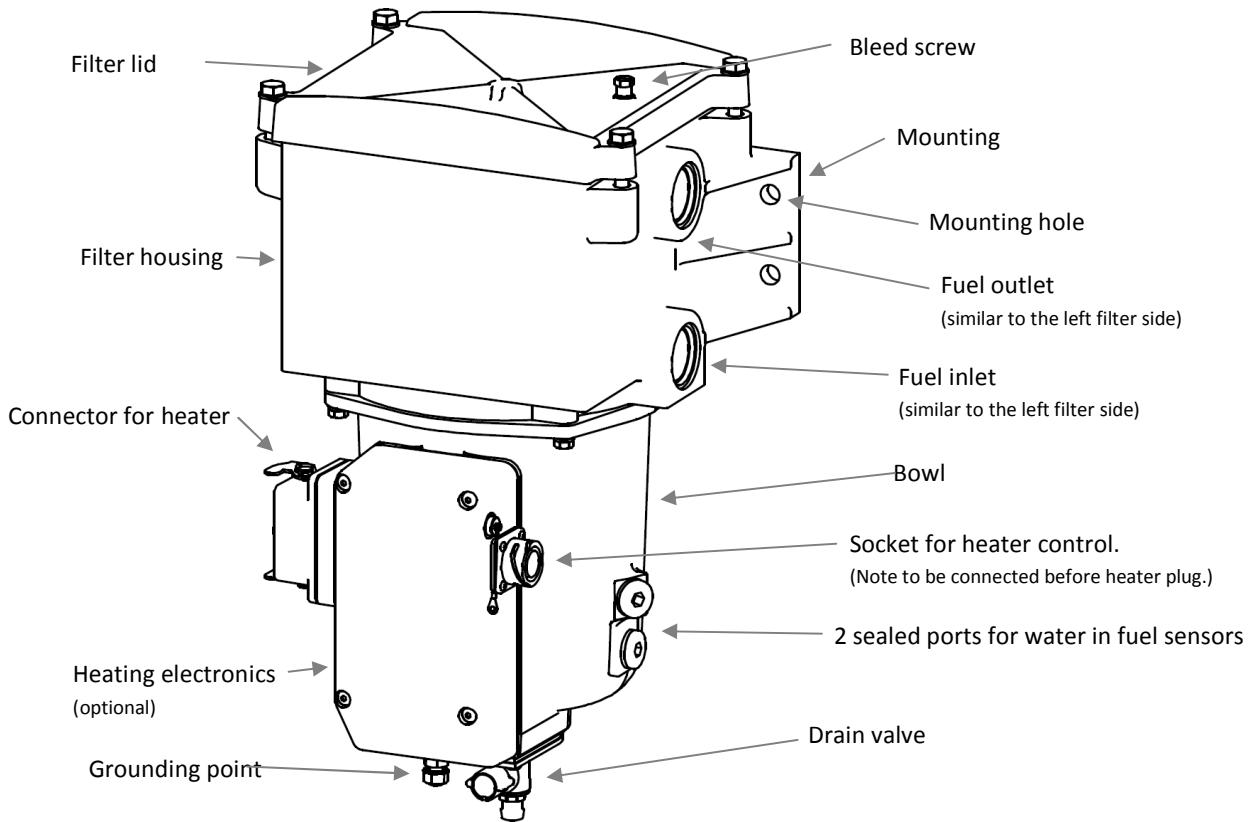
5.1 General arrangement drawing

Using the example of the SWK-2000/10:

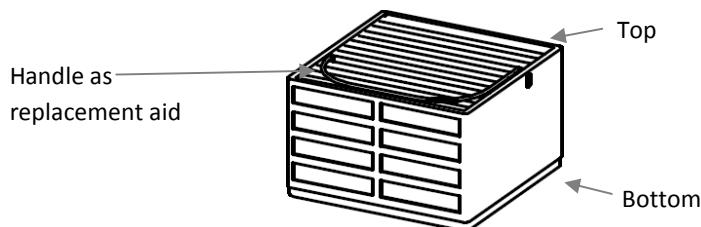




Using the example of the SWK-2000/40/M/H:



Example of a filter element:



The filter shown here may differ from your purchased filter. The actual appearance and arrangement of the components depends on the configuration of the filter you have chosen.



