

MAHLE

Industrial Filtration

PRODUCT RANGE

FLUID TECHNOLOGY



All technical details were valid at the time of going to print. Since we are continuously developing our products, we reserve the right to make technical alterations. Unfortunately, we also cannot fully exclude possible errors. Please understand that no legal claims can be made based upon either the details given or the illustrations and descriptions provided. Texts, photographs, technical drawings and any other form of presentations made in this publication are protected by copyright and property of MAHLE Filtersysteme GmbH, Industrial Filtration. Any further use in print or electronic media requires the express approval. Any form of duplication, translation, processing, recording on microfilm or saving in electronic systems is prohibited without the express approval of MAHLE Filtersysteme GmbH, Industrial Filtration.

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MAHLE Filtersysteme GmbH, Industrial Filtration



Industrial Filtration

Dear Customers, Partners and Prospective Buyers,

There is hardly an industry in which our innovative solutions in the areas of fluid technology, dust filtration, and process technology are not being applied. From the automotive industry to chocolate-making, MAHLE Industrial Filtration has been developing and producing high-quality industrial filters for any application for decades. They are just as efficient and economical in the machine and system building, chemical, pharmaceutical, and food industries as in environmental, drive, and energy technology, as well as maritime and mobile machinery systems.

As one of the world's leading fluid technology partners, we provide machine builders and users of mobile and stationary hydraulic systems with highly effective filters and filter systems, units, and accessories to keep hydraulic and lubricant fluids clean.

MAHLE Industrial Filtration is an independent service area with its own engineering, production, and sales teams, integrated in the MAHLE Group, and thus is backed by the strength of a worldwide market leader. The MAHLE Group is among the top 30 automotive suppliers globally and is the world market leader for combustion engine components, systems and peripherals.

We would like to present our new product catalogue fluid technology to you, which provides you with a comprehensive overview of our product range fluid technology. All technical documentation and brochures can be downloaded from our website www.mahle-industrialfiltration.com.

We are looking forward to your feedback!

Yours sincerely,

Director and General Manager
Profit Center Industrial Filtration

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SUCTION FILTERS

AIR BREATHERS

RETURN LINE FILTERS

LOW PRESSURE FILTERS

MEDIUM PRESSURE FILTERS

HIGH PRESSURE FILTERS

DUPLEX FILTERS

MAINTENANCE INDICATORS

FILTER ELEMENTS

Oil care

OIL MIST SEPARATION

FILTERS FOR INDUSTRIAL PROCESS TECHNOLOGY

APPENDIX

Suction Filter

Pi 160

1. Features

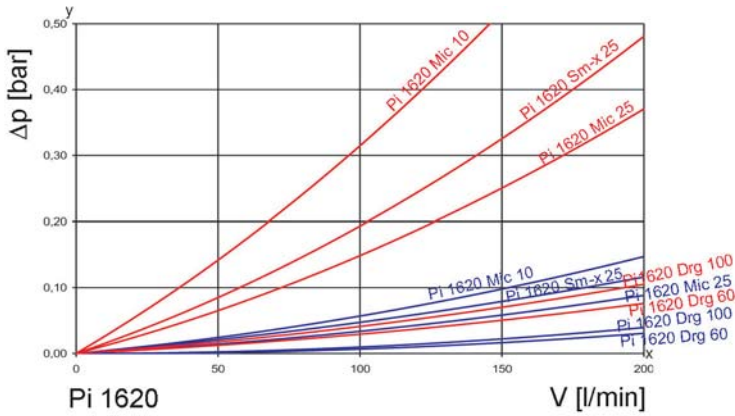
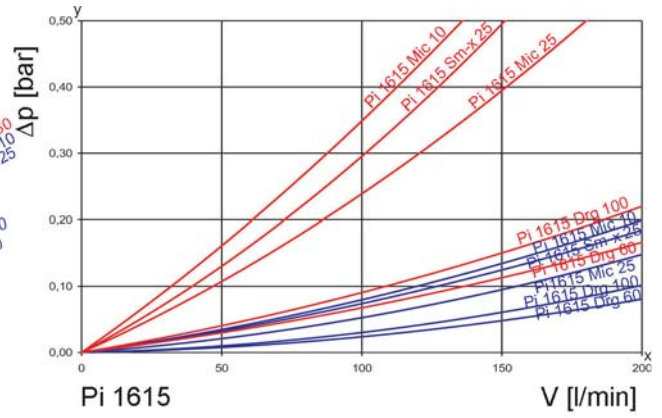
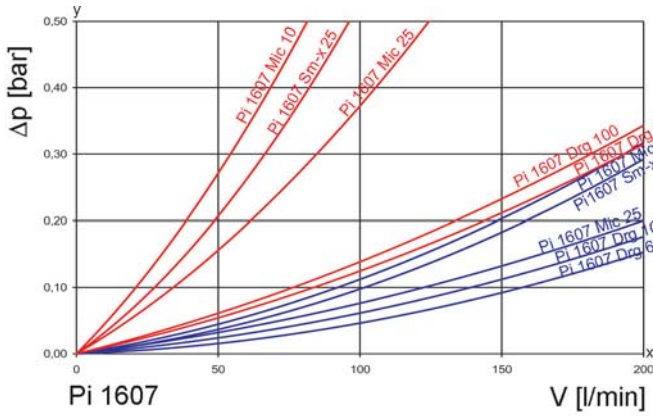
High performance filters for modern hydraulic systems

- Provided for tank mounting
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded or flanged connections
- Vacuum gauge serial production
- Quality filters, easy to service
- Quick-lock design and shut off valve
- Equipped with highly efficient Mic, Sm-x or Drg filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution



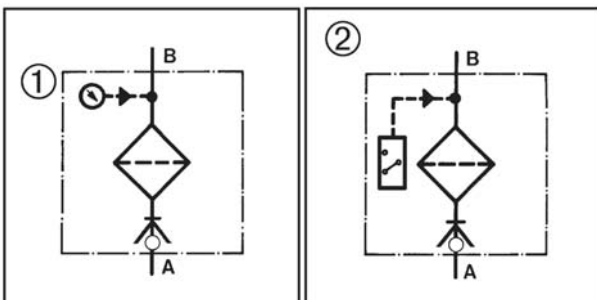
2. Flow rate/pressure drop curve complete filter

190 mm²/s
33 mm²/s



y = differential pressure Δp [bar]
x = flow rate V [l/min]

3. Symbols



4. Order numbers

Example for ordering filters:

1. Housing design	2. Filter element
V=100 l/min, pressure gauge, Type: Pi 1615-366 Order number: 77774813	Sm-x 25 Type: 852 754 Sm-x 25 Order number: 77730195

4.1 Housing design

Nominal size* NG [l/min] Sm-x + Mic/Drg	Order number	Type	①	②	②
			with vacuum gauge	with vacuum switch 230V	with vacuum switch 42V
80/100	77774854	Pi 1607-166			
	77774847	Pi 1607-165			
	77774714	Pi 1607-170			
100/160	77774839	Pi 1615-166			
	77774821	Pi 1615-165			
	77774706	Pi 1615-170			
	77774813	Pi 1615-366			
	77774805	Pi 1615-365			
	77774730	Pi 1615-370			
	77774797	Pi 1615-466			
	77774789	Pi 1615-465			
	77774722	Pi 1615-470			
	160/315	77874480	Pi 1620-366		
77874498		Pi 1620-365			
77874506		Pi 1620-370			

* at operational viscosity (33 mm²/s); Sm-x 25 (T20(c) y 200) and $\Delta p \leq 0.1$ bar

4.2 Filter element

Nominal size NG [l/min]	Order number	Type	Filter material	Filter surface [cm ²]
80	77729338	852 753 Mic 10	Mic 10	5700
	77729429	852 753 Mic 25	Mic 25	5700
	77729577	852 753 Sm-x 25	Sm-x 25	3750
100	77729387	852 754 Mic 10	Mic 10	15850
	77729445	852 754 Mic 25	Mic 25	15850
	77730195	852 754 Sm-x 25	Sm-x 25	10400
160	77874514	852 821 Mic 10	Mic 10	16750
	77874522	852 821 Mic 25	Mic 25	16750
	77874530	852 821 Sm-x 25	Sm-x 25	11000

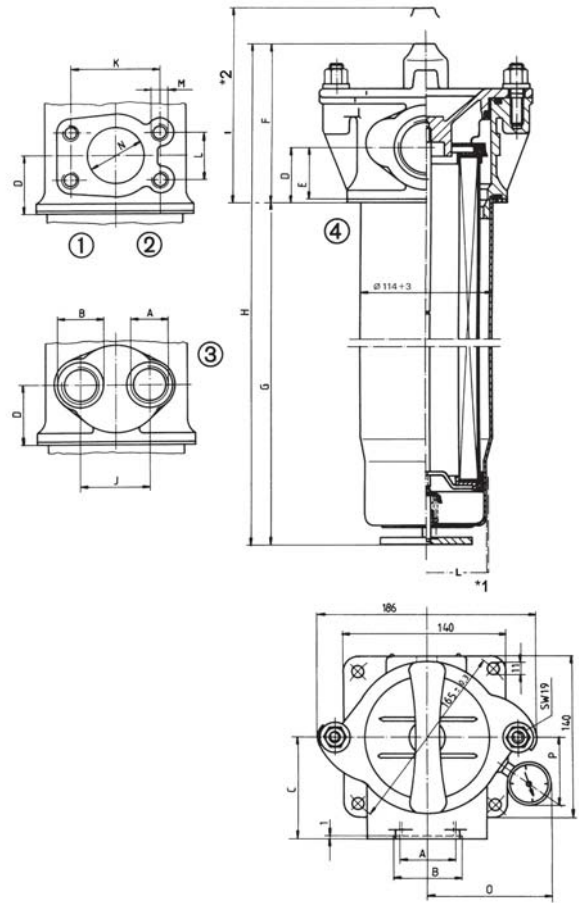
4.3 Filter elements wire mesh

Nominal size* NG [l/min]	Order number	Type	Filter material	Filter surface [cm ²]
100	77862345	852 753 Drg 60	Drg 60	2300
	77729486	852 753 Drg 100	Drg 100	2300
160	77862352	852 754 Drg 60	Drg 60	6250
	77729528	852 754 Drg 100	Drg 100	6250
315	77874548	852 821 Drg 60	Drg 60	6650
	77874555	852 821 Drg 100	Drg 100	6650

* at operational viscosity (33 mm²/s) and Drg 100

5. Technical specifications

Design:	suction filter for tank mounting with shut off valve
Installation:	horizontally under oil level or vertically above oil level with optional extension pipe
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Filter head material:	GDAL
Filter housing material:	St
Sealing material:	NBR/AL
Indicating range	
vacuum gauge:	-1 bar to 1.5 bar
Pressure setting vacuum switch:	-200 mbar
Electrical data of vacuum switch (PiS 3070):	
Maximum voltage:	230 V~/=
Maximum current on contact:	6 A
Contact:	change-over switch
Electrical connections:	AMP 6.3 DIN 46248 for bushings according to DIN 46247
Fitting position:	any fitting positions possible (fitting position has to be defined when ordering indicators with defined switch point)
Type of protection:	IP 00 - without protecting cap IP 54 - with protecting cap
Vacuum switch 42 V (HES 2200 BP)	
Contact:	normally open
Breaking capacity:	42 V/6 W as ohmic resistor
Type of protection:	IP 54 – with protecting cap
Electrical connections:	AMP 6.3 DIN 46248 for re- ceptacle for tabs according to connection method, 2 pole

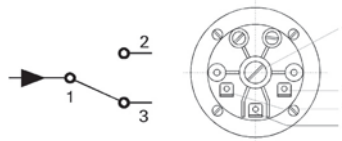


*1 Extension pipe available upon request

*2 Extension height min.

Connecting plan

- 1 supply line
- 2 operating contact
- 3 normally closed contact
- 4 adjusting screw



We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.

6. Dimensions

Dimension	Pi 1607-...		Pi 1615-...		Pi 1615-...		Pi 1615-...		Pi 1620-...	
O/P	110/64	166	110/64	166	110/64	366	110/64	466	110/64	366
O/P	135/71	165	135/71	165	135/71	365	135/71	465	135/71	365
O/P	130/55	170	130/55	170	130/55	370	130/55	470	130/55	370
Fig.	4		4		2		3		1	
A	G1½		G2		SAE 2"		2 x G1		SAE 3"	
B	56		68				41			
C	87		87		87		87		95	
D	49		49		53		53		73	
E	46		46		50		50		70	
F	144		144		144		144		182	
G	178		471		471		471		433	
H	322		615		615		615		615	
I	375		680		680		680		710	
J							60			
K					77,8				106.4	
L					42.9				61.9	
M					M12				M16	
N					50				76	
Weight [kg]	2.7		3.5		3.5		3.5		5.0	

7. Installation, operating and maintenance instructions

7.1 Filter installation

When installing the filter make sure that sufficient space is available to remove the filter element and the filter housing. Preferably the filter should be installed with the housing pointing downwards. The maintenance indicator must be visible.

7.2 When should the filter element be replaced or cleaned?

Filters equipped with visual and electrical maintenance indicator: During cold starts, the indicator may give a warning signal. If vacuummeter shows > 0,2 bar or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced or cleaned after the end of the shift. Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (Mic or Sm-x) cannot be cleaned.

7.3 Element replacement

1. Stop system and relieve filter from pressure.
2. Unscrew nuts, turn cover counter-clockwise and pull. Unscrew element from support.
3. Check O-ring on the filter for damage. Replace, if necessary.
4. Make sure that the order number on the spare element corresponds to the order number of the filter name-plate.
5. Complete installation.

7.4 Cleaning methods for cleanable elements

a) Ultrasonic cleaning

Insert the contaminated suction filter element into an ultrasonic bath for approx. 3 minutes; then rinse in clean liquid. Afterwards, blow air into the filter from the clean side inward.

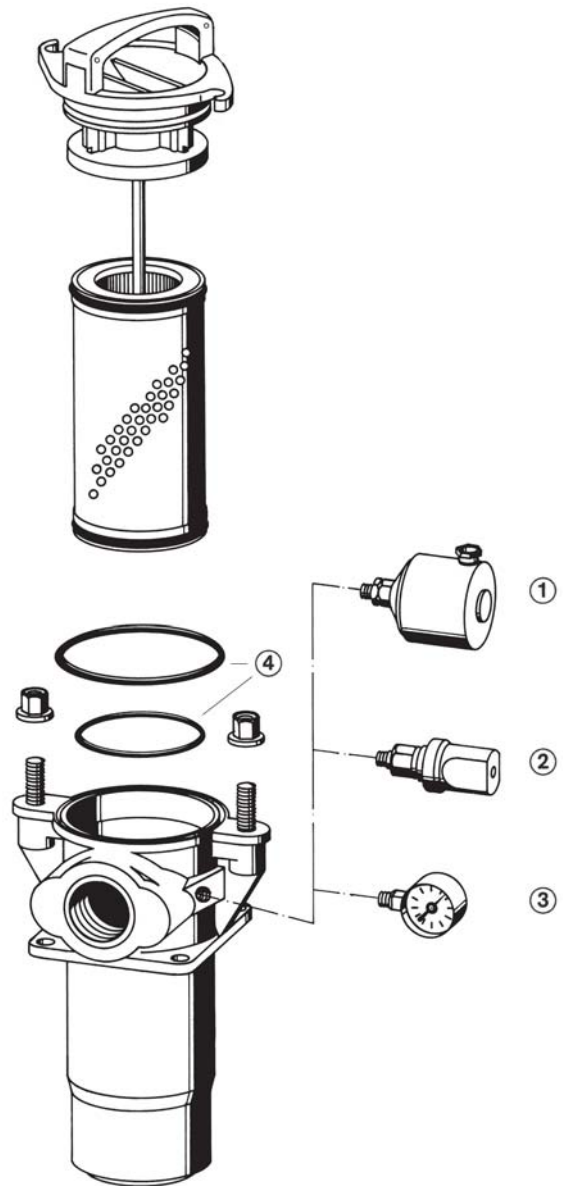
b) Manual cleaning

1. Remove coarse external contamination in a separate cleaning tank using a brush and cleaning agent.
2. Place filter in unused cleaning liquid (approx. 20 min)
3. Wash filter with cleaning liquid from the outside to the inside.
4. Dry element with pressured-air from the clean side to the dirt side; the cleaning efficiency is about 60–70%

Using either method, be sure that no dirt is entering to the clean side of filter.

8. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
①	Vacuum switch 230 V (PiS 3070/200 mbar)	77669724
②	Vacuum switch 42 V (HES 2200 BP)	78308892
③	Pressure gauge (-1 to 1.5 bar)	76345763
④	Seal kit for filter housing + filter element	
	NBR	77874563
	FPM	77904840
	EPDM	77904857



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 78356396.08/2008

Suction Filters

Pi 1710

Nominal size up to 480

1. Features

Pumps incorporated in hydraulic systems must be protected from coarse contaminants which when not removed by any other filtering devices may gain access to tank.

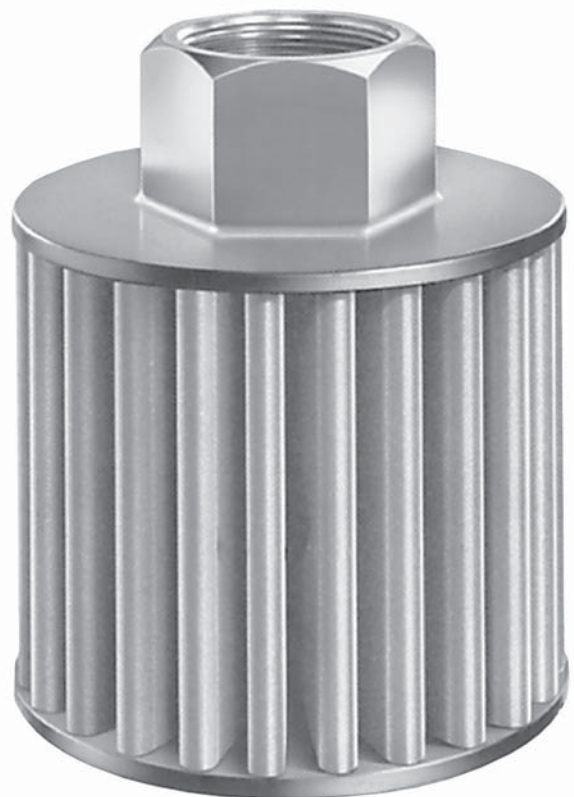
MAHLE suction filters, series Pi 1710, stand out for their rugged construction and large filter surface area.

The filter surface is dimensioned to ensure long life at the proper corresponding flow rate.

The installation should be ahead of the pump in the tank for optimal protection.

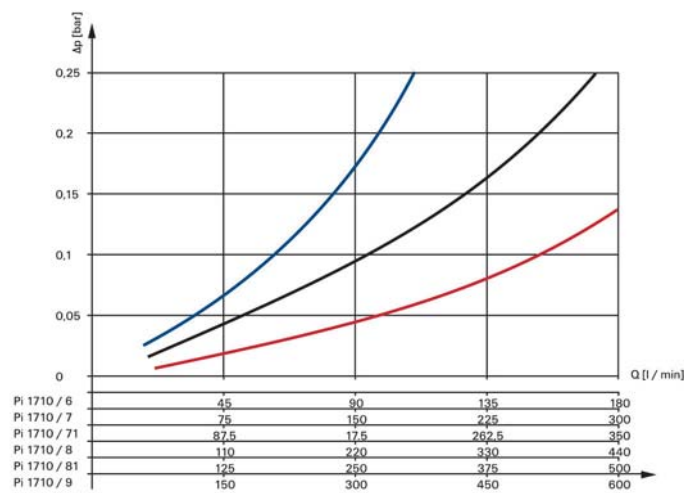
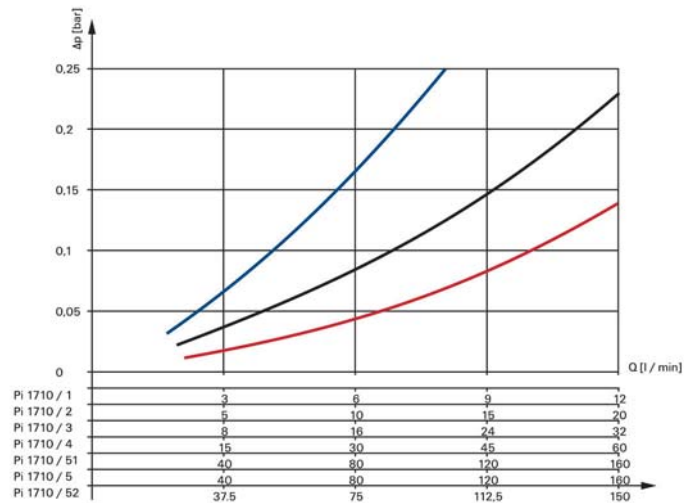
The standard filter material is a 100 µm stainless steel wire mesh.

- Rugged construction
- Large filtering surface area
- Worldwide distribution



2. Flow rates/pressure drop curve

— 500 mm²/s
— 190 mm²/s
— 33 mm²/s



3. Order numbers

3.1 Housing design

Nominal size NG [l/min]	Order number	Type	Filter surface [cm ²]
10	77661598	Pi 1710/1	100
15	77661606	Pi 1710/2	105
30	77661614	Pi 1710/3	170
50	77661622	Pi 1710/4	400
60	77661697	Pi 1710/51	510
80	77661630	Pi 1710/5	650
120	77661705	Pi 1710/52	950
150	77661648	Pi 1710/6	1120
240	77661655	Pi 1710/7	1500
290	77661689	Pi 1710/71	1880
360	77661663	Pi 1710/8	2800
410	77661713	Pi 1710/81	3500
480	77661671	Pi 1710/9	3500

4. Technical specifications

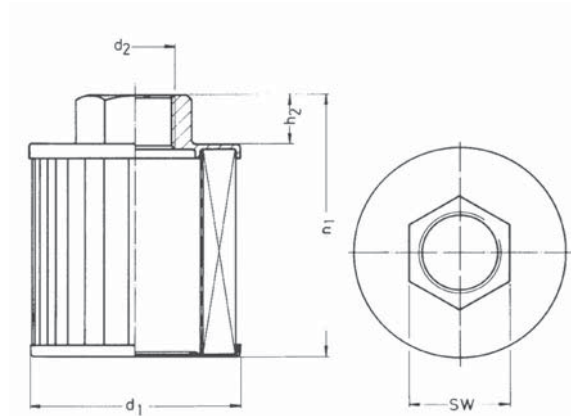
Flow capacity:	10 to 480 l/min at 33 mm ² /s viscosity and 0.1 bar Δ p
Temperature range:	-10 °C to +120 °C
Degree of filtration:	100 μ m
Other ratings:	on request
Material of connecting port + end cap:	PA 6 GF 30
Material of end cap:	galvanized steel
Material of inner tube:	galvanized steel
Material of wire mesh:	stainless steel 1.4301

We draw attention to the fact that all values indicated are average values and do not always occur in specific cases of applications. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EG (ATEX 95).

The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you are planning to use other fluids please contact us for additional support.

Subject to technical alteration.



5. Dimensions

All dimensions except "d₂" in mm.

Type	d ₁	d ₂	h ₁	h ₂	SW	Weight [kg]
Pi 1710/1	46	G¼	60	18	22	0.10
Pi 1710/2	46	G3/8	60	18	22	0.10
Pi 1710/3	61	G½	53	13	27	0.14
Pi 1710/4	61	G¾	87	13	32	0.20
Pi 1710/51	87	G1	87	21	41	0.32
Pi 1710/5	87	G1	108	21	41	0.35
Pi 1710/52	87	G1	152	21	41	0.40
Pi 1710/6	99	G1¼	122	21	46	1.00
Pi 1710/7	99	G1½	159	28	50	1.00
Pi 1710/71	99	G1½	189	28	50	1.05
Pi 1710/8	131	G2	161	30	65	1.20
Pi 1710/81	131	G2	191	30	65	1.40
Pi 1710/9	131	G2½	198	37	80	1.50

6. Cleaning methods

a) Ultrasonic cleaning

Insert the contaminated suction filter element into an ultrasonic bath for approximately 3 minutes, then rinse in clean liquid. Afterwards, blow air into the filter from the clean side outward.

The cleaning effect is approximately 80-90 %.

b) Manual cleaning

1. Remove coarse external contamination in a separate cleaning tank using a brush and cleaning agent.
2. Place filter in unused cleaning liquid (approximately 20 minutes).
3. Wash filter with cleaning liquid from the inside to the outside. The cleaning effect is approximately 60-70 %.

Using either method be sure that no dirt is washed on the inside of the element.

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78357287.06/2008

Low Pressure Filter/Suction Filter Pi 1941

Nominal pressure 10/25 bar (140/360 psi), up to nominal size 63

1. Features

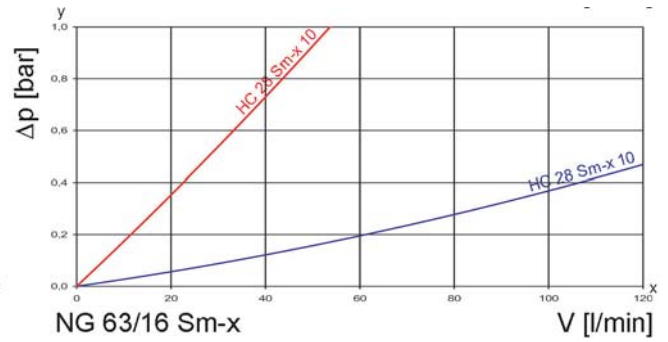
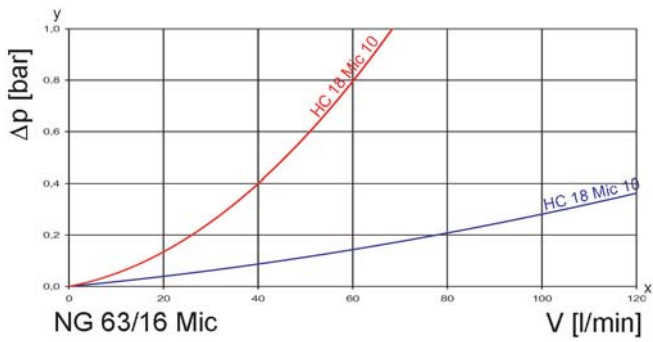
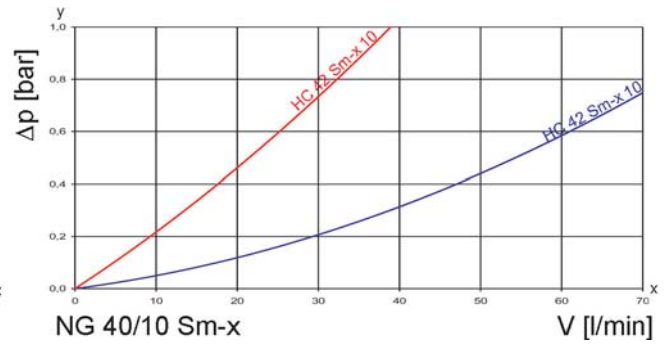
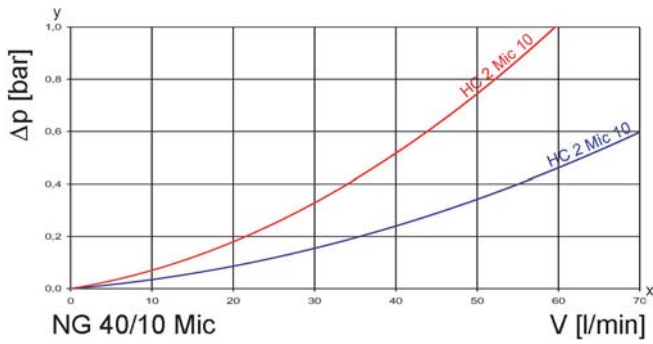
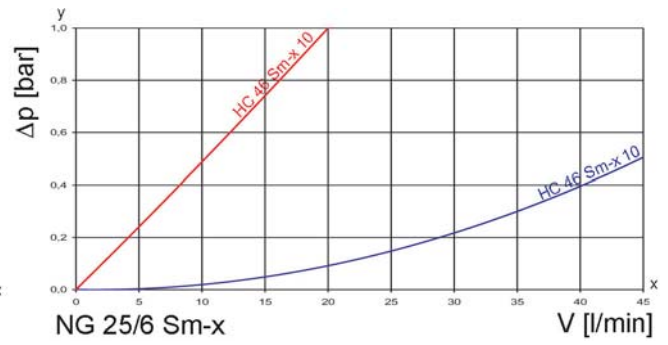
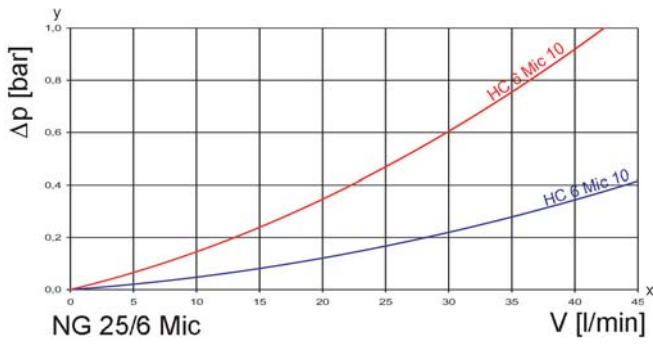
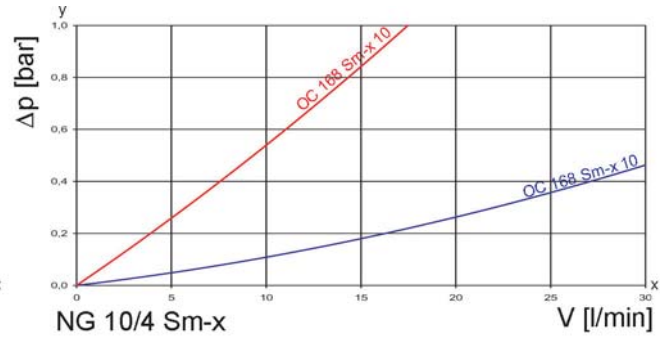
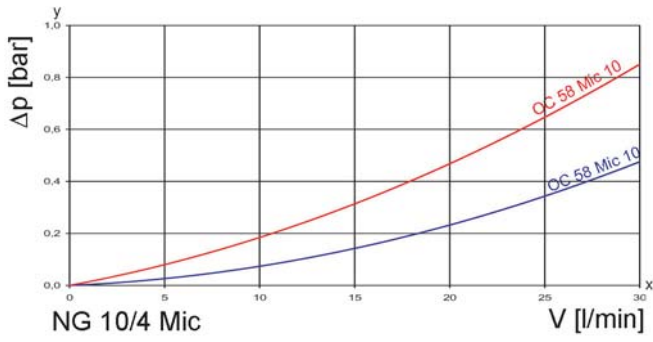
High performance filters for modern hydraulic systems

- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual maintenance indicator
- Threaded connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre Sm-x and Mic filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution



2. Flow rate/pressure drop curve complete filter

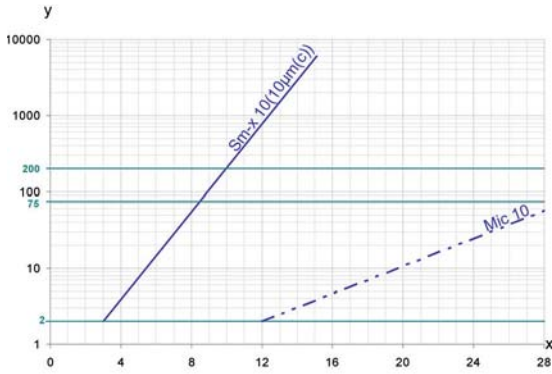
■ 190 mm²/s
■ 33 mm²/s



y = differential pressure Δp [bar]

x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particle size μm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x-Elemente with
max. Δp 5 bar

Sm-x 10 $\beta_{10(C)} \geq 75$

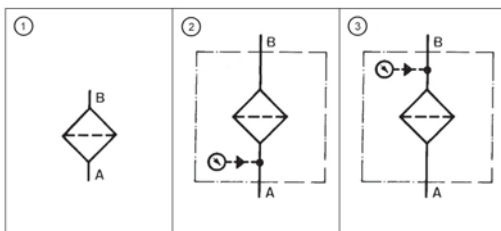
values guaranteed up to
5 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic filter elements: Verification of burst resistance
DIN ISO 2942	Hydraulic filter elements: Determination of fabrication integrity
DIN ISO 2943	Hydraulic filter elements: Verification of material compatibility with hydraulic fluids
DIN ISO 3723	Hydraulic filter elements: Method for testing end-cap load
DIN ISO 3724	Hydraulic filter elements: Verification of flow fatigue characteristics
ISO 3 968.2	Hydraulic filter elements: Evaluation of pressure drop versus flow
ISO 16889	Hydraulic filter elements: Testing of filter performance

6. Symbols



7. Order numbers

Example for ordering filters:

1. Housing design

V= 63 l/min, pressure gauge + spin-on cartridge Mic 10

Type Pi 1941/10/G¾/DM + HC 18

Order number 77807811 + 77643331

7.1 Housing design/order number for pressure-side installation

Nominal flow rate NG [l/min]	Order number	Type	①	②
			no options	with pressure gauge
10	77664360	Pi 1941/10/G¼		
	77812225	Pi 1941/10/G¼/DM		
25	77664386	Pi 1941/10/G3/8		
	77815509	Pi 1941/10/G3/8/DM		
40	77664394	Pi 1941/10/G½		
	77664402	Pi 1941/10/G½/DM		
63	77664378	Pi 1941/10/G¾		
	77807811	Pi 1941/10/G¾/DM		

7.2 Spin-on cartridges

Nominal flow rate NG [l/min] press-/suct. side	Order number	Type	Filter material	max. Δ p [bar]	Filter surface [cm²]
10/4	77785983	OC 58	Mic 10	5	1775
	77500184	OC 168	Sm-x 10		1309
25/6	77501273	HC 6	Mic 10	5	3000
	77501232	HC 46	Sm-x 10		2075
40/10	72013241	HC 2	Mic 10	5	5440
	77501372	HC 42	Sm-x 10		3360
63/16	77643331	HC 18	Mic 10	5	7000
	77643398	HC 28	Sm-x 10		3400

7.3 Housing design/order numbers for suction-side installation

Nominal flow rate NG [l/min]	Order number	Type	①	③
			no options	with vacuum gauge
4	77664360	Pi 1941/10/G¼		
	77894033	Pi 1941/10/G¼/UM		
6	77664386	Pi 1941/10/G3/8		
	77894041	Pi 1941/10/G3/8/UM		
10	77664394	Pi 1941/10/G½		
	77894058	Pi 1941/10/G½/UM		
16	77664378	Pi 1941/10/G¾		
	77658966	Pi 1941/10/G¾/UM		

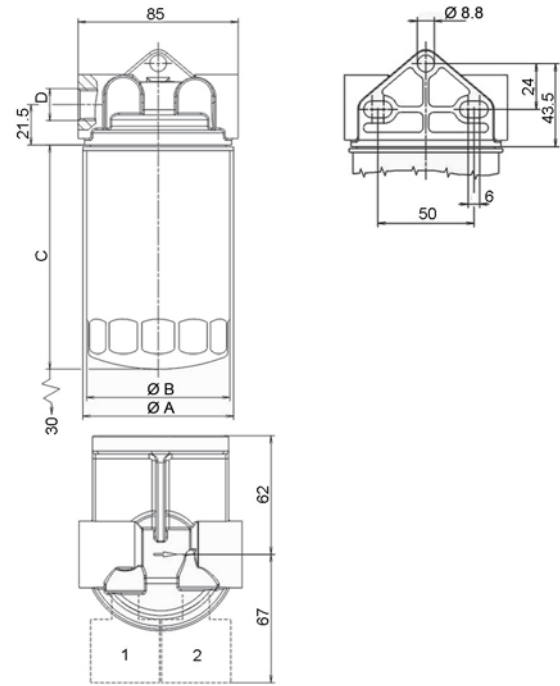
8. Technical specifications

Design:	line mounting filter
Nominal pressure*:	10 bar (140 psi)
Test pressure:	13 bar (180 psi)
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Filter head material:	GDAL
Spin-on cartridge material:	St
Sealing material:	NBR
Installation position:	preferably vertical
Indicating range pressure manometer:	0 to 10 bar
Indicating range vacuum gauge:	-1 to 0 bar

*For the combination of the housing designs as per 7.1 with medium-pressure spin-on cartridges at 25 bar pressure refer to data sheet "spin-on cartridges" for dimensions and specifications.

