

ultrafilter process filtration free of particles & sterile

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# Sterile filter elements and housings for compressed air, technical gases and liquids

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# Free of particles & sterile

## Free of particles and sterile

Compressed air, technical gases and liquids require a certain purity in most applications. In most cases, the media has to be free of particles.

Especially the food and beverage, pharmaceutical or chemical industries require a special degree of puritiy of the used media. Compressed air and technical gases must be free of particles, but also free of bacteria, microorganism and viruses.

As opposed to their size, microorganism are a serious problem for most sensitive production areas. As living organisms, they are able to proliferate in the right ambient condition and to contaminate the production.

Only a few viable organism in a clean or sterile production process can result in immense damages. Not only resulting in a lower product quality but also by complete uselessness of the production charge.

# Sterile filter elements and filter housings from ultrafilter

Ultrafilter offers a complete range for process filtration of compressed air, technical gases and liquids.

Ultrafilter GmbH offers a wide range of sterile filters for different applications. Depending on the application a wide range of filter elements with nominal or absolute retention rates can be offered.

Within the production of our process filters, only the highest quality materials are used.

All process filters are made of inert materials, without adhesives, additives or surface active components.

Ultrafilter GmbH offers a wide range of stainless steel lter housings for the individual filtration requirements.

All Ultrafilter stainless steel filter housings are build and designed according to international requirements.

Depending on the requirements, stainess steel filter housings can be offered in different stainless steel qualities (304, 316L) and different connections.

Ultrafilter filter housings achieve high volumes flow at low differential pressures due an improved construction.

Due to the modular design different element types can be installed.

# **Ultrafilter P-SRF**

for compressed air and technical gases



#### **Ultrafilter P-SRF**

The P-SRF is a wounded depth filter with inner and outer guard end caps made of stainless steel. Consisting of a threedimensional borosilicate depth media, the P-SRF achieves a void volume of 95 %, ensuring a high containment capacity at high flow rates and low differential pressure. A retention rate of > 99.99998 % related to 0.01 µm is achieved during operation.

All components meet the FDA requirements for the contact with food in accordance with the CFR requirements (code of federal regulations) tilte 21.

## Features and advantages

- · Non-fibre releasing filter element
- Manufactured without use of binders or other chemical additives
- Corresponds to cGMP requirements (current Good Manufacture Practice) and is manufactured according to DIN EN ISO 9001.
- P-SRF has passed the toxicological test according to USP XX Class VU for plastics.

- Packing industry
- Biotechnology
- Breweries
- Chemical industry
- Diaries
- Fermentation processes
- · Food & beverage industry
- Pharmaceutical industry
- Hospitals

element size	A mm	B mm	Ø C mm	Ø D mm	correction factor
03/10	76	12	3/4"	42	0,12
04/10	104	12	3/4"	42	0,17
04/20	104	14	1"	52	0,19
05/20	104	14	1"	52	0,19
05/25	128	14	1"	62	0,32
05/30	128	16	2"	86	0,46
07/25	180	14	1"	62	0,47
07/30	180	16	2"	86	0,68
10/30	254	16	2"	86	1,00
15/30	381	16	2"	86	1,55
20/30	508	16	2"	86	2,10
30/30	762	16	2"	86	3,28
30/50	762	16	2"	140	5,89

# Vent filter P-BE for storage tanks



#### **Ultrafilter P-BE**

The P-BE is a wounded depth filter with inner and outer guard end caps made of stainless steel. Consisting of a threedimensional borosilicate depth media, the P-BE achieves a void volume of 95 %, ensuring a high containment capacity at high flow rates and low differential pressure. A retention rate of > 99.999% related to 0.01  $\mu$ m is achieved during operation.

All components meet the FDA requirements for the contact with food in accordance with the CFR requirements (code of federal regulations) tilte 21.

## Features and advantages

- · Non- fibre releasing filter element.
- Manufactured without use of binders or other chemical additives.
- Corresponds to cGMP requirements (current Good Manufacture Practice) and is manufactured according to DIN EN ISO 9001.
- P-BE has passed the toxicological test according to USP XX Class VU for plastics.

