

Operating Manual

Filter for compressed air and hot steam

FWP series

Version: 08/2017/EN

Coalescing filter	FWP 20 - 190
Activated carbon filter	FWP 20 - 190
Dust filter	FWP 20 - 190
Sterile filter	FWP 20 - 190
Steam filter	FWP 20 - 190



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1. General Information

1.1 Manufacturer



FST GmbH

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! Please forward all product enquiries to our sales office!

In case of questions as to the product, please provide the following information:

- Type of filter: e.g. FWP 110
- Filter element type: e.g. EFSTP 120 STPL
- Production number: e.g. 08/10

This information is given on the type plate of the filter housing (type of filter, production number) and on the respective filter element (type of filter element). (→Page 11)

1.2 Definitions

In the following, the terms "coalescing filter", "activated carbon filter", "dust filter", "sterile filter", and "steam filter" are referred to as "filter" insofar as common features are concerned.

1.3 Warranty Information

Information on warranty can be found in our "General Terms of Sale and Delivery".
(→ www.fstweb.de)

In the following cases, no warranty is given:

- If the safety notes and instructions in the present Operating Manual or the accompanying documents are not observed.
- If the filter is operated or maintained by persons who do not have the required qualification. (→ see "Target Group": Page 5)
- If the filter is not used as intended. (→ Page 7)
- If the filter is damaged due to aggressive components in compressed air, hot steam (saturated steam), or in the environment.
- If no original parts of the manufacturer are used for maintenance and repair.
- If the filter is operated despite evident defect

1.4 About this Operating Manual

The present Operating Manual includes any technical information required to be known for installation, operation, maintenance, and disposal of the filter.

Target Group

The present Operating Manual addresses all persons involved in works on and with the filter. We expressly point out that these persons have to be skilled personnel which is familiar with the handling of pressure equipment and/or steam generators due to its qualification and experience. If you do not have any experience in the handling of such equipment, please seek expert advice. We recommend to have installation, commissioning, and maintenance effected by a specialising company.

Using the Operating Manual

Please carefully read the present Operating Manual and the accompanying documents prior to installation and commissioning and observe the notes. Safe operation and proper functioning of the filter can only be ensured by observing the instructions and notes. Please pay particular attention to the safety notes.

Keep the Operating Manual in close proximity to the filter where it is freely accessible.

Should you once sell or lend out the filter, please hand the Operating Manual and all accompanying documents over to the new owner.

The manufacturer does not accept any liability for damages resulting from non-observance of the Operating Manual.

Any information given in the present Operating Manual is applicable at the time of publication. Since components and processes can be modified at any time and these modifications affect filter maintenance, the most recent information should be on hand before starting maintenance works.

General Information

Signs and Symbols

- Boxes are used for lists.
- 1) Enumerations imply that the steps need to be performed in a certain order.
- Cross references refer to information on another page or in another document.



Please note!

Here, issues are mentioned which require special attention.
Observing the notes supports safe handling of the product.



Tip!

Here, issues are mentioned which require special attention.
Observing the tips helps to operate the product quite efficiently.



CAUTION!

This symbol indicates a potentially detrimental situation.
If this situation cannot be avoided, there is a risk of bodily injury or damage of the product or adjacent components of the equipment.



WARNING!

This symbol indicates a potentially hazardous situation.
If this situation cannot be avoided, there is a risk of serious or fatal injuries.



DANGER!

This symbol indicates an imminent hazard.
If this hazard cannot be avoided, serious or fatal injuries occur.

2. Specification of Performance

The filter is used to remove solid, liquid, and – for activated carbon filter elements – also gaseous contaminants from compressed air, nitrogen, and other uncritical gases of fluid group 2. (Fluid group 2: → see Pressure Equipment Directive 97/23/EC). When combined with a sterile filter element, microbiological contaminants can be removed.

When combined with a steam filter element, solid contaminants can be removed from hot steam (saturated steam). Depending on the selected sealants, steam temperatures of up to 134 °C and/or 200 °C (option) are admissible.

Typical applications:

- Filter used as interface between steel and stainless steel materials
- Final filtration with highest requirements on purity degree (clean gas)
- Sterile filtration for generation of sterile compressed air (inline steam sterilisation possible)
- Steam filtration for generation of pure hot steam for sterilisation

The specifications on filter performance given in the following Operating Manual and product data sheets exclusively refer to compressed air and nitrogen, for steam filters to saturated steam. For specifications with regard to other gases, please contact the manufacturer or one of the authorized sales partners.

2.1 Intended Use

The filter is exclusively designed for cleaning of compressed air, nitrogen, or hot steam (saturated steam)! Using the filter for cleaning of other gases (e.g. carbon dioxide) must be agreed upon with the manufacturer in advance. It may be necessary to observe special safety directives.

Depending on the application, a suitable filter element is to be selected. (→ Page 9).



DANGER! Caused by fire and explosion when used for oxygen

When oxygen comes into contact with other materials in the filter and mounted parts, violent flames and filter bursting may occur.

Never use this filter for oxygen or oxygen-rich gases.

For filtration of oxygen, please seek the manufacturer's advice.

The filter is designed to be installed in a place complying with the following requirements:

- Frost-free (for dry compressed air, please also see → the table on Page 9)
- Dry
- No vibrations from brackets or connected piping
- Free from hazards by explosive atmosphere inside or outside the filter. (The standard filter version does not comply with ATEX)

The filter must only be operated with compressed air, nitrogen, or hot steam within the maximum admissible operating conditions. The maximum admissible operating conditions of the filter housing are specified on the type plate (→ Page 11). The maximum admissible operating conditions of the filter may be limited by sealants and filter elements used (→ Page 9).

Modification of the filter or use of non-original parts may result in unforeseeable hazards and damages during operation. These actions must only be taken after prior inspection and approval by the manufacturer. Use original spare parts of the manufacturer, only.

Technical Specification

Any other use shall be deemed unintended and is not permitted. The manufacturer does not accept any liability for damages resulting from unintended use.

The nominal operating conditions can be seen in the following table. (→ Page 9)

For an individual design of the filter tailored to your operating conditions and for other gases, please refer to your contract documents or contact the manufacturer.

Filtration performance may be reduced significantly if the filter is used beyond these operating conditions.