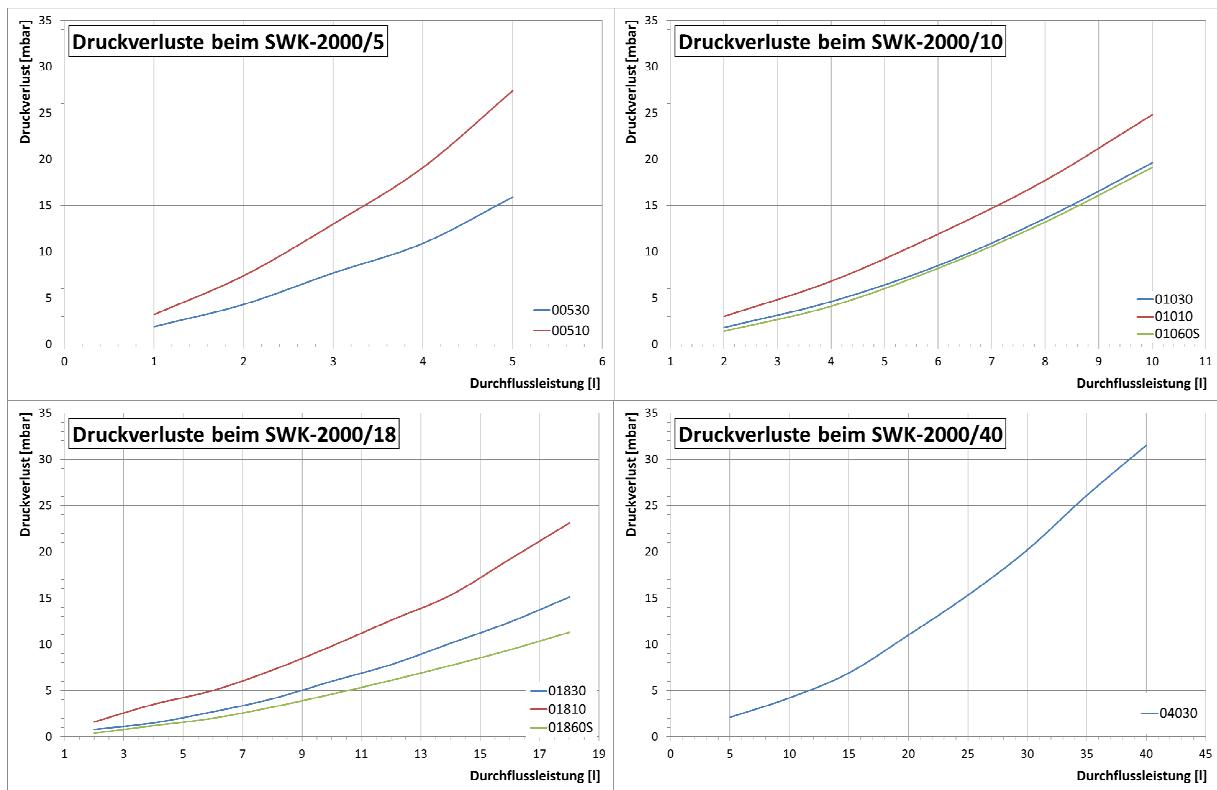
5.2 Weights and dimensions

	SWK-2000/5	SWK-2000/10	SWK-2000/18	SWK-2000/40	SWK-2000/130
Width	140 mm /WSA: 210 mm	150 mm, /WSA: 220 mm	210 mm	290 mm	420 mm
Height	275 mm /50: 310 mm	340 mm	410 mm	470 mm	720 mm
Depth	90 mm	110 mm	165 mm	250 mm	370 mm
Weight	< 2,5 kg	< 3 kg	< 10 kg	< 15 kg	< 55 kg
Mounting holes	2 x Ø 9 mm	2 x Ø 9 mm	4 x Ø 9 mm	4 x Ø 12 mm	4 x Ø 15 mm

5.3 Characteristics

	SWK-2000/5	SWK-2000/10	SWK-2000/18	SWK-2000/40	SWK-2000/130
Flow performance	5 l	10 l	18 l	40 l	130 l
Water-holding capacity	75 ml	125 ml	340 ml	1,3 l	7 l
Water separation	> 99 % of the free water ¹				
Available filter units	10 µm (coated cellulose paper) 30 µm (coated cellulose paper) 30 µm (stainless steel mesh) 60 µm (stainless steel mesh)				

¹ The water separation was detected at W. Lösing Filterproduction GmbH based on the DIN 4020 and the ISO-TS 16332.