- · Chemical and Petrachemical industry
- Pharmaceutical Industry
- Biotechnology
- Cosmetics Industry
- · Breweries and dairies
- · Food and beverages
- Water treatment systems
- · Fermentation processes

element size	A mm	B mm	Ø C mm	Ø D mm	correction factor	
03/10	76	12	3/4"	42	0,12	psid mbar volume flow —>
05/25	128	14	1"	62	0,32	1,5 100 Volume flow
05/30	128	16	2"	86	0,46	0,9 60 g = 0
10/30	254	16	2"	86	1,00	0,9 60 differential pressure
20/30	508	16	2"	86	2,10	0 0 0 20 40 60 80 100 120 3
30/30	762	16	2"	86	3,28	0 10 20 20 40 50 60 70 🕏



#### **Ultrafilter P-GS**

The ultra lter P-GS lter ist designed for removal of particles from gases, liquids and steam.

The P-GS consists of a regenerable weldless filter pipe made from sintered stainless steel. The retention rate extends from 1  $\mu$ m to 25  $\mu$ m.

### Features and advantages

- Good durability against most liquids, aggressive gases and steams.
- The porosity level is more than 50 % ensuring high particle and dirt load capacity as well as a good flow rate at a low differential pressure.
- Regeneration by ultrasonic bath.

- Aseptic packing
- Chemical Industry
- Breweries and dairy industry
- · Electronic industry
- Fermentation processes
- Food and beverages
- Pharmaceutical industry
- Plastic industry

element size	A mm	B mm	Ø C mm	Ø D mm	correction factor
03/10	76	12	3/4"	42	0,12
04/10	104	12	3/4"	42	0,17
04/20	104	14	1"	52	0,19
05/20	104	14	1"	52	0,19
05/25	128	14	1"	62	0,32
05/30	128	16	2"	86	0,46
07/25	180	14	1"	62	0,47
07/30	180	16	2"	86	0,68
10/30	254	16	2"	86	1,00
15/30	381	16	2"	86	1,55
20/30	508	16	2"	86	2,10
30/30	762	16	2"	86	3,28
30/50	762	16	2"	140	5,89



### Features and advantages

- The P-SM offers an especially economical preand final filtration.
- Regeneration of stainless steel mesh by ultrasonic bath or back flush.
- Welded contact points, guaranteeing a constant pore diameter, even under extreme operating conditions.
- Also suitable for high viscosity liquids.
- Withstands a differential pressure of up to 5 bar (flow from outside to inside).
- Suitable for operating temperatures of up to 200°C.

#### **Ultrafilter P-SM**

Pre- and final filter with absolute retention rate for particle removal from ageous solutions, water and other liquids, as well as gases.

The P-SM consists of a regenerable stainless steel mesh, with stainless steel outer guard and endcaps. The retention rate extends from 5  $\mu$ m up to 250  $\mu$ m.

- Water filtration
- Chemicals
- Solvents
- Biological liquids
- Pharmaceutics and cosmetics
- · Food and beverages
- Syrup
- Oils
- Collants

element size	A mm	B mm	Ø C mm	Ø D mm	correction factor
03/10	76	12	3/4"	42	0,12
04/10	104	12	3/4"	42	0,17
04/20	104	14	1"	52	0,19
05/20	104	14	1"	52	0,19
05/25	128	14	1"	62	0,32
05/30	128	16	2"	86	0,46
07/25	180	14	1"	62	0,47
07/30	180	16	2"	86	0,68
10/30	254	16	2"	86	1,00
15/30	381	16	2"	86	1,55
20/30	508	16	2"	86	2,10
30/30	762	16	2"	86	3,28
30/50	762	16	2"	140	5,89



#### **Ultrafilter PP-TF**

Depth filter for particle removal from water and aquaeous solutions with a nominal retention rate of 1  $\mu m$  to 50  $\mu m$ .

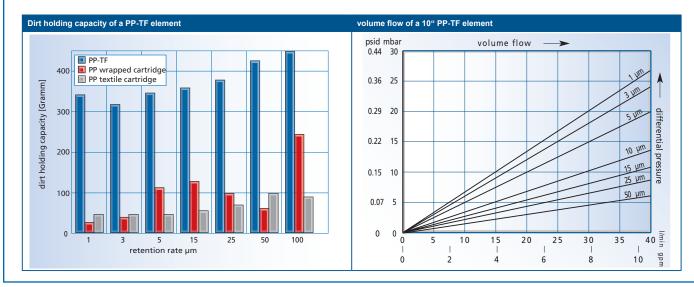
The PP-TF is a pleated polypropylene filter with an inner and outer guard of polypropylene.