The supplied compressed air must comply with the following conditions:

All filters free from aggressive and corrosive substances	The filter can be damaged by aggressive and corrosive substances. Hazardous operating situations result therefrom.
Coalescing filters Dust filters free from large quantities of water, coarsely filtered	The filter only removes finely distributed contaminants (aerosols) carried by the compressed air flow. Flowing liquids may lead to overloading of the filter. The filter must be protected from water hammers and be splash-proof. We highly recommend coarse filtration using a water separator or coarse filter upstream of the filter.
Activated carbon filters free from liquid contaminants, finely filtered	The filter only removes gaseous contaminants (vapours) carried by the compressed air flow. Liquid contaminants may lead to overloading of the filter. The filter must be protected from liquid contaminants. We highly recommend fine filtration using a coalescing filter upstream of the filter.
Sterile filter free from liquid contaminants, finely filtered	The filter is designed for removal of smallest microorganisms carried by a <u>dry</u> compressed air flow. Flowing liquids, liquid contaminants (aerosols), and large quantities of solid contaminants may lead to overloading of the filter. The filter must be protected from water hammers and be splash-proof. We highly recommend a corresponding system upstream of the filter.

2.2 Technical Specification

Coalescing filter, dust filter, activated carbon filter, sterile filter

Filter	Nominal volume flow rate	Compressed air connection	Weight	Height	Width	Depth	Matching filter insert
	V [m ³ /h]*	Inch	[kg]	[mm]	[mm]	[mm]	
FWP20	30	G 1/4	2.3 kg	295	147	108	EFSTP90**
FWP30	50	G 3/8	2.4 kg	295	147	108	EFSTP90**
FWP70	100	G 1/2	2.4 kg	295	147	108	EFSTP90**
FWP90	160	G 3/4	2.4 kg	295	147	108	EFSTP90**
FWP110	330	G 1	3.4 kg	387	188	135	EFSTP120**
FWP120	500	G 1 ½	3.5 kg	387	188	135	EFSTP120**
FWP130	1,000	G 1 ½	6.2 kg	561	233	170	EFSTP140**
FWP140	1,500	G 2	6.2 kg	561	233	170	EFSTP140**
FWP170	2,000	G 2	7.7 kg	867	233	170	EFSTP180**
FWP180	2,500	G 2 ½	11.7 kg	867	275	200	EFSTP180**
FWP190	1,000	G 3	13.1 kg	1131	289	200	EFSTP190**

Steam filter for hot steam

Filter	Nominal steam flow	Connection	Weight	Height	Width	Depth	Matching filter element
	V [kg/h]***	Inch	[kg]	[mm]	[mm]	[mm]	
FWP20	4 - 10	G 1/4	2.3 kg	295	147	108	EFSTP90D**
FWP30	6 - 15	G 3/8	2.4 kg	295	147	108	EFSTP90D**
FWP70	10 - 35	G 1/2	2.4 kg	295	147	108	EFSTP90D**
FWP90	13 - 55	G 3/4	2.4 kg	295	147	108	EFSTP90D**
FWP110	22 - 95	G 1	3.4 kg	387	188	135	EFSTP120D**
FWP120	30 - 160	G 1 ½	3.5 kg	387	188	135	EFSTP120D**
FWP130	55 - 220	G 1 ½	6.2 kg	561	233	170	EFSTP140D**
FWP140	70 - 320	G 2	6.2 kg	561	233	170	EFSTP140D**
FWP170	100 - 400	G 2	7.7 kg	867	233	170	EFSTP180D**
FWP180	140 - 610	G 2 ½	11.7 kg	867	275	200	EFSTP180D**
FWP190	210 - 920	G 3	13.1 kg	1131	289	200	EFSTP190D**

All filters

Classification acc. to PED 97/23/EC	<ul style="list-style-type: none"> ■ FWP20 to FWP120: Section 3 Clause 3 ■ FWP130 to FWP170: Category I (16 bar) ■ FWP180 to FWP190: Category I (12 bar)
Fluid group	2
Max. admissible pressure (PS)	<ul style="list-style-type: none"> ■ FWP20 to FWP170: 16 bar ■ FWP180 to FWP190: 12 bar
Max. admissible temperature (TS)	<ul style="list-style-type: none"> ■ Filter housing without filter element (standard gasket): 134 °C ■ Filter housing without filter element (high-temperature gasket): 200 °C (option) ■ Filter with filter element V: 65 °C ■ Filter with filter element ZN, XN, XXN: 100 °C ■ Filter with filter element A: 45 °C ■ Filter with filter element STPL (filtration/sterilisation): 80 °C / 121 °C ■ Filter with filter element D: see housing without filter element
Min. admissible temperature (TS)	+1 °C

* = Standardised to 1 bar(a) and 20 °C as well as to operating conditions of 7 bar operating overpressure.

** = The filter can be fitted with filter elements providing different filtration performance. The letter at the end of the filter element name defines the filtration performance. For detailed information on the filtration performance of the different elements and further details, please refer to the corresponding product data sheets. They can be downloaded from the Internet:
 → www.fstweb.de → Download

*** = Standardised to saturated steam at 134 °C (2 bar)
 The filter can be fitted with filter elements providing different filtration performance and steam throughput. The letter at the end of the filter element name defines the filtration performance. For detailed information on the filtration performance of the different elements and further details, please refer to the corresponding product data sheets. Product data sheets can be downloaded from the Internet:
 → www.fstweb.de → Download

3. Safety Notes

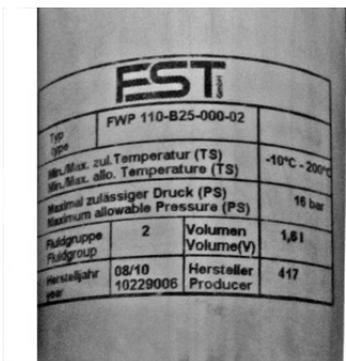
The filter has been built according to the state of the art and recognised safety rules. However, handling of the filter bears risks that every person working on the filter must be aware of. In particular, improper handling of compressed air or hot steam may result in serious injuries and death. If you are not experienced in using such pressure equipment, please seek expert advice.



Please note!

- In order to exclude hazards for persons or property damage, observe the safety notes when handling the filter.
- Observe the special safety notes in the relevant chapters.
- Observe legal directives and accident prevention regulations.
- If applicable, observe the safety notes in the local site regulations.