5.4 Available options

	SWK-2000/5	SWK-2000/10	SWK-2000/18	SWK-2000/40	SWK-2000/130
heating	x ²	x	-	x	-
Water sensor	x	x	x	x	x
Relative pressure switch	x	x	x	x	x
Differential pressure switch	x	x	x	x	x
Clogging indicator	x	x	x	x	x
Transp. bowl	x	x	x	-	-
Metal bowl	x	x	x	x	x
Heavy-Duty design	x ²	Not applicable because only Heavy-Duty version available.			

² Only in connection with option /50



5.5 Materials used

Filter cover, filter housing	Aluminium
Bowl	Aluminium or transparent PA
Drain valve	Brass, PBT
Gaskets	TPE and/or HNBR
Bleed screw	Steel
Outboard screws	Stainless steel A2

5.6 Electrical data

Electrical components are installed only in conjunction with a filter heater water in fuel sensor and/or pressure switch. The electrical data on these options please refer to chapters 6.1 and 6.2. Filter sizes for which the above options are available please refer to chapter 5.4.

5.7 Mechanical connections

	SWK-2000/5	SWK-2000/10	SWK-2000/18	SWK-2000/40	SWK-2000/130
Fuel inlet	M16x1,5	M22x1,5	M26x1,5	M33x2	G2"
Fuel outlet	M16x1,5	M22x1,5	M26x1,5	M33x2	G2"
Recommended minimum-cross-section performance	8 mm	12 mm	20 mm	26 mm	40 mm

Adapter for the fuel inlet and fuel outlet can be obtained as an accessory through the W. Lösing Filtertechnik e. K..

5.8 Temperature ranges

Filters are designed to operate in temperature range of -40 °C to 80 °C.

You can request a high temperature model, temperature-resistant from -20 °C to 105 °C at W. Lösing Filtertechnik e. K. or your dealer.

On the filter with fuel pre-heating system selected thermal fuses are installed. Fuses will be irrevocably destroyed when ignoring the stated temperature limit.



6 Options

Please refer to chapter 5.4 which options are available for your filter.

6.1 Filter heating

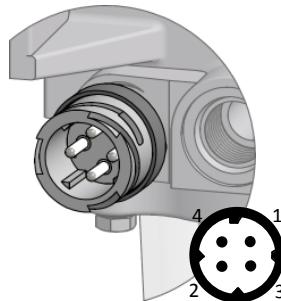
Different heating coils are used as a heating element in the different filter sizes. The heating of the filter size SWK-2000/40 is treated separately in one of the following chapters. Heating controls of SWK-2000/40/MH are operating differently than models SWK-2000/5/50/H and SWK-2000/10/H.

6.1.1 Heating system SWK-2000/5/50 and /10

Types of fuel pre-heating systems

Operating voltage	Heating power rating
12 VDC	250 W
24 VDC	300 W
24 VDC	450 W

Heating connection

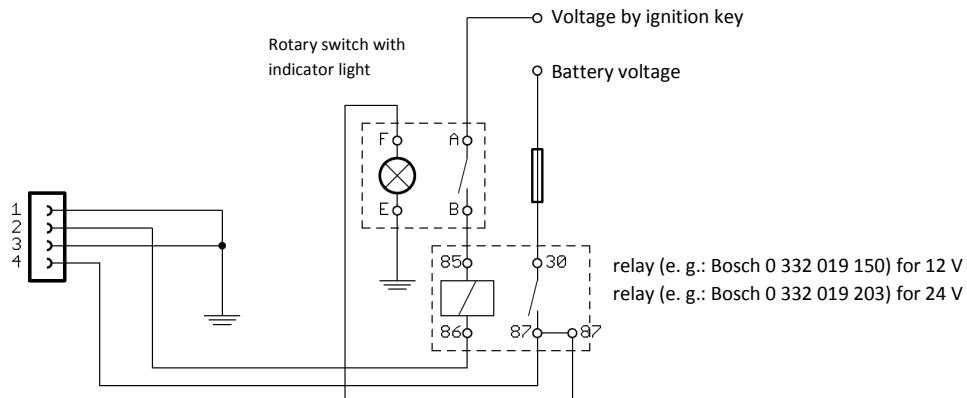


Connectors

Pin 1	GND
Pin 2	Control terminal
Pin 3	GND (not used for all types)
Pin 4	VCC (have to be protected by electric fuse)

When fuel temperature is <5 °C, the control signal is connected to ground. At temperatures >10 °C, the signal is interrupted.