We draw attention to the fact that all values indicated are average values and do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.



1 = pressure gauge

2 = vacuum gauge

Subject to technical alteration without prior notice.

9. Dimensions

All dimensions except "D" in mm.

Type	Dimension Ø A	Dimension Ø B	Dimension C	Dimension D	Weight [kg] Execution Mic*	Weight [kg] Execution Sm-x*
Pi 1941/10/G¼	80	76	120	G¼	0.67	0.82
Pi 1941/10/G 3/8	80	76	120	G 3/8	0.67	0.82
Pi 1941/10/G½	95	93	141	G½	0.82	1.02
Pi 1941/10/G¾	95	93	210	G¾	1.02	1.02

*Design with manometer + 0.1 kg

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove the spin-on cartridge.

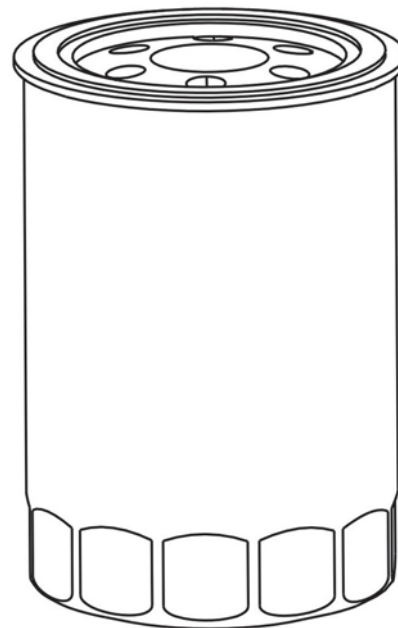
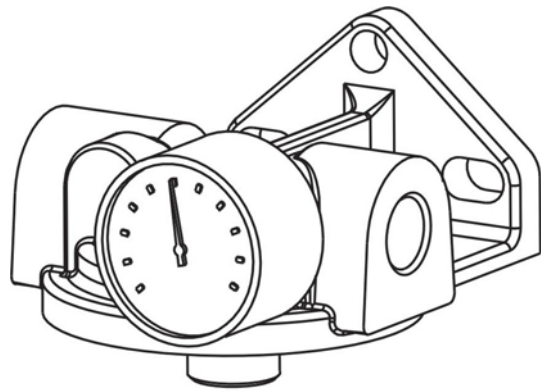
Preferably the filter should be installed with the spin-on cartridge pointing downwards.

10.2 When should the spin-on cartridge be replaced?

1. Filter equipped with the vacuum gauge for suction-side installation: During cold start the vacuum gauge may for a short period indicate > 0.2 bar. With increasing operating temperature the indicator needle must drop clearly below the 0.2 bar mark. Should this not be the case, the spin-on cartridge must be replaced after the end of the shift.
2. Filters without maintenance indicator: The spin-on cartridge should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
3. Please always ensure that you have original MAHLE spare cartridges in stock.

10.3 Change of spin-on cartridge

1. Stop system and relieve filter from pressure.
2. Unscrew the spin-on cartridge with the aid of a belt spanner by turning same to the left.
3. Make sure that the order number on the new spin-on cartridge corresponds to the order number of the name-plate.
4. The seal of the spin-on cartridge should be lightly oiled.
5. Screw cartridge on in accordance with the printed-on instructions.



11. Spare parts list

Position	Type	Order number
①	Pressure gauge (not shown)	77870611
②	Vacuum gauge	77617558

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78357337.07/2008

Low Pressure Filter/Suction Filter

Pi 220

Nominal pressure 10 bar (140 psi), up to nominal size 160

1. Features

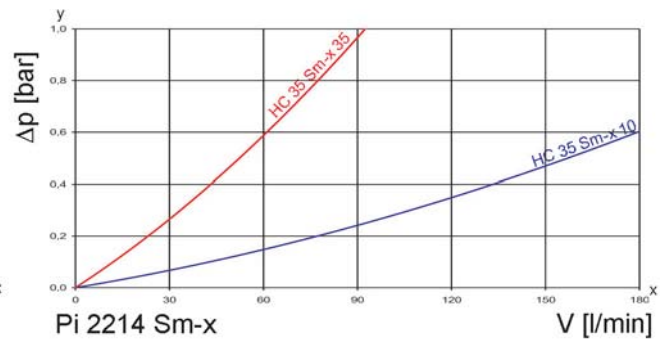
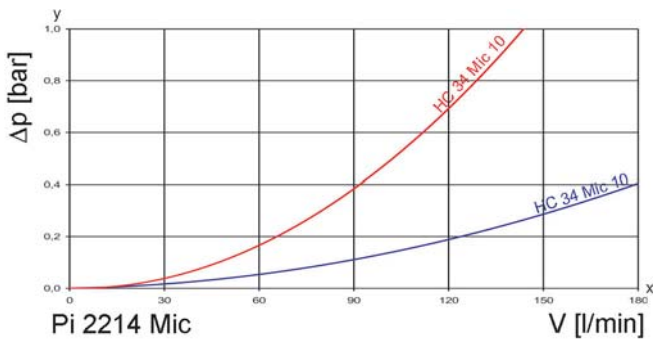
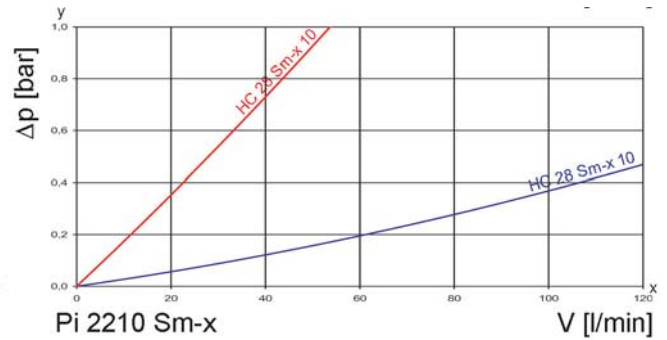
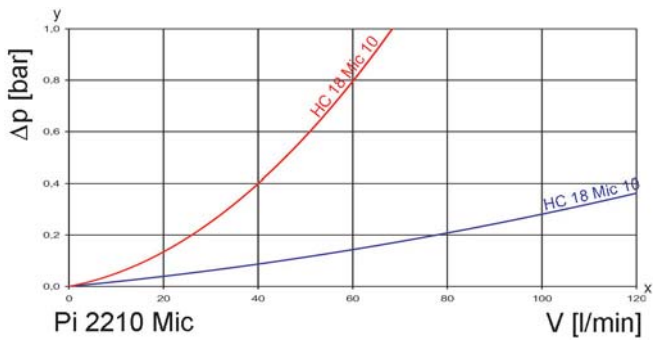
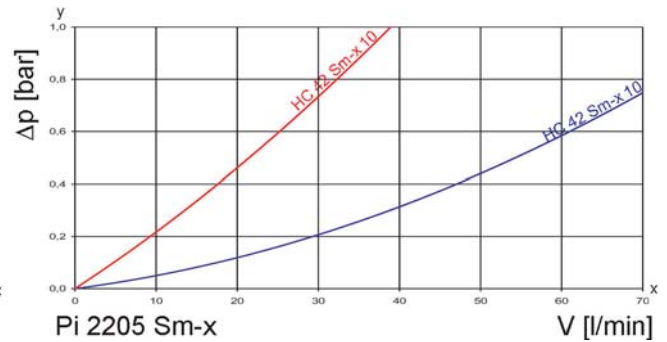
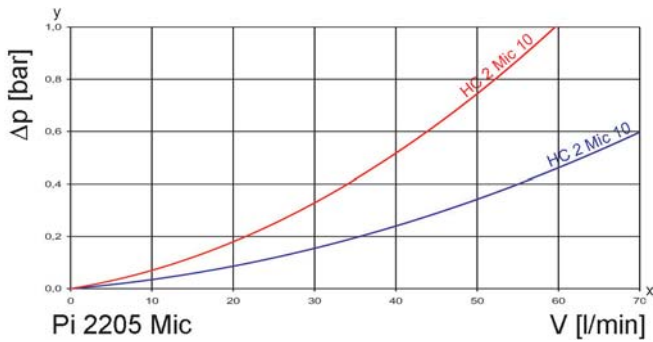
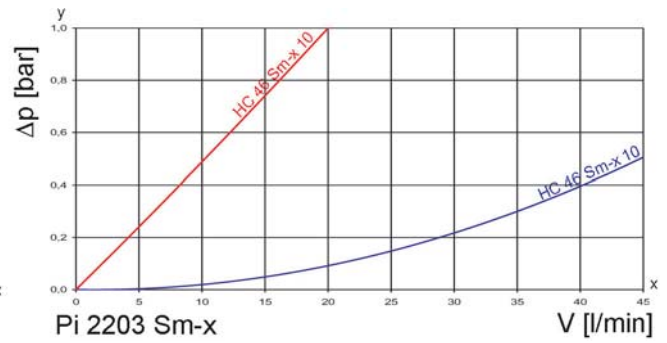
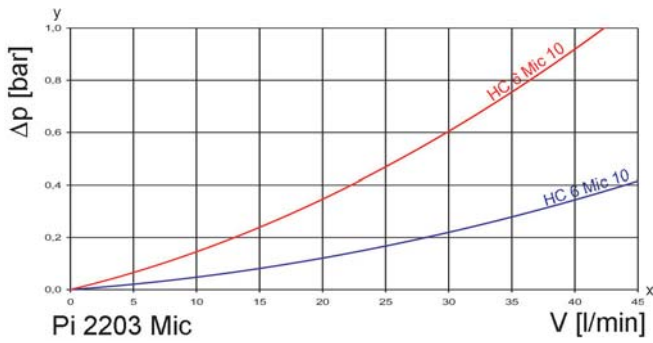
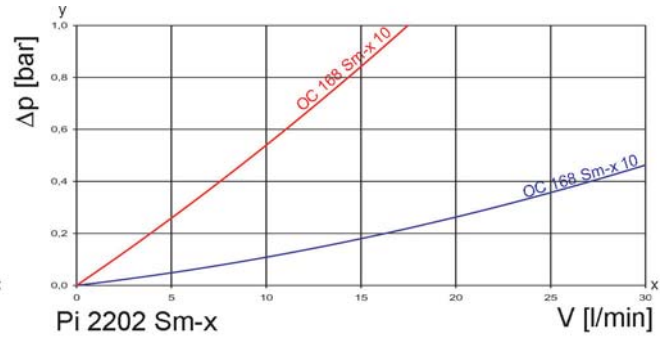
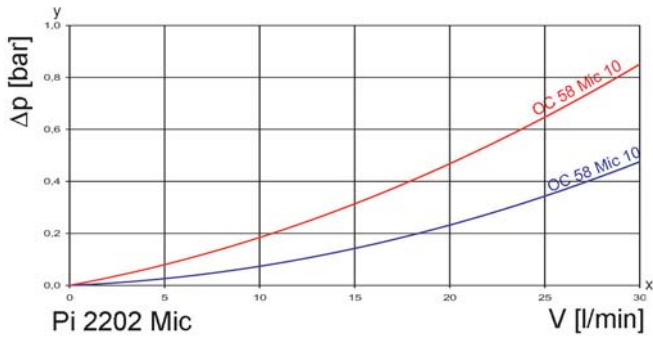
High performance filters for modern hydraulic systems

- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electronic/electrical maintenance indicator
- Threaded connections
- Quality filters, easy to service
- Equipped with highly efficient Mic or Sm-x filter elements
- Beta rated elements according to ISO 16889
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution



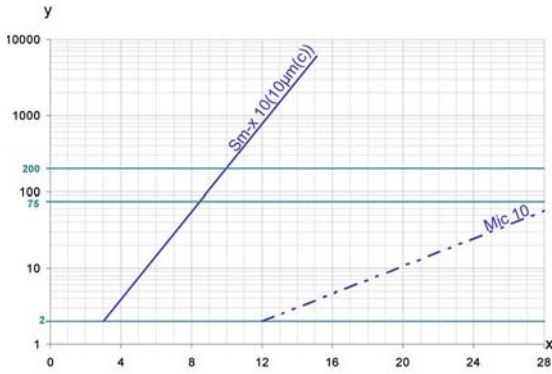
2. Flow rate/pressure drop curve complete filter

■ 190 mm²/s
■ 33 mm²/s



y = differential pressure Δp [bar]
 x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particle size [μm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x-elements with
max. Δp 5 bar

Sm-x 10 $\beta_{10(C)} \geq 200$

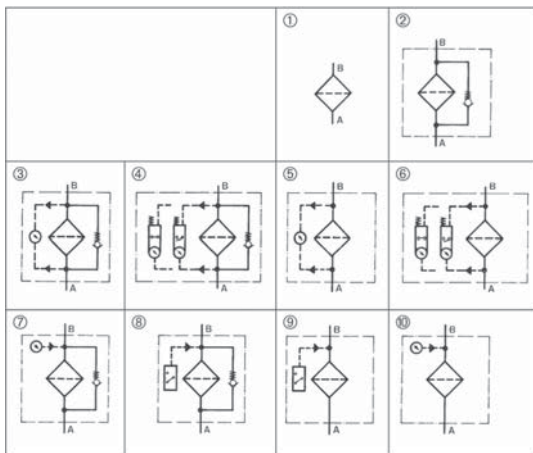
values guaranteed up to
5 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility
DIN ISO 3723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3724	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power-filters-evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters-multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Housing design	2. Spin-on cartridge
V=25 l/min, bypass, electrical maintenance indicator	Mic 10
Type: Pi 2202-058	Type: OC 58
Order number: 77665649	Order number: 77785983

7.1 Housing design/order number for pressure-side installation

Nominal size NG [l/min]	Order number	Type	① no options	② with bypass valve	③ with bypass valve and visual indicator	④ with bypass valve and electrical indicator	⑤ with visual indicator	⑥ with electrical indicator
25	77665656	Pi 2202-60						
	77665623	Pi 2202-56						
	77665631	Pi 2202-57						
	77665649	Pi 2202-58						
	77665664	Pi 2202-68						
	77665672	Pi 2202-69						
40	77665714	Pi 2203-60						
	77665680	Pi 2203-56						
	77665698	Pi 2203-57						
	77665706	Pi 2203-58						
	77665748	Pi 2203-68						
	77665755	Pi 2203-69						
63	77665813	Pi 2205-60						
	77665789	Pi 2205-56						
	77665797	Pi 2205-57						
	77665805	Pi 2205-58						
	77665847	Pi 2205-68						
	77665854	Pi 2205-69						
100	77666001	Pi 2210-60						
	77665979	Pi 2210-56						
	77665987	Pi 2210-57						
	77665995	Pi 2210-58						
	77666050	Pi 2210-68						
	77666068	Pi 2210-69						
160	77666126	Pi 2214-60						
	77666092	Pi 2214-56						
	77666100	Pi 2214-57						
	77666118	Pi 2214-58						
	77666183	Pi 2214-68						
	77666191	Pi 2214-69						

When filter with non bypass configuration is selected, the collapse pressure of the spin-on cartridge must not be exceeded.

7.2 Spin-on cartridges

Nominal size NG [l/min] Press./Suct. side	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
25/10	77785983	OC 58	Mic 10	5	1175
	77500184	OC 168	Sm-x 10		1309
40/16	77501273	HC 6	Mic 10	5	3000
	77501232	HC 46	Sm-x 10		2075
63/25	72013241	HC 2	Mic 10	5	5440
	77501372	HC 42	Sm-x 10		3360
100/40	77643331	HC 18	Mic 10	5	7000
	77643398	HC 28	Sm-x 10		3400
160/63	77504194	HC 34	Mic 10	5	14025
	77643844	HC 35	Sm-x 10		7638

7.3 Housing design/order numbers for suction-side installation

Nominal size NG [l/min]	Order number	Type	① no options	② with bypass 0.25 bar	⑦ with bypass 0.25 bar and vacuum gauge	⑥ with bypass 0.25 bar and vacuum switch	⑧ with vacuum switch	⑩ with vacuum gauge
10	77665656	Pi 2202-060						
	77736614	Pi 2202-067						
	77736622	Pi 2202-062						
	77736630	Pi 2202-061						
	77736606	Pi 2202-065						
	77736598	Pi 2202-066						
16	77665714	Pi 2203-060						
	77665730	Pi 2203-067						
	77736689	Pi 2203-062						
	77736697	Pi 2203-061						
	77736671	Pi 2203-065						
	77665722	Pi 2203-066						
25	77665813	Pi 2205-060						
	77736747	Pi 2205-067						
	77665821	Pi 2205-062						
	77736754	Pi 2205-061						
	77665839	Pi 2205-065						
	77736739	Pi 2205-066						
40	77666001	Pi 2210-060						
	77735947	Pi 2210-067						
	77666027	Pi 2210-062						
	77666019	Pi 2210-061						
	77666035	Pi 2210-065						
	77666043	Pi 2210-066						
63	77666126	Pi 2214-060						
	77666175	Pi 2214-067						
	77666142	Pi 2214-062						
	77666134	Pi 2214-061						
	77666159	Pi 2214-065						
	77666167	Pi 2214-066						

When filter with non bypass configuration is selected, the collapse pressure of the spin-on cartridge must not be exceeded.

8. Technical specifications

Design:	line mounting filter
Nominal pressure:	10 bar (140 psi)*
Test pressure:	13 bar (180 psi)
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Bypass setting:	
Pressure side:	Δp 3.5 bar \pm 10%
Suction side:	Δp 0.25 bar \pm 10%
Filter head material:	GDAL
Filter housing material:	St
Sealing material:	NBR/AL
Maintenance indicator setting:	Δp 2.2 bar \pm 0.3 bar
Indicating range vacuum meter:	-1 bar to +1.5 bar
Pressure setting vacuum switch:	200 mbar
Type of protection (suction side):	IP 54
Electrical data of maintenance indicator:	
Max. voltage:	250 V AC/200 V DC
Max. current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M20x1.5

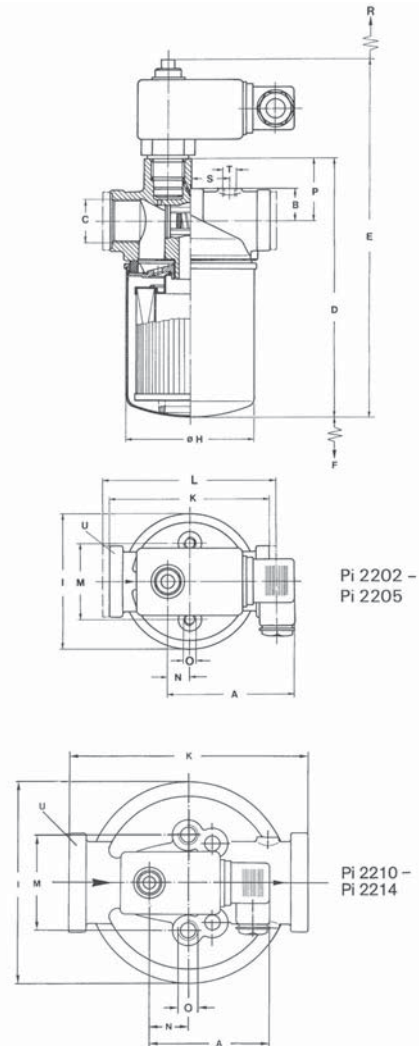
The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.

* For the contamination of the housing designs as per 7.1 with medium-pressure spin-on cartridges refer to leaflet "spin-on cartridges" for dimensions and specifications. Operating pressure on request.



9. Dimensions

All dimensions except "C" and "T" in mm.

Type	A	B	C	D	E	F	G	H	I	K	L	M	N	O	P	R	S*	T*	U	Weight [kg]
Pi 2202	78	19	G $\frac{1}{2}$	181	241	30	-	76	80	-	109	45	13	M8x10	37.5	45	23.5	G1/8	36	0.90
Pi 2203	78	19	G $\frac{1}{2}$	201	261	30	-	93	80	-	109	45	13	M8x10	37.5	45	23.5	G1/8	36	1.00
Pi 2205	78	19	G $\frac{3}{4}$	268	328	30	-	93	80	95	-	45	13	M8x10	37.5	45	23.5	G1/8	36	1.25
Pi 2210	78	30	G1 $\frac{1}{4}$	242	302	40	-	136	128	150	-	60	24,5	M12x15	43.5	45	40	G1/8	55	2.30
Pi 2214	78	30	G1 $\frac{1}{4}$	382	442	40	-	136	128	150	-	60	24,5	M12x15	43.5	45	40	G1/8	55	2.70

*with suction-side installation only.

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove spin-on cartridge. Filter should be installed with the spin-on cartridge pointing downwards.

The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2.

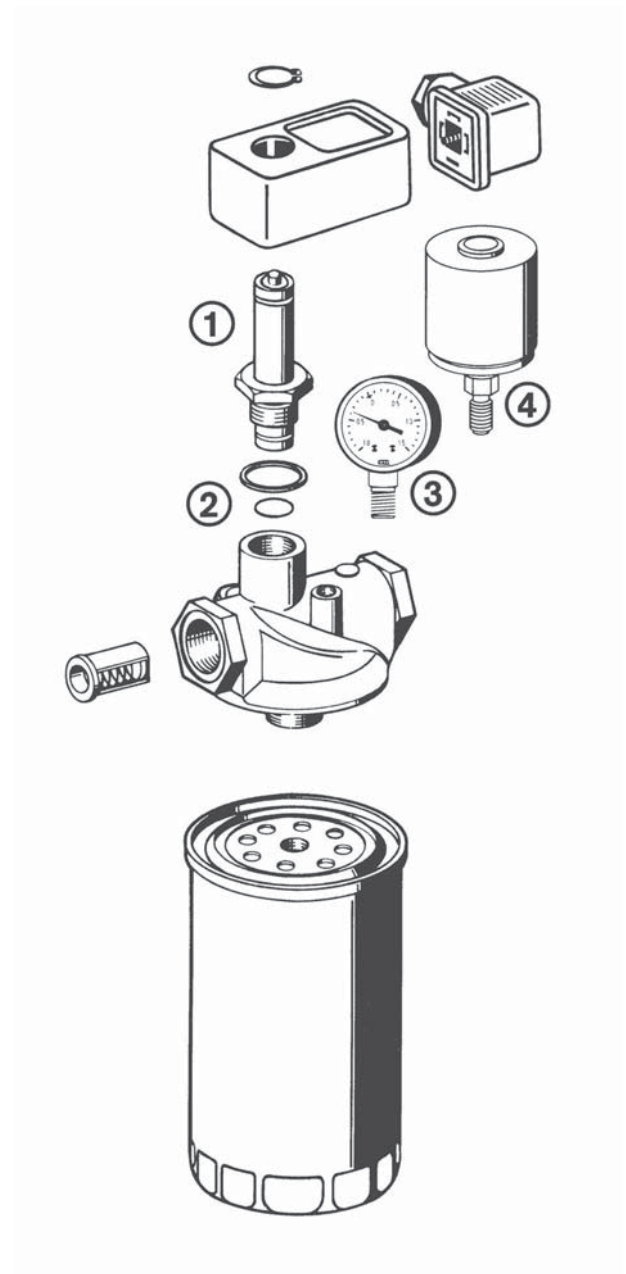
The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

10.3 When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
- Filters without maintenance indicator:
The filter element should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
- Please always ensure that you have original MAHLE spare elements in stock: disposable elements (Sm-x) cannot be cleaned.

10.4 Spin-on cartridge exchange

- Stop system and relieve filter from pressure.
- Unscrew the spin-on cartridge with the aid of a belt spanner by turning same to the left
- Make sure that the order number on the spin-on cartridge corresponds to the order number of the plate.
- The seal of the screw-on cartridge should be lightly oiled.
- Screw cartridge on in accordance with the printed-on instructions.



11. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
①	Maintenance indicator	
	Visual PiS 3098	77669971
	Electrical PiS 3097	77669948
	Electrical upper part only	77536550
②	Seal kit for maintenance indicator	
	NBR	77760309
③	Vacuum gauge	77548027
④	Vacuum switch PiS 3070	77669724

MAHLE

Industrial Filtration

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78356610.07/2008

Low Pressure Filter/Suction Filter

Pi 270

Nominal pressure 10 bar (140 psi), up to nominal size 315

1. Features

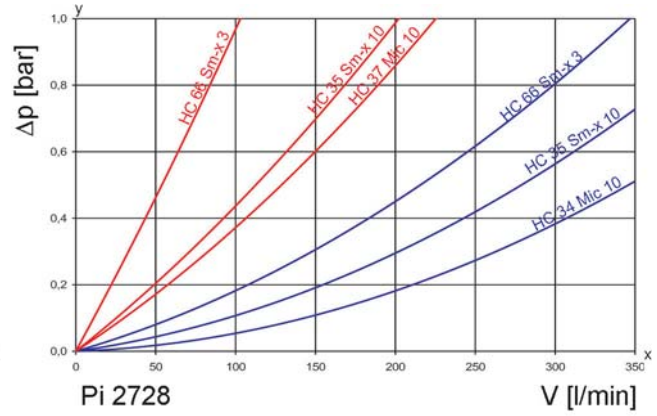
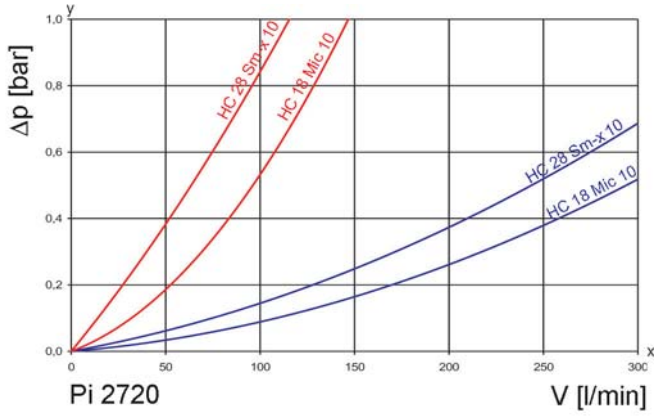
High performance filters for modern hydraulic systems

- Provided for pipe installation
- Modular system
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- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded connections
- Quality filters, easy to service
- Equipped with highly efficient Mic or Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution



2. Flow rate/pressure drop curve complete filter

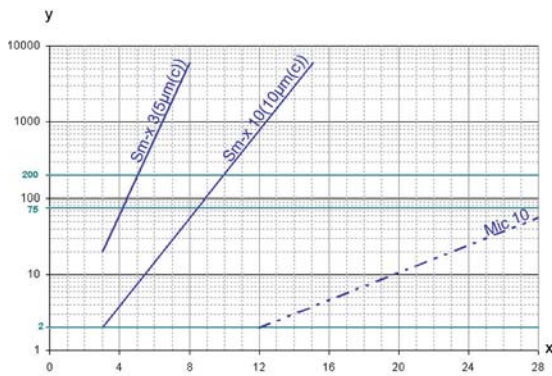
190 mm²/s
33 mm²/s



y = differential pressure Δp [bar]

x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value

x = particle size [μm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)
Sm-x elements with max. Δp 5 bar

Sm-x	3	$\beta_{5(C)}$	≥ 200
Sm-x	10	$\beta_{10(C)}$	≥ 200

values guaranteed up to 5 bar differential pressure

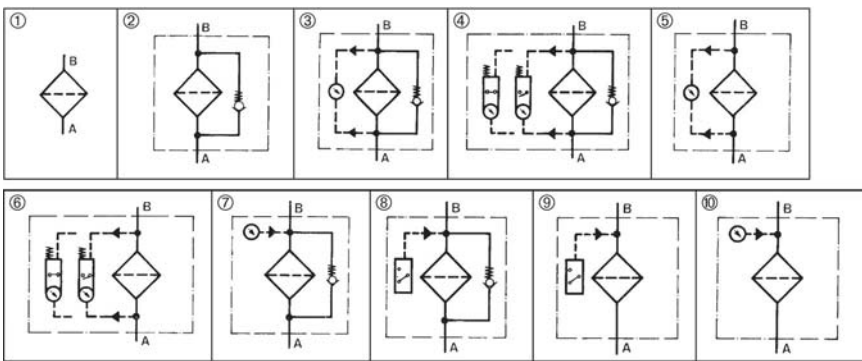
Subject to technical alteration without prior notice.