This filter element distinguishes itself by an exceedignly high dirt hold capacity as well as a high flow rate with a low differential pressure and a long service life.

## Features and advantages

- Manufactured in accordance with cGMP requirements (current Good Manufacture Practice).
- no migration of Iter medium, non-fibre releasing, thermally, binderfree welded without chemical additives

- Biological liquids
- Chemicals
- Collants
- Cosmetics
- Etchants
- Food and beverages
- · Jet printer inks
- Oils
- Photolithografical liquids
- Pharmaceutics
- Solvents





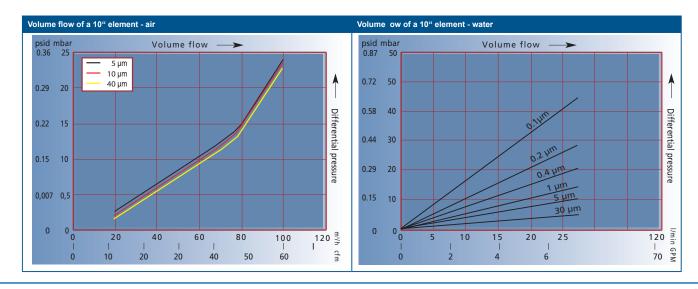
#### Features and advantages

- Manufactured in accordance with cGMP requirements (current Good Manufacture Practice) and complies with FDA requirements for the contact with food.
- no migration of filter medium, non-fibre releasing.
- thermally, binderfree welded without chemical additives.
- Pre-rinsed with  $18M\Omega$  cm water, which leads to extremely low extractables.

#### **Ultrafilter PP**

- Depth filter for particle removal from water and aquaeous solutions and gases with a nominal retention rate of 1 µm to 30 µm.
- The P-PP is a pleated polypropylene filter with an inner and outer guard of propylene.
- This filter element distinguishes itself by an exceedignly high dirt hold capacity as well as a high flow rate with a low differential pressure and a long service life.

- Biological liquids
- Chemicals
- Collants
- Compressed air and other gases
- · Cosmetics and pharmaceutics
- Food and beverages
- Syrup
- Oils und jet printer inks
- Solvents
- Water



## **Ultrafilter PP100**

for particle retention out of liquids



#### **Ultrafilter PP100**

Depth filter for particle removal from water and aquaeous solutions with an absolute retention rate of  $0.45 \ \mu m$  to  $40 \ \mu m$ .

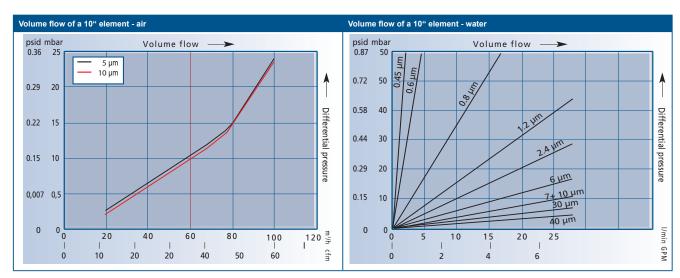
The PP100 is a pleated polypropylene filter with an inner and outer guard of propylene.

This filter element distinguishes itself by an exceedignly high dirt hold capacity as well as a high flow rate with a low differential pressure and a long service life.

## Features and advantages

- Manufactured in accordance with cGMP requirements (current Good Manufacture Practice) and complies with FDA requirements for contact with Food in accordance with CFR Title 21.
- no migration of filter medium, non-fibre releasing
- thermally, binderfree welded without chemical additives.
- Pre-rinsed with 18MΩ cm water, which leads to extremely low extractables

- Biological liquids
- Chemicals
- Collants
- Compressed air and other gases
- · Cosmetics and pharmaceutics
- Etchants
- · Food and beverages
- · Jet printer inks
- Photolithografische Flüssigkeiten
- Serums
- Syrup
- Solvents
- Water





#### **Ultrafilter PF-BEV**

Membrane filter for particle removal from water and aquaeous solutions with an absolute retention rate of 0.2  $\mu m$  to 0.45  $\mu m$ .