External interconnection



6.1.2 Fuel pre-heating system SWK-2000/40/MH or /MHS

In the heated filter of the SWK-2000/40 series, a heating power of 1400 W is fed into the fuel. The heating system is in a 230 V and a 440 VAC version available.

Control electronics

The control electronics are identical for all versions of the filters described here.

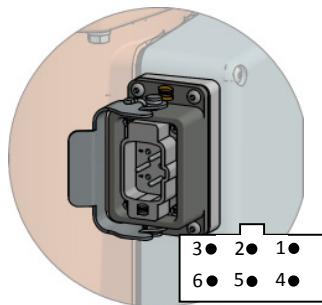
Operating voltage:	24 VDC
Maximum operating voltage:	36 VDC
Minimum operating voltage:	16 VDC
Power input:	< 10 W

Types of heating systems

Operating voltage	heater power rating
230 VAC (50 Hz/60 Hz)	1400 W
440 VAC (50 Hz/60 Hz)	1400 W



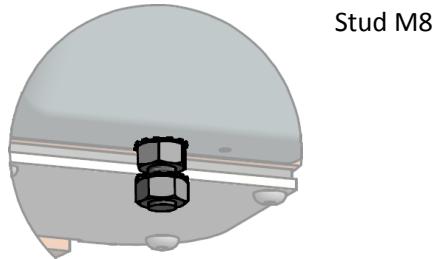
Heating voltage connection



Connector: Harting

- Pin 1 Heating voltage (see operating voltage from the heater)
- Pin 3 Heating voltage (see operating voltage from the heater)
- Pin 5 Protective conductor

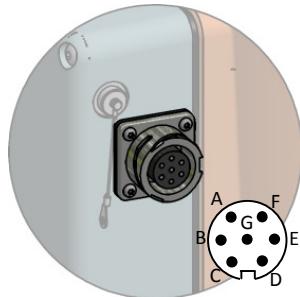
Separate protective earth terminal





Control connector (available with Cannon or Hummel connector)

Cannon:



Connector Cannon

Pin A	Pin 1
Pin B	Pin 2
Pin C	Pin 3
Pin D	Pin 4
Pin E	Pin 5
Pin F	Pin 6
Pin G	Pin 7