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 3723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3724	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power filters; evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters-multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Filter design	2. 2x filter elements
V = 250 l/min, bypass, electrical maintenance indicator Type: Pi 2720-058 Order number: 77694060	Mic 10 Type: HC 18 Order number: 77643331

7.1 Housing design/order numbers for pressure side installation

Nominal size NG [l/min]	Order number	Type	①	②	③	④	⑤	⑥
			no options	with bypass 3.5 bar	with bypass 3.5 bar and visual indicator	with bypass 3.5 bar and electrical indicator	with visual indicator	with electrical indicator
250	77694011	Pi 2720-060						
	77694029	Pi 2720-056						
	77694078	Pi 2720-057						
	77694060	Pi 2720-058						
	77694045	Pi 2720-068						
	77694037	Pi 2720-069						
315	77694128	Pi 2728-060						
	77694136	Pi 2728-056						
	77694185	Pi 2728-057						
	77694177	Pi 2728-058						
	77694151	Pi 2728-068						
	77694144	Pi 2728-069						

When filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

7.2 Spin-on cartridge/order numbers for pressure side installation

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
250	77643331	HC 18	Mic 10	5	7000
	77643398	HC 28	Sm-x 10		3400
315	77504194	HC 34	Mic 10	5	14025
	78714750	HC 66	Sm-x 3		7638
	77643844	HC 35	Sm-x 10		7638

7.3 Housing design/order numbers for suction side installation

Nominal size NG [l/min]	Order number	Type	① no options	② with bypass 0.25 bar	⑦ with bypass 0.25 bar + vacuum gauge	⑧ with bypass 0.25 bar + vacuum switch	⑨ with vacuum switch	⑩ with vacuum gauge
80	77694011	Pi 2720-060						
	77694094	Pi 2720-067						
	77694102	Pi 2720-062						
	77694110	Pi 2720-061						
	77694086	Pi 2720-065						
	77694052	Pi 2720-066						
125	77694128	Pi 2728-060						
	77694201	Pi 2728-067						
	77694219	Pi 2728-062						
	77694227	Pi 2728-061						
	77694193	Pi 2728-065						
	77694169	Pi 2728-066						

When filter with non bypass configuration is selected Δp of 5 bar may not be exceeded.

7.4 Spin-on cartridge/order numbers for suction side installation

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
80	77643331	HC 18	Mic 10	5	7000
125	77504194	HC 34	Mic 10		14025

9. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove spin-on cartridge. Filter should be installed with the spin-on cartridge pointing downwards. The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2.

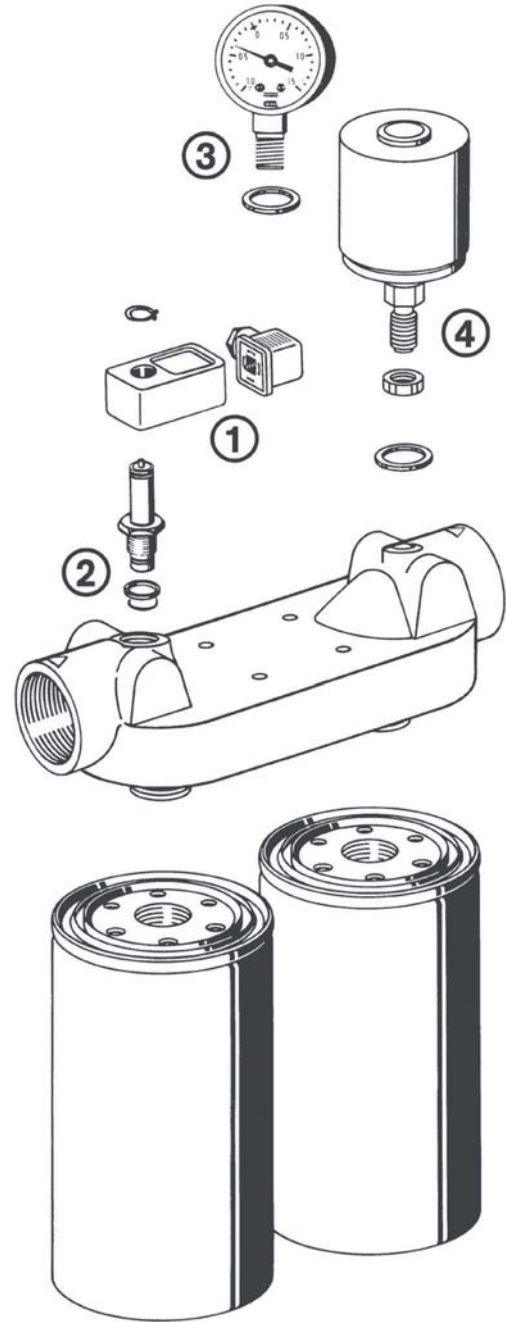
The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

10.3 When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
- Filters without maintenance indicator:
The filter element should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
- Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (Sm-x, Mic) cannot be cleaned.

10.4 Spin-on cartridge replacement

- Stop system and relieve filter from pressure.
- Unscrew the spin-on cartridge by using a filter wrench by turning counter-clockwise.
- Make sure that the order number on the spin-on cartridge corresponds to the order number of the filter plate.
- Oil the seal of the spin-on cartridge.
- Spin-on cartridge must be installed according to the printed instructions.



10. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
①	Maintenance indicator	
	Visual PiS 3098/2.2	77669971
	Electrical PiS 3097/2.2	77669948
	Electrical upper section only	77536550
②	Seal kit for maintenance indicator	
	NBR	77760309
③	Vacuum gauge	77548027
④	Vacuum switch	
	PiS 3070/200 mbar	77669724

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 78356677.06/2008

Air Breather Filter Pi 0101 - Pi 0185

1. Features

The Pi 0101 through Pi 0126 breather filters have housings made of non-corrosive material.

The air intake is located in the upper section, this prevents surface dust to be drawn in from the tank top. The cover is designed to prevent entry of splash-water. The disposable, pleated elements can be replaced in a matter of seconds.

The Pi 0140 through Pi 0185 breather filters have a housing made of galvanized sheet metal. The built-in o-ring provides accurate sealing at the tank connection. With the choice of Mic or Sm-L elements the CETOP RP 98 H requirements are fulfilled. These specify the same filtration degree for the breather filter as the system filter utilizes.

Mol-elements prevent oil aerosol from emerging the tank. The oil aerosol coagulate, forming drops within the pleated coalescer layer, which are returned to the tank.

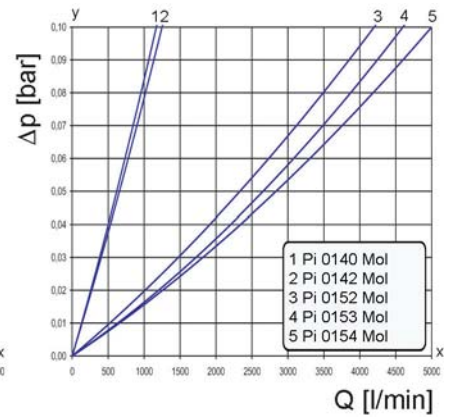
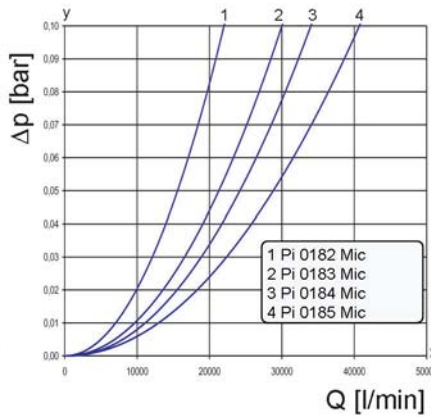
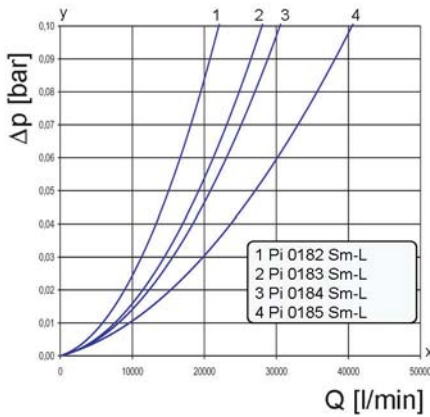
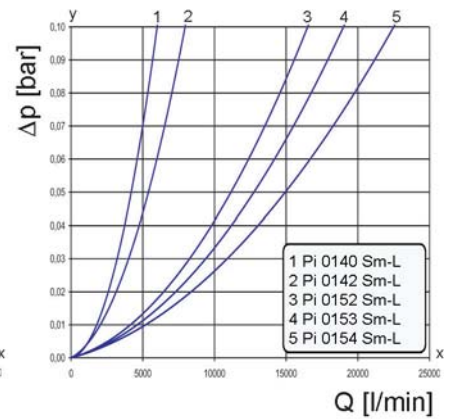
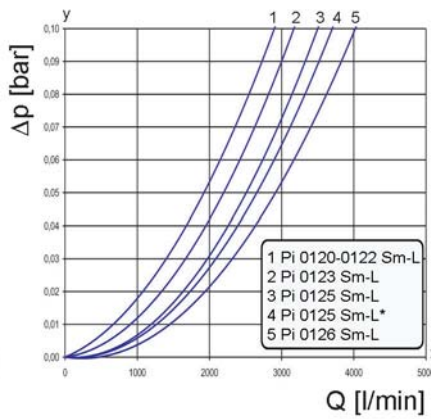
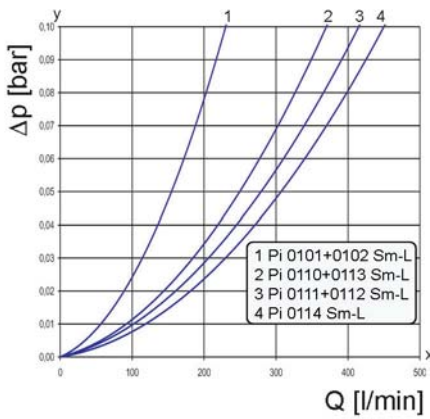
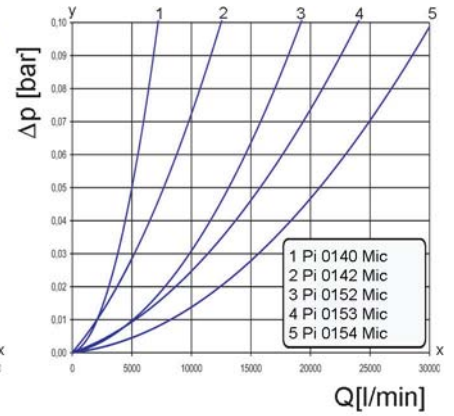
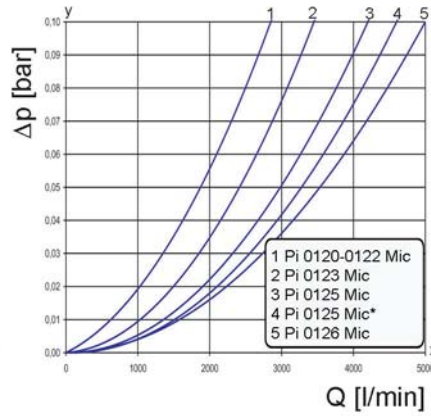
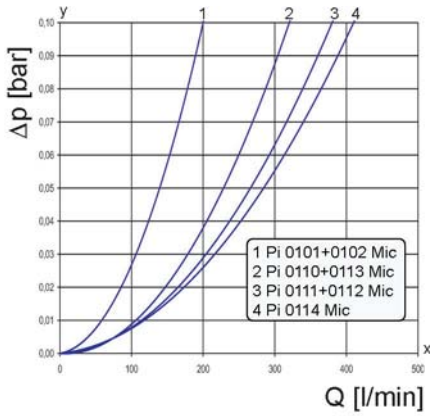
Filters are fixed by threads, clamps or flanges.

Air breather filter Pi 0101 - 0185 are offering the following features

- Corrosion resistant
- Compact design
- Equipped with Mic, Sm-L and Mol elements
- High dirt holding capacity
- Versatile mounting option: screwed, clamped or flanged
- Versatile combination possibilities
- Wide range of accessories
- Worldwide distribution



2. Flow rate/pressure drop curve complete filter



y = differential pressure Δp [bar]

x = air flow rate Q [l/min]

* ohne Gitter

3.1 Filter complete							3.2 Filter elements		
Order number	Type	Mic	Sm-L	Mol	Cover with integrated service integrator (UM)	Connection for maintenance indicator (VA)	Order number	Type	Quantity per pack
77575830	Pi 0101 Mic	■					77687692	852 514 Mic	3
77575848	Pi 0101 Sm-L		■				77643562	852 514 Sm-L	3
77575806	Pi 0102 Mic	■					77687692	852 514 Mic	3
77575814	Pi 0102 Sm-L		■				77643562	852 514 Sm-L	3
77734700	Pi 0110 Mic	■					77687643	852 507 Mic	3
77734718	Pi 0110 Sm-L		■				77643547	852 507 Sm-L	3
77734734	Pi 0111 Mic	■					77687643	852 507 Mic	3
77734742	Pi 0111 Sm-L		■				77643547	852 507 Sm-L	3
77734767	Pi 0112 Mic	■					77687643	852 507 Mic	3
77734775	Pi 0112 Sm-L		■				77643547	852 507 Sm-L	3
77734791	Pi 0113 Mic	■					77687643	852 507 Mic	3
77734809	Pi 0113 Sm-L		■				77643547	852 507 Sm-L	3
77734825	Pi 0114 Mic	■					77687643	852 507 Mic	3
77734833	Pi 0114 Sm-L		■				77643547	852 507 Sm-L	3
77575681	Pi 0120 Mic	■					77687767	852 519 Mic	3
77575699	Pi 0120 Sm-L		■				77643554	852 519 Sm-L	3
70343778	Pi 0120 Mic- UM	■			■		77687767	852 519 Mic	3
70343781	Pi 0120 Sm-L/UM		■		■		77643554	852 519 Sm-L	3
77575657	Pi 0121 Mic	■					77687767	852 519 Mic	3
77575665	Pi 0121 Sm-L		■				77643554	852 519 Sm-L	3
79335928	Pi 0121 Mic/UM	■			■		77687767	852 519 Mic	3
79337494	Pi 0121 Sm-L/UM		■		■		77643554	852 519 Sm-L	3
77575624	Pi 0122 Mic	■					77687767	852 519 Mic	3
77575632	Pi 0122 Sm-L		■				77643554	852 519 Sm-L	3
70344281	Pi 0122 Mic/UM	■			■		77687767	852 519 Mic	3
70343781	Pi 0122 Sm-L/UM		■		■		77643554	852 519 Sm-L	3
77575590	Pi 0123 Mic	■					77687767	852 519 Mic	3
77575608	Pi 0123 Sm-L		■				77643554	852 519 Sm-L	3
79337486	Pi 0123 Mic/UM	■			■		77687767	852 519 Mic	3
76317812	Pi 0123 Sm-L/UM		■		■		77643554	852 519 Sm-L	3
77728223	Pi 0125 Mic	■					77687767	852 519 Mic	3
77728231	Pi 0125 Sm-L		■				77643554	852 519 Sm-L	3
79311853	Pi 0125 Mic/UM	■			■		77687767	852 519 Mic	3
79364241	Pi 0125 Sm-L/UM		■		■		77643554	852 519 Sm-L	3
77728165	Pi 0126 Mic	■					77687767	852 519 Mic	3
77728173	Pi 0126 Sm-L		■				77643554	852 519 Sm-L	3
79343260	Pi 0126 Mic/UM	■			■		77687767	852 519 Mic	3
79326695	Pi 0126 Sm-L/UM		■		■		77643554	852 519 Sm-L	3
77749732	Pi 0140 Mic	■					77687999	852 621 Mic	3
77749740	Pi 0140 Sm-L		■				77645625	852 621 Sm-L	3
77765498	Pi 0140 Mol			■			77789365	852 621 Mol	3
77749765	Pi 0140 Mic/VA	■				■	77687999	852 621 Mic	3
77749773	Pi 0140 Sm-L/VA		■			■	77645625	852 621 Sm-L	3
77765506	Pi 0140 Mol/VA			■		■	77789365	852 621 Mol	3
77730724	Pi 0142 Mic	■					77687999	852 621 Mic	3
77730732	Pi 0142 Sm-L		■				77645625	852 621 Sm-L	3
77765514	Pi 0142 Mol			■			77789365	852 621 Mol	3
77728272	Pi 0142 Mic/VA	■				■	77687999	852 621 Mic	3

3.1 Filter complete							3.2 Filter elements		
Order number	Type	Mic	Sm-L	Mol	Cover with integrated service indicator (UM)	Connection for maintenance indicator (VA)	Order number	Type	Quantity per pack
77728280	Pi 0142 Sm-L/VA						77645625	852 621 Sm-L	3
77765522	Pi 0142 Mol/VA						77789365	852 621 Mol	3
76102107	Pi 0145 Mic						76101174	852 985 Mic	2
76102123	Pi 0145 Sm-L						76101182	852 985 Sm-L	2
76102115	Pi 0145 Mic/UM						76101174	852 985 Mic	2
76102131	Pi 0145 Sm-L/UM						76101182	852 985 Sm-L	2
76102149	Pi 0146 Mic						76101174	852 985 Mic	2
76102164	Pi 0146 Sm-L						76101182	852 985 Sm-L	2
76102156	Pi 0146 Mic/UM						76101174	852 985 Mic	2
76102172	Pi 0146 Sm-L/UM						76101182	852 985 Sm-L	2
76102180	Pi 0147 Mic						76101174	852 985 Mic	2
76102206	Pi 0147 Sm-L						76101182	852 985 Sm-L	2
76102198	Pi 0147 Mic/UM						76101174	852 985 Mic	2
76102214	Pi 0147 Sm-L/UM						76101182	852 985 Sm-L	2
76102222	Pi 0148 Mic						76101174	852 985 Mic	2
76102248	Pi 0148 Sm-L						76101182	852 985 Sm-L	2
76102230	Pi 0148 Mic/UM						76101174	852 985 Mic	2
76102255	Pi 0148 Sm-L/UM						76101182	852 985 Sm-L	2
76102263	Pi 0149 Mic						76101174	852 985 Mic	2
76102289	Pi 0149 Sm-L						76101182	852 985 Sm-L	2
76102271	Pi 0149 Mic/UM						76101174	852 985 Mic	2
76102297	Pi 0149 Sm-L/UM						76101182	852 985 Sm-L	2
77749328	Pi 0152 Mic						77687726	852 516 Mic	2
77749336	Pi 0152 Sm-L						77687759	852 516 Sm-L	2
77765530	Pi 0152 Mol						77789381	852 516 Mol	2
77749351	Pi 0152 Mic/VA						77687726	852 516 Mic	2
77749369	Pi 0152 Sm-L/VA						77687759	852 516 Sm-L	2
77765548	Pi 0152 Mol/VA						77789381	852 516 Mol	2
77728306	Pi 0153 Mic						77687726	852 516 Mic	2
77728314	Pi 0153 Sm-L						77687759	852 516 Sm-L	2
77765555	Pi 0153 Mol						77789381	852 516 Mol	2
77728330	Pi 0153 Mic/VA						77687726	852 516 Mic	2
77728348	Pi 0153 Sm-L/VA						77687759	852 516 Sm-L	2
77765563	Pi 0153 Mol/VA						77789381	852 516 Mol	2
77749799	Pi 0154 Mic						77687726	852 516 Mic	2
77749807	Pi 0154 Sm-L						77687759	852 516 Sm-L	2
77765571	Pi 0154 Mol						77789381	852 516 Mol	2
77749823	Pi 0154 Mic/VA						77687726	852 516 Mic	2
77749831	Pi 0154 Sm-L/VA						77687759	852 516 Sm-L	2
77765589	Pi 0154 Mol/VA						77789381	852 516 Mol	2
77950918	Pi 0182 Mic						77950298	852 822 Mic	1
77950926	Pi 0182 Sm-L						77950348	852 822 Sm-L	1
77950934	Pi 0182 Mol						77873318	852 822 Mol	1
77950959	Pi 0182 Mic/VA						77950298	852 822 Mic	1
77950967	Pi 0182 Sm-L/VA						77950348	852 822 Sm-L	1

3.1 Filter complete							3.2 Filter elements		
Order number	Type	Mic	Sm-L	Mol	Cover with integrated service indicator (UM)	Connection for maintenance indicator (VA)	Order number	Type	Quantity per pack
77950975	Pi 0182 Mol/VA						77873318	852 822 Mol	1
77950538	Pi 0183 Mic						77950298	852 822 Mic	1
77950546	Pi 0183 Sm-L						77950348	852 822 Sm-L	1
77873219	Pi 0183 Mol						77873318	852 822 Mol	1
77950785	Pi 0183 Mic/VA						77950298	852 822 Mic	1
77950835	Pi 0183 Sm-L/VA						77950348	852 822 Sm-L	1
77950843	Pi 0183 Mol/VA						77873318	852 822 Mol	1
77950215	Pi 0184 Mic						77950298	852 822 Mic	1
77950223	Pi 0184 Sm-L						77950348	852 822 Sm-L	1
77950850	Pi 0184 Mol						77873318	852 822 Mol	1
77950876	Pi 0184 Mic/VA						77950298	852 822 Mic	1
77950884	Pi 0184 Sm-L/VA						77950348	852 822 Sm-L	1
77950892	Pi 0184 Mol/VA						77873318	852 822 Mol	1
77954498	Pi 0185 Mic						77950298	852 822 Mic	1
77954506	Pi 0185 Sm-L						77950348	852 822 Sm-L	1
77954514	Pi 0185 Mol						77873318	852 822 Mol	1
78224123	Pi 0185 Mic/VA						77950298	852 822 Mic	1
78224149	Pi 0185 Sm-L/VA						77950348	852 822 Sm-L	1
78224131	Pi 0185 Mol/VA						77873318	852 822 Mol	1

4. Technical specifications

Separation:

Mic	10 μm
Sm-L	3 μm
Mol	oil vapors

Temperature range:

-10 °C to +100 °C
(other temperature ranges on request)

Housing material:

Pi 0101 to Pi 0126	polyamide
Pi 0140 to Pi 0142	galvanized sheet metal
Pi 0145 to Pi 0149	polyamide
Pi 0152 to Pi 0154	galvanized sheet metal
Pi 0182 to Pi 0185	steel/Al

Sealing material:

Pi 0126	rubberized cork
Pi 0140 to Pi 0185	NBR

Resistance:

all hydraulic oils

We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department would be pleased to offer you advice.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.

Other elements for HFA, HFC and HFD fluids on request.

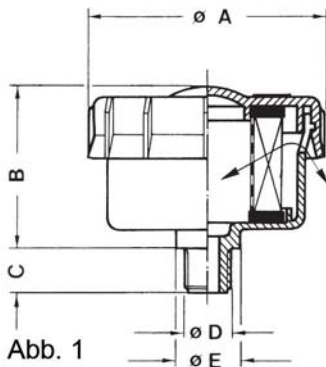


Abb. 1

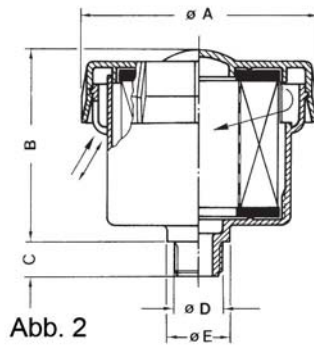


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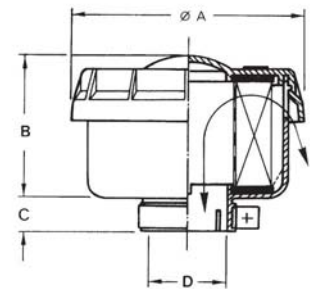


Abb. 3

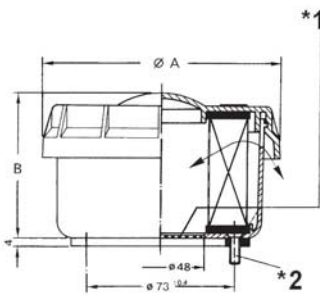


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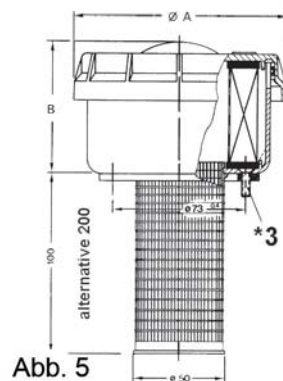


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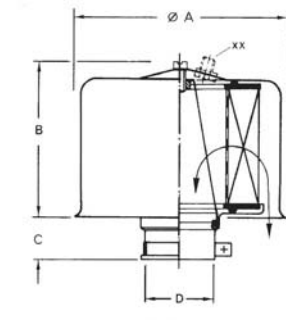


Abb. 6

*1 mm dia screen removable

*2 6x screw M5x16 DIN 7500 (cross-slotted)

*3 6x screw M5x16 DIN 7500 (cross-slotted)

*4 optional connection for maintenance indicator (VA)

5. Dimensions

Type	Air flow rate [l/min]*			Fig.	Dimensions				
	Mic	Sm-L	Mol		[mm/inch]	[mm]	[mm]	[mm]	[mm]
Type	Mic	Sm-L	Mol	Type	D	A	B	C	E
Pi 0101	60	55	-	1	M12x1.5	62	44	12	17
Pi 0102	60	55	-	1	G1/4	62	44	12	17
Pi 0110	100	90	-	2	M16.5x1.5	80	67	12	21
Pi 0111	110	100	-	2	M22x1.5	80	67	13	27
Pi 0112	110	100	-	2	G1/2	80	67	13	26
Pi 0113	100	90	-	2	G3/8	80	67	12	22
Pi 0114	120	110	-	2	G3/4	80	67	15	32
Pi 0120	1000	900	-	1	M33x2	118	73	20	-
Pi 0121	1000	900	-	1	G1	118	73	19	-
Pi 0122	1000	900	-	3	Ø 25	118	73	16	-
Pi 0123	1450	1300	-	3	Ø 40	118	73	16	-
Pi 0125	750	650	-	4	Ø 73****	118	81	-	-
Pi 0125 (without enclosure)	1600	1400	-	4	Ø 73****	118	81	-	-
Pi 0126	1350	1150	-	5	Ø 73****	118	81	-	-
Pi 0140	2000	1700	130	6	Ø 40**	142	95	30	-
Pi 0142	2400	2000	140	6	Ø 52**	142	95	30	-
Pi 0145	2100	1800	***	4	Ø 73****	118	133	-	-
Pi 0146	1800	1500	***	5	Ø 73****	118	133	-	-
Pi 0147	2000	1700	***	3	Ø 40**	118	133	19	-
Pi 0148	2400	2000	***	3	Ø 52**	118	133	23	-
Pi 0149	1600	1300	***	1	G1½	118	135	17	38.5
Pi 0152	5300	4200	570	6	Ø 73 ****	230	117	30	-
Pi 0153	6300	4600	620	6	Ø 76**	230	117	30	-
Pi 0154	7700	5200	640	6	Ø 80**	230	117	30	-
Pi 0182	7200	5800	-	6	Ø 70**	230	320	30	-
Pi 0183	9600	7600	-	6	Ø 76**	230	320	30	-
Pi 0184	10500	8100	-	6	Ø 80**	230	320	30	-
Pi 0185	13000	9600	-	6	Ø 100**	230	320	30	-

*) when Δp is 0.01 bar (air flow can be reduced by air humidifying)

***) clearance H11

****) in preparation

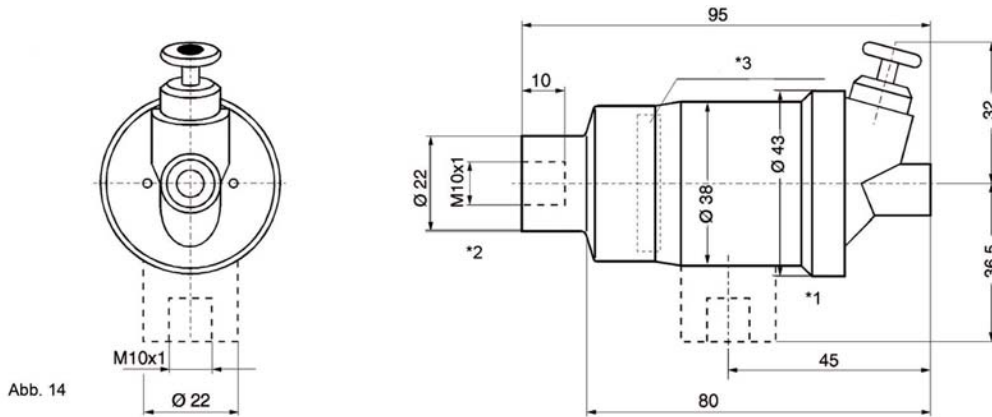
*****) connection according to DIN 24557 T2 (6x screw M5x16 and seal included in delivery)

6. Maintenance indicator

The types Pi 0101 - 0185 may be equipped with a maintenance indicator for optimal filter element exploitation. They indicate when the filter element must be serviced and thus save unnecessary costs.