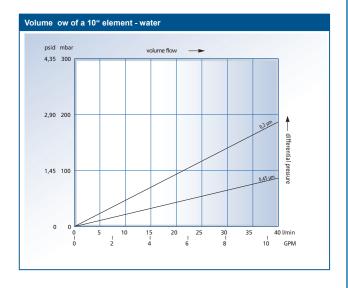
The P-PF-BEV is a polyethersulfone membrane filter with an inner and outer guard of propylene..

The filter media polyethersulfone is inherently hydrophilic and distinguishes itself by having an asymetrically designed pore structure. The pore size steadily decreases towards the center of the medium.

## Features and advantages

- Manufactured in accordance with cGMP requirements (current Good Manufacture Practice).
- P-PF-BEV meets the FDA requirements for the contact with food in accordance with CFR (Code of Federal Regulations) Title 21. P-PF-BEV has passed the USP XX Class VI tests for plastics.
- thermally, binderfree welded without chemical additives

- · Food and beverages
- · Rinsing or cleaning water
- Sterile water
- Mixing or blending water



## **Ultrafilter PF-PES**

for sterile filtration of aqueous solutions



#### **Ultrafilter PF-PES**

Membrane filter for particle removal from water and aquaeous solutions and solvents with an absolute retention rate of 0.04  $\mu$ m to 0.6  $\mu$ m.

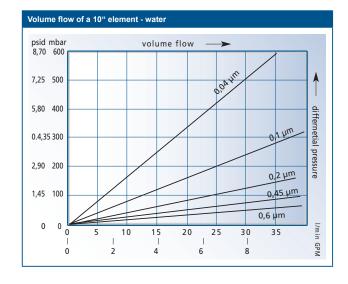
The P-PF-PES is a polyethersulfone membrane filter with an inner and outer guard of propylene.

The filter media polyethersulfone is inherently hydrophilic and distinguishes itself by having an asymetrically designed pore structure. The pore size steadily decreases towards the center of the medium.

#### Features and advantages

- Manufactured in accordance with cGMP requirements (current Good Manufacture Practice).
- P-PF-PES meets the FDA requirements for the contact with food in accordance with CFR (Code of Federal Regulations) Title 21. P-PF-PES has passed the USP XX Class VI tests for plastics.
- Pre-rinsed with  $18M\Omega$  cm water, which leads to extremely low extractables.

- · Serum & blood-based products
- Antibiotics
- Injectables
- · Diagnostic reagents
- · Deionised water
- · Sterile water
- Chemically treated water
- Acids and bases
- Ketones etc.





#### Features and advantages

- Manufactured in accordance with cGMP requirements (current Good Manufacture Practice).
- P-PF-PP meets the FDA requirements for the contact with food in accordance with CFR (Code of Federal Regulations) Title 21. P-PF-PP has passed the USP XX Class VI tests for plastics.
- The membrane is non-fibre realising and thermally welded without use of binders or chemical additives.

#### **Ultrafilter PF-PP**

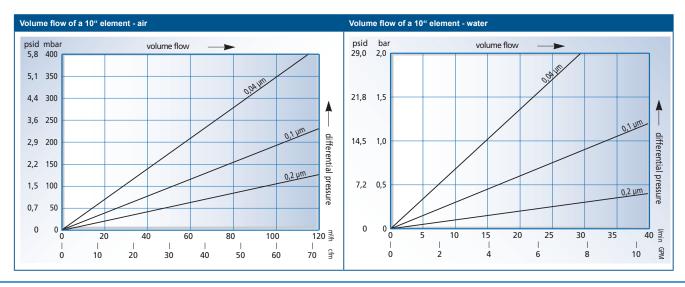
Membrane filter for filtration of solvents, alcohols, chemicals and gases with an absolute retention rate of 0.04  $\mu m$  to 0.2  $\mu m$ .

The P-PF-PP is a pleated propylene membrane filter with an inner and outer guard of propylene.

The filter media propylene is inherently hydrophobic with a highly porous membrane structure.