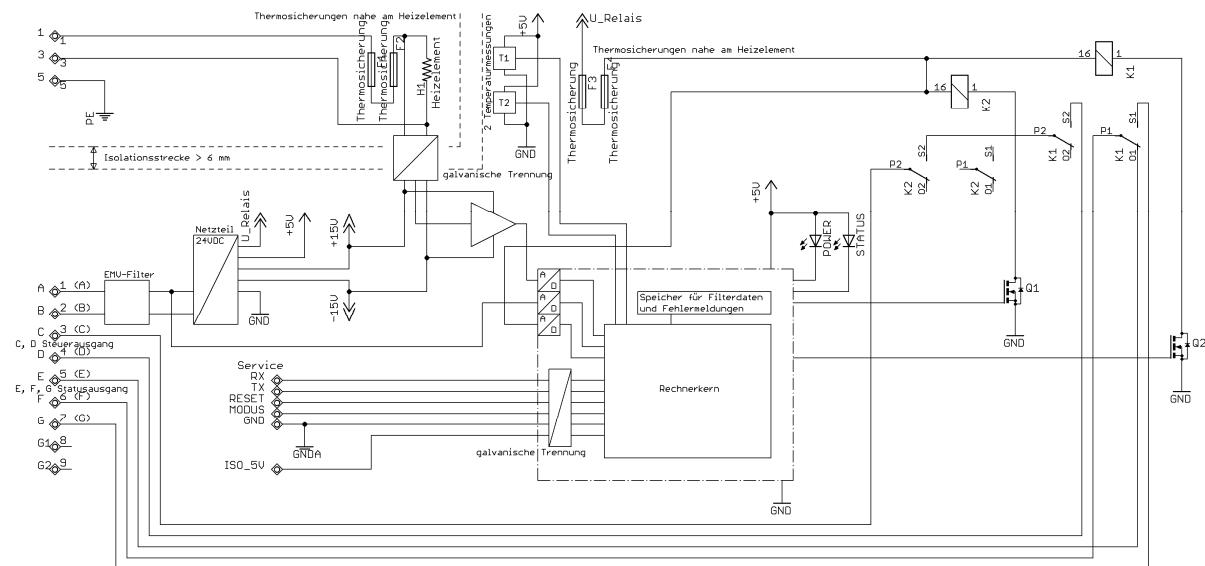
Connector Hummel

Pin 1	24 VDC (for control electronics)
Pin 2	GND
Pin 3	24 VDC (for external main contactor)
Pin 4	Switching output for main contactor
Pin 5	Connection to 6 (F) when error
Pin 6	Medium changer connection (status)
Pin 7	Connection to 6 (F) when heating OK
Pin 8	Not used
Pin 9	Not used

Hummel:



Simplified diagram of the heating system





6.2 Water in fuel sensor (WIF)

Multiple WIF sensors are available either Bedia or Separ designed.

All sensor parts of the SEPAR-series are potential free. The detection of water is by capacitive measurement principle.



The exact technical specifications for water sensors can be found in a separate manual.

6.3 Differential pressure switch

The pressure switch is fitted in the fuel line at both the inlet and the outlet, and outputs an electrical signal when the differential pressure produced by the filter exceeds a calibrated value. The pressure switch is used as an indicator for highly contaminated filter elements.

6.4 Relative pressure switch

The relative pressure switch is fitted at the outlet port and outputs an electrical signal when the vacuum in the fuel line exceeds a calibrated value (measured against ambient air pressure). The pressure switch is used as an indicator for highly contaminated filter elements.

6.5 Vacuum gauge

The vacuum gauge is mounted in the outlet line of the filter and measures negative pressure (vacuum) downstream of the filter. You can use the vacuum gauge as a pollution indicator for the filter element.

To do this, remove the filter with a new filter element and clean fuel in operation. Now on the vacuum gauge, line pressure after the filter can be read. The pointer is then positioned at the value at which the filter element should be changed. We recommend to select about 200 mbar pressure increase as alarm value.

6.6 Bowl

Plastic bowls (PA) are standard for SWK-2000/5, SWK-2000/10 and SWK-2000/18. Aluminium bowls are available for those models as an option. For models SWK-2000/40 and SWK-2000/130 only aluminium is available.

The advantage of transparent plastic bowl is that you can evaluate the water level and the degree of contamination of the collecting area without sensors.

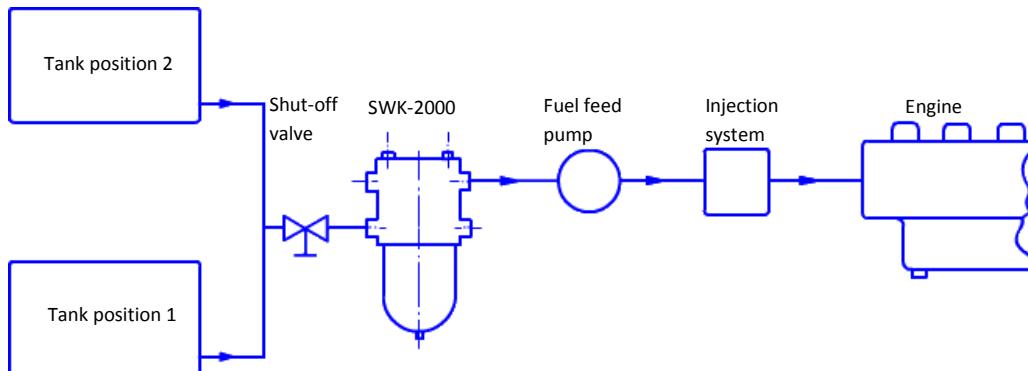
The metal bowl is for harsher requirements and is resistant to broader range of temperatures and chemicals.



7 Assembly

7.1 Selection of mounting position

The SWK-2000 should be installed in an easily location in the suction line of the fuel system between fuel tank and fuel pump. Any combination of inlet and outlet ports can be used.



REFERENCE

A shut off valve is always recommended in between the tank and the filter. If the filter is positioned below the tank (position 1), there is always a slight pressure on the fuel inlet of the filter, which can facilitate the priming of the filter.



REFERENCE

When the filter is positioned higher than the tank (position 2), we recommend the hand priming pump of W. Lösing Filtertechnik e. K. (see chapter 11) to be mounted in the fuel line.

Please note that the filters have to be installed on an even surface.