Vacuum indicator/ Air breather

Indicator setting [mbar \pm 10 %]	Temperature resistance [°C]	Execution	Type	Order number	Indication
- 50	- 40 to + 110	1	TB 745	78309056	visual, self- locking
- 50		2	TB 745/1	78309064	
- 65		2	TB 746/1	78309049	



*1 Execution 1

*2 Execution 2

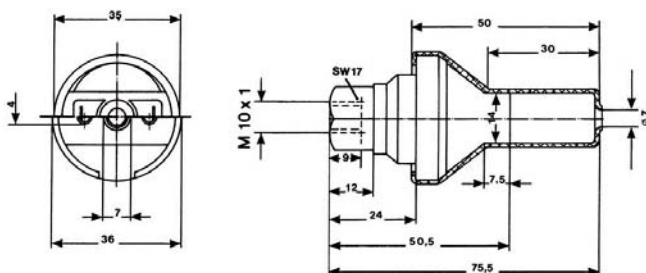
*3 Indication: Position of display at nominal value in mbar

Standard seal material of maintenance indicator: NBR

Seal material types LES/LEO: Silicone rubber

Vacuum switch

Permissible over- pressu- re max. [bar]	Tempe- rature resistance [°C]	Indicator setting [mbar \pm 4]	Contact type	Connection size	Type	Order number	Material lower section	Material upper section
0.1 bar	- 20 to + 80 peaks to 120	- 50	normally open	M10x1 (inside)	LES 250 I	78308918	GD-ZnAl	Polycarbonat
		- 50	normally closed		LEO 250 I	78308926	GD-ZnAl	Polycarbonat



6. Maintenance indicator

Retrofit cover with integrated service indicator

Order number	Type
79343013	Retrofit cover with integrated service indicator for Pi 0120-0149/UM

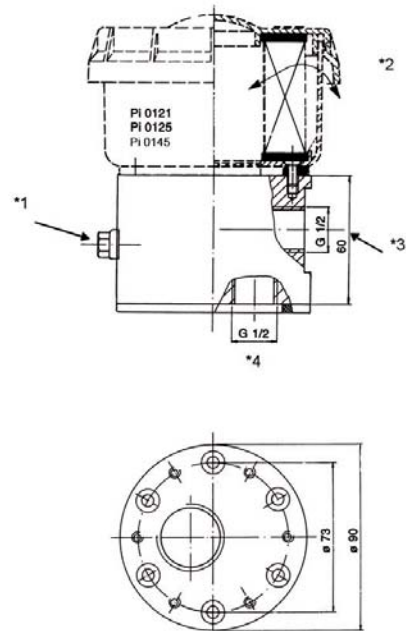
- Integrated 3-step service indicator offers optimized filter element service life
- Switching level 100 % at 50 mbar
- Indication of 50 %, 75 %, 100 % of switching level by red gauge
- Gauge self-locking, handy turning knob to lock



7. Filling adapter

Order number	Type
78258956	Filling adapter
78259111	Filling adapter with Walther coupling and dust cap

Tank connection: flange acc. DIN 24557 part 2
 Material: Al anodized
 Sealing material: cork
 Fixing screws: 6 pcs M5x70 DIN 912 (included in delivery)



*1 Connection for vacuum indicator (G1/8)

*2 Parts shown as dotted lines not included in delivery

*3 Connection for filling coupling

*4 Connection for extension pipe

7. Filling adapter

Characteristics of filling adapter MD012 and MD019:

- Robust adapter for filling with big cross-section for optimized filling
- Coupling for filling with dust cap acc. delivery specifications of the automotive industry
- Filling barrier integrated in the air breather
- Cover with visual service indicator, 3-step, gauge, value self-locking
- Versatile connecting options

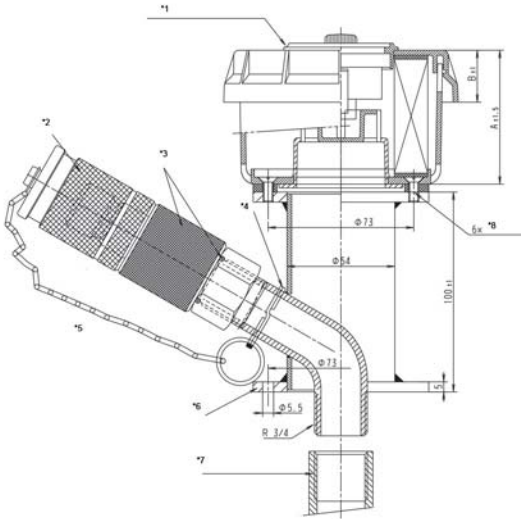


Fig. Pi 0125 - Pi 0145 UM MD012

- *1 Maintenance switch LTB 9
- *2 Dust cap 76319008 Walther MD-012-5-19
- *3 Closing nipple
- *4 Steel ring
- *5 Walther MD-012-2WR 526
- *6 Flange pattern DIN 24557 D 73
- *7 Optional: Extension pipe DIN 2391;
Length acc. to customer specification
- *8 On circumference

Order number	Type
76318968	Pi 0125 Mic-UM/OS/MD012
76318976	Pi 0125 Sm-L-UM/OS/MD012
76318984	Pi 0145 Mic-UM/OS/MD012
76318992	Pi 0145 Sm-L-UM/OS/MD012

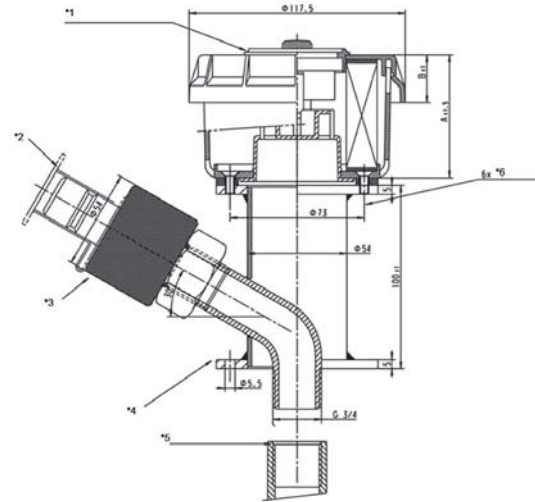


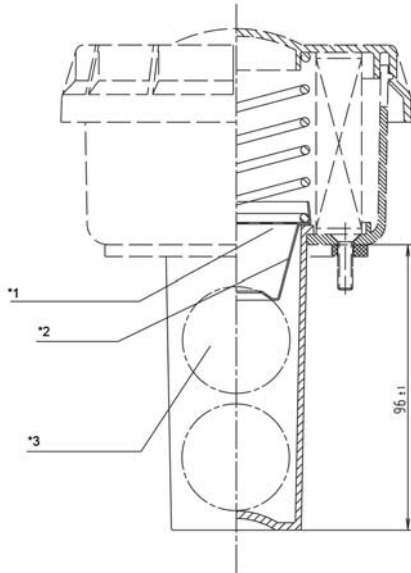
Fig. Pi 0125 - Pi 0145 UM MD019

- *1 Maintenance switch LTB 9
- *2 Dust cap PVC, Walther LP-019-5-74-KU
- *3 Closing nipple, Walther MD-019-2-WR526-19-1VF
- *4 Flange pattern DIN 24557 D 73
- *5 Optional: Extension pipe DIN 2391;
Length acc. to customer specification
- *6 On circumference

Order number	Type
76101406	Pi 0125 Mic-UM/OS/MD019
76101430	Pi 0125 Sm-L-UM/OS/MD019
76101414	Pi 0145 Mic-UM/OS/MD019
76101448	Pi 0145 Sm-L-UM/OS/MD019

8. Accessories

Order number	Type
79343377	Expansion kit with spillage protection to combine with Pi 0125/0126 or Pi 0145/0146

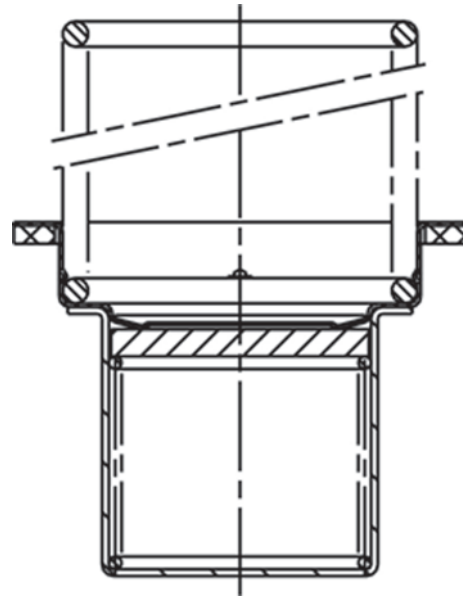


- *1 Perforated disc
- *2 Valve disc
- *3 Float ball: Opening point, max. 0.15 bar

Operating principle of spillage protection:

The float ball (*3) is guided over the filling strainer. If the liquid level in the tank rises, the ball rises accordingly and closes the tank outlet by means of the valve disc (*2). The valve disc is flexibly loaded to prevent the permissible pressure inside the tank from being exceeded.

Order number	Type
79735382	Retrofit kit with preloaded valve to combine with Pi 0125/0126 or Pi 0145/0146 Valve opening pressure: 0.05 bar suction pressure; 0.2 bar pre-load pressure



Advantages of preloaded valve:

- Pump support due to preloaded reservoir
- Minimized air exchange with the contaminated/humid ambient
- Reduced ingress of humidity into the hydraulic system

MAHLE

Industrial Filtration

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70364076.07/2008

RETURN LINE FILTERS

Tank top return-line filter

Pi 5000

Nominal size 40 up to 100
according to DIN 24550

1. Features

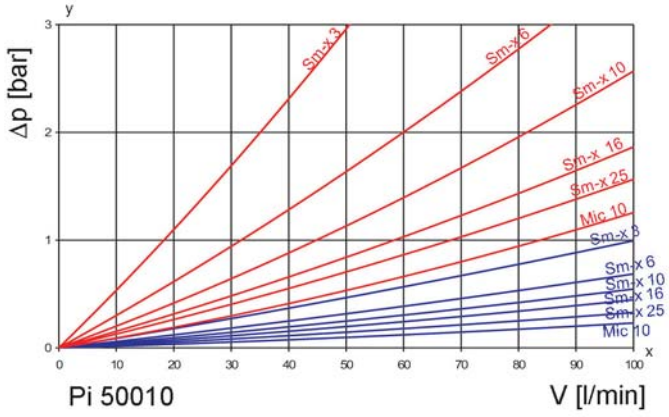
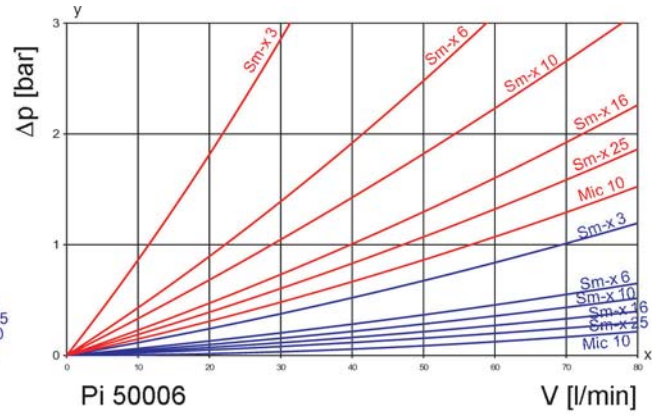
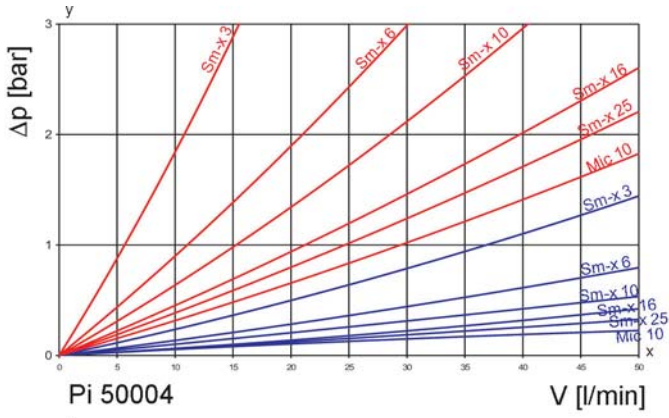
High performance filters for modern hydraulic system

- Provided for tank top installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded connections
- Quality filters, easy to service
- Equipped with highly efficient Mic oder Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- NPT- and SAE-connections on request
- Worldwide distribution



2. Flow rate/pressure drop curve complete filter

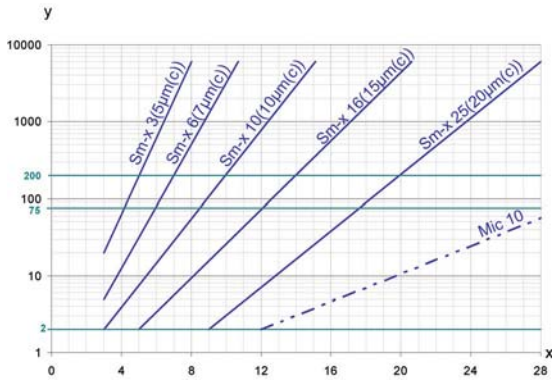
■ 190 mm²/s
■ 33 mm²/s



y = differential pressure Δp [bar]

x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value

x = particle size [µm]

determined by multipass tests (ISO 16889)

calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x-elements with
max. Δp 10 bar

Sm-x 3 $\beta_3 \geq 75$

Sm-x 6 $\beta_6 \geq 75$

Sm-x 10 $\beta_{10} \geq 75$

Sm-x 16 $\beta_{16} \geq 75$

Sm-x 25 $\beta_{25} \geq 75$

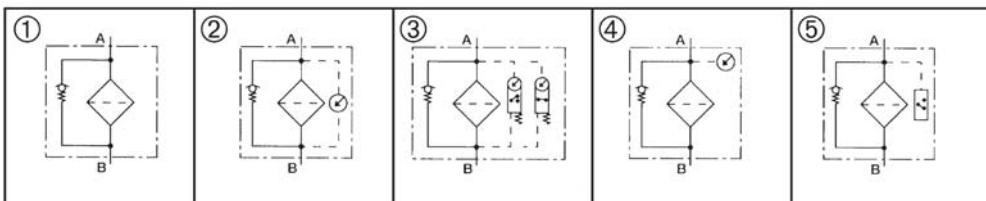
values guaranteed up to
10 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2 941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2 942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2 943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 3 723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3 724	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3 968	Hydraulic fluid power-filters-evaluation of pressure drop versus flow characteristics
ISO 10 771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16 889	Hydraulic fluid power filters-multi-passmethod for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Filter housing	2. Filter element
Housing design = Bypass valve 3.5 bar Pressure switch normally closed (DSS) Type: Pi 50006-050 = NG 63	Type: Pi 25006 RN = Sm-x 25

7.1 Housing design* Pi 50004- Pi 50006- Pi 50010-

Nominal size NG [l/min]	Housing code	①	②	③	④	⑤	⑥	with breather MIC-element (BE-MIC)	with breather Sm-L-element (BE-SML)	with filling connection (BA)	with anti spillage sleeve
		with bypass valve 3.5 bar	with visual indicator 2.2 bar	with electr. indicator 2.2 bar	with pressure gauge (DM)	with pressure switch normally closed (DSS)	with pressure switch normally open (DSO)				
50004 50006 50010	- 056	■									
	- 057	■	■								
	- 058	■	■	■							
	- 059	■			■						
	- 050	■				■					
	- 052	■					■				
	- 076	■	■					■			■
	- 077	■	■						■		■
	- 078	■	■	■				■			■
	- 079	■	■	■					■		■
	- 080	■			■			■			■
	- 081	■			■				■		■
	- 082	■				■		■			■
	- 083	■				■			■		■
	- 084	■					■	■			■
	- 085	■						■	■		■
	- 086	■			■			■		■	■
	- 087	■			■				■	■	■
	- 088	■				■		■		■	■
	- 089	■					■		■	■	■
- 090	■						■	■		■	
- 091	■						■		■	■	

* a wider range of executions is available on request.

7.2 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
40	77925001	Pi 13004 RN Mic 10 NBR	Mic 10	10	900
	77962210	Pi 15004 RN Mic 25 NBR	Mic 25		900
	77923998	Pi 21004 RN Sm-x 3 NBR	Sm-x 3		820
	77964034	Pi 22004 RN Sm-x 6 NBR	Sm-x 6		820
	77924004	Pi 23004 RN Sm-x 10 NBR	Sm-x 10		820
	77962244	Pi 24004 RN Sm-x 16 NBR	Sm-x 16		820
	77960206	Pi 25004 RN Sm-x 25 NBR	Sm-x 25		820
63	77925019	Pi 13006 RN Mic 10 NBR	Mic 10	10	1585
	77962228	Pi 15006 RN Mic 25 NBR	Mic 25		1585
	77924012	Pi 21006 RN Sm-x 3 NBR	Sm-x 3		1445
	77964042	Pi 22006 RN Sm-x 6 NBR	Sm-x 6		1445
	77924020	Pi 23006 RN Sm-x 10 NBR	Sm-x 10		1445
	77962251	Pi 24006 RN Sm-x 16 NBR	Sm-x 16		1445
	77960214	Pi 25006 RN Sm-x 25 NBR	Sm-x 25		1445
100	77925027	Pi 13010 RN Mic 10 NBR	Mic 10	10	2610
	77962236	Pi 15010 RN Mic 10 NBR	Mic 25		2610
	77924038	Pi 21010 RN Sm-x 3 NBR	Sm-x 3		2380
	77940844	Pi 22010 RN Sm-x 6 NBR	Sm-x 6		2380
	77924046	Pi 23010 RN Sm-x 10 NBR	Sm-x 10		2380
	77962269	Pi 24010 RN Sm-x 16 NBR	Sm-x 16		2380
	77960222	Pi 25010 RN Sm-x 25 NBR	Sm-x 25		2380

* a wider range of element types is available on request

8. Technical specifications

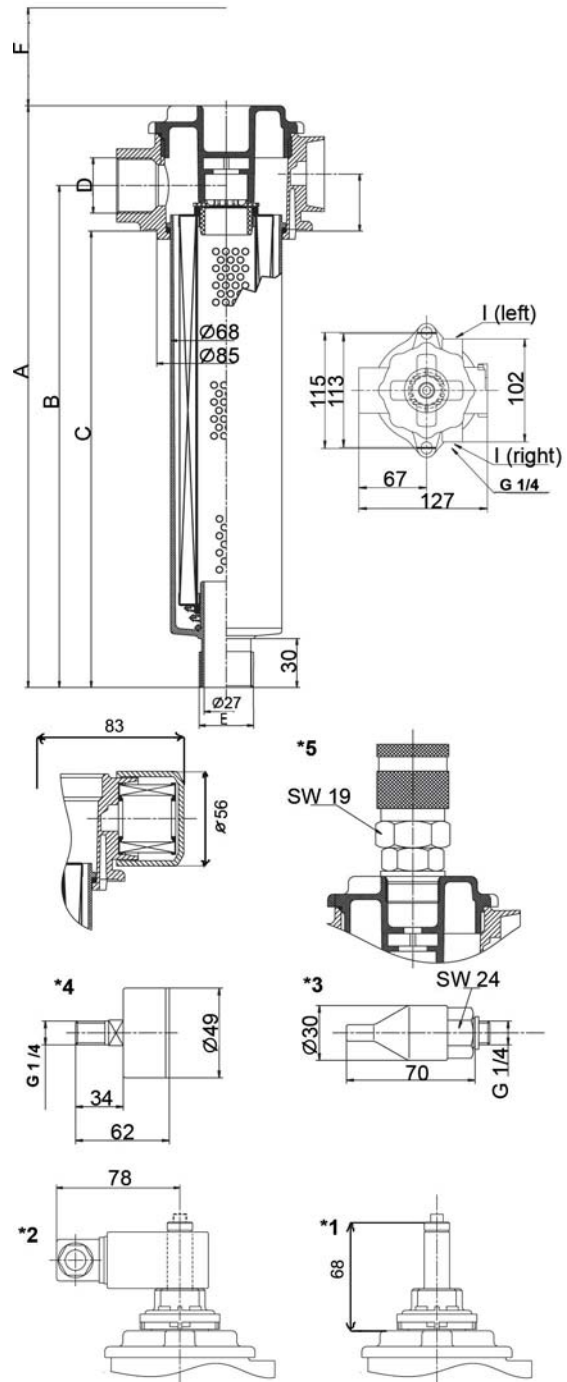
Design:	tank top installation
Nominal pressure:	10 bar (140 psi)
Test pressure:	13 bar (180 psi)
Temperature range:	-10 °C to +80 °C (other temperature ranges on request)
Bypass setting:	3.5 bar ± 10%
Filter head material:	GD Al
Filter housing material:	plastic
Sealing material:	plastic
Maintenance indicator setting	2.2 bar ± 10 %
PiS 3084/85:	
Electrical data of maintenance indicator:	
Max. voltage:	250 V AC/200 V DC
Max. current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M20x1.5

The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

With the inrush current of 70 VA the indicator can trigger small contactors or contactor relays. Inductivity in the direct current may require the use of a signal suppressor.

Recommended max. flow rate of the filling unit at viscosity of 500 mm²/s and a degree of filtration 3 µm: NG 40 = 8 l/min, NG 63 = 15 l/min, NG 100 = 25 l/min.



9. Dimensions

All dimensions except "D" in mm.

Type	A	B	C	D*	E DIN 2999	F	Weight [kg]
Pi 50004	208	159	131	G1	G1	100	0.65
Pi 50006	268	219	191	G1	G1	130	0.68
Pi 50010	358	309	281	G1	G1	200	0.74

*NPT- and SAE- connections on request

- 1 = Standard maintenance indicator visual PiS 3084
- 1 + 2 = Standard maintenance indicator electrical PiS 3085
- 3 = Pressure switch
- 4 = Pressure gauge 0 to 6 bar
- 5 = Quick release coupling for filling

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that:

- a) that sufficient space is available to remove filter element and filter housing,
- b) the mounting hole in the tank top is not excessively large, to ensure proper sealing,
- c) the filter is free of tension after installation

Preferably the filter should be installed with the filter housing pointing downwards. In this position the visual pressure indicator is accessible and visible.

10.2 Connecting the electrical pressure indicator

The electrical pressure indicator is connected via a 2-pole appliance plug according to DIN EN 17 5301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

10.3 When must the filter element be replaced?

1. Filters equipped with visual and/or electrical pressure indicator:
During cold starts, the indicator may give a warning signal. Press the button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
2. Filters without pressure indicator:
The filter element should be replaced after trial run or flushing of the system. Afterward follow instructions of the manufacturer.
3. Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (Sm-x) cannot be cleaned.

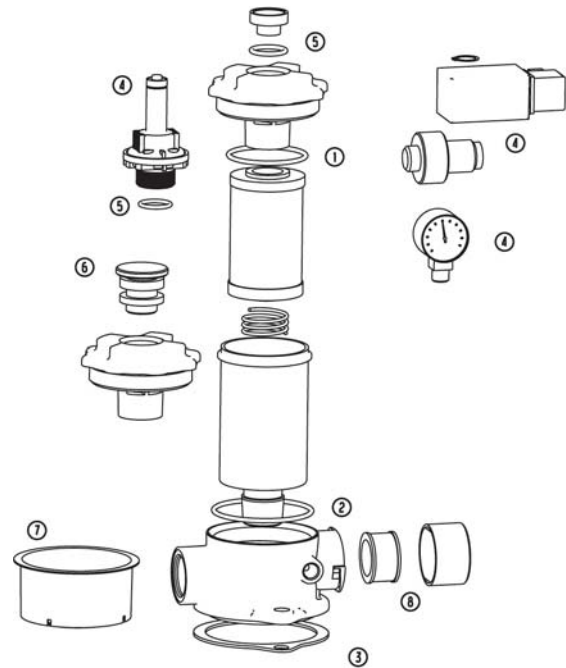
10.4 Element replacement

1. Stop system and relieve filter from pressure.
2. Unscrew cover, turning counter-clockwise.
3. Remove filter housing and filter element by pulling upwards.
4. Remove filter element with a side-to-side motion.
5. Clean the housing using a suitable cleaning solvent.
6. Check O-ring on filter cover and filter housing for damage. Replace, if necessary.
7. Make sure that the order number on the spare element corresponds to the order number of the filter name-plate.
8. Remove filter element from the plastic bag and reassemble filter in reverse order (items 1 to 6).

Subject to technical alteration without prior notice.

11. Spare parts list

Order numbers for spare parts		
Pos.	Type	Order number
Pi 50004-50010		
Seal kit for housing		
Without air breather		
	NBR	77999709
①	FPM	77999725
-	EPDM	77999741
③	With air breather	
	NBR	77999717
	FPM	77999733
	EPDM	77999758
Maintenance indicator		
	Visual PiS 3084/ 2.2 bar	77737802
	Electrical PiS 3085/ 2.2 bar	77738032
④	Electrical upper section only	77536550
	Pressure Gauge	78381998
	Pressure switch normally closed	77845845
	Pressure switch normally open	77870595
Seal kit for maintenance indicator		
⑤	NBR	77760218
	FPM	77760226
	EPDM	77760234
⑥	Thread connection for filling	77969017
	Quick release coupling	77965130
⑦	Anti spillage sleeve	77927643
Air breather element		
⑧	Paper 852 514 Mic	77687692
	Glas fibre 852 514 Sm-L	77643562



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 70363176.07/2008

Tank top return-line filter

Pi 5000

Nominal size 160 up to 1000
according to DIN 24550

1. Features

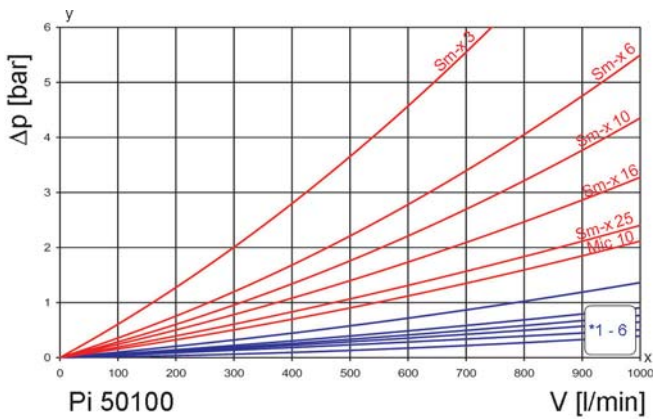
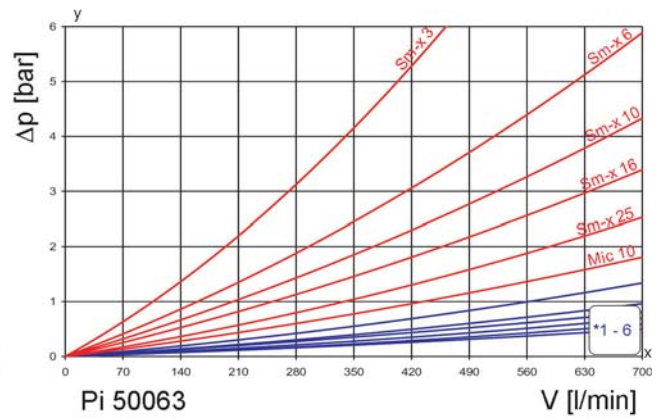
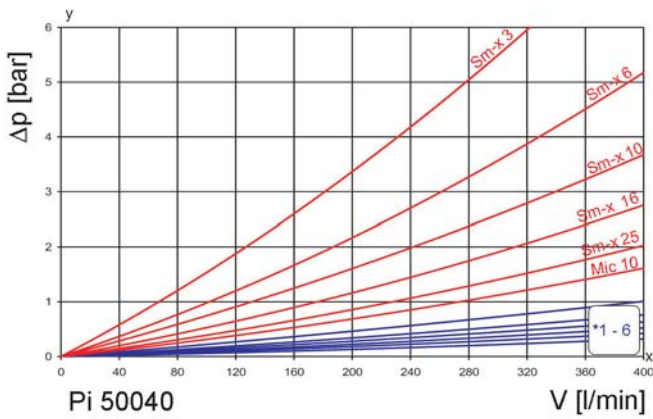
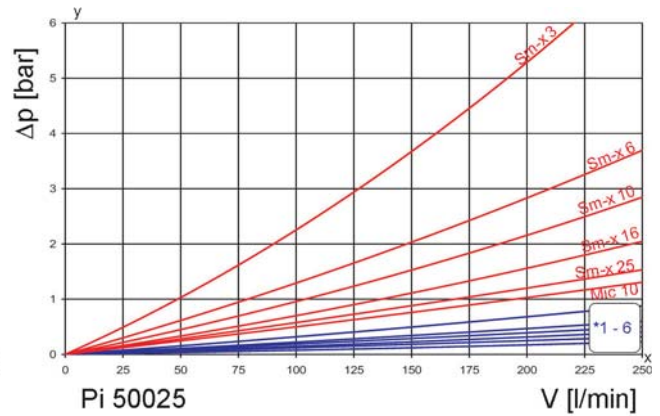
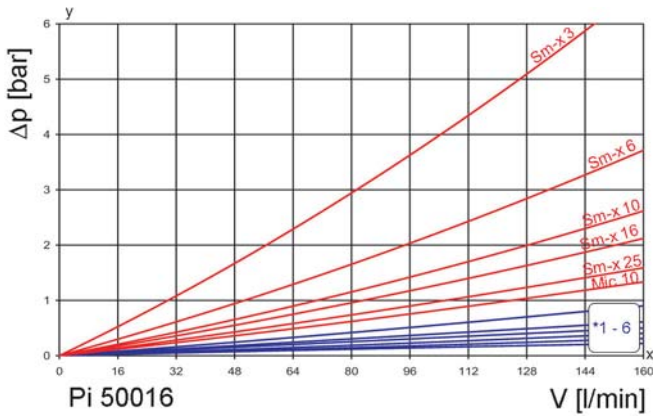
High performance filters for modern hydraulic systems

- Provided for tank top installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded or flanged connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- NPT- and SAE-connections on request
- Worldwide distribution



2. Flow rate/pressure drop curve complete filter

■ 190 mm²/s
■ 33 mm²/s



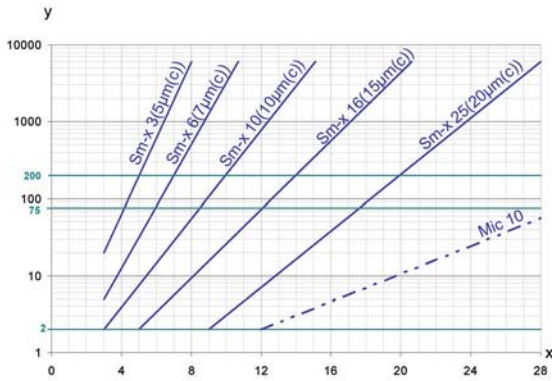
y = differential pressure Δp [bar]

x = flow rate V [l/min]

*1 - 6

1. Sm-x 3
2. Sm-x 6
3. Sm-x 10
4. Sm-x 16
5. Sm-x 25
6. Mic 10

3. Separation grade characteristics



y = beta-value
x = particle size [µm]

determined by multipass tests (ISO 16889)
calibration according to ISO 1171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x elements with
max. Δp 10 bar

Sm-x 3	$\beta_{5(C)}$	≥ 200
Sm-x 6	$\beta_{7(C)}$	≥ 200
Sm-x 10	$\beta_{10(C)}$	≥ 200
Sm-x 16	$\beta_{15(C)}$	≥ 200
Sm-x 25	$\beta_{20(C)}$	≥ 200

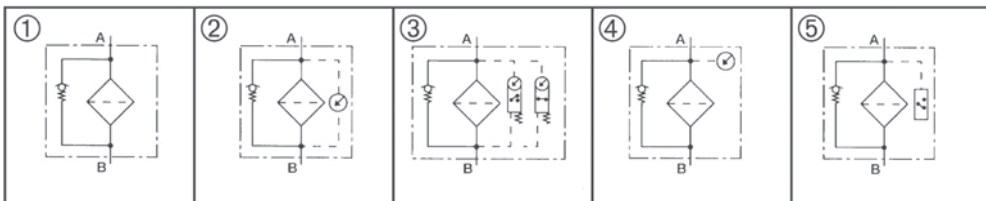
values guaranteed up to
10 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification material compatibility with fluids
DIN ISO 2923	Fluidtechnik-Hydraulik Filterelemente; method for end load test
DIN ISO 2924	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power filters; evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters; multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Housing design	2. Filter element
Bypass valve 3.5 bar, Connection execution 2 = DN 38 Type: Pi 50016-056/NG 160	Sm-x 25 NBR Type: Pi 2516 RN

7.1 Housing design* Pi 50016- Pi 50025 - Pi 50040 - Pi 50063 - Pi 50100-

Nominal size NG [l/min]	Housing code	①	①	②	③	④	⑤	⑤	with filling connection (BA)
		with bypass valve 3.5 bar	with indicator cavity	with visual maintenance indicator 2.2 bar	with electrical maintenance indicator 2.2 bar	with pressure gauge (DM)	with pressure switch normally open (DSS)	with pressure switch normally closed (DSO)	
160 250 400 630 1000	- 047								
	- 056								
	- 057								
	- 058								
	- 059								
	- 050								
	- 052								
	- 092								
	- 093								
	- 094								
	- 095								
	- 096								
	- 097								

* a wider range of executions is available on request

7.2 Connection executions

Nominal size NG [l/min]	Type	Standard connection according DIN 24550 part 1	/1	/2	/3	/4	/5	/6
			160	Pi 50016-...	G1¼	G1½	DN 38	
250	Pi 50025-...	G1½		DN 38	G1¼			
400	Pi 50040-...	DN 51	G1½			G2	DN 64	
630	Pi 50063-...	DN 64	G1½			G2		DN 51
1000	Pi 50100-...	DN 76						

DN 38 = SAE 1½"

DN 51 = SAE 2"

DN 64 = SAE 2½"

DN 76 = SAE 3"

3000 psi

7.3 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
160	77925035	Pi 13016 RN Mic 10 NBR	Mic 10	10	3750
	77924137	Pi 21016 RN Sm-x 3 NBR	Sm-x 3		3750
	77964067	Pi 22016 RN Sm-x6 NBR	Sm-x 6		3750
	77924145	Pi 23016 RN Sm-x10 NBR	Sm-x 10		3750
	77963648	Pi 24016 RN Sm-x16 NBR	Sm-x 16		3750
	77960230	Pi 25016 RN Sm-x25 NBR	Sm-x 25		3750
250	77925043	Pi 13025 RN Mic 10 NBR	Mic 10	10	6050
	77924152	Pi 21025 RN Sm-x 3 NBR	Sm-x 3		6050
	77964075	Pi 22025 RN Sm-x6 NBR	Sm-x 6		6050
	77924160	Pi 23025 RN Sm-x10 NBR	Sm-x 10		6050
	77963655	Pi 24025 RN Sm-x16 NBR	Sm-x 16		6050
	77960248	Pi 25025 RN Sm-x25 NBR	Sm-x 25		6050
400	77925050	Pi 13040 RN Mic 10 NBR	Mic 10	10	9450
	77924178	Pi 21040 RN Sm-x 3 NBR	Sm-x 3		8250
	77964083	Pi 22040 RN Sm-x6 NBR	Sm-x 6		8250
	77924186	Pi 23040 RN Sm-x10 NBR	Sm-x 10		8250
	77963663	Pi 24040 RN Sm-x16 NBR	Sm-x 16		8250
	77960255	Pi 25040 RN Sm-x25 NBR	Sm-x 25		8250
630	77925068	Pi 13063 RN Mic 10 NBR	Mic 10	10	15500
	77924194	Pi 21063 RN Sm-x 3 NBR	Sm-x 3		13515
	77964091	Pi 22063 RN Sm-x6 NBR	Sm-x 6		13515
	77924202	Pi 23063 RN Sm-x10 NBR	Sm-x 10		13515
	77963671	Pi 24063 RN Sm-x16 NBR	Sm-x 16		13515
	77960263	Pi 25063 RN Sm-x25 NBR	Sm-x 25		13515
1000	77925076	Pi 13100 RN Mic 10 NBR	Mic 10	10	18335
	77924210	Pi 21100 RN Sm-x 3 NBR	Sm-x 3		18335
	77964109	Pi 22100 RN Sm-x6 NBR	Sm-x 6		18335
	77924228	Pi 23100 RN Sm-x10 NBR	Sm-x 10		18335
	77963689	Pi 24100 RN Sm-x16 NBR	Sm-x 16		18335
	77960271	Pi 25100 RN Sm-x25 NBR	Sm-x 25		18335

*a wider range of element types is available on request

8. Technical specifications

Design:	tank top installation
Nominal pressure :	10 bar (140 psi)
Test pressure:	13 bar (180 psi)
Temperature range:	- 10 °C to +80 °C (other temperature ranges on request)
Bypass setting:	Δp 3.5 bar \pm 10 %
Filter head material:	GD Al
Filter housing material:	St.
Filter cover material:	GD Al/G Al
Maintenance indicator setting:	Δp 2.2 bar \pm 10 %
Electrical data of maintenance indicator:	
Maximum voltage:	250 V AC/200 V DC
Maximum current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M20x1.5

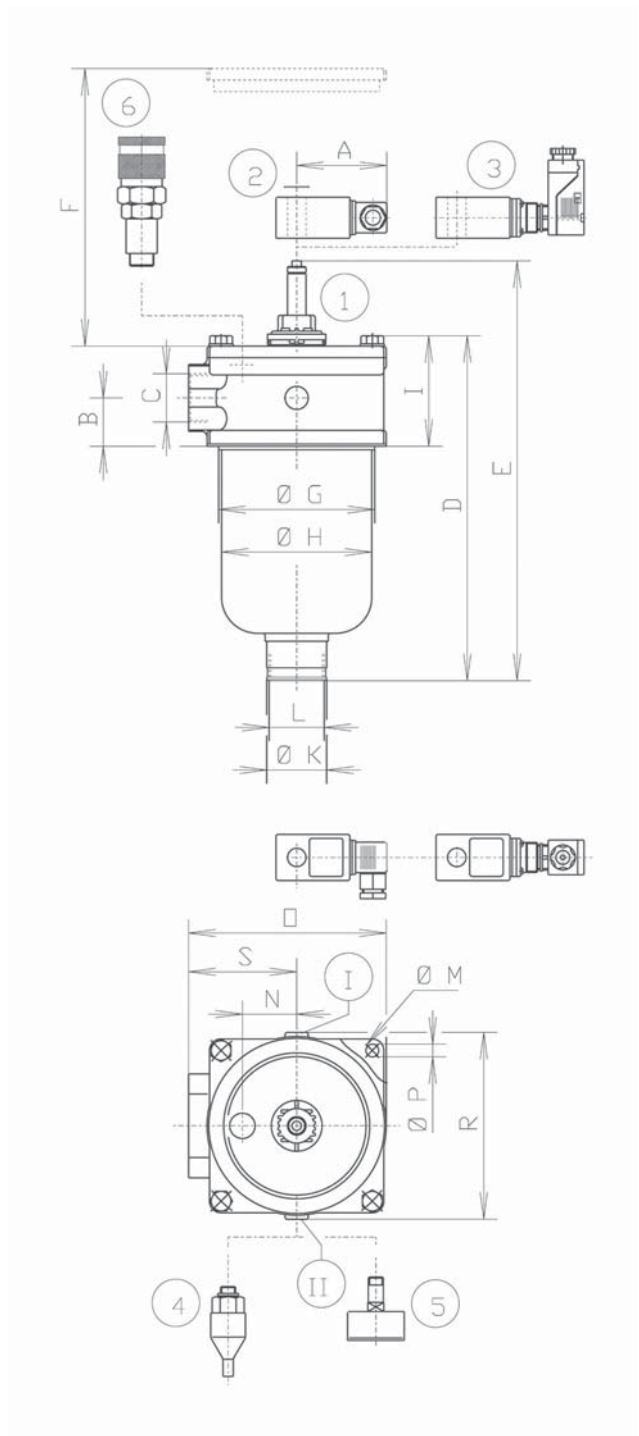
The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values and do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.