3.1 Signs and Instructions



Type plate of filter attached to filter housing (Example: FWP110)



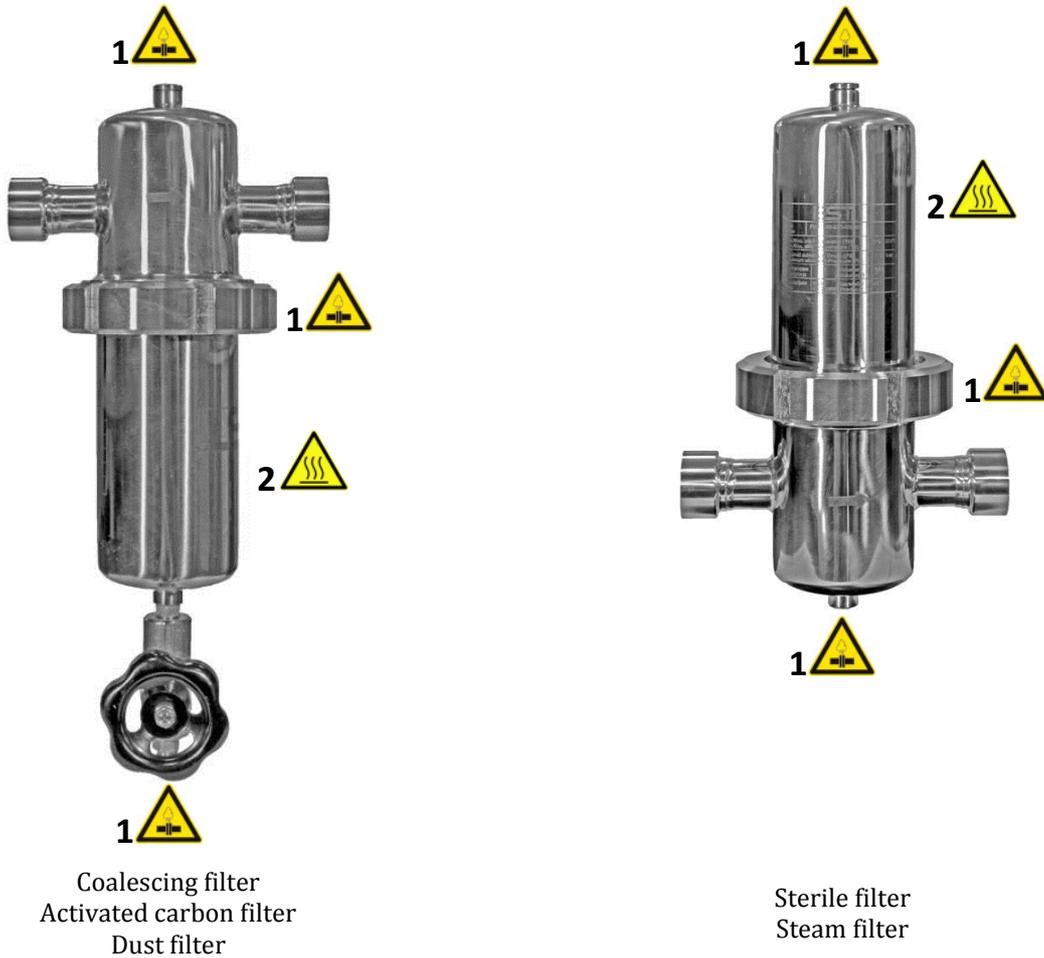
Marking of filter element attached to filter element (Example: EFSTP120XN)

The type plate gives important information. Always keep the type plate in a clearly readable state.

Due to the admissible temperatures of the filter, the marking of the type plate and / or the filter element is etched or engraved for being permanent.

The type plate of the filter exclusively refers to the mere filter housing without taking into consideration the sealants and filter elements which can be selected. The marking of the filter element is attached to the filter element itself, only. The maximum admissible operating conditions of the filter may be limited by sealants and filter elements used (→ Page 9).

3.2 Danger Zones at Filter



- 1** Hazard by pressure-bearing parts
- 2** Hazard by hot surfaces



DANGER! – Overpressure (1)

The filter is pressurised.

Suddenly escaping compressed air or hot steam may result in serious injuries. Never perform any mechanical works on the filter as long as it is pressurised.



WARNING! – Hot surfaces (2)

Depending on the compressed air or hot steam temperature, the surfaces of the filter may be very hot.



Touching of these surfaces without protective equipment may result in burns.

Avoid direct contact with these surfaces. If applicable, limit access or provide hot components with a thermal insulation.

Never exceed the maximum admissible temperature of the filter. (→ Page 9).

3.3 General Safety Notes



DANGER! – Overload

The filter must only be operated with compressed air or hot steam within the maximum admissible operating conditions. The maximum admissible operating conditions of the filter housing are specified on the type plate (→ Page 11). The maximum admissible operating conditions of the filter may be limited by sealants and filter elements used (→ Page 9).

Exceeding the maximum admissible operating conditions may cause serious injuries and death.

The operator has to make sure that the connected pressure source is protected against exceeding of the maximum admissible operating pressure (PS) and the minimum and maximum admissible temperature (TS).

Please also refer to Section "Intended use". (→ Page 7)



DANGER! – Unauthorised Intervention

Modifications to the filter may result in hazardous operating conditions. Violations may cause serious injuries and death.

Never change the filter function by modifications.

Never perform any welding works on pressure-bearing parts.

All modifications to the filter require the prior written consent of the manufacturer.



DANGER! – Suspected misuse

Using the filter for unintended purposes may result in hazards. Violations may cause serious injuries and death.

Never use the filter as climbing aid.

Never use the filter as support for external loads.

Never use the filter components for unintended purposes.