When installing the filter sufficient space of least 600 mm above the filter lid must be allowed.

Below the filter sufficient space must be left to either place a suitable container for draining bowl or to attach a hose directly to the drain valve to allow drainage of water out of the filter.

7.2 Filter installation

Install the filter with the back against a sufficiently viable and flat surface. Depending on the filter option the SWK-2000 offers two or four holes for mounting the filter: The diameter of the mounting holes can be found in the technical data (s. chap. 5.2).

Subsequently, the fuel ports are connected. There are ports for inlet and outlet on either side of the filter housing. Matching fittings and adapters are a necessity. Please consult section 5.7 for port size.



Ensure in the design of the fuel lines that the radii of the curve segments are greater than 5-times pipe diameter in order to keep flow turbulence to a minimum.

7.3 Electrical connection

In its standard version, the SWK-2000 requires no electrical connections. Only when options with electrical connections are selected, such as filter heater, water sensor and pressure switch, the filter must be wired. For details see the appropriate subsections chapter 6.

7.4 Disassembly

Turn off the engine.

Set a suitable container under the drain valve.

Close shut off valves from tank. Open the bleed screw on the filter lid and then the drain valve. Let the filter run empty.

Remove the inlet and outlet pipes from the filter. Make sure that any still existing fuel can also flow into the provided container, to avoid pollution of the environment. Fuel leaking into the environment should be collected directly by an absorbent rag.

Loosen the screws on the rear panel and remove the filter carefully.

Dispose of the filter and the fuel and the materials needed (e. g. rag) in accordance with chapter 12.



8 Commissioning

After the filter has been installed in accordance with chapter 7, it can be put in operation.

1. Make sure that a filter element is inserted in the filter and check if all the openings of the filter are sealed.
2. Lay rags out to hold small amounts of fuel.
3. Open, if available, the shut off valve before the filter.
4. Loosen the bleed screw cautiously about 1-2 turns. Never turn the screw all the way out!
5. For priming of the fuel system use fuel priming pump.
6. Once the first small amounts of fuel come out of the bleed screw, tighten the screw again (observe the tightening torque, see chapter 9.1).
7. Start the engine.



9 Maintenance

For all maintenance works pay attention on providing suitable container under the SWK-2000 to catch spilled fuel and for proper disposal (s. chap. 12).

Basically, the housing of the Separ filter is maintenance free. The maintenance is restricted to removal of accumulated water in the bowl and to regular replacement of the filter element.

When screws of the filter are loosen and tightened again, please observe the tightening torques (s. chap. 9.1).

9.1 Tightening torques

The tightening torques listed to be strictly observed. Lid and bowl retainer ring screws have to be tightened in multipile turns and crosswise. Shown torques will result in no leakages of the filter and avoid damages to the filter.

Bolted assembly	Height	Thigthening torque
Bleed screw	M6	4 Nm
Cover screws	M6 x 30	8 Nm
Bowl screws	M6 x 25	8 Nm

9.2 Drainage of water

If you find accumulated water at the bottom of the bowl, or the water sensor (optional)has triggered an alarm water has to be drained out of the bowl.



REFERENCE

You should, if water has collected in the bowl, not wait to long with the drainage, as within a few days visible biomass might be found at the interface between water and diesel fuel. This defines itself as pollution to the bowl wall and can, if it dissolves, reduce the service life of the filter element.

The following describes how the drainage must be performed. Make sure that during the operation no fuel can escape into the environment. Collect the fuel and dispose it properly (s. chap. 12).

1. Shut down the engine.
2. Close, if available, the shut off valve before the filter. In case of switchable filter switch lever to the other filter.
3. Open the bleed screw above the filter lid.



4. Open the drain valve. Water and dirt are flushed out of the bowl. Leave the drain valve open as long until cleaned fuel leaks. Collect drained fluids in a container and dispose per local regulations.
5. Close the drain valve and the bleed screw (observe the tightening torque, s. chap. 9.1).
6. After the system has been primed, the engine can be restarted.

If the engine still shows power losses, replace the element.

9.3 Back-flushing process

If the filter element is clogged by dirt particles and currently there is no way to replace the element, back-flushing can be used as an alternative. Hereby a part of the collected dirt again can be washed out. Depending on the degree of contamination through this a part of the performance of the filter element can be restored.