## **Anwendungsbereiche**

- Photo-lithografical solutions
- Alcohols
- Bases
- Etchants
- Solvents
- Photoresists
- Fermentation gases
- Technical gases
- · Tank ventilation



## **Ultrafilter PF-PT**

for aggresive liquids and gases



#### **Ultrafilter PF-PT**

Pleated membrane filter for particle removal from aggressive solvents, chemicals and gases with a nominal retention rate.

The PF-PP filter is a high quality Teflon filter media, offering maximum assurance of filtration performance and durability against chemicals in severe process conditions.

The retention rate extends from 0.1  $\mu$ m to 1  $\mu$ m. The Teflon® filter media is inherently hydrophobic with a

highly porous membrane structure.

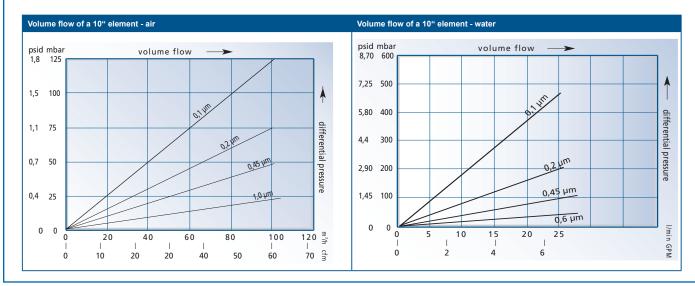
All components meet the FDA requirements for the contact with food in accordance with the CFR (Code of FederalRegulations) Title 21. PF-PT filter elements have passed the toxicological tests according to US-PXX Class VI forplastics.

In particular, the requirements of the chemical, biological, cosmetic, electronic and the pharmaceutical industries are fulfilled

## Features and advantages

- Manufactured in accordance with cGMP requirements (current Good Manufacture Practice).
- The membrane is non-fibre realising and thermally welded without use of binders or chemical additives.

- Particle removal from water
- Chemicals
- Biological liquids
- Solvents
- Cosmetics
- Photo-lithogra cal solutions
- Paints & dyes
- Jet printer inks
- Coatings



## **Prozessfilter**

#### Konformität und Beständigkeit

#### Chemical durability of filter media

Media		Filter	type	
	PP 100	PF-PES	PF-PP	PP-PT
	PP	PF-BEV		
acetone	1	3	1	1
benzole	3	1	3	2
benzyl alcohol	1	-	1	1
butanol	1	1	1	1
chloroform	2	3	2	2
cyclohexanon	1	3	1	1
steam	1	1	1	1
acetic acid	1	1	1	1
ethanole	1	1	1	1
hydrogen fluoride 50 %	1	-	1	1
formamide	1	-	1	1
formaldehyde	1	1	1	1
fluorosilicic acid	2	-	2	2
hydraulic fluid	1	2	1	1
caustic potash 32 %	1	1	1	1
kerosine	1	-	1	1
adhesives	-	1	-	-
paint	-	1	-	-
methanole	1	1	1	1
motor oil	-	1	-	-
caustic soda 32 %	1	1	1	1
n-hexane	2	1	2	1
ozone	-	1	-	-
perchloric acid 25 %	1	-	1	1
vegetable oil	-	1	-	-
phosphoric acid 25 %	1	-	1	1
phosphoric acid 85 %	1	-	1	1
pyridine	2	3	2	1
nitric acid 25 %	1	3	1	1
lubricant	1	1	1	1
sulfuric acid 25 %	1	1	1	1
sulfuric acid 98 %	2	3	1	1
silicone	1	1	1	1
toluole	3	3	3	2
trichloroacetic acid 25 %	1	-	1	1
water	1	1	1	1
citric acid	1	1	-	-

- 1 = recommended
- 2 = limited recommendable
- 3 = not recommended
- = not tested

A complete list for all filter elements and media can be achieved upon request.

## **Declaration of Conformity**

- Quality starts with the right choice of raw materials. Only the best materials are used in our production. We pay total attention to ensuring the highest quality and efficiency levels. This is ensured by continuous quality approvals..
- All products perfectly match to each other and comply highest quality requirements. System solutions with highest operational safety and efficiency can be achieved at any time.
- All process filters are made of inert materials, without adhesives, additives or surface active components.
- To comply with the stringent regulations of the FDA for contact with food the ultrafilter plastic filters have passed the toxicological tests according to USP Class VI and are biologically inert.
- All ultrafilter sterile filter are integrity tested to ensure highest operational safety and continously high quality.