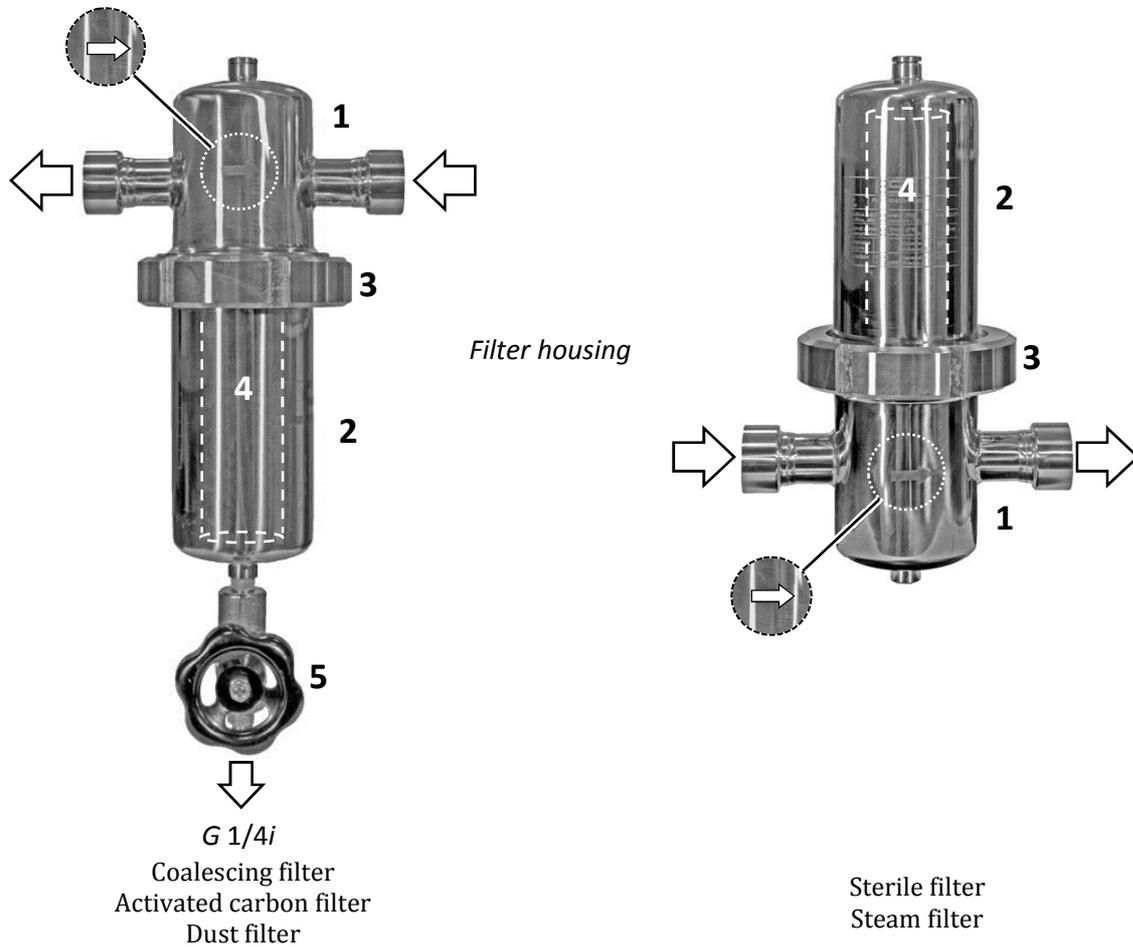
Please also refer to Section "Intended Use". (→ Page 7)



Additional Safety Notes

Further safety notes can be found in the respective chapters and in the operating manuals to the various accessories.

4. Technical Product Description



- | | |
|--|--|
| <p>1 Filter head with inlet and outlet
(one flat gasket for sealing of
filter housing parts located inside the filter head)</p> <p>2 Filter bowl</p> | <p>3 Screw connection of housing, threaded ring
(threaded pipe connection for food and
beverage)</p> <p>4 Filter element (inside)</p> <p>5 Shut-off valve</p> |
|--|--|

For further views and combinations of the filter, please refer to the Annex.

4.1 Functional Description

Coalescing filter and dust filter (types V, ZN, XN, XXN)

The filter (1) is installed in the compressed air pipe and the compressed air flows through the filter. In the filter, the compressed air is guided through a filter element (4). The filter element is provided with a woven filter medium forming a dense braiding consisting of finest fibres.

The compressed air freely flows through the woven filter medium. However, dust particles and finest droplets get caught in the braiding of the fibres and are thus separated from the compressed air flow. The dust particles remain in the woven filter medium. The droplets go through the woven filter medium and unite to form larger drops (coalescing effect). These large drops leave the woven filter medium on the outside of the filter element and go down along the filter element by gravity.

The drops are collected in the filter bowl (2) until a small volume of liquid has accumulated (condensate). This liquid has to be drained manually using the shut-off valve. As an option, automatic condensate drains are available.

When using a coalescing filter, the air always flows through the filter element from the inside to the outside. In case of dust filters, the flow direction is also from the inside to the outside due to reduced dust quantities in final filtration.



The condensate is to be disposed off separately

Condensate from compressed air filters is often contaminated and contains an oil / water mixture. Such condensate must not be discharged in the public sewage line.

The filter manufacturer also offers condensate treatment systems which clean the water and prepare it for disposal in the public sewage line.

Activated carbon filter (type A)

The filter (1) is installed in the compressed air pipe and the compressed air flows through the filter. In the filter, the compressed air is guided through an activated carbon element (4). The activated carbon in the element removes oil vapour from the compressed air and stores it in its internal structure.

Moreover, the activated carbon element is provided with a woven filter medium forming a dense braiding consisting of finest fibres. The compressed air freely flows through the woven filter medium. However, dust particles and abraded particles from the activated carbon get caught in the braiding of the fibres and are thus separated from the compressed air flow. Dust particles and abraded particles remain in the woven filter medium.

For activated carbon filters with integrated woven filter medium, the air always flows through the activated carbon element from the inside to the outside.

Increasing loading of the activated carbon with contaminants slowly reduces the cleaning effect until the activated carbon is saturated. In this case, the saturated activated carbon element is to be replaced by a new one. The service life of the activated carbon element is dependent upon the quality of the incoming compressed air. (→ Page 23)

Sterile filter (types STPL, SMPL)

The filter (1) is installed in the compressed air pipe and the compressed air flows through the filter. In the filter, the compressed air is guided through a filter element (4). The filter element is provided with a woven filter medium forming a dense braiding consisting of finest fibres.

The compressed air freely flows through the woven filter medium. However, microorganisms get caught in the braiding of the fibres and are thus separated from the compressed air flow. The microorganisms remain in the woven filter medium. Since microorganisms are "live", they are able to grow through the woven filter medium. The growth rate depends upon the type of microorganisms and the purity degree, in particular the degree of humidity, of the compressed air used. In due time, the microorganisms need to be killed by sterilisation before live organisms have grown entirely through the filter element.

When using a sterile filter, the air always flows through the filter element from the outside to the inside.

For detailed information on the sterilisation of sterile filter elements, please refer to the validation guideline of the respective sterile filter element and the accompanying documents. The validation guideline can be downloaded from the Internet:

→ www.fstweb.de → Download

Steam filter for hot steam (types D25, D1, DPL1)

The filter (1) is installed in the steam pipe and hot steam flows through the filter. In the filter, the steam is guided through a filter element (4). The filter element is provided with a sintered compact and / or a filter structure forming finest pores.