1. Turn off the engine.
2. Open the bleed screw on the filter lid.
3. Place a container under the drain valve.
4. Open the drain valve by push or pull of the handle and turn it to a vertical position.
5. The clean fuel, which is located on the clean above the filter element, then flows back through the filter element and cleans the element from water droplets and fine dirt.
6. Drain as much fuel from the filter so that the dirt is flushed out of the bowl.
7. Close the drain valve.
8. Close the bleed screw.
9. Prime the fuel system.
10. The engine can be re-started again.

If the engine still continues to show power loss, repeat the process or replace the element (s. chap 9.4).

9.4 Element replacement

The filter element of the SWK-2000 should be changed if resistance exceeds engine manufacturers specification, but at least once a year.



Replacement of the element:

1. Turn off the engine. In switchable filters it is sufficient if you switch to the other filter.
2. Close, if available, the shut off valve before the filter.
3. Open the bleed screw on the filter lid.
4. Open the drain valve. Water and dirt are flushed out of the bowl. Leave the drain valve open as long until cleaned fuel leaks. Collect liquids in a container and dispose according to the local regulations.
5. Close the drain valve and the bleed screw (observe the tightening torque, s. chap. 9.1).
6. Loosen the screws on top of the filterlid in multiple turns and crosswise. Otherwise damage may be caused to the lid.
7. Take off the lid. Remove the springcassette. Lift the filter element at the bracket located at the element out of the filter. Dispose the filter element according to the requirements in chapter 12.
8. Insert the new filter element. It is important to make sure that the sealing surface is the bottom and the "Separ" logo represents the front.
9. Insert the spring cassette.
10. Replace if necessary the lid seal and hold the sealing surface of the filter housing and the lid seal clean. If a new gasket is not on hand, make sure that the seal is free from particles and slightly greased to ensure a perfect seal.
11. Put the lid back to its previous position and tighten the cover screws crosswise (observe the tightening torque, s. chap. 9.1) to prevent damage and leaks.
12. After the system has been primed, the engine can be restarted (s. chap. 8).

9.5 Cleaning

Plastic bowl and gaskets should be cleaned with diesel fuel only. Alcohol-containing detergents and solvents can damage plastic bowl and gaskets severely.

All other parts can be cleaned from the outside with standard cleaners.



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10 Repair

Actual spare part lists can be obtained from W. Lösing Filtertechnik e. K. or your distributor. Please consider the recommendations/instructions given in chapter 7 for assembly and disassembly of the filter.

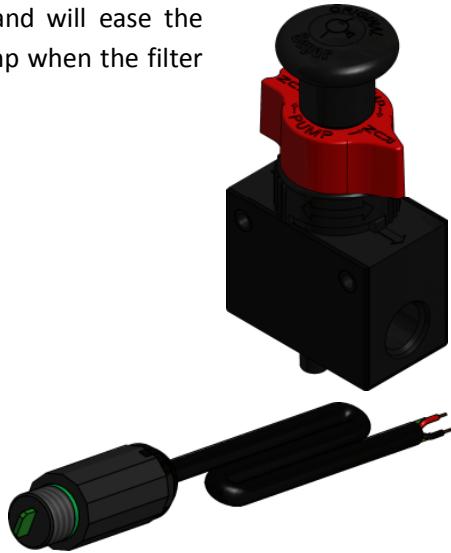
Repairs that go beyond the replacement of parts must be carried out by W. Lösing Filtertechnik e. K. or an authorized company. W. Lösing Filtertechnik e. K. accepts no liability for any damage caused by unauthorized persons or organizations.



11 Accessories

A variety of accessories for the SEPAR filter can be obtained by W. Lösing Filtertechnik e. K. or your distributor:

The hand priming pump can also be installed in the fuel line and will ease the priming process. It is recommended to use the hand priming pump when the filter is situated higher than the fuel tank.



The water sensor is available as an option (s. chap. 6.2) and as a separate product. It triggers an alarm when the water level rises in the bowl and water should be drained. As a digital output signal are low-active and high-active.



12 Disposal

Drain and remove the filter according to the instructions in chapter 7.4.

Disused fuel filters might contain harmful residues. As these spill fuel filter have to be disposed as per the local regulations.

The previous rendered diesel-water-dirt mixture belongs to the waste oil containing waste. With diesel fuel saturated absorbent, rags, etc. should be collected in non-combustible containers with self-closing lid.

Dispose any waste according to local regulations

13 Appendix B: Specific drawings