- 1 = Standard maintenance indicator visual
PiS 3084
- 1 + 2 = Standard maintenance indicator electrical
PiS 3085
- 3 = Further executions see data sheet maintenance indicator
- 4 = Pressure switch
- 4 + 5 = Can be mounted at I or II alternatively
- 5 = Pressure gauge
- 6 = Coupling for filling



9. Dimensions

All Dimensions except "L" in mm.

Type	A	B	C	D	E	F	G	H	I	K	L	M	N	O	P	R	S	T	U	V	Weight [kg]
Pi 50016 - ...	78	42	see 7.2	299	364	180	135,0	130	96	52	G1½	185	47	171	11	162	93,5	70	35,7	M12	3,2
Pi 50025 - ...	78	42		349	414	270	135,0	130	96	52	G1½	185	47	171	11	162	93,5	70	35,7	M12	3,4
Pi 50040 - ...	78	57		427	489	270	175,5	163	120	70	G2	220	60	214	11	212	108	77,8	42,9	M12	6,4
Pi 50063 - ...	78	57		577	639	420	175,5	163	120	70	G2	220	60	214	11	212	108	89	50,8	M12	6,9
Pi 50100 - ...	78	72		577	636	420	200,0	190	149	-	G3	250	75	255	11	240	135	106	62,0	M16	11,1

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that:

- that sufficient space is available to remove filter element and filter housing,
- the mounting hole in the tank top is not excessively large, to ensure proper sealing,
- the filter is free of tension after installation

Preferably the filter should be installed with the filter housing pointing downwards. In this position the maintenance indicator is accessible and visible.

10.2 Connecting the electrical maintenance indicator

The electrical maintenance indicator is connected via a 2-pole appliance plug according to DIN EN 17 5301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

10.3 When must the filter element be replaced?

- Filters equipped with visual and/or electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
- Filters without maintenance indicator:
The filter element should be replaced after trial run or flushing of the system. Afterward follow instructions of the manufacturer.
- Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (Sm-x and Mic) cannot be cleaned.

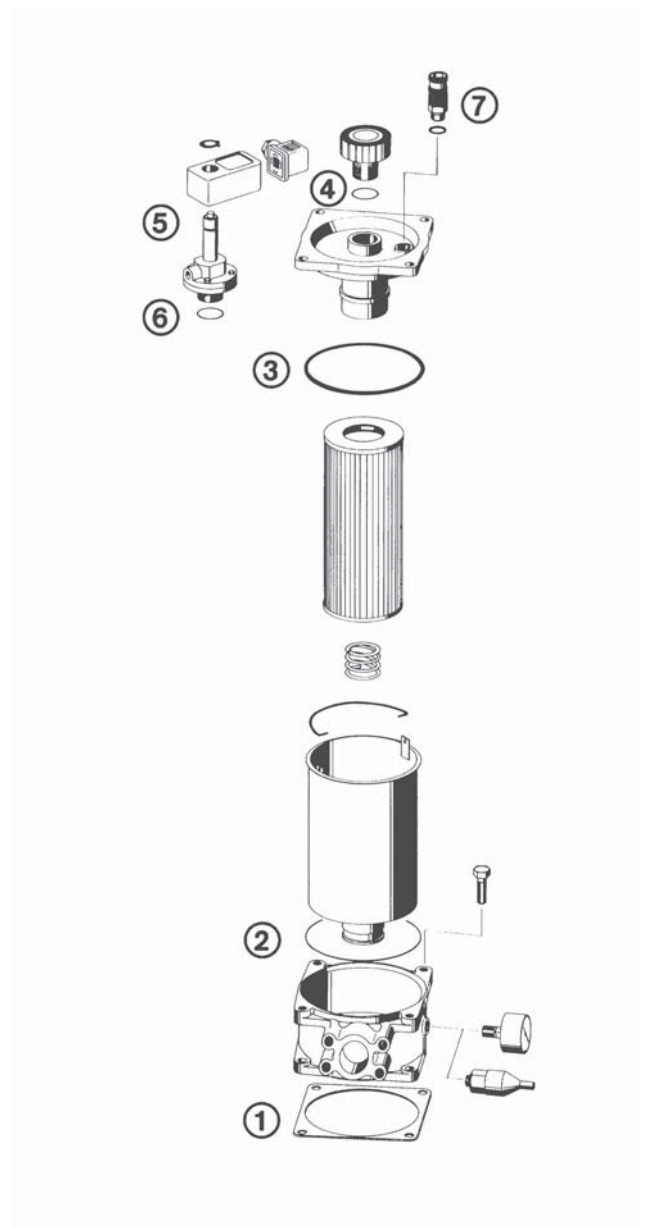
10.4 Element replacement

- Stop system and relieve filter from pressure.
- Unscrew cover, turning counter-clockwise.
- Remove filter housing and filter element by pulling upwards.
- Remove filter element with a side-to-side motion.
- Clean the housing using a suitable cleaning solvent.
- Check O-ring on filter cover and filter housing for damage. Replace, if necessary.
- Make sure that the order number on the spare element corresponds to the order number of the filter name-plate.
- Remove filter element from the plastic bag and reassemble filter in reverse order (items 1 to 6).

Subject to technical alteration without prior notice.

11. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
	Seal kit for housing	
① to ④	NG 160/250	
	NBR	78227902
	FPM	78227910
	EPDM	78227928
	NG 400/630	
	NBR	78227936
	FPM	78227944
	EPDM	78227951
	NG 1000	
	NBR	78227969
FPM	78227977	
EPDM	78227985	
⑤	Maintenance indicator	
	Visual PiS 3084/2.2	77669914
	Electrical PiS 3085/2.2	77669864
	Electrical upper section only	77536550
	Pressure gauge	78381998
	Pressure switch	
Normally open	77845845	
Normally closed	77870595	
⑥	Seal kit for maintenance indicator	
	NBR	78383382
	FPM	78383390
	EPDM	78383408
⑦	Quick-release coupling	77965130



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 www.mahle-industriefiltration.com
 70363178.07/2008

Duplex-tank top return line filter

Pi 5100

Nominal size 40 up to 1000
according DIN 24550

1. Features

High performance filters for modern hydraulic systems

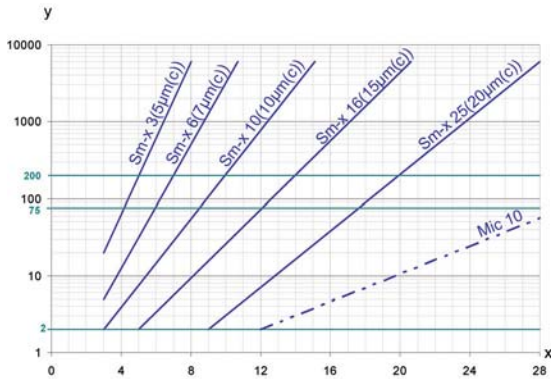
- Provided for tank top installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded and flanged connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution



2. Flow rate/pressure drop curve complete filter

see data sheet Pi 5000

3. Separation grade characteristics



y = beta-value

x = particle size [µm]

determined by multipass tests (ISO 16889)
calibration according to ISO 1171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x elements with

max. Δp 10 bar

Sm-x 3 $\beta_{5(C)} \geq 200$

Sm-x 6 $\beta_{7(C)} \geq 200$

Sm-x 10 $\beta_{10(C)} \geq 200$

Sm-x 16 $\beta_{15(C)} \geq 200$

Sm-x 25 $\beta_{20(C)} \geq 200$

values guaranteed up to
5 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification material compatibility with fluids
DIN ISO 2923	Fluidtechnik-Hydraulik Filterelemente; method for end load test
DIN ISO 2924	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power filters; evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters; multipass method for evaluation filtration performance of a filter element

6. Symbols

see data sheet Pi 5000

7. Order numbers

7.1 Housing design

Nominal size NG [l/min]	Order number	Type	①	②	③	with electrical indicator (2 setting points, 3 LED)
			with bypass 3.5 bar and indicator cavity	with bypass 3.5 bar and visual indicator 2.2 bar	with bypass 3.5 bar and electrical indicator 2.2 bar	
40	78337438	Pi 51004-047				
	78275729	Pi 51004-057				
	78275737	Pi 51004-058				
	78278202	Pi 51004-058/PiS 3103				
63	78337446	Pi 51006-047				
	78275513	Pi 51006-057				
	78275307	Pi 51006-058				
	78337453	Pi 51006-058/PiS 3103				
100	77994320	Pi 51010-047				
	78274110	Pi 51010-057				
	77993306	Pi 51010-058				
	78337461	Pi 51010-058/PiS 3103				
160	78276453	Pi 51016-047				
	78337479	Pi 51016-057				
	78276644	Pi 51016-058				
	78267775	Pi 51016-058/PiS 3103				
250	78276479	Pi 51025-047				
	78336323	Pi 51025-057				
	78316044	Pi 51025-058				
	78276420	Pi 51025-058/PiS 3103				
400	78276487	Pi 51040-047				
	78337495	Pi 51040-057				
	78337503	Pi 51040-058				
	78337511	Pi 51040-058/PiS 3103				
630	78276495	Pi 51063-047/6				
	78336844	Pi 51063-057/6				
	78336547	Pi 51063-058/6				
	78337529	Pi 51063-058/6/PiS 3103				
1000	78337537	Pi 51100-047				
	78337545	Pi 51100-057				
	78337420	Pi 51100-058				
	78337552	Pi 51100-0/PiS 3103				

When filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

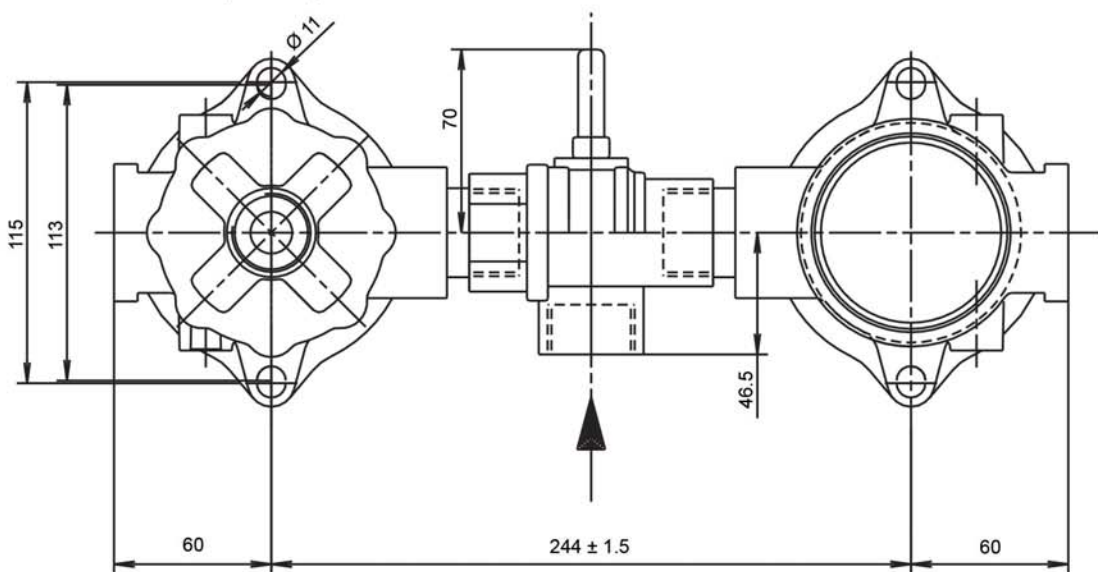
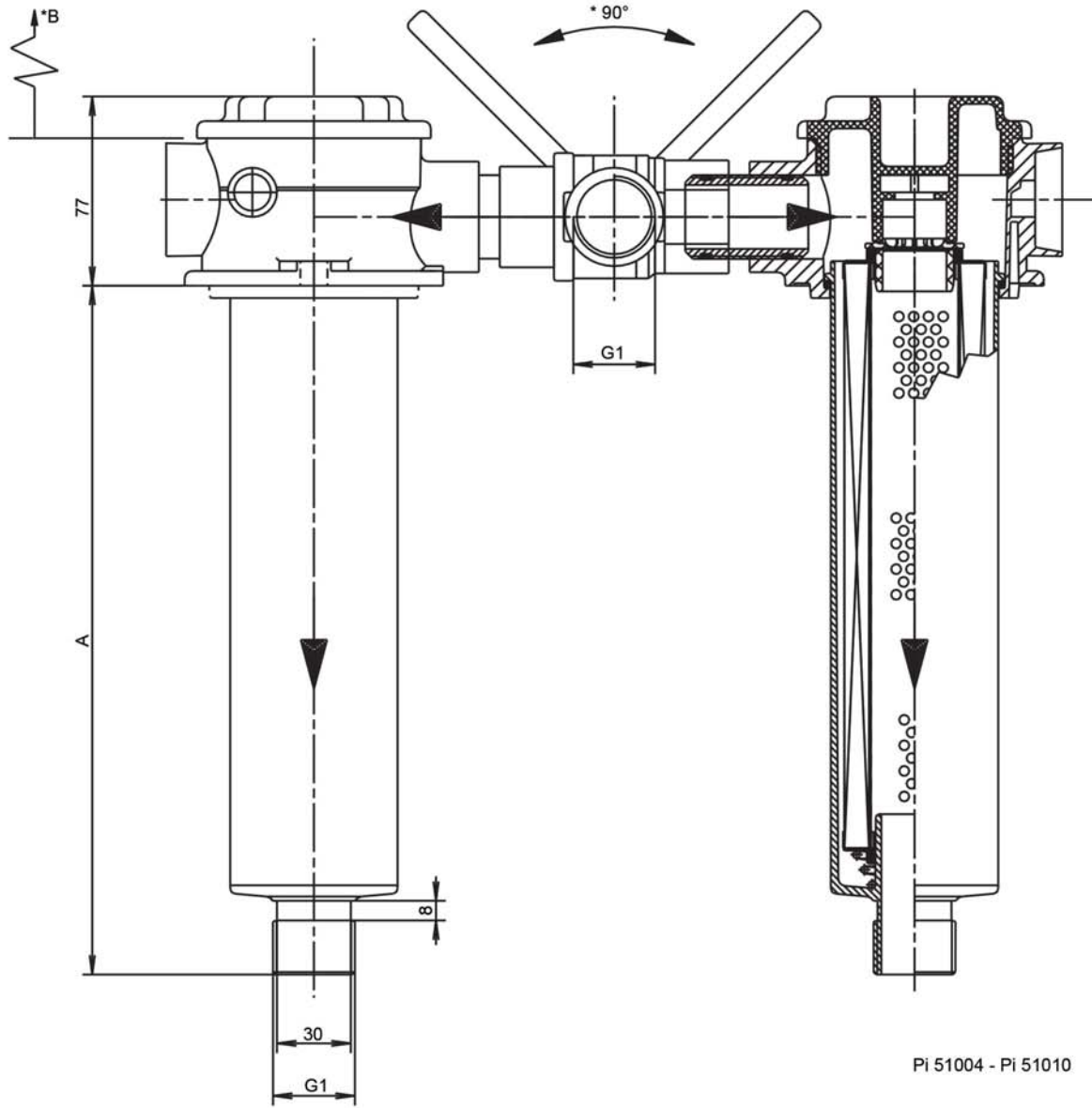
7.2 Filter elements

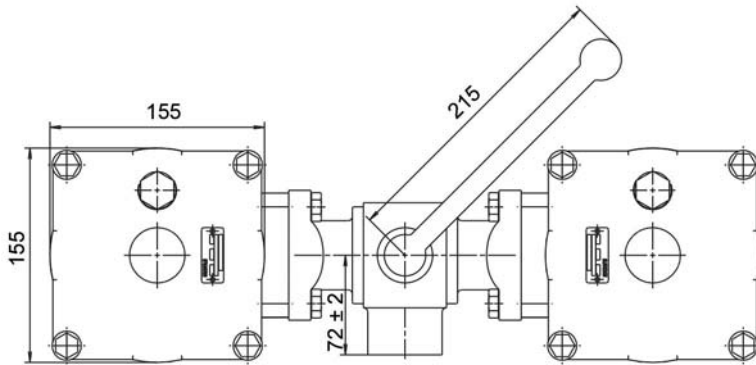
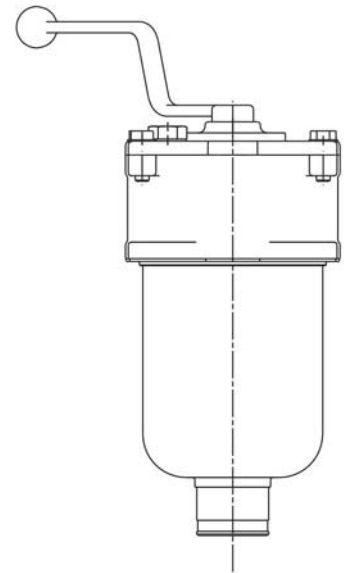
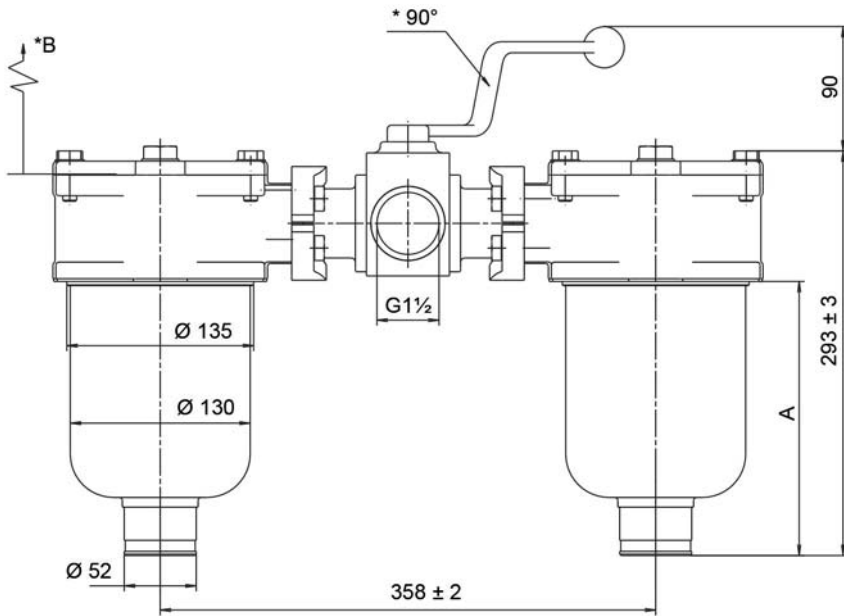
see data sheet Pi 5000

8. Technical specifications

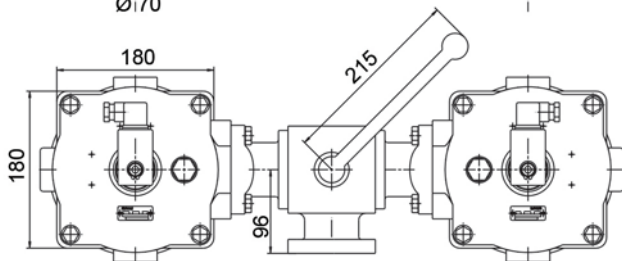
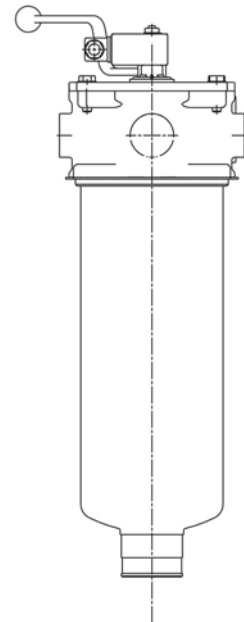
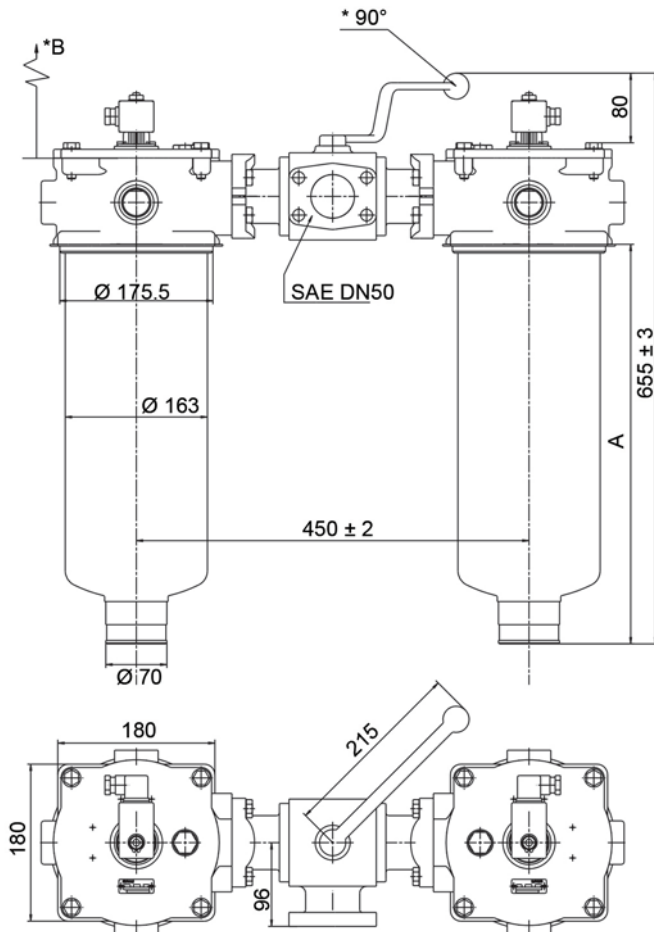
see data sheet Pi 5000

9. Dimensions

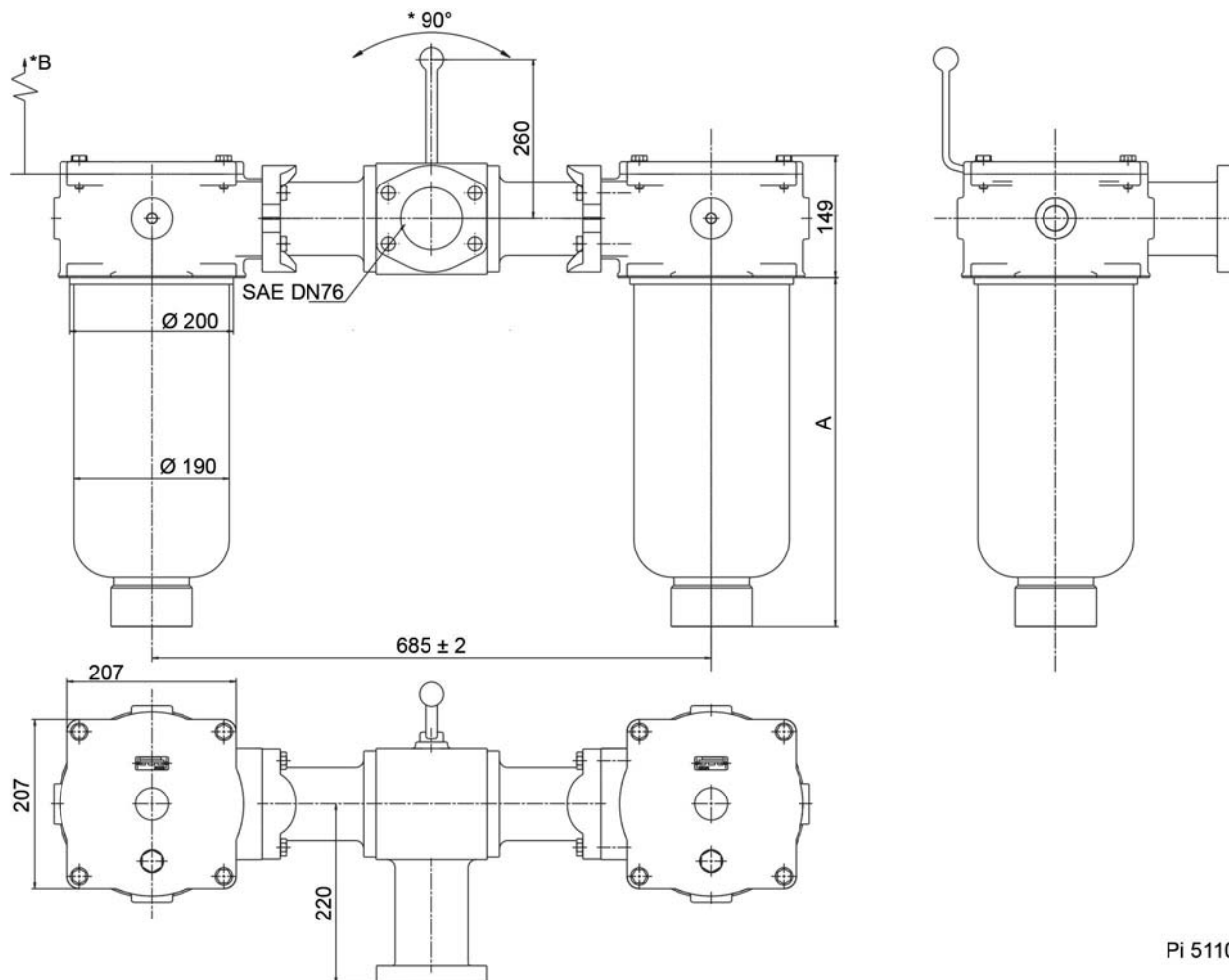




Pi 51016 - Pi 51025



Pi 51040 - Pi 51063



Pi 51100

*B= Minimum clearance for filter element removal

* 90°= Pivoting range

Type	A	B
Pi 51004	130	150
Pi 51006	190	210
Pi 51010	280	300
Pi 51016	198	220
Pi 51025	290	310
Pi 51040	458	480
Pi 51063	458	480
Pi 51100	427	450

10. Installation, operating and maintenance instructions

see data sheet Pi 5000

11. Spare parts list

see data sheet Pi 5000

MAHLE Filtersysteme GmbH, Industriefiltration, Schleifbachweg 45, D-74613 Öhringen, Phone +49 (0) 79 41/67-0,
 Fax +49 (0) 79 41/67-2 34 29, industriefiltration@mahle.com, www.mahle-industriefiltration.com
 70364395.07/2008

Tank Top Return-Line Filter

Pi 530

Nominal size 35 and 50

1.Features

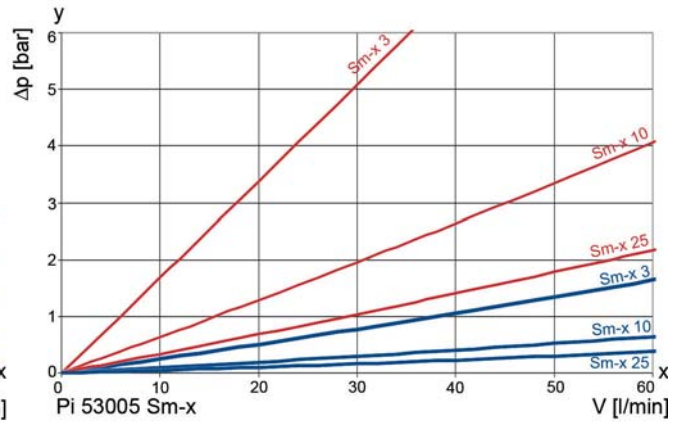
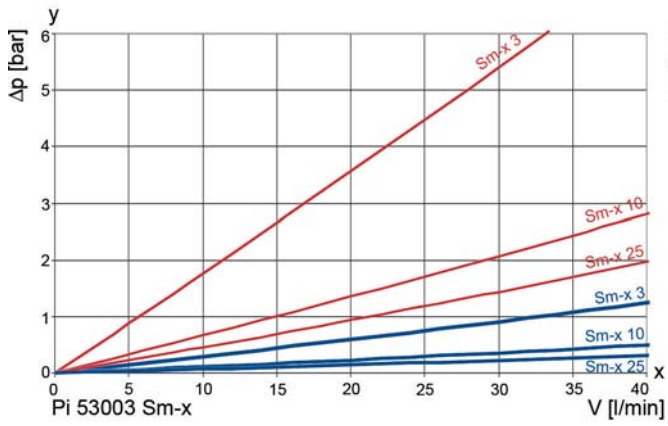
High performance filters for modern hydraulic systems