# P-EG stainless steel housing

for sterile filtration of gases



### Features and advantages

- 18 different sizes for operating volumes from 60 to 23.040 Nm³/h related to 7 bar.
- Complies to the requirements of the European directive 97/23/EG for pressure vessels.
- Plug connection guarantees that the elements remain safely fixed at all times.
- Different element sizes can be installed due to the modular design.

#### **Ultrafilter P-EG**

- The P-EG stainless steel housing was developped for purification of compressed air an other technical gases.
- With the optimized construction they offer low differential pressure at high flow rates.

- · Breweries
- Chemical & pharmaceutical Industry
- Cosmetics Industry
- Dairies
- Food and beverages
- Water treatment systems
- Aseptic packing

volume flow			connection	filter e	lement			weight in			
housing size	nominal	maximal					(BSP-housing/ DIN FI. from 0432)				kg
	m³/h	m³/h	R/DN	size	qty.	height	width	Ø	conheight	rem.height	
0006	60	90	R 3/8	03/10	1	220	108	70	55	90	2,0
0009	90	120	R 1/2	04/10	1	248	105	70	55	120	2,1
0012	120	180	R 1/2	04/20	1	248	108	70	55	120	2,2
0018	180	270	R 3/4	05/20	1	272	125	70	55	150	2,4
0027	270	360	R 1	05/25	1	298	125	85	74	150	3,2
0036	360	480	R 1 1/4	07/25	1	350	140	85	74	200	3,7
0048	480	720	R 1 1/2	07/30	1	388	170	104	94	200	5,1
0072	720	1080	R 2	10/30	1	463	170	104	93	280	5,2
0108	1080	1440	R 2	15/30	1	590	170	104	93	450	5,8
0144	1440	1920	R 2 1/2	20/30	1	740	216	129	107	580	8,1
0192	1920	2880	R 3	30/30	1	1002	216	129	111	850	9,6
0288	2880	4320	R 3	30/50	1	1027	240	154	113	850	13,0
0432	4320	5760	DN 100	20/30	3	1020	410	219	200	580	45,0
0576	5760	7680	DN 100	30/30	3	1275	410	219	200	850	46,0
0768	7680	11520	DN 150	30/30	4	1332	480	273	240	850	70,0
1152	11520	15360	DN 150	30/30	6	1395	540	324	250	850	80,0
1536	15360	19200	DN 200	30/30	8	1520	660	406	300	850	135,0
1920	19200	23040	DN 200	30/30	10	1520	660	406	300	850	135,0

## P-BE stainless steel housing

for aeration of storage tanks



#### Features and advantages

- 12 different sizes for operating volumes from 3 to 1980 Nm³/h related to 1 bar.
- Complies to the requirements of the European directive 97/23/EG for pressure vessels.
- Different element sizes can be used due to the modular design. Apart from sterile filters, polypropylene or Teflon\* membrane filters can be used.

#### **Ultrafilter P-BE**

- P-BE filter are used to ensure 100 % sterility in the storage of pharmaceutical products, chemicals, food or of fermenters.
- The two-part housing is user-friendly designed and has a splash protection to prevent liquids come in contact with the filter media.

- · Breweries, Dairies
- · Chemical & pharmaceutical Industry
- Cosmetics Industry
- Fermentation processes
- · Food and beverages

	volum	ne flow		filter e	lement	dimensio	ons in mm	
housing size	im m	³/h at	connection	inter e	iement	umensio	113 III IIIII	weight in kg
	Δp 20 mbar	Δp 40 mbar		size	qty.	height	Ø	
0006	4,5	9	DN 32	03/10	1	110	85	1,5
0027	12	24	DN 40	05/25	1	168	104	2,2
0032	17	35	DN 50	05/30	1	186	114	2,4
0072	35	70	DN 50	10/30	1	312	114	3,3
0144	70	140	DN 80	20/30	1	550	154	9,2
0192	105	210	DN 80	30/30	1	805	154	11,5
0432	210	420	DN 100	20/30	3	670	219	43,0
0576	315	630	DN 100	30/30	3	925	219	44,0
0768	420	840	DN 150	30/30	4	950	273	70,0
1152	630	1260	DN 150	30/30	6	950	324	80,0
1536	840	1680	DN 200	30/30	8	960	406	135,0
1920	1050	2010	DN 200	30/30	10	960	406	135,0