The steam can flow freely through the pores of the filter element. However, solid contaminants, which are larger than the respective pore size of the filter element, get caught in the filter structure and are separated from the steam flow. The contaminants remain in the filter structure.

When using a steam filter, the steam always flows through the filter element from the outside to the inside.

4.2 Options

For possible configurations, please refer to the Annex or the manufacturer's price list.

For detailed descriptions of the options, please refer to the operating manuals and product data sheets delivered separately.

Product data sheets can be downloaded from the Internet: → www.fstweb.de → Download

5. Transport and Storage

5.1 Transport

**DANGER! – Damage**

Damages to the filter may result in unforeseeable hazards.
Operation of a damaged filter may cause serious injuries and death.
Never operate a damaged filter.

Despite due care transport damages cannot be excluded. Therefore, check the filter for possible damages after transport and removal of the packaging.

Any damage is to be reported immediately to the carrier and the manufacturer and / or its sales partner.

Please consider the following for transport:

- Consider size and weight of the filter. (→ See 9)
Auxiliary means may be required for carrying / transport.
Make sure of appropriate lifting devices being provided for transport as well as loading and unloading.
- Persons charged with transport shall have an appropriate qualification.
- Remove the packaging material only after the filter is positioned at its final place of installation.
- Applicable national accident prevention regulations are to be observed.

5.2 Storage

Maintaining the filter's quality requires a suitable place of storage and good preparation of the filter for storage.

Store the filter in the supplied transport packaging. If necessary, the filter should be protected from dust by an additional cover.

The place of storage has to meet the following conditions:

- Indoors
- Weatherproof
- Frost-free
- Dry

6. Installation

6.1 Installation of Connecting Pipes

**DANGER! – Overpressure**

The filter is pressurised.

Suddenly escaping compressed air or hot steam may result in serious injuries.

Never perform any mechanical works on the filter as long as it is pressurised.

**DANGER! – Overload**

The filter must only be operated with compressed air or hot steam within the maximum admissible operating conditions. The maximum admissible operating conditions of the filter housing are specified on the type plate (→ Page 11). The maximum admissible operating conditions of the filter may be limited by sealants and filter elements used (→ Page 9).

Exceeding the maximum admissible operating conditions may cause serious injuries and death.

The operator has to make sure that the connected pressure source is protected against exceeding of the maximum admissible operating pressure (PS) and the minimum and maximum admissible temperature (TS).

Please also refer to Section "Intended use". (→ Page 7)

**DANGER! – Components bursting by external forces**

The filter components are not designed for forces applied externally and may burst due to this additional load.

Bursting pressurised components may cause serious injuries and death.

The connected pipes are to be supported by the customer. Transmission of loads or stresses into the connecting points of the filter is not admissible.

Proper installation is required for safe and trouble-free operation of the filter.

In order to avoid transport damages, accessories may be provided separately and must be mounted after installation of the filter.

Please pay attention to the following items for installation of the compressed air pipe or steam line:

- Make sure that filter and compressed air supply or steam supply are unpressurised. If the compressed air supply or the steam supply need to be pressurised during installation, the shut-off valves are to be protected against unintended opening.
- The compressed air source (e.g. compressor) or vapour source must be provided with safety equipment to protect from unintended exceeding of the maximum admissible operating pressure.
- The compressed air pipes or steam lines must be provided with shut-off valves by means of which the filter can be separated from the piping. We recommend to use shut-off valves with continuous opening behaviour. This avoids a sudden pressure compensation between pipe sections.
- If operation cannot be interrupted for maintenance, we recommend to install a bypass line around the filter.
- The pipes must be suitable for the maximum admissible operating pressure.
- The connecting points must be compatible with the inlet and outlet of the filter regarding nominal width, nominal pressure, and type. (→ See attached installation drawing)

- The pipelines must not transmit any vibrations or pulsations to the filter. This may damage filter and accessories. If necessary, install compensators or pulsation dampers in the piping to be connected.
- Wet pipelines upstream of the filter should be installed at a slope in order to drain condensate (water and oil) in flow direction. If upward installation of a pipeline cannot be avoided, a condensate drain must be provided at the lowest point of the pipeline. This prevents condensate from being accumulated in the pipeline and being swept away suddenly by the compressed air flow or vapour flow. Such water hammers may damage the filter and have to be avoided.
- Install a valve in the piping system with which the filter can be depressurised and a pressure gauge which indicates the pressure in the filter.
- Install the filter in upright position.
- Pay attention to the direction of flow! (→ Functional Description Page 15) The arrow on the housing indicates the direction of flow of the filter element from the outside to the inside.
- Make sure of an appropriate distance between the filter and adjacent walls and other parts of the equipment.
- Make sure of sufficient clearance under or above the filter for being able to exchange the filter element without any problems. (→ For information on the installation height, please refer to the Annex.)
- Before closing the connected pipes, make sure that there are no objects or contaminants left in the pipes.
- The filter is supported by the connected pipes. Provide for sufficient support of the incoming and outgoing pipeline so as to ensure that the weight of the filter can be carried even if the filter is completely filled with liquid.
- When the installation is checked for tightness, the maximum admissible operating pressure of the filter must not be exceeded. (→ See information on type plate, Page 11)
- Check all components for visible damages. In case of damaged components, the filter must not be operated!

TIPP

Suitable place of installation

In most applications, compressed air cools down on its way through the piping system. In doing so, humidity condenses from the compressed air. In order to obtain utmost filtration performance, the filter should therefore be installed in a cold place in the piping system if possible. The best place of installation of the filter is often directly upstream of the equipment to be protected by the filter. (e.g. a compressed air dryer or a compressed air distributor)

7. Commissioning



DANGER! – Overpressure

The filter is pressurised.

Suddenly escaping compressed air or hot steam may result in serious injuries.

Never perform any mechanical works on the filter as long as it is pressurised.

After installation the filter is immediately ready for use and can be pressurised.

If all conditions for commissioning are met, commissioning can be started. Perform the following steps in the indicated order.

7.1 Pressurisation of Filter



CAUTION! – Fluid hammers and overload

Quick opening of valves may result in fluid hammers and excessive flow rates in the filter. Fluid hammers and excessive flow rates may damage the filter.



Open valves **very slowly** and make sure that the flow noise does not become too loud when opening the valve. Be very careful when opening valves which can be opened quickly by pivoting.