- Provided for tank top installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance control
- Threaded alt. hose connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre Sm-x filter
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution



2. Flow rate/pressure drop curve complete filter

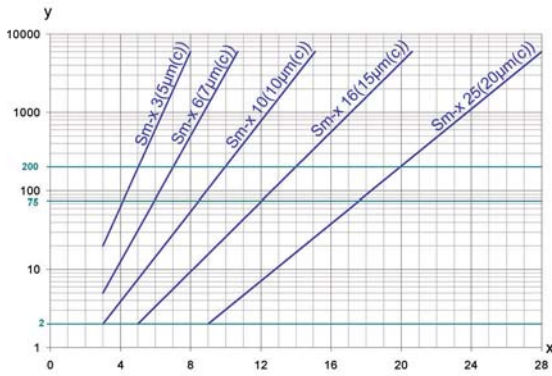
■ 190 mm²/s
■ 33 mm²/s



y = differential pressure p [bar]

x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value

x = particle size [μm]

determined by multipass tests (ISO 16889)

calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x-elements with
max. Δp 10 bar

Sm-x 3 $\beta_{5(C)} \geq 200$

Sm-x 10 $\beta_{10(C)} \geq 200$

Sm-x 25 $\beta_{20(C)} \geq 200$

values guaranteed up to

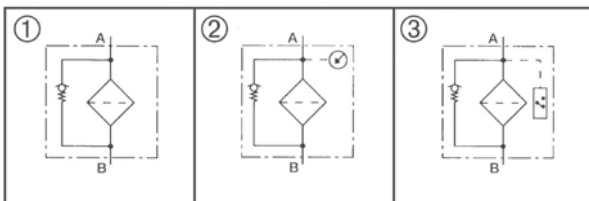
5 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2 941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2 942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2 943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 3 723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3 724	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3 968	Hydraulic fluid power-filters-evaluation of pressure drop versus flow characteristics
ISO 10 771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16 889	Hydraulic fluid power filters-multi-passmethod for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Housing design	2. Filter element
Housing NG 35 with hose connection, bypass valve, breather and pressure gauge Type: Pi 53003/1-141	Mic 10 Type: 852 939 Mic 10

7.1 Housing design

Nominal size NG [l/min]	Type	Version filter head	①		②	③	③
			with bypass 1.5 bar	with breather	with bypass and gauge	with pressure switch normally closed	with pressure switch normally open
35	Pi 53003/1-009	Filter head PA 6 with hose- connection DN20					
	Pi 53003/1-020						
	Pi 53003/1-144						
	Pi 53003/1-145						
	Pi 53003/1-146						
	Pi 53003/1-141						
	Pi 53003/1-142						
	Pi 53003/1-143						
	Pi 53003/2-009	Al-filter head G½					
	Pi 53003/2-020						
50	Pi 53005/1-009	Filter head PA 6 with hose- connection DN20					
	Pi 53005/1-020						
	Pi 53005/1-044						
	Pi 53005/1-145						
	Pi 53005/1-146						
	Pi 53005/1-141						
	Pi 53005/1-142						
	Pi 53005/1-143						
	Pi 53005/2-009	Al-filter head G½					
	Pi 53005/2-020						

7.2 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δ p [bar]	Filter surface [cm²]
35	78309387	852 939 Mic 10	Mic 10	5	870
	78206781	852 939 Mic 25	Mic 25		
	79312117	852 588 Sm-x 3	Sm-x 3	10	650
	79312125	852 588 Sm-x 10	Sm-x 10		
	79312133	852 588 Sm-x 25	Sm-x 25		
50	78309395	852 940 Mic 10	Mic 10	5	1100
	79312315	852 940 Mic 25	Mic 25		
	79312158	852 945 Sm-x 3	Sm-x 3	10	810
	79312166	852 945 Sm-x 10	Sm-x 10		
	79312174	852 945 Sm-x 25	Sm-x 25		

* a wider range of element types is available on request

7.3 Breather element (only for filter head PA 6, batch size 3 pcs.)

Nominal size NG [l/min]	Order number	Type	Filter material	Filter surface [cm ²]
35	78206831	852 937	Mic	40
50				

8. Technical Specifications

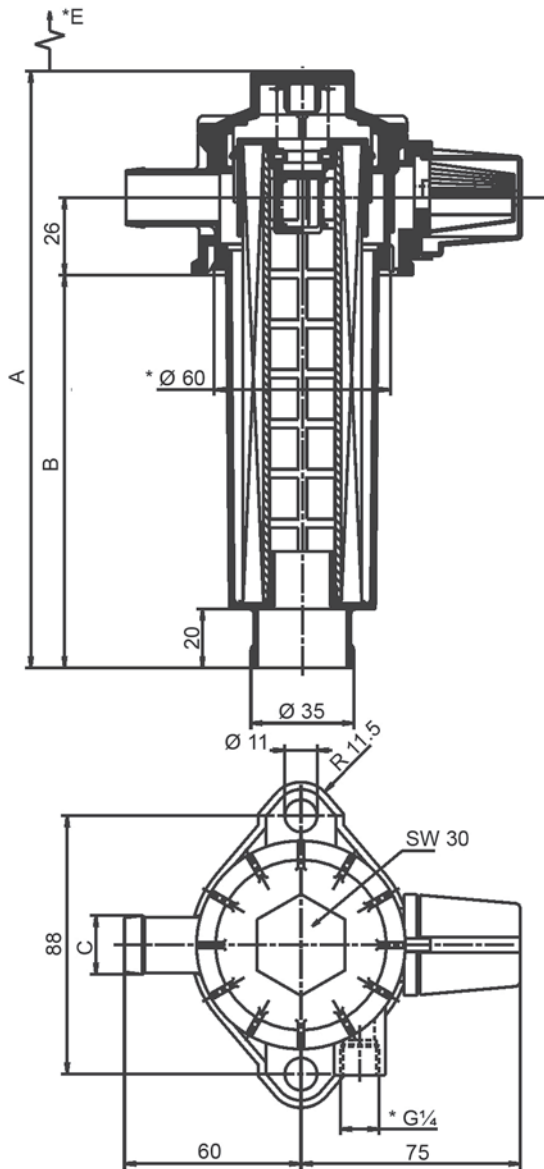
Design:	tank mounting filter
Nominal pressure:	6 bar (90 psi)
Test pressure:	9 bar (130 psi)
Temperature range:	-10 °C to +80 °C (other temperature ranges on request)
Bypass setting:	Δp 1.5 bar
Filter head material:	plastic-PA 6/Al
Filter housing material:	plastic PA 6
Filter cover material:	plastic PA 6
Indication range of pressure gauge:	0 to 4 bar
Activating pressure of pressure switch:	1.2 bar
Electrical data of pressure switch:	
Max. voltage:	42 V
Max. current:	2 A
Contact load:	100 VA
Type of protection:	IP 65 - with protection cap
Contact:	normally open/closed
Electrical connection:	AMP 6,3 DIN 46248 connector according to DIN 46247, connection method 2-pole

We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.

9. Dimensions

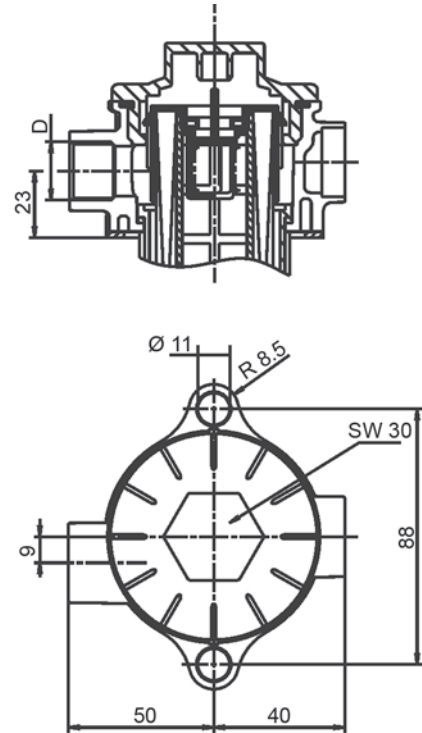


Version with filter head PA 6

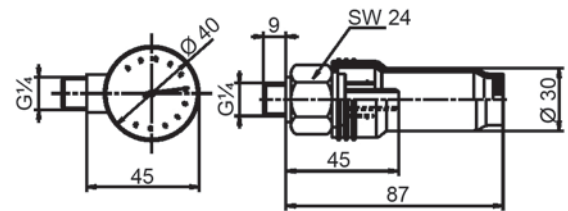
*E= Minimum clearance for filter element removal

* Ø 60= Mounting hole Ø 60

*G $\frac{1}{4}$ = Option



Version with filter head AI



All dimensions except "D" in mm.

Typ	A	B	C	D	E
Pi 53003/1	203	133,5	DN20	-	130
Pi 53003/2	203	135,5	-	G $\frac{1}{2}$	130
Pi 53005/1	241	171,5	DN20	-	180
Pi 53005/2	241	173,0	-	G $\frac{1}{2}$	180

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that :

- Sufficient space is available to remove filter element and filter housing
- The mounting hole in the tank top is not excessively large, to ensure proper sealing,
- The filter is free of tension after installation, max. torque 7 Nm. Preferably the filter should be installed with the filter housing pointing downwards.

10.2 Connecting the electrical pressure switch

The electrical pressure switch is connected via connectors according to DIN 46247.

10.3 When should the filter element be replaced?

- Filters equipped with pressure gauge:
When the dynamic pressure reaches 1.2 bar (red/green indication), the filter element must be replaced.
- Filters equipped with pressure switch:
During cold starts, the pressure switch may give a signal. If the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
- Filters without indicator:
The filter element should be replaced after trial run or flushing of the system.
Afterwards follow instructions of manufacturer.
- Please, always ensure that you have original MAHLE spare elements in stock: Disposable elements (Mlc, Sm-x) cannot be cleaned.

10.4 Element replacement

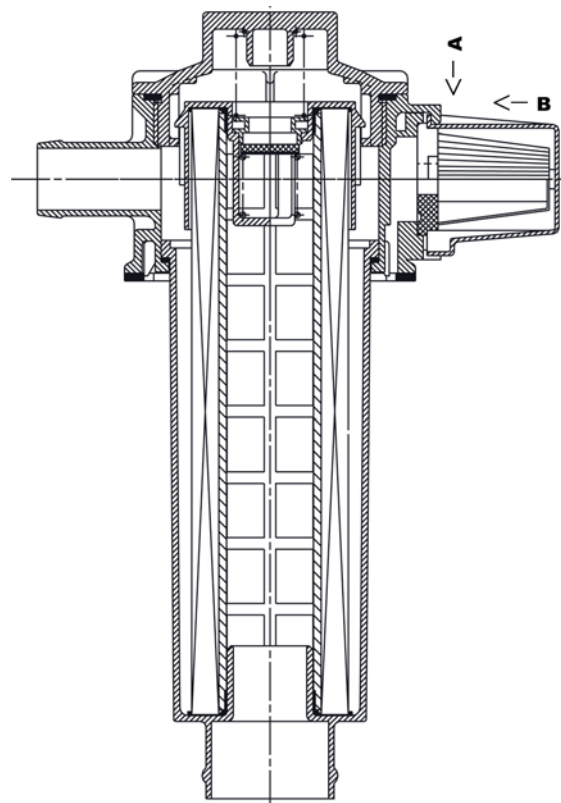
- Stop system and relieve filter from pressure.
- Unscrew cover, turning counter-clockwise.
- Remove filter housing and filter element by pulling upwards.
- Remove filter element with a side-to-side motion.
- Clean the filter housing with a suitable medium.
- Check O-rings on filter cover and filter housing for damage. Replace, if necessary.
- Make sure that the order number on the spare element corresponds to the order number of the filter name-plate.
- Remove filter element from plastic bag and reassemble in reverse order (items 1 to 4).
- Contaminated Mic elements can be reduced to ashes. Sm-x filter elements must be disposed in another way.

10.5 Replacement of air breather filter element (plastic filter head only)

- Push slightly on the lid and air breather element downwards (lid A).
- Remove lid and element from the lower hook.
- Pull out element from the lid.
- Install new element in the lid.
- Installation in reverse order.
- Check correct position of the lid.

Note: Filter element and air breather element should be always replaced at the same time.

Subject to technical alteration without prior notice.



11. Spare parts list

Order numbers for spare parts	
Type	Order number
Seal kit NBR	
Pi 530.../1	78309072
Pi 530.../2	78209062
Pressure gauge	79358326
Pressure switch	
normally closed	77870587
normally open	77863814
Breather element for Pi 530.../1 (batch size 3 pcs.)	78206831

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www.mahle-industriefiltration.com
70329496.10/2008

LOW PRESSURE FILTERS

Low Pressure Filter

Pi 150

Nominal pressure 10/25 bar (140/360 psi), nominal size up to 630

1. Features

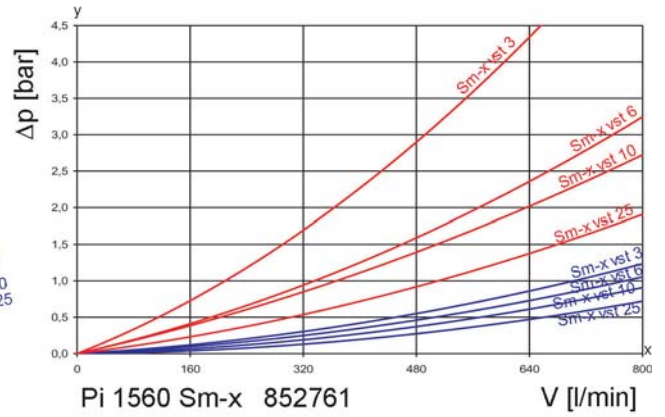
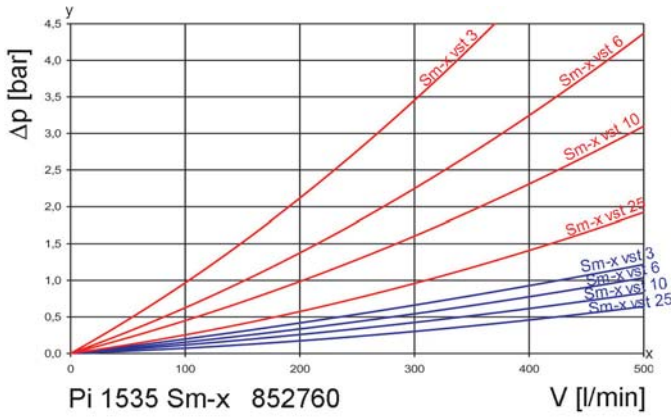
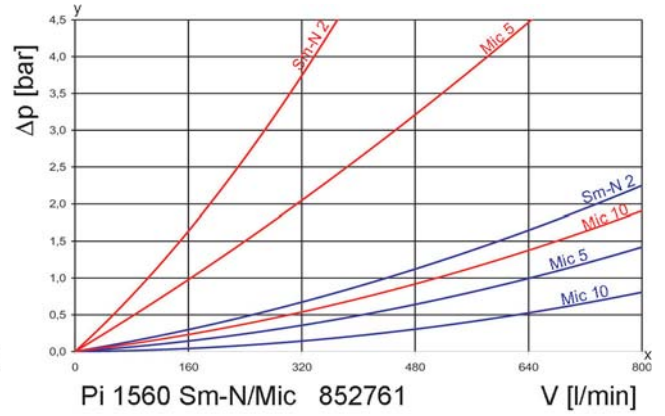
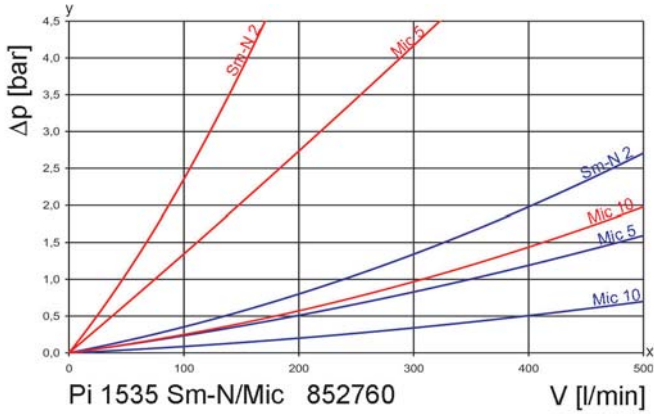
High performance filters for modern hydraulic systems

- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution



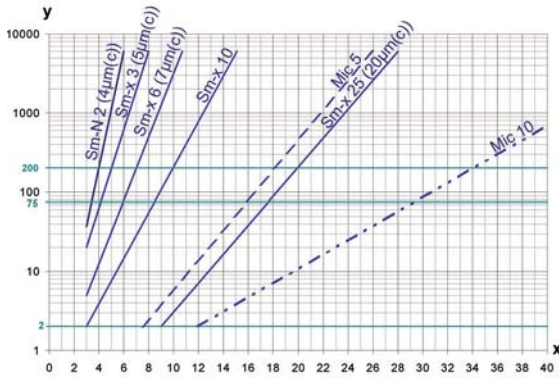
2. Flow rate/pressure drop curve complete filter

■ 190 mm²/s
■ 33 mm²/s



y = differential pressure Δp [bar]
 x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particle size [µm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

measured according to ISO 16889 (multipass test)

Sm-x elements with max. Δp 10 bar
Sm-N 2 elements with max. Δp 5 bar

Sm-N	2	$\beta_{4(C)}$	≥ 200
Sm-x	3	$\beta_{5(C)}$	≥ 200
Sm-x	6	$\beta_{7(C)}$	≥ 200
Sm-x	10	$\beta_{10(C)}$	≥ 200
Sm-x	25	$\beta_{20(C)}$	≥ 200

values guaranteed up to 10 bar differential pressure, Sm-N 2 elements up to 5 bar differential pressure

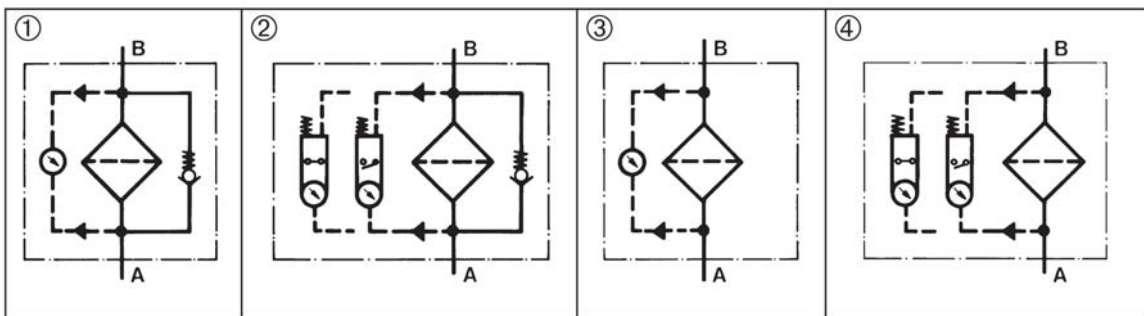
The filter element Sm-N 2 is an element with a very large dirt holding capacity, especially for bypass filtration.

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 3723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3724	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power filters; evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters; multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Housing design	2. Filter element
V = 400 l/min, bypass, electrical indication, nominal pressure 10 bar Type: Pi 1535 / 10-058 Order number: 77774631	Sm-x 10 Type: 852 760 Sm-x 10 Order number: 77774425

7.1 Housing design

Nominal size NG [l/min]	Order number	Type	Nominal pressure [bar]	①	②	③	④
				with bypass valve and visual indicator	with bypass valve and electrical indicator	with visual indicator	with electrical indicator
400	77774649	Pi 1535 / 10-057	10				
	77774631	Pi 1535 / 10-058					
	77804909	Pi 1535 / 10-068					
	77804917	Pi 1535 / 10-069					
	77955982	Pi 1535 / 25-057	25				
	77907892	Pi 1535 / 25-058					
630	77774623	Pi 1560 / 10-057	10				
	77774615	Pi 1560 / 10-058					
	77804941	Pi 1560 / 10-068					
	77804958	Pi 1560 / 10-069					
	77955990	Pi 1560 / 25-057	25				
	77970718	Pi 1560 / 25-058					

When filter with non bypass configuration is selected the collapse pressure of the element must not be exceeded.

7.2 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter media	max. Δp [bar]	Filter surface [cm ²]	
400	77774458	852 760Mic 5	Mic 5	5	23800	
	77774441	852 760 Mic 10	Mic 10		23800	
	77955859	852 760 Sm-N 2	Sm-N 2		16000	
	400	77774433	852 760 Sm-x 3	Sm-x 3	10	14500
		78299042	852 760 Sm-x 6	Sm-x 6		14500
		77774425	852 760 Sm-x 10	Sm-x 10		14500
		77806565	852 760 Sm-x 25	Sm-x 25		14500
630	77774417	852 761 Mic 5	Mic 5	5	47600	
	77774409	852 761 Mic 10	Mic 10		47600	
	78375867	852 761 Sm-N 2	Sm-N 2		32000	
	630	77774391	852 761 Sm-x 3	Sm-x 3	10	29000
		78225898	852 761 Sm-x 6	Sm-x 6		29000
		77774383	852 761 Sm-x 10	Sm-x 10		29000
		77806573	852 761 Sm-x 25	Sm-x 25		29000

* a wider range of element types is available on request.

8. Technical specifications

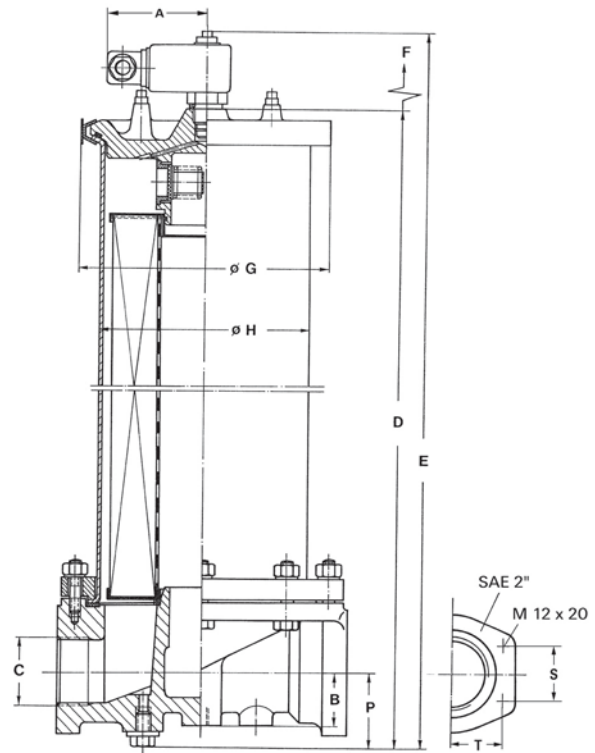
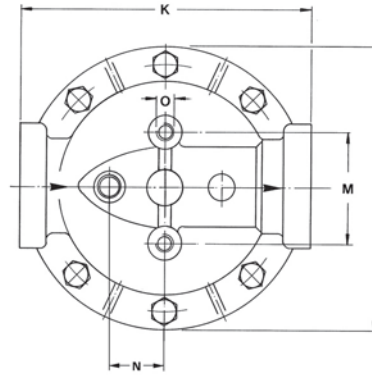
Nominal pressure:	10/25 bar (140/360 psi)
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Bypass setting:	Δp 3.5 bar \pm 10 %
Material filter head/cover:	GAL
Material filter housing:	St
Sealing material:	NBR
Maintenance indicator setting:	Δp 2.2 bar \pm 10 %
Electrical data of maintenance indicator:	
Max. voltage:	250 V AC/200 V DC
Max. current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M20x1.5

The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values and do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Housings with nominal pressure 10 bar (140 psi) are fitted standard with air bleeder valve, housings with nominal pressure 25 bar (360 psi) with a venting screw.



Subject to technical alteration without prior notice.

9. Dimensions

All dimensions except "C" in mm.

Type	A	B	C	D	E	F	G	H	I	K	M	N	O	P	R	S	T	Weight [kg]
Pi 1535	78	42	G1½	607	643	425	190	164	225	230	90	44	M12x20	59	45	-	-	17,1
Pi 1560	78	42	SAE 2"	1035	1068	850	190	164	225	230	90	44	M12x20	59	45	42,9	77,8	27,1

NPT- and SAE connections on request.

* Standard pressure series hole pattern 3000 PSI

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove filter element and filter housing.

10.2 Connecting the electrical maintenance indicator

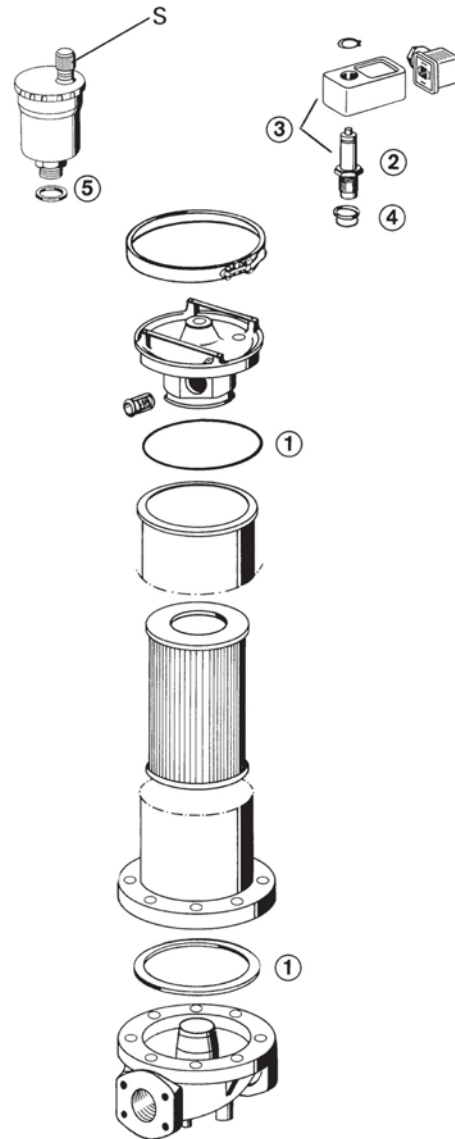
The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

10.3 When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
- Filters without maintenance indicator:
The filter element should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
- Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (Sm-x, Sm-N, Mic) cannot be cleaned.

10.4 Element replacement

- Stop system and relieve filter from pressure.
- Loosen quick-action clamp, remove cover, and open drain valve. Housing completely vented.
- Remove filter element from the filter housing.
- Check seal for damages, replace if necessary.
- Make sure that the order number on the spare element corresponds to the order number of the filter name-plate. Remove the plastic bag and push element over the spigot in the filter head.
- Close drain valve, relocate cover, and close the quick-action clamp. Filters are automatically vented via the air bleeder valve (10 bar version), the protection cap S has to be turned 2 times for being open.



11. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
①	Seal kit	
	NBR	77831407
	FPM	77831415
	EPDM	77831423
② + ③	Maintenance indicator	
	Visual PiS 3098/2.2	77669971
	Electrical PiS 3097/2.2	77669948
	Electrical upper part only	77536550
④	Seal kit for maintenance indicator PiS 3098/2.2 + PiS 3097/2.2	
	NBR	77760309
	FPM	77760317
	EPDM	77760325
⑤	Air bleeder valve	76396428

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78356305.07/2008

Low Pressure Filter

Pi 1500

Nominal pressure 10/25 bar (140/360 psi), nominal size up to 600
Filter elements according to DIN 24550

1. Features

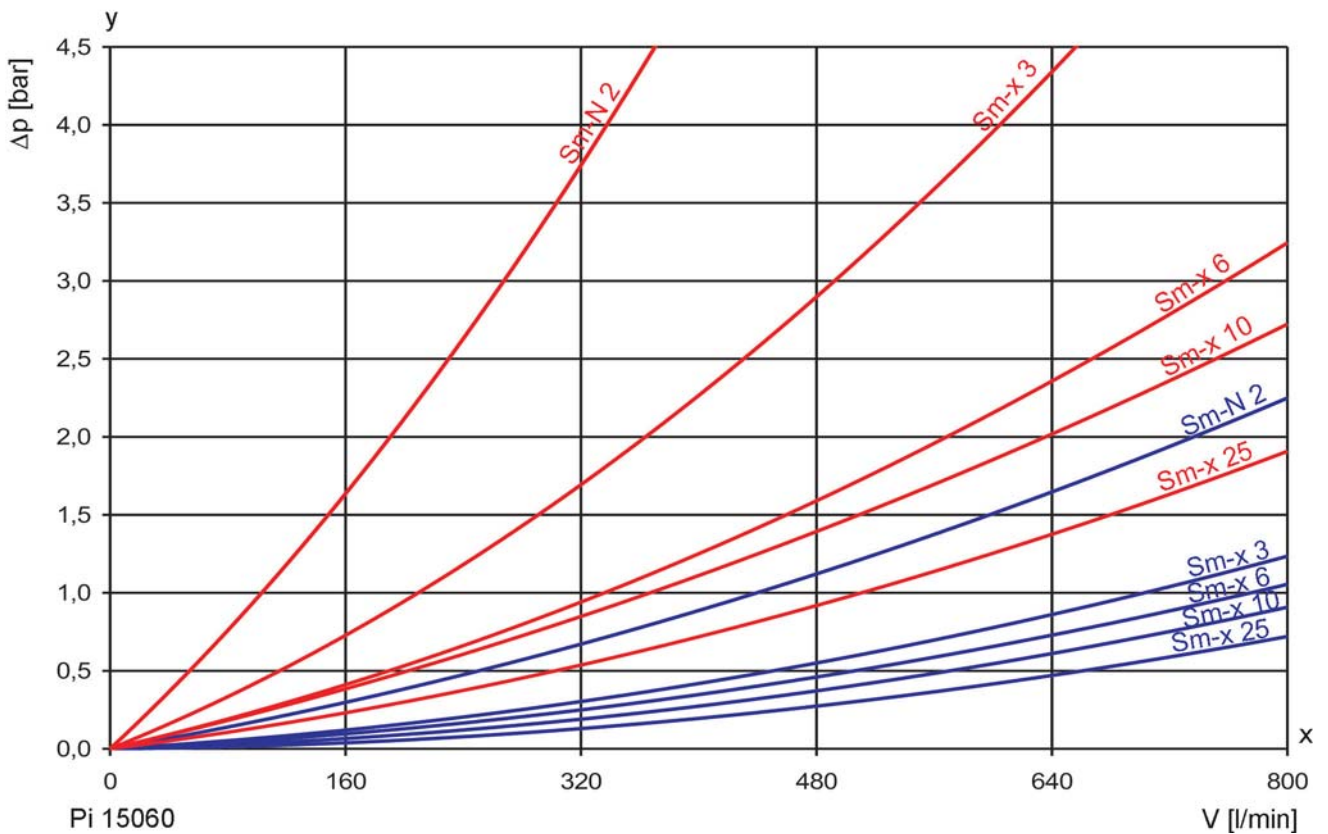
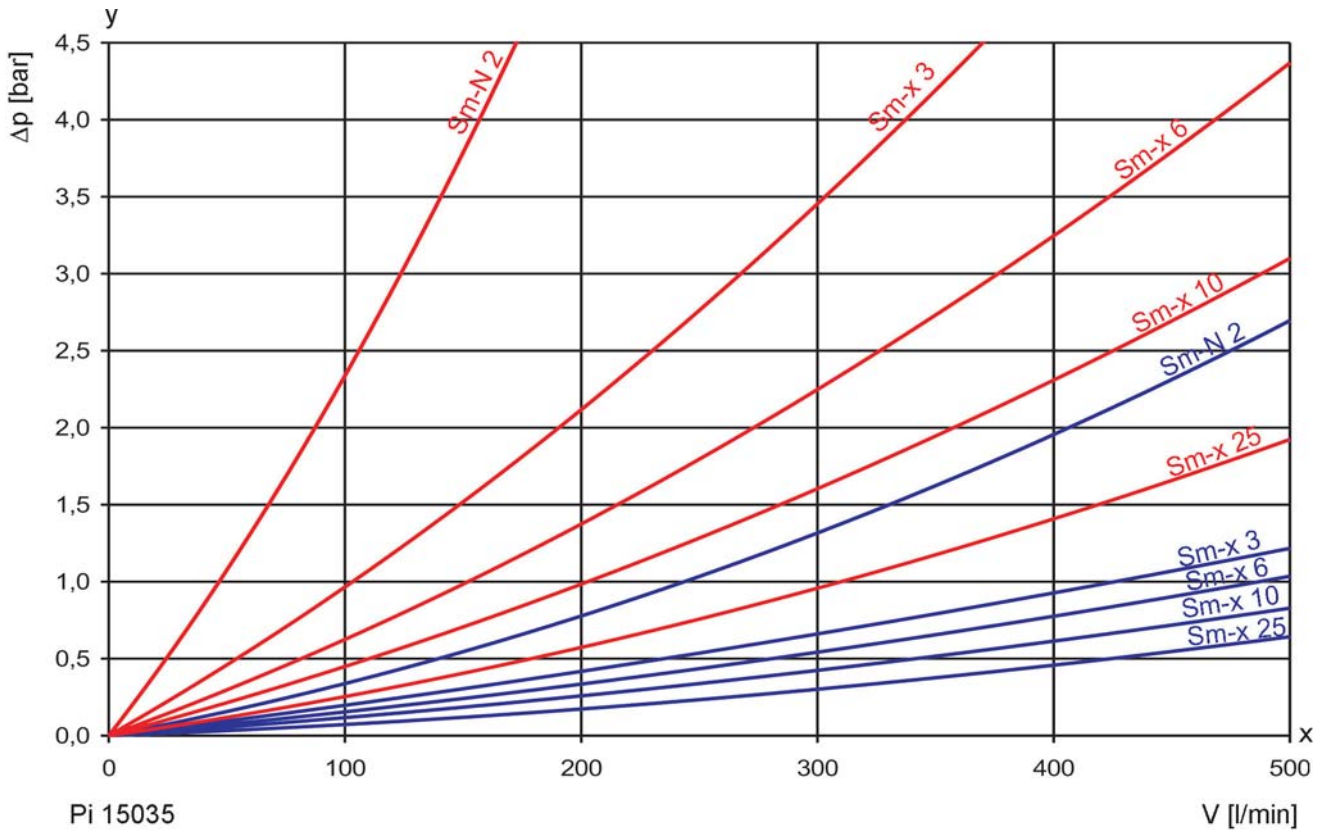
High performance filters for modern hydraulic systems

- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution



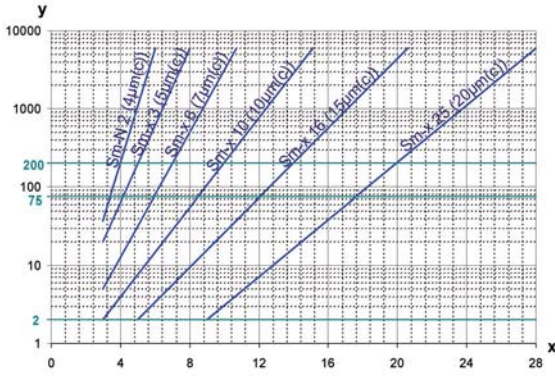
2. Flow rate/pressure drop curve complete filter

■ 190 mm²/s
■ 33 mm²/s



y = differential pressure Δp [bar]
 x = flow rate V [l/min]

3. Separation characteristics



y = beta-value
x = particle size [μm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x-/Sm-N 2 elements with
max. Δp 10 bar

Sm-N	2	$\beta_{4(C)} \geq 200$
Sm-x	3	$\beta_{5(C)} \geq 200$
Sm-x	6	$\beta_{7(C)} \geq 200$
Sm-x	10	$\beta_{10(C)} \geq 200$
Sm-x	16	$\beta_{15(C)} \geq 200$
Sm-x	25	$\beta_{20(C)} \geq 200$

Values guaranteed up to 10 bar differential pressure.