# PG-EG stainless steel housing for gas filtration in sanitary quality



#### Features and advantages

- 14 different sizes for operating volumes from 7,5 to 2.700 Nm3/h related to 7 bar.
- Complies to the requirements of the European directive 97/23/EG for pressure vessels.
- Plug connection guarantees that the elements remain safely fixed at all times.
- Different element sizes can be installed due to the modular design
- Condensate drain and de-aeration are equipped with pharma valves

#### **Ultrafilter PG-EG**

- The PG-EG stainless steel housing was developped for purification of compressed air and other technical gases in pharmcaceutical, biotechnology or chemical industry.
- PG-EG housings are first choice in critical applications in sterile filtration.

- Breweries, dairies
- Chemical & pharmaceutical Industry
- Biotechnology
- Water treatment systems
- Food and beverages
- Fermentation processes

housing size	volume flow at 1 bar m³/h	connection	filter e	lement		di	mensions in m	ım		weight in kg
	nom		size	qty.	Α	В	С	D	E	
0006	7,5	DN 10	03/10	1	260	120	70	98	90	1,2
0018	22,5	DN 15	05/20	1	315	120	70	98	150	1,4
0032	45,0	DN 35	05/30	1	360	160	114	136	150	2,8
0048	60,0	DN 32	07/30	1	410	160	114	126	200	3,1
0072	90,0	DN 40	10/30	1	485	160	114	117	280	3,5
0108	135,0	DN 50	15/30	1	610	160	114	125	450	4,0
0144	180,0	DN 65	20/30	1	820	185	129	150	580	7,0
0192	270,0	DN 80	30/30	1	1080	185	129	150	850	8,8
0432	540,0	DN 100	20/30	3	1090	410	219	200	580	43,0
0576	810,0	DN 100	30/30	3	1350	410	219	200	850	44,0
0768	1080,0	DN 150	30/30	4	1410	480	273	240	850	70,0
1152	1620,0	DN 150	30/30	6	1460	540	324	250	850	80,0
1536	2160,0	DN 200	30/30	8	1600	660	406	300	850	135,0
1920	2700,0	DN 200	30/30	10	1600	660	406	300	850	135,0

# PF-EG stainless steel housing

for filtration of liquids



#### Features and advantages

- 12 different sizes for operating volumes from 3 to 600 l/min.
- Complies to the requirements of the European directive 97/23/EG for pressure vessels.
- Bajonet-connection guarantees that the elements remain safely fixed at all times.
- Different element sizes can be installed due to the modular design.
- DN 40 clamp connection at housing top.

#### **Ultrafilter PF-EG**

- The PF-EG stainless steel housing was developped for purification of liquids in pharmaceutical, biochemical and chemical processes, as well as for beverages.
- PF-EG housings are first choice in critical applications in sterile filtration.

- Breweries
- Dairies
- Biotechnology
- · Chemical & pharmaceutical Industry
- food and beverages
- · Water treatment systems
- Fermentation processes

housing size	volume flow	connection	filter element connection			dimensions in mm		
Housing Size	in I/min	Connection	size	connection	height	Ø	kg	
0003	3	DN 10	03/10	1	280	180	1,4	
0012	12	DN 25	5/3 Code 7	1	375	250	3,9	
0025	25	DN 25	10/3 Code 7	1	505	250	4,8	
0050	50	DN 25	20/3 Code 7	1	765	250	6,1	
0075	75	DN 25	30/3 Code 7	1	1025	250	7,4	
0080	80	DN 40	10/3 Code 7	3	690	330	14,1	
0150	150	DN 40	20/3 Code 7	3	935	330	16,5	
0225	225	DN 40	30/3 Code 7	3	1205	330	19,6	
0250	250	DN 50	20/3 Code 7	5	965	400	20,6	
0375	375	DN 50	30/3 Code 7	5	1215	400	23,6	
0400	400	DN 65	20/3 Code 7	8	985	500	33,6	
0600	600	DN 65	30/3 Code 7	8	1235	500	37,9	



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Technical alterations reserved.



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