Pressurise the filter as follows:

- 1) Check whether the filter is completely closed.
- 2) Check whether all accessories are safely installed.
- 3) Make sure that the compressed air supply or the vapour supply are pressurised upstream or downstream of the filter inlet. If necessary, the compressor or steam generator needs to be started.
- 4) Open the valves upstream and downstream of the filter **very slowly** until you hear first clearly audible flow noises. Stop the operation if the flow noise becomes louder.
- 5) Check the system for leakages during pressurisation. Should leakages be detected, stop pressurisation and eliminate them. In order to eliminate leakages, depressurise the filter. (→ Page 21)
- 6) If no further flow noise can be heard when opening the valves and no further pressure increase is detected, the valves can be opened completely.
- 7) Now, free flow through the filter is possible.

8. Decommissioning



WARNING! – Escaping compressed air or hot steam

Escaping compressed air or hot steam is very loud and may sweep away small parts. This may cause damage to ears, eyes, and skin.



Escaping hot steam may cause burns.

If necessary, close openings, which are used for releasing pressure, with a sound absorber matching the pressure. When releasing pressure, open valves **very slowly**, only.



Wear eye and ear protection when working close to the filter.



- 1) Close the valves upstream and downstream of the filter.
- 2) Now, the filter is decommissioned.
- 3) Before performing any works on the filter, it must be depressurised. For this purpose, open a valve installed in the pipeline by the customer and monitor a pressure gauge installed by the customer. Wait until the pressure indicated on the pressure gauge has dropped to 0 bar. Depending on the filter configuration, you can also open the manual drain valve (5).

Attention: The valves on filter and condensate drains are not suitable for discharging large volumes. For this purpose, we recommend to install a valve in the piping system.

9. Maintenance and Repair



DANGER! – Overpressure

The filter is pressurised.

Suddenly escaping compressed air or hot steam may result in serious injuries. Never perform any mechanical works on the filter as long as it is pressurised.



WARNING! – Escaping compressed air or hot steam

Escaping compressed air or hot steam is very loud and may sweep away small parts.

This may cause damage to ears, eyes, and skin.



Escaping hot steam may cause burns.

If necessary, close openings, which are used for releasing pressure, with a sound absorber matching the pressure. When releasing pressure, open valves **very slowly**, only.



Wear eye and ear protection when working close to the filter.



CAUTION! – Qualification and experience required

Persons working on and with the filter must be skilled personnel familiar with handling of compressed air equipment due to their qualification and experience. If you do not have any experience in the handling of such equipment, please seek expert advice. We urgently recommend to have commissioning and maintenance effected by a specialising company.

Please observe the following maintenance requirements:

- Please refer to the instructions given in Section "Intended Use". (→ Page 7)
- Please observe the "Safety Notes" and in particular the "General Safety Notes". (→ Pages 11, 13)
- Provide the required spare parts. Use original spare parts of the manufacturer, only. Prepared spare part kits can be obtained from the manufacturer. (→ Page 4)
- Perform maintenance operations on a depressurised filter, only. (→ Page 21)

Please observe the following items to complete maintenance:

- Make sure that all connections are tightened and tight.
- Check whether the filter is completely closed.
- Perform a leak test.
- Commission the filter as described on → Page 20.

9.1 Regular Maintenance Intervals

The following table provides an overview of the maintenance activities to be effected routinely. They are described in detail on the following pages.

Component	Maintenance activity	Daily to weekly	Every three months and / or when residual oil content deteriorates.	Yearly and / or at latest at a differential pressure of 50 mbar	Yearly and / or at latest at a differential pressure of 350 mbar	Yearly and / or at latest at a differential pressure of 30 % of the steam pressure	See Page
Filter element of sterile filter	Check germination number downstream of filter, sterilisation if applicable	■					
Differential pressure gauge (external)	Check differential pressure of filter element	■*					
Filter element of activated carbon filters	Replace filter element		■**				24
Filter element at operating pressure of 0 to 4 bar	Replace filter element			■			24
Filter element at operating pressure of 5 to 16 bar	Replace filter element				■		24
Filter element of steam filter	Replace filter element					■	24

* = Information on maintenance can be found in the separate operating manuals of these components.
 ** = Clearly reduce the maintenance intervals at compressed air temperatures exceeding 35 °C

In order to monitor the filter element, we highly recommend to use an external differential pressure gauge. Sterile filters are excluded from this recommendation since differential pressure gauges cannot be sterilised easily. The differential pressure gauges are to be installed in the connecting pipe by the customer.

9.1.1 Differential Pressure Gauge (if available): Visual Inspection and Function Monitoring

The differential pressure gauge indicates the condition of the filter element. In the course of time, filter elements in the filter clog whereby the compressed air flow is reduced. The differential pressure continually increases.

- 1) Check the differential pressure gauge for external damages.
- 2) Check the differential pressure gauge for leakages.
- 3) You can write down the differential pressure to document the degree of contamination of the filter element over time.
 - In case of constant compressed air flow and operating pressure, the differential pressure should change only slightly over long periods and / or increase only slowly. Replace the filter element if the differential pressure increases more quickly.

Maintenance and Repair

- If the differential pressure suddenly drops despite constant compressed air flow, the filter element may have been damaged by a fluid hammer.

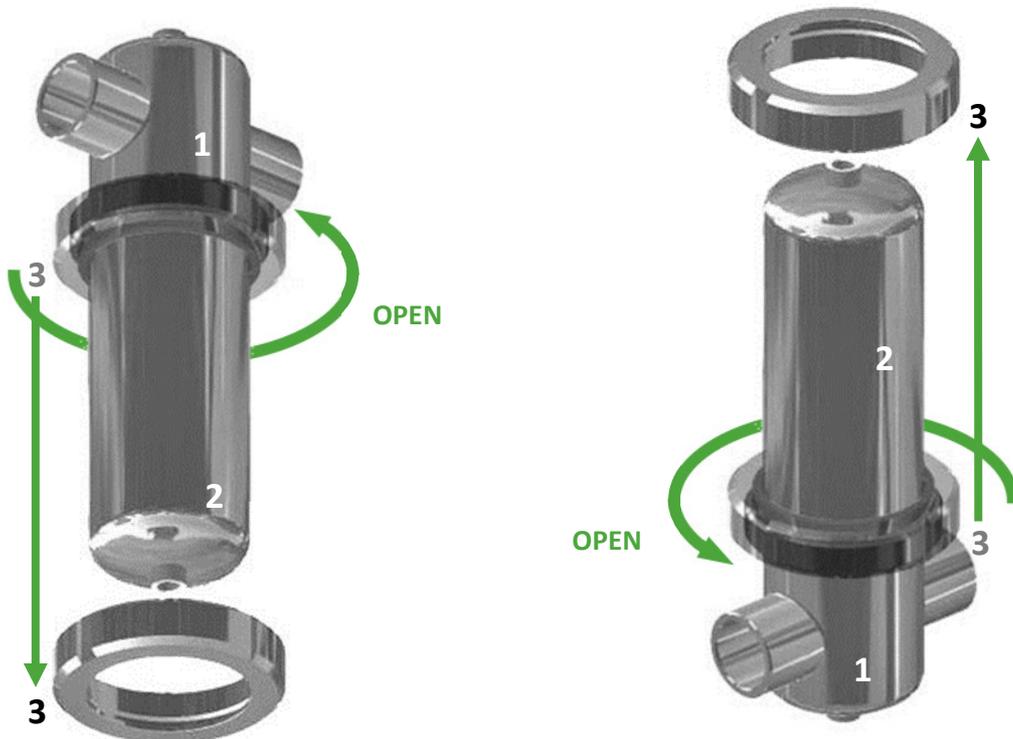
9.1.2 Replacing Filter Elements

In order to prevent failures, filter elements have to be replaced within the prescribed maintenance intervals. (→ Page 23)

- 1) Provide an appropriate filter element.
- 2) Take the filter element out of the packaging only when the filter element is to be installed. Make sure of cleanliness and do not touch the filter elements with dirty hands or tools.

Opening the filter housing:

- 3) Depressurise the filter (→ Page 21).
- 4) Remove the condensate line from the filter if any.
- 5) Open the depressurised housing by screwing the housing (3) out of the filter head (1) as shown in the figure. If compressed air or hot steam escapes from the thread, interrupt the opening immediately and depressurise the filter. (→ Page 21) In case of larger filters or filters which have already been operated for some time, a conventional hook wrench may be required. If the housing screwing cannot be opened using these means, first check whether the filter is still pressurised.
- 6) Remove the threaded ring (3) and the filter bowl (2) from the filter head (1).



Replacing the filter element:

- 1) Turn the old filter element (4) until bayonet catches are visible, pull the old filter element out of the filter head (1) by slightly turning and pulling it.
- 2) Clean the filter holder and the threads of the housing components.
- 3) If necessary, replace the flat gasket of the filter housing. Undamaged flat gaskets can be used again.
- 4) Take the new filter element out of the packaging and insert it in the filter holder by slightly turning and pushing it. Lock the filter element by turning it until the bayonet catches are no longer visible.

Closing the filter housing:

- 5) Close the filter housing by placing the filter bowl (2) onto the filter head (1) and by turning the threaded ring of the housing (3) in opposite direction to the opening direction and by tightening it.
- 6) Mount all parts that have been dismantled before.
- 7) Check all connections for tight fit.
- 8) Commission the filter as described on → Page 20.



Disposal

A clean filter element can be disposed of in domestic waste.

If the filter element is contaminated with hazardous substances, the type of disposal is to be defined by the waste producer on the basis of the type of contamination.

10. Failures and Actions



CAUTION! – Qualification and experience required

Persons working on and with the filter must be skilled personnel familiar with handling of compressed air equipment due to their qualification and experience. If you do not have any experience in the handling of such equipment, please seek expert advice. We urgently recommend to have commissioning and maintenance effected by a specialising company.

The following table explains possible causes of failures and indicates recommended actions for trouble-shooting.

Coalescing filter and dust filter (types V, ZN, XN, XXN)

Failure	Cause	Recommended action
Condensate and oil in pipeline downstream of filter	<ul style="list-style-type: none"> ■ Volume flow rate through filter too high ■ Operating pressure too low ■ Temperature downstream of filter lower than upstream of filter ■ Highly variable inlet temperature ■ Condensate drain (external) at filter defective ■ Shut-off valve between filter and condensate drain (external) closed ■ Bypass line (external) is open ■ Pipelines connected downstream of the filter have already been contaminated with oil when assembled or have been contaminated by the bypass line which was open before. ■ Oil breakthrough on compressor 	<ul style="list-style-type: none"> ■ Compare operating conditions to specified values and correct operating conditions if applicable (→ Page 9) ■ Check filter element and replace it if applicable ■ Check condensate drain (external) for proper function and eliminate defects ■ Keep bypass line (external) closed. Protect against unintended opening if necessary ■ Clean or replace pipelines ■ Monitor oil consumption of compressor and eliminate defects if necessary.
High pressure drop through filter	<ul style="list-style-type: none"> ■ Shut-off valves closed ■ High differential pressure through filter element ■ Large volumes of dust block the filter element 	<ul style="list-style-type: none"> ■ Check and open valves if necessary ■ Check and replace filter elements if necessary

Sterile filter (types STPL, SMPL)

Failure	Cause	Recommended action
High germination number downstream of filter	<ul style="list-style-type: none"> ■ Filter element has not been sterilised for some time ■ Filter element was damaged during last sterilisation ■ Volume flow rate through filter too high ■ Operating pressure too low ■ Bypass line is open ■ Pipelines connected downstream of the filter have already been contaminated with germs when assembled or have been contaminated by the bypass line open before. 	<ul style="list-style-type: none"> ■ Sterilise filter element ■ Check filter element and replace it if applicable ■ Compare operating conditions to specified values and correct operating conditions if applicable (→ Page 9) ■ Keep bypass line closed. Protect against unintended opening if necessary ■ Clean or replace pipelines
High pressure drop through filter	<ul style="list-style-type: none"> ■ Shut-off valves closed ■ High differential pressure through filter element ■ Large volumes of dust block the filter element 	<ul style="list-style-type: none"> ■ Check and open valves if necessary ■ Check and replace filter elements if necessary

Steam filter for hot steam (types D25, D1, DPL1)

Failure	Cause	Recommended action
High pressure drop through filter	<ul style="list-style-type: none"> ■ Shut-off valves closed ■ High differential pressure through filter element ■ Large volume of dirt blocks filter element 	<ul style="list-style-type: none"> ■ Check and open valves if necessary ■ Check and replace filter elements if necessary

11. Annex and Technical Documents

11.1 Manufacturer's Declaration and Declaration of Conformity

Manufacturer's Declaration

Herewith we declare that the below mentioned products in their conception and design in which we placed them on the market comply with the standards and directives mentioned below.

Manufacturer/authorised representative:	FST GmbH Weiherdamm 17 D-57250 Netphen
Description of the assembly:	Filter 16bar-series for fluid group II Type FWP 20 to FWP 120 (Filter types FWP 20 to FWP 120 fall under article 4, paragraph 3 of the directive 2014/68/EU and will not be marked with the CE mark.)
Description of the pressure equipment constituting the assembly:	The filter essentially consists of a pressure vessel. The filter is described in the product data sheet and in the operating manual in more detail.
Harmonised standards applied:	DIN EN ISO 12100
Other European Commission directives applied:	2014/68/EU 2006/95/EG * 2004/108/EG * (* = applied depending on optionally chosen electrical accessories)

In case changes are made to the product without prior consultation and written approval of the manufacturer this declaration will become void.

Signature:



01.08.2017, ppa. Christian Ruff, Technical Manager

EU – Declaration of Conformity

acc. to the pressure equipment directive 2014/68/EU

Herewith we declare under the sole responsibility that the below mentioned products in their conception and design in which we placed them on the market have undergone the procedures of conformity assessment acc. to annex III of the above mentioned directive and are in conformity with this directive.

Manufacturer/authorised representative:	FST GmbH Weiherdamm 17 D-57250 Netphen
Description of the assembly:	Filter 16bar-series for fluid group II Type FWP 130 to FWP190* (* = max. allowable pressure for FWP180 and FWP190 = 12bar)
Description of the pressure equipment constituting the assembly:	The filter essentially consists of a pressure vessel. The filter is described in the product data sheet and in the operating manual in more detail.
Conformity assessment procedure followed:	Module A
Harmonised standards applied:	DIN EN ISO 12100
Other Community Directives applied:	2006/95/EG ** 2004/108/EG ** (** = applied depending on optionally chosen electrical accessories)

In case changes are made to the product without prior consultation and written approval by the manufacturer this declaration will become void.

Signature:



01.08.2017, ppa. Christian Ruff, Technical Manager

11.2 Installation Drawing and Filter Configuration

Product data sheets can be downloaded from the Internet: → www.fstweb.de → Download

Techn. Daten
Baureihe FWP - Kunde FST GmbH

DN	Typ	*A	*I	*M	Kege/ Mutter	*B	*T	*F	*L	*D	*N	*S	Filter- element			
		DIN11850 Schweißende	DIN ISO	Gew.-stz. k DIN 11851		G3 Muffe DIN 2999	Klemmstz. DIN 32676	Flansch PN 16 DIN 2633	Ansi Flansch 150 lb.	Gew.-stz. SMS	NPT-Muffe	Flansch 11864/2	C	D/ RohrØ	Gehäuse	Filter- element
10	FWP20-*08	108	B	71	B2	147	143	177	B	B	B	B	155	13x1.5	70 x 2	2,5"
10	FWP30-*10	108	B	71	67	147	143	177	B	B	B	B	155	13x1.5	70 x 2	2,5"
15	FWP70-*15	108	B	71	67	151	143	177	B	B	B	B	155	19x1.5	70 x 2	2,5"
20	FWP90-*20	108	B	73	67	151	143	183	B	B	B	B	155	23x1.5	70 x 2	2,5"
25	FWP110-*25	135	B	89	82	188	177	210	B	B	B	B	182	29x1.5	85 x 2	5"
40	FWP120-*40	135	B	89	82	198	177	218	B	B	B	B	182	41x1.5	85 x 2	5"
40	FWP130-*40	170	B	124	117	233	212	253	B	B	B	B	217	41x1.5	104 x 2	10"
50	FWP140-*50	170	B	108	101	233	212	259	B	B	B	B	217	53x1.5	104 x 2	10"
50	FWP170-*50	170	B	108	101	233	212	259	B	B	B	B	217	53x1.5	104 x 2	20"
65	FWP180-*65	200	B	125	117	275	255	289	B	B	B	B	247	70x2	129 x 2	20"
80	FWP190-*80	200	B	125	117	289	255	299	B	B	B	B	251	85x2	129 x 2	30"

DN	Typ	*A	*I	*M	Kege/ Mutter	*B	*T	*F	*L	*D	*N	*S	Anschluß / D				
		DIN11850/DIN ISO Schweißende	DIN ISO	Gew.-stz. k DIN 11851		G3 Muffe DIN 2999	Klemmstz. DIN 32676	Flansch PN 16 DIN 2633	Ansi Flansch 150lb.	Gew.-stz. SMS	NPT-Muffe	Flansch 11864/2	1/2"	3/8"	1/2"	3/4"	1"
10	FWP20-*08	13x1.5	17.2x1.6	10/13	B2	147	143	177	B	B	B	B	10/13	10/17.2	10/13	10/13	10/13
10	FWP30-*10	13x1.5	17.2x1.6	10/13	67	147	143	177	B	B	B	B	10/13	10/17.2	10/13	10/13	10/13
15	FWP70-*15	19x1.5	21.3x1.6	15/19	67	151	143	177	B	B	B	B	15/19	15/21.3	1/2" / 21.3	1/2" / 19	15/19
20	FWP90-*20	23x1.5	26.9x1.6	20/23	67	151	143	183	B	B	B	B	20/23	20/26.9	3/4" / 26.7	3/4" / 23	20/23
25	FWP110-*25	29x1.5	33.7x2	25/29	82	188	177	210	B	B	B	B	25/29	25/33.7	1" / 33.4	1" / 29	25/29
40	FWP120-*40	41x1.5	48.3x2	40/41	82	198	177	218	B	B	B	B	40/41	40/48.3	1 1/2" / 48.3	1 1/2" / 41	40/41
40	FWP130-*40	41x1.5	48.3x2	40/41	117	233	212	253	B	B	B	B	40/41	40/48.3	1 1/2" / 48.3	1 1/2" / 41	40/41
50	FWP140-*50	53x1.5	60.3x2	50/53	101	233	212	259	B	B	B	B	50/53	50/60.3	2" / 60.3	2" / 53	50/53
50	FWP170-*50	53x1.5	60.3x2	50/53	101	233	212	259	B	B	B	B	50/53	50/60.3	2" / 60.3	2" / 53	50/53
65	FWP180-*65	70x2	76.1x2.3	65/70	117	275	255	289	B	B	B	B	65/70	65/76.1	2 1/2" / 73	2 1/2" / 70	65/70
80	FWP190-*80	85x2	88.9x2.3	80/85	117	289	255	299	B	B	B	B	80/85	80/88.9	3" / 88.9	3" / 85	80/85

- bei Ausführung mit
Differenzdruckmanometer
ändert sich das Maß "B"
um 2x +25mm