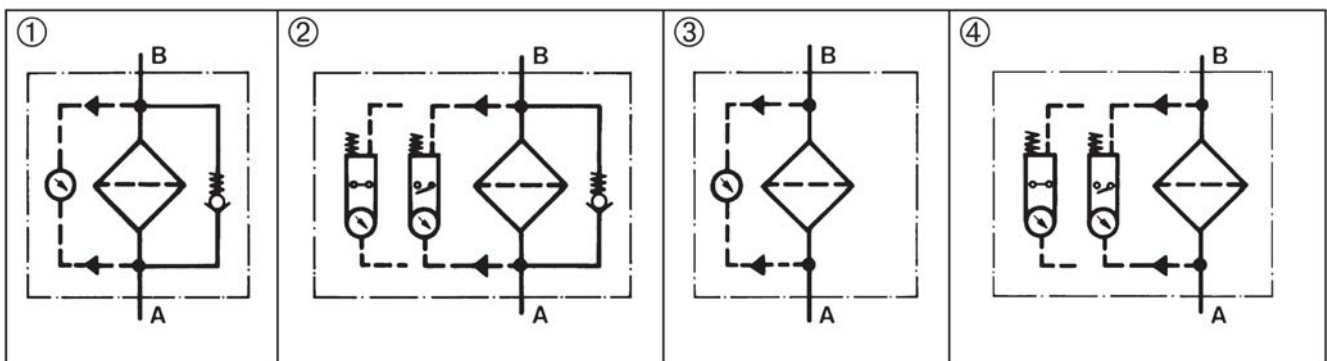
The filter element Sm-N 2 is an element with a very large dirt holding capacity, especially for bypass filtration.

5. Quality assurance

MAHLE filters and filter elements are manufactured respectively, tested in accordance with the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 2923	Hydraulic fluid power filter elements; method for end load test
DIN ISO 2924	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power-filters-evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters-multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Filter housing	2. Filterelement
V = 350 L/min, bypass, electrical maintenance indicator, Nominal pressure: 10 bar Type: Pi 15035/10-058 Order number: 76101778	Sm-x 10 Type: Pi 23063 RN Sm-x 10 Order number: 77924202

7.1 Housing design

Nominal size NG [l/min]	Order number	Type	Nominal pressure [bar]	①	②	③	④
				with bypass valve and visual indicator	with bypass valve and electrical indicator	with visual indicator	with electrical indicator
350	76101760	Pi 15035/10-057	10				
	76101778	Pi 15035/10-058					
	76101786	Pi 15035/10-068					
	76101794	Pi 15035/10-069					
	76101851	Pi 15035/25-057	25				
	76101869	Pi 15035/25-058					
600	76101802	Pi 15060/10-057	10				
	76101810	Pi 15060/10-058					
	76101828	Pi 15060/10-068					
	76126353	Pi 15060/10-069					
	76101877	Pi 15060/25-057	25				
	76101885	Pi 15060/25-058					

When filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

7.2 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter material	Number	max. Δp [bar]	Filter surface [cm ²]
350	76112650	Pi 2S063 RN SM-N 2	Sm-N 2	1	10	8850
	77924194	Pi 21063 RN SM-x 3	Sm-x 3	1		13515
	77964091	Pi 22063 RN SM-x 6	Sm-x 6	1		13515
	77924202	Pi 23063 RN SM-x 10	Sm-x 10	1		13515
	77963671	Pi 24063 RN SM-x 16	Sm-x 16	1		13515
	77960263	Pi 25063 RN SM-x 25	Sm-x 25	1		13515
600	76112650	Pi 2S063 RN SM-N 2	Sm-N 2	2	10	2 x 8850
	77924194	Pi 21063 RN SM-x 3	Sm-x 3	2		2 x 13515
	77964091	Pi 22063 RN SM-x 6	Sm-x 6	2		2 x 13515
	77924202	Pi 23063 RN SM-x 10	Sm-x 10	2		2 x 13515
	77963671	Pi 24063 RN SM-x 16	Sm-x 16	2		2 x 13515
	77960263	Pi 25063 RN SM-x 25	Sm-x 25	2		2 x 13515

*a wider range of element types is available on request

8. Technical specifications

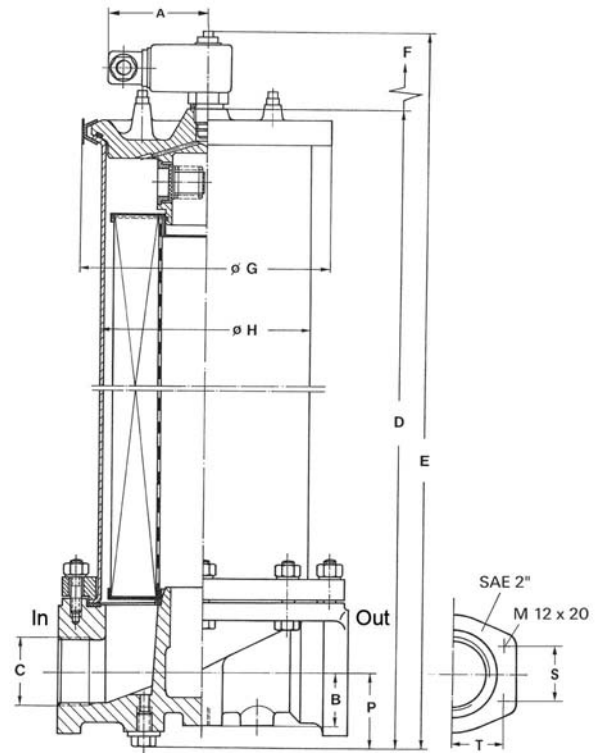
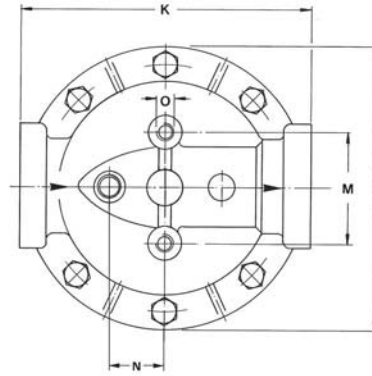
Nominal pressure:	10/25 bar (140/360 psi)
Temperature range:	- 10 °C to + 120 °C (other temperature ranges on request)
Bypass setting:	Δp 3.5 bar \pm 10 %
Filter head material:	GAL
Filter housing material:	St
Sealing material:	NBR
Maintenance indicator setting:	Δp 2.2 bar \pm 10 %
Electrical data of maintenance indicator:	
Maximum voltage:	250 V AC/200 V DC
Maximum current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M20x1.5

The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicators details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Housing with nominal pressure 10 bar are fitted standard with an air bleeder valve.



Subject to technical alteration without prior notice.

9. Dimensions

All dimensions except "C" in mm.

Type	A	B	C	D	E	F	G	H	I	K	M	N	O	P	R	S	T	Weight [kg]
Pi 15035	78	42	G1½	607	643	425	190	164	225	230	90	44	M12x20	59	45	-	-	17,1
Pi 15060	78	42	SAE 2"	1035	1068	850	190	164	225	230	90	44	M12x20	59	45	42,9	77,8	27,1

NPT- and SAE-connections on request.

* Standard pressure series hole pattern 3000 PSI

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing filter make sure that sufficient space is available to remove filter element and filter housing.

10.2 Connecting the electrical maintenance indicator

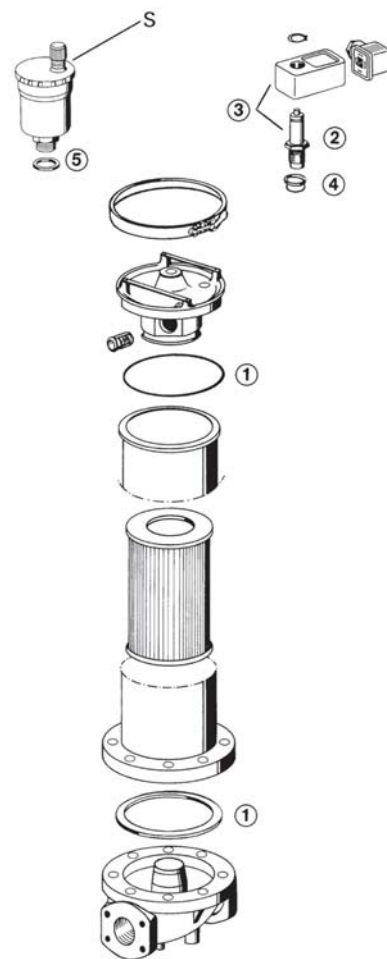
The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electric upper section can be inverted to change from normally open position to normally closed position or vice versa.

10.3 When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
- Filters without maintenance indicator:
The filter element should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
- Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (Sm-x, Sm-N) cannot be cleaned.

10.4 Element replacement

- Stop system and relieve filter from pressure.
- Loosen quick-action clamp, remove cover, and open drain valve. Housing completely vented.
- Remove filter element from filter housing. Remove spacer sleeve at Pi 15060. After proper cleaning please use again.
- Check seals for damage. Replace, if necessary.
- Make sure that the part number on the spare element corresponds with the part number on the filter label. It is necessary to replace always both elements of Pi 15060. Remove the plastic bag and push element over the spigot in the filter head. Attach sleeve on Pi 15060 and fit second element.
- Close drain valve, relocate cover, and close the quick-action clamp. Filters are automatically vented via the air bleeder valve, the protection cap has to be turned 2 times for being open.



11. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
①	Seal kit	
	NBR	77831407
	FPM	77831415
	EPDM	77831423
② + ③	Maintenance indicator	
	Visual PiS 3098/2.2	77669971
	Electrical PiS 3097/2.2	77669948
	Electrical upper section only	77536550
④	Seal kit for differential pressure indicator PiS 3098/2.2 + PiS 3097/2.2	
	NBR	77760309
	FPM	77760317
	EPDM	77760325
⑤	Air bleeder valve	76396428
	Adapter for filter elements (Pi 15060)	76102073

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797845123.06/2008

Line filter
Pi 1907

Nominal pressure 16 bar (230 psi), nominal size 400 up to 6000

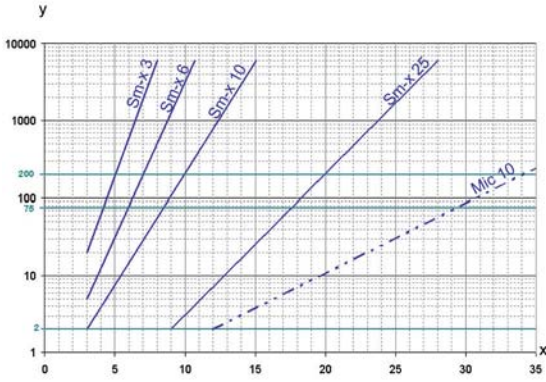
1. Features

High performance filters for modern hydraulic systems

- Provided for pipe installation
- Modular design
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Flanged connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution



2. Separation grade characteristics



y = beta-value

x = particle size [μm]

determined by multipass tests (ISO 16889)

calibration according to ISO 11171 (NIST)

3. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x elements with max. Δp 10 bar

Sm-x	3	$\beta_{5(C)}$	\geq	200
Sm-x	6	$\beta_{7(C)}$	\geq	200
Sm-x	10	$\beta_{10(C)}$	\geq	200
Sm-x	25	$\beta_{20(C)}$	\geq	200

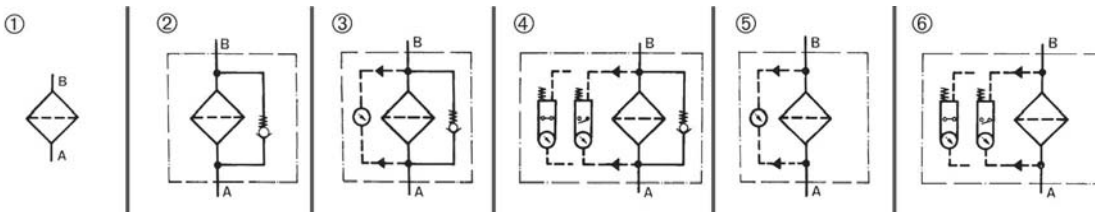
values guaranteed at 5 bar differential pressure

4. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 3723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3724	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power-filters-evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters; multipass method for evaluation filtration performance of a filter element

5. Symbols



6. Types (Example for ordering filters)

Pi 1907	3	16	150	V	E	Mg	Abh	852888 Sm-x 10
1	2	3	4	5	6	7	8	9

1 Filter type	
2 Number of elements	(up to DN 125, 1; DIN 150 and 200 3 ea.)
3 Nominal pressure	
4 Connection size	
5 Bypass valve	
6 Maintenance indicator	E = electrical, M = visual
7 Magnets	(available for flange size DN 100 up to DN 200)
8 Cover lifting device	(available for flange size DN 150, DN 200)
9 Filter element	

7. Technical specifications

Design:		line mounting filter
Fitting position:		preferable upright
Nominal pressure:		16 bar (NG 150 and 200 also available with operating pressure 10 bar)
Connections:	NG 400 630 800 1250 1800 3500 6000	
	DN 50 65 80 100 125 150 200	
		Flange connections up to DN 200/ PN 16: DIN 2633
		Flange connectinos DN 150 and DN 200/ PN 10: DIN 2632/DIN 2633
Temperature range:		- 10 °C to + 100 °C (other temperature ranges on request)
Filter housing material:		steel welded construction
Sealing material:		NBR (other material on request)
Bypass setting:		Δp 3.5 bar \pm 10 %
Maintenance indicator setting:		Δp 2.2 bar \pm 10 %
Electrical data of maintenance indicator:		
Maximum voltage:		230 V ~/-
Maximum current:		2.5 A
Contact load:		60 VA/40 W
Inrush current:		70 VA
Type of protection:		IP 65 in inserted and secured status
Contact:		normally open/closed
Cable sleeve:		M20x1.5

The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

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We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

8. Filter elements

Filter-material	Degree of filtration [µm]	NG 400/ DN 50	NG 630/ DN 65	NG 800/ DN 80	NG 1250/ DN 100	NG 1800/ DN 125	NG 3500/ DN 150	NG 6000/ DN 200
Sm-x Δ p 10 bar		(9090 cm ²)	(14750 cm ²)	(14750 cm ²)	(21850 cm ²)	(28500 cm ²)	(65550 cm ²)	(85506 cm ²)
	3	Pi 21040 RN	Pi 21063 RN	Pi 21063 RN	852 888 Sm-x 3	852 884 Sm-x 3	852 888 Sm-x 3	852 884 Sm-x 3
	6	Pi 22040 RN	Pi 22063 RN	Pi 22063 RN	852 888 Sm-x 6	852 884 Sm-x 6	852 888 Sm-x 6	852 884 Sm-x 6
	10	Pi 23040 RN	Pi 23063 RN	Pi 23063 RN	852 888 Sm-x 10	852 884 Sm-x 10	852 888 Sm-x 10	852 884 Sm-x 10
	25	Pi 25040 RN	Pi 25063 RN	Pi 25063 RN	852 888 Sm-x 25	852 884 Sm-x 25	852 888 Sm-x 25	852 884 Sm-x 25
Mic Δ p 10 bar		(9450 cm ²)	(15550 cm ²)	(15550 cm ²)	(21850 cm ²)	(28500 cm ²)	(65550 cm ²)	(85500 cm ²)
	10	Pi 13040 RN	Pi 13063 RN	Pi 13063 RN	852 888 Mic 10	852 884 Mic 10	852 888 Mic 10	852 884 Mic 10
Drg Δ p 10 bar		(6370 cm ²)	(10320 cm ²)	(10320 cm ²)	(16500 cm ²)	(23700 cm ²)	(49500 cm ²)	(71100 cm ²)
	25	Pi 35040 RN	Pi 35063 RN	Pi 35063 RN	852 888 Drg 25	852 884 Drg 25	852 888 Drg 25	852 884 Drg 25
	40	Pi 36040 RN	Pi 36063 RN	Pi 36063 RN	852 888 Drg 40	852 884 Drg 40	852 888 Drg 40	852 884 Drg 40
	60	Pi 37040 RN	Pi 37063 RN	Pi 37063 RN	852 888 Drg 60	852 884 Drg 60	852 888 Drg 60	852 884 Drg 60
	100	Pi 38040 RN	Pi 38063 RN	Pi 38063 RN	852 888 Drg 100	852 884 Drg 100	852 888 Drg 100	852 884 Drg 100

() Filter surface area

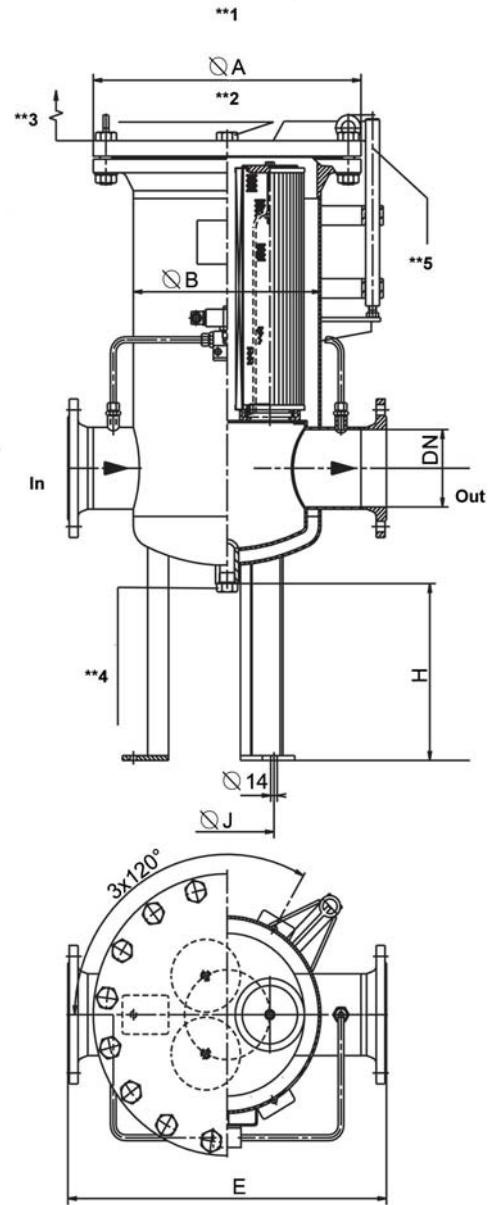
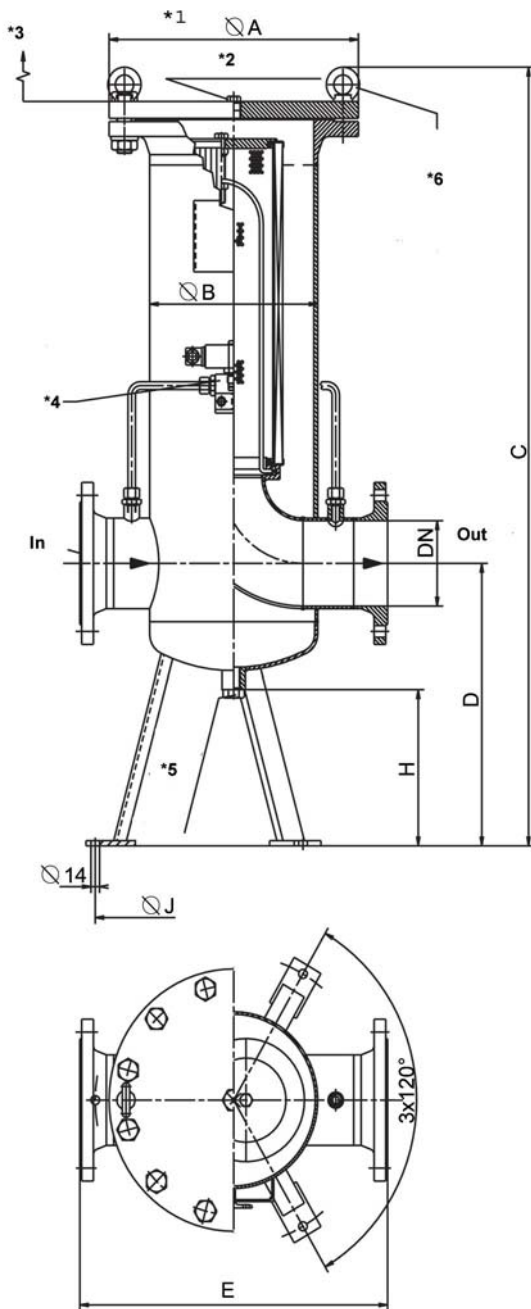
9. Dimensions

All dimensions in mm.

Nominal size NG [l/min]	Connection size DN	Nominal pressure PN [bar]	A	B	C	D	E	G	H	J	K
400	50	16	285	169	890	250	380	G½	110	300	200
630	65		285	169	890	250	380	G½	110	300	350
800	80		285	169	890	250	380	G½	110	300	350
1250	100		340	220	1200	365	450	G½	195	380	450
1800	125		405	273	1200	435	500	G½	240	450	450
3500	150		580	407	1530	600	690	G1	300	440	450
6000	200		715	508	1465	550	740	G1	170	500	450
3500	150	10	565	407	1530	600	690	G1	300	440	450
6000	200		670	508	1465	550	740	G1	170	500	450

NPT- and SAE-connections on request.

9. Dimensions



- *1 illustration shows execution up to flange size DN 125
- *2 vent screw
- *3 "K" height required for element removal
- *4 maintenance indicator visual/electrical
- *5 drain plug "G"
- *6 Lifting eye; available for versions starting with size DN 100

- **1 illustration shows execution up to flange size DN 125
- **2 vent screw
- **3 "K" height required for element removal
- **4 drain plug "G"
- **5 cover lifting device

Subject to technical alteration without prior notice.

10. Commissioning

- Prior to commissioning the filter open the venting screw and wait until liquid emerges. Then tighten the venting screw.
- After that all sealing points must be optically inspected for leaks.
- If the maintenance indicator gives a signal when the operating temperature has been reached, the filter element must be exchanged after the end of the shift.
- For element exchange stop system and relieve filter from pressure. Empty filter over drain plug, remove hex nuts, remove container top, remove hex nut, remove valve plate, remove nut, remove filter element.
- Clean filter housing using a suitable medium.
- Clean contaminated filter elements or replace by new MAHLE filters (only Drg-elements are cleanable).
- Inspect all sealing points and seals and replace by new if required.
- Assembly is performed in reverse order.
- Following commissioning inspect all sealing points for leaks.

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79322728.08/2008

Low Pressure Filter/Suction Filter Pi 1941

Nominal pressure 10/25 bar (140/360 psi), up to nominal size 63

1. Features

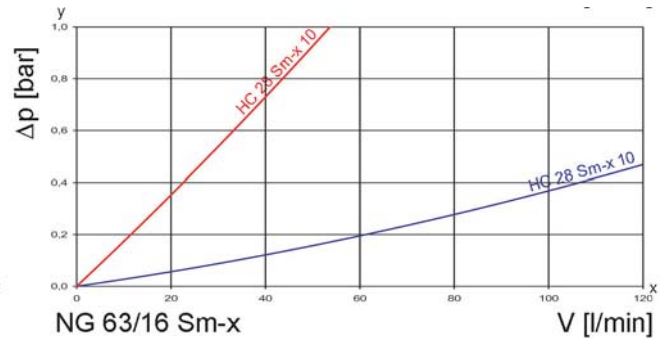
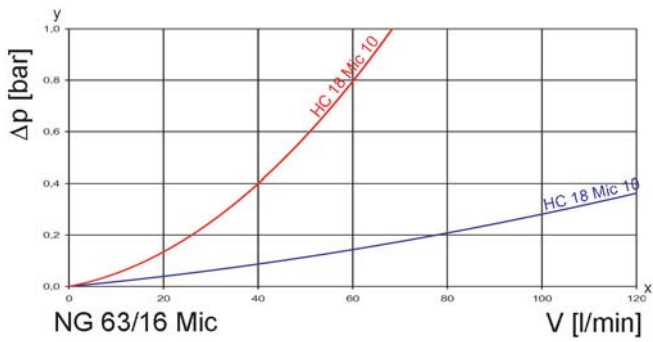
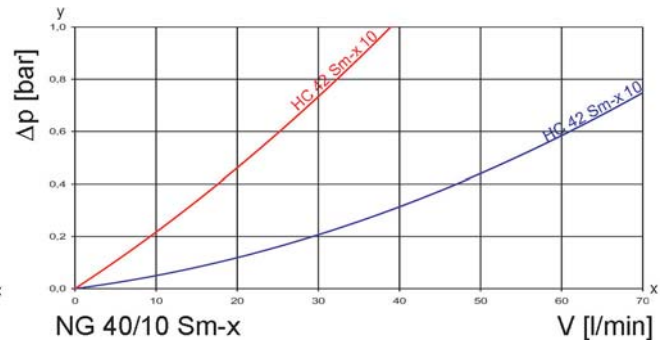
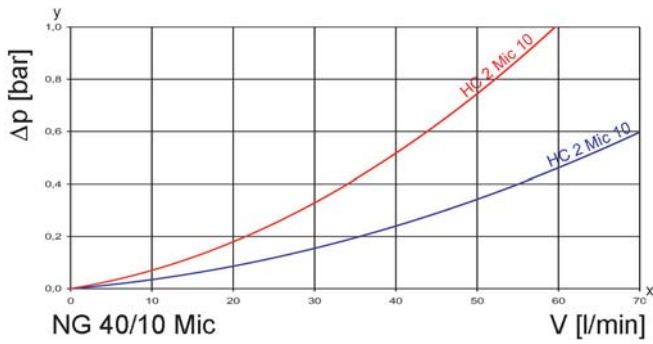
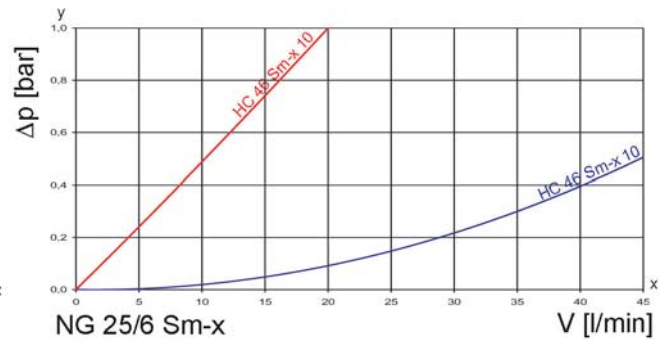
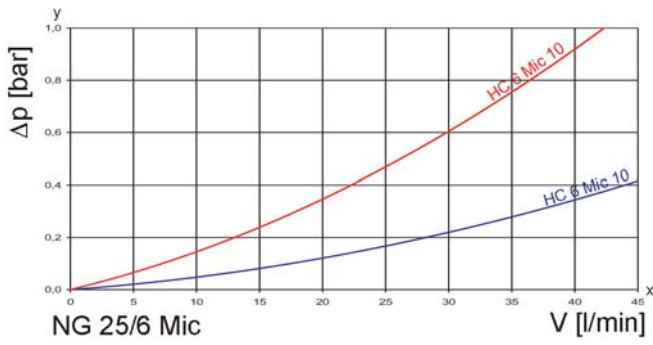
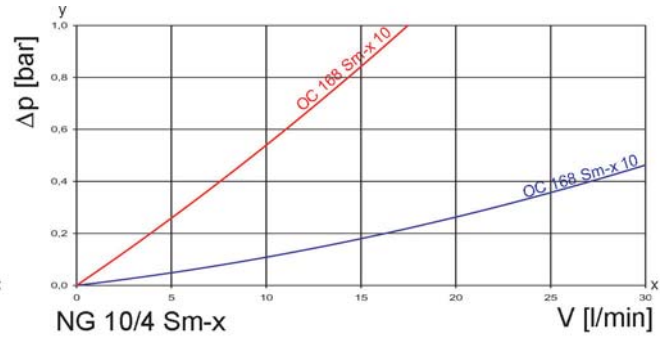
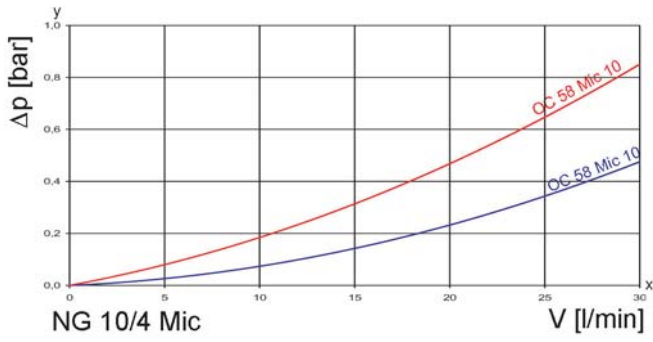
High performance filters for modern hydraulic systems

- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual maintenance indicator
- Threaded connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre Sm-x and Mic filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution



2. Flow rate/pressure drop curve complete filter

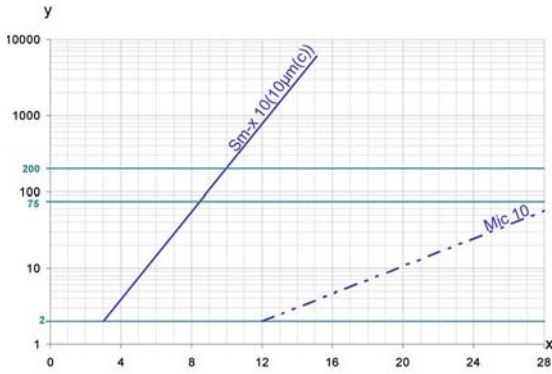
■ 190 mm²/s
■ 33 mm²/s



y = differential pressure Δp [bar]

x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particle size μm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x-Elemente with
max. Δp 5 bar

Sm-x 10 $\beta_{10(C)} \geq 75$

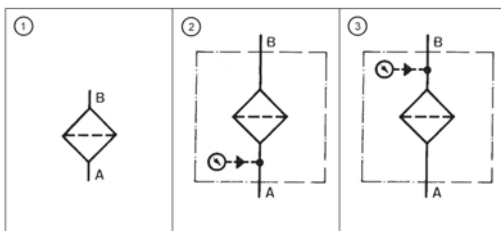
values guaranteed up to
5 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic filter elements: Verification of burst resistance
DIN ISO 2942	Hydraulic filter elements: Determination of fabrication integrity
DIN ISO 2943	Hydraulic filter elements: Verification of material compatibility with hydraulic fluids
DIN ISO 3723	Hydraulic filter elements: Method for testing end-cap load
DIN ISO 3724	Hydraulic filter elements: Verification of flow fatigue characteristics
ISO 3 968.2	Hydraulic filter elements: Evaluation of pressure drop versus flow
ISO 16889	Hydraulic filter elements: Testing of filter performance

6. Symbols



7. Order numbers

Example for ordering filters:

1. Housing design

V= 63 l/min, pressure gauge + spin-on cartridge Mic 10

Type Pi 1941/10/G¾/DM + HC 18

Order number 77807811 + 77643331

7.1 Housing design/order number for pressure-side installation

Nominal flow rate NG [l/min]	Order number	Type	①	②
			no options	with pressure gauge
10	77664360	Pi 1941/10/G¼		
	77812225	Pi 1941/10/G¼/DM		
25	77664386	Pi 1941/10/G3/8		
	77815509	Pi 1941/10/G3/8/DM		
40	77664394	Pi 1941/10/G½		
	77664402	Pi 1941/10/G½/DM		
63	77664378	Pi 1941/10/G¾		
	77807811	Pi 1941/10/G¾/DM		

7.2 Spin-on cartridges

Nominal flow rate NG [l/min] press-/suct. side	Order number	Type	Filter material	max. Δ p [bar]	Filter surface [cm²]
10/4	77785983	OC 58	Mic 10	5	1775
	77500184	OC 168	Sm-x 10		1309
25/6	77501273	HC 6	Mic 10	5	3000
	77501232	HC 46	Sm-x 10		2075
40/10	72013241	HC 2	Mic 10	5	5440
	77501372	HC 42	Sm-x 10		3360
63/16	77643331	HC 18	Mic 10	5	7000
	77643398	HC 28	Sm-x 10		3400

7.3 Housing design/order numbers for suction-side installation

Nominal flow rate NG [l/min]	Order number	Type	①	③
			no options	with vacuum gauge
4	77664360	Pi 1941/10/G¼		
	77894033	Pi 1941/10/G¼/UM		
6	77664386	Pi 1941/10/G3/8		
	77894041	Pi 1941/10/G3/8/UM		
10	77664394	Pi 1941/10/G½		
	77894058	Pi 1941/10/G½/UM		
16	77664378	Pi 1941/10/G¾		
	77658966	Pi 1941/10/G¾/UM		

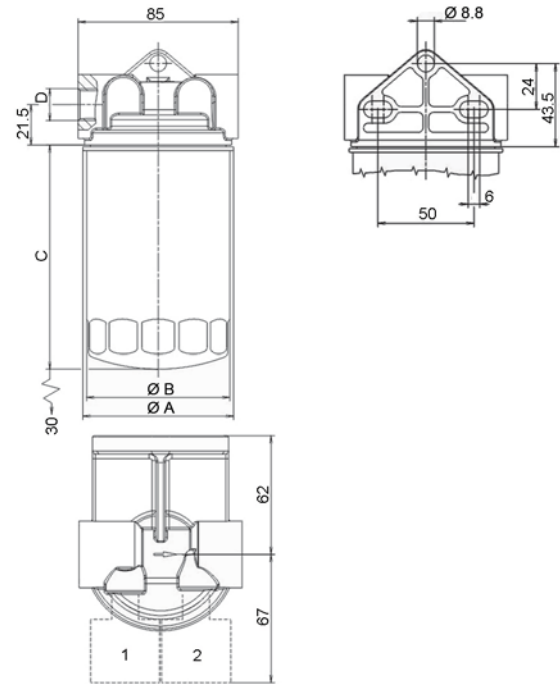
8. Technical specifications

Design:	line mounting filter
Nominal pressure*:	10 bar (140 psi)
Test pressure:	13 bar (180 psi)
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Filter head material:	GDAL
Spin-on cartridge material:	St
Sealing material:	NBR
Installation position:	preferably vertical
Indicating range pressure manometer:	0 to 10 bar
Indicating range vacuum gauge:	-1 to 0 bar

*For the combination of the housing designs as per 7.1 with medium-pressure spin-on cartridges at 25 bar pressure refer to data sheet "spin-on cartridges" for dimensions and specifications.

We draw attention to the fact that all values indicated are average values and do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.



1 = pressure gauge

2 = vacuum gauge

Subject to technical alteration without prior notice.

9. Dimensions

All dimensions except "D" in mm.

Type	Dimension Ø A	Dimension Ø B	Dimension C	Dimension D	Weight [kg] Execution Mic*	Weight [kg] Execution Sm-x*
Pi 1941/10/G¼	80	76	120	G¼	0.67	0.82
Pi 1941/10/G 3/8	80	76	120	G 3/8	0.67	0.82
Pi 1941/10/G½	95	93	141	G½	0.82	1.02
Pi 1941/10/G¾	95	93	210	G¾	1.02	1.02

*Design with manometer + 0.1 kg

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove the spin-on cartridge.

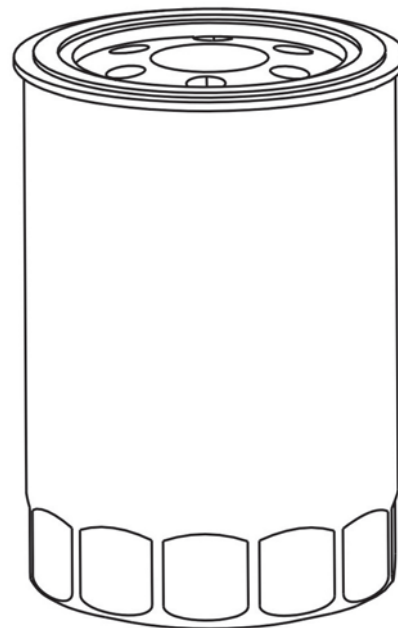
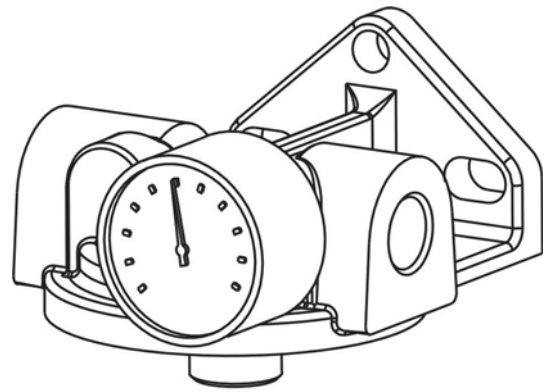
Preferably the filter should be installed with the spin-on cartridge pointing downwards.

10.2 When should the spin-on cartridge be replaced?

1. Filter equipped with the vacuum gauge for suction-side installation: During cold start the vacuum gauge may for a short period indicate > 0.2 bar. With increasing operating temperature the indicator needle must drop clearly below the 0.2 bar mark. Should this not be the case, the spin-on cartridge must be replaced after the end of the shift.
2. Filters without maintenance indicator: The spin-on cartridge should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
3. Please always ensure that you have original MAHLE spare cartridges in stock.

10.3 Change of spin-on cartridge

1. Stop system and relieve filter from pressure.
2. Unscrew the spin-on cartridge with the aid of a belt spanner by turning same to the left.
3. Make sure that the order number on the new spin-on cartridge corresponds to the order number of the name-plate.
4. The seal of the spin-on cartridge should be lightly oiled.
5. Screw cartridge on in accordance with the printed-on instructions.



11. Spare parts list

Position	Type	Order number
①	Pressure gauge (not shown)	77870611
②	Vacuum gauge	77617558

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78357337.07/2008

Low Pressure Filter

Pi 1975

Nominal pressure 6 bar (90 psi), nominal size 50

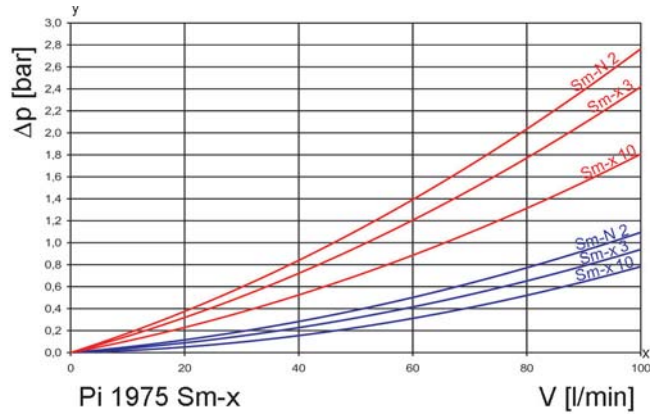
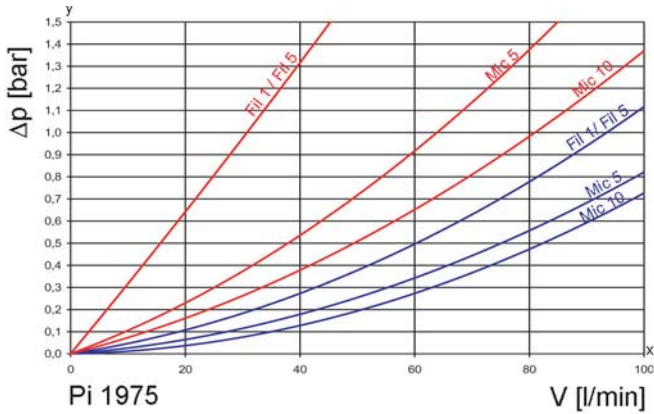
1. Features

High performance filters for modern hydraulic systems

- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution

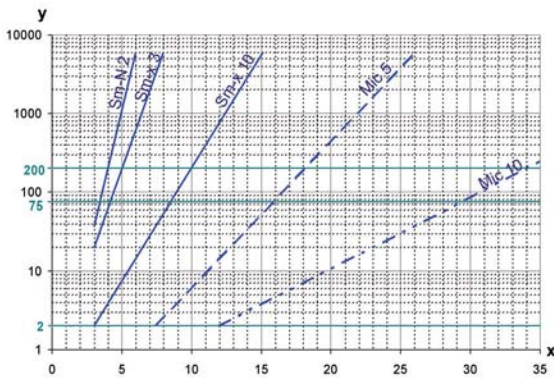


2. Flow rate/pressure drop curve complete filter



y = differential pressure Δp [bar]
x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particle size [μm]
determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x-/Sm-N 2 elements with
max. Δp 5 bar

Sm-N	2	$\beta_{4(C)} \geq 200$
Sm-x	3	$\beta_{5(C)} \geq 200$
Sm-x	10	$\beta_{10(C)} \geq 200$

Values guaranteed up to 5 bar differential pressure, Sm-N 2 elements up to 5 bar differential pressure.

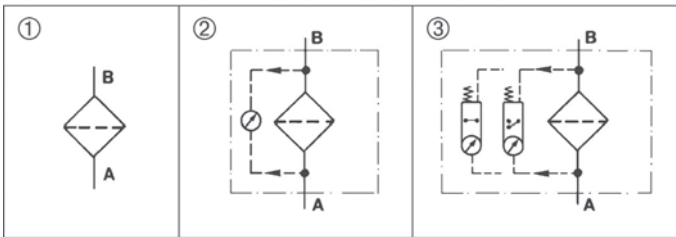
The filter element Sm-N 2 is an element with a very large dirt holding capacity, especially for bypass filtration.

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter element; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter element, verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter element, verification of material compatibility with fluids
DIN ISO 2923	Hydraulic fluid power filter element, method for end load test
DIN ISO 2924	Hydraulic fluid power filter element, verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power filters; evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters; multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Housing design	2. Filter elements
with electrical indicator Type: Pi 1975-E Order number: 77664980	Sm-x 10 Type: 852 275 Sm-x 10 Order number: 77725583

7.1 Housing design

Nominal size NG [l/min]	Order number	Type	① with indicator	② with visual indicator	③ with electrical indicator
50	77664956	Pi 1975			
	77664964	Pi 1975-M			
	77664980	Pi 1975-E			

The collapse pressure of the element must not be exceeded.

7.2 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
50	77698814	852 275 Mic 5	Mic 5	5	27000
	77675903	852 275 Mic 10	Mic 10		27000
	77678121	852 275 FIL 1	FIL 1	1.4	-
	77678113	852 275 FIL 5	FIL 5		-
	79309303	852 275 Sm-N 2	Sm-N 2	5	13150
	77956220	852 275 Sm-x 3	Sm-x 3		15500
	77725583	852 275 Sm-x 10	Sm-x 10		15500

* a wider range of element types is available on request

8. Technical specifications

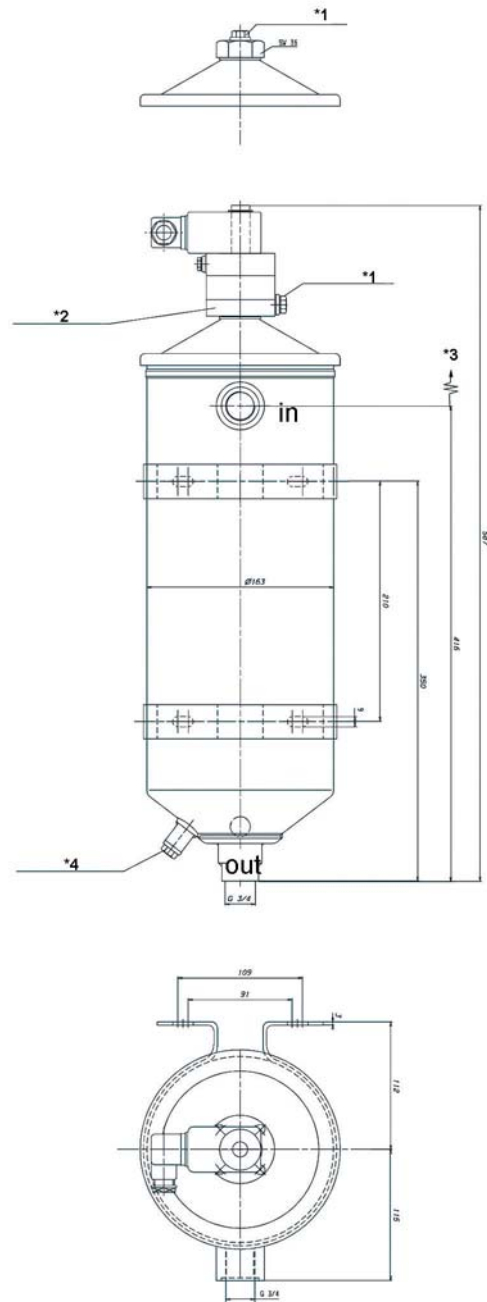
Design:	in-line filter
Nominal pressure:	6 bar (90 psi)
Test pressure:	8 bar (110 psi)
Temperature range:	- 10 °C to + 120 °C (other temperature ranges on request)
Filter head material:	St
Sealing material:	NBR/Cu
Maintenance indicator setting:	Δp 1.2 bar \pm 0.2 bar
Electrical data of maintenance indicator:	
Maximum voltage:	250 V AC/200 V DC
Maximum current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M20x1.5

The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.



Design without indicator- weight 8 kg

- *1 vent screw G $\frac{1}{4}$
- *2 SW 36/for maintenance
- *3 heigh required for element removal 400
- *4 drain plug G $\frac{1}{4}$ 90° ill. turned by 90 °
- in = inlet
- out = outlet

9. Installation, operating and maintenance instructions

9.1 Filter installation

When installing filter make sure that sufficient space is available to remove filter element and filter housing. Preferably the filter should be installed with the filter housing pointing downwards. The maintenance indicator must be visible.

9.2 Connecting the electrical maintenance indicator

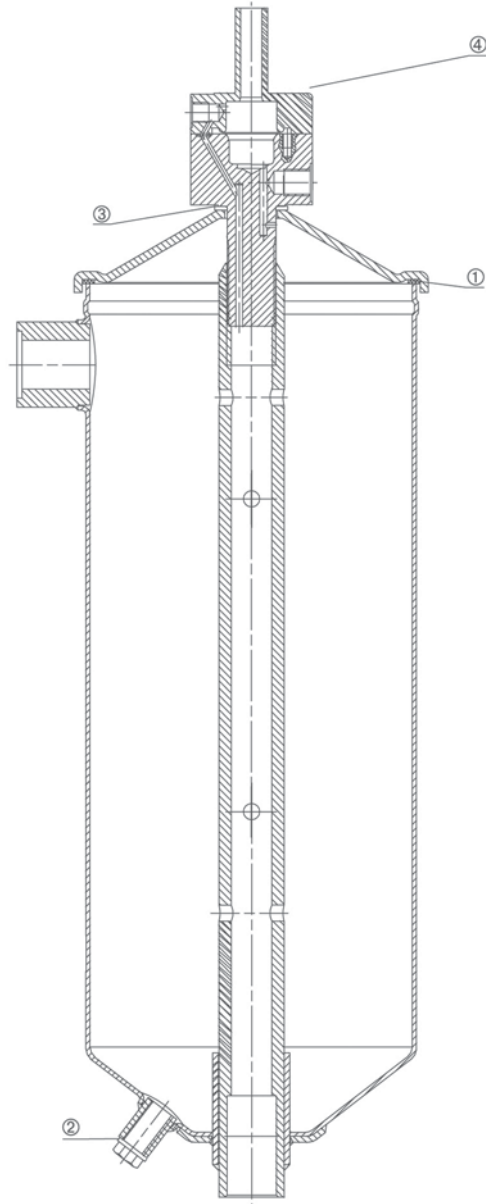
The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open to normally closed position or vice versa.

9.3 When should the filter be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
- Filters without maintenance indicator:
The filter element should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
- Please always make sure that you have original MAHLE spare elements in stock: Disposable elements (Mic, FIL, Sm-N or Sm-x) cannot be cleaned.

9.4 Element replacement

- Stop system and relieve filter from pressure.
- Remove cover screw, then lift off cover. On executions with indicator please unscrew maintenance indicator.
- Remove filter element.
- Check seals for damage. Replace if necessary.
- Make sure that the order number on the spare element corresponds to the order number of the filter name-plate. Remove plastic bag and push element over the spigot in the filter housing.
- Close drain screw, relocate cover and close it with cover screws and/or the indicator. Filters are automatically vented via the air bleeder valve. (Back off the screw 1-2 turns till medium escapes. Tight vent screw).



9. Spare parts list

Order number for spare parts		
Position	Type	Order number
① - ③	Seal kit for housing	
	NBR	77898836
④	Maintenance indicator	
	Visual PiS 3112/1.2	78287690
	Electrical PiS 3113/1.2	78287708
	Electrical upper section only	77536550
	Seal kit for maintenance indicator	
	NBR	78389280

MAHLE

Industrial Filtration

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www.mahle-industriefiltration.com
78357378.07/2008

Low Pressure Filter Pi 200

Nominal pressure 25/63 bar (360/910 psi), nominal size up to 450

1. Features

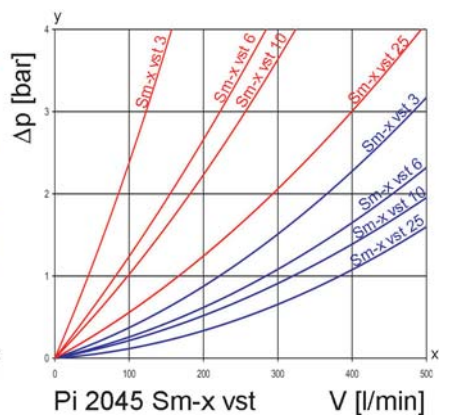
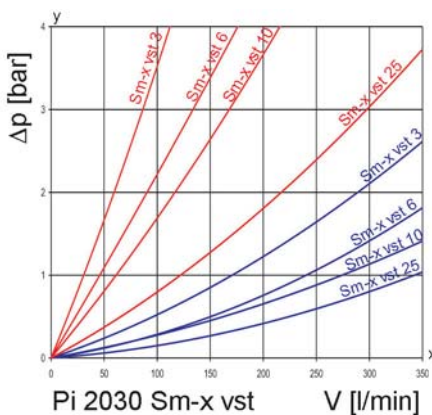
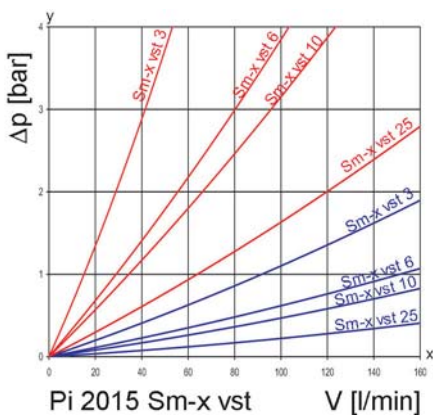
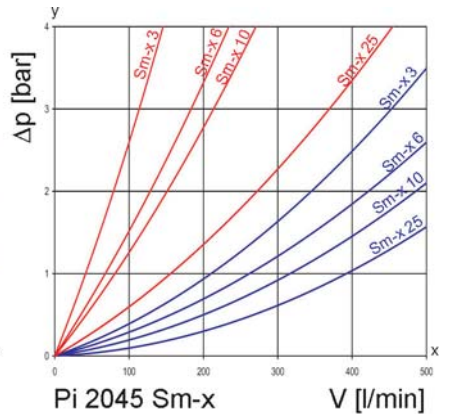
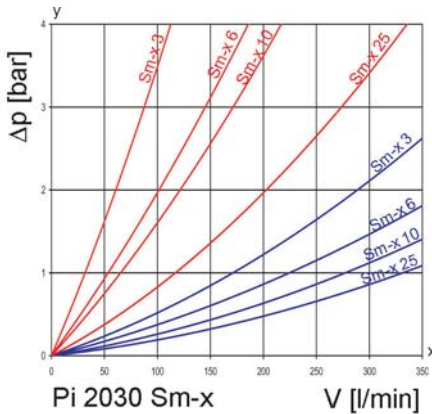
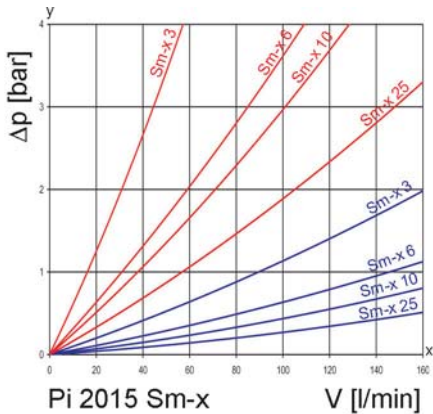
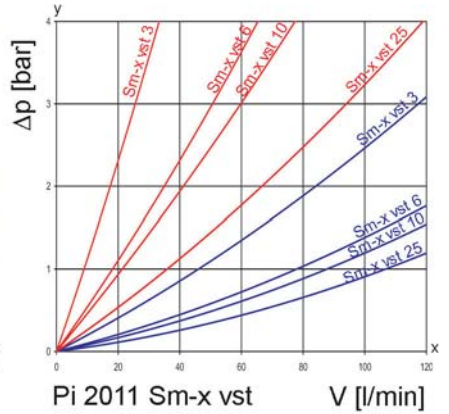
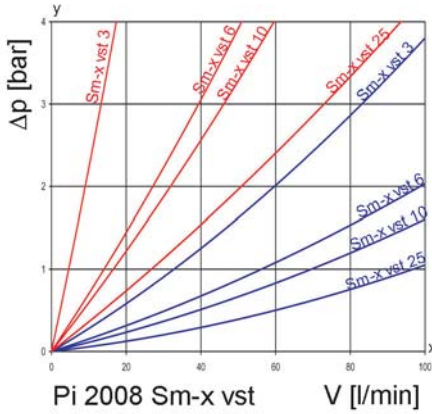
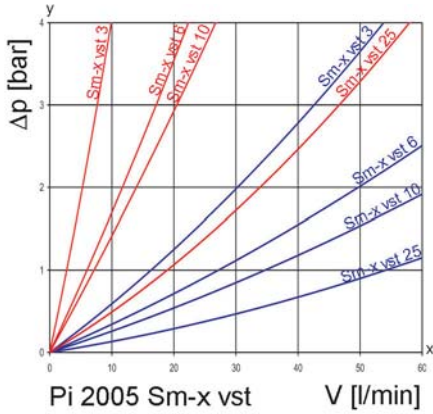
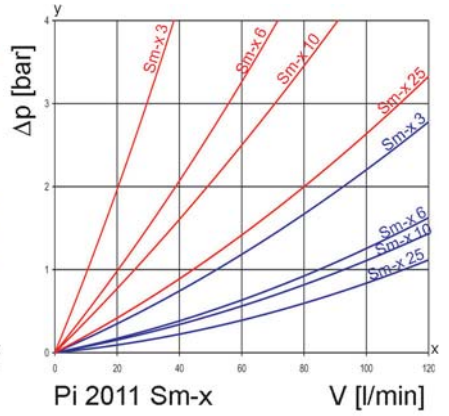
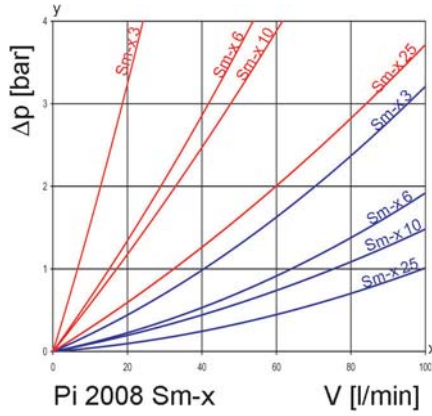
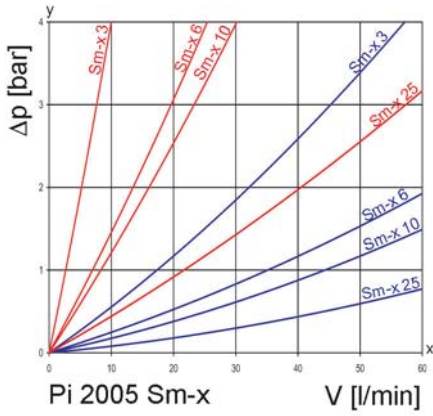
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- Elements with high differential pressure stability and dirt holding capacity
- NPT- and SAE-connections on request
- Worldwide distribution



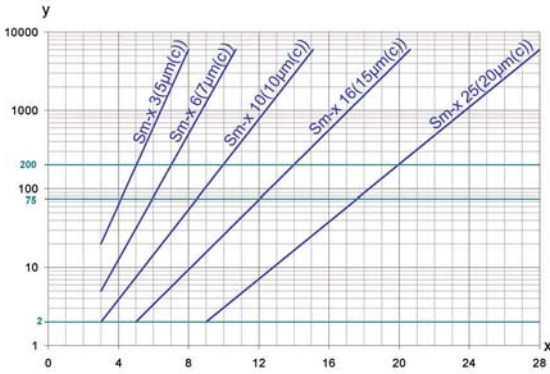
2. Flow rate/pressure drop curve complete filter

190 mm²/s
33 mm²/s



y = differential pressure Δp [bar]
x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particle size [μm]

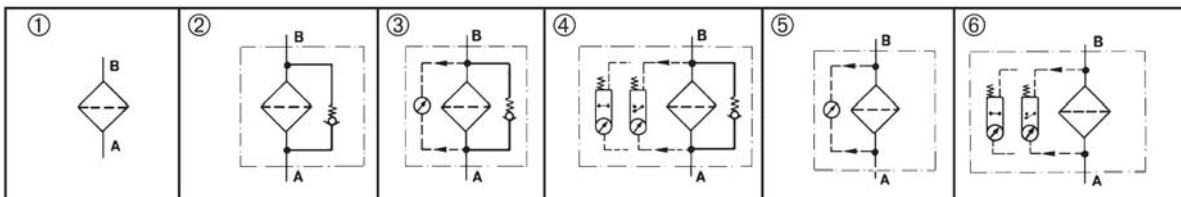
determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

5. Quality assurance

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ISO 3968	Hydraulic fluid power filters; evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters; multipass method for evaluation filtration performance of a filter element

6. Symbols



4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x elements with
max. Δp 20 bar

Sm-x	3	$\beta_{5(C)} \geq 200$
Sm-x	6	$\beta_{7(C)} \geq 200$
Sm-x	10	$\beta_{10(C)} \geq 200$
Sm-x	25	$\beta_{20(C)} \geq 200$

values guaranteed up to 10
bar differential pressure

Sm-x vst elements with
max. Δp 210 bar

Sm-x vst	3	$\beta_{5(C)} \geq 200$
Sm-x vst	6	$\beta_{7(C)} \geq 200$
Sm-x vst	10	$\beta_{10(C)} \geq 200$
Sm-x vst	25	$\beta_{20(C)} \geq 200$

values guaranteed up to 20
bar differential pressure

7. Order numbers

Example for ordering filters:

1. Filter housing	2. Filter element
V=80 l/min and visual/electrical maintenance indicator Type: Pi 2008-69 Order number: 77665284	Sm-x vst 3 Type: Pi 2208 Sm-x vst 3 Order number: 77680200

7.1 Housing design

Nominal size NG [l/min]	Order number	Type	①	②	③	④	⑤	⑥
			no options	with bypass valve	with bypass valve and visual indicator	with bypass valve and electrical indicator	with visual indicator	with electrical indicator
50	77665144	Pi 2005-060						
	77665110	Pi 2005-056						
	77665128	Pi 2005-057						
	77665136	Pi 2005-058						
	77665169	Pi 2005-068						
	77665177	Pi 2005-069						
80	77665235	Pi 2008-060						
	77665201	Pi 2008-056						
	77665219	Pi 2008-057						
	77665227	Pi 2008-058						
	77665276	Pi 2008-068						
	77665284	Pi 2008-069						
110	78205114	Pi 2011-060						
	78205122	Pi 2011-056						
	78205130	Pi 2011-057						
	78205148	Pi 2011-058						
	78205155	Pi 2011-068						
	78205163	Pi 2011-069						
150	77840580	Pi 2015-060						
	76165203	Pi 2015-056						
	76165211	Pi 2015-057						
	79320748	Pi 2015-058						
	76165229	Pi 2015-068						
	78396616	Pi 2015-069						
300	77665474	Pi 2030-060						
	77665441	Pi 2030-056						
	77665458	Pi 2030-057						
	77665466	Pi 2030-058						
	77665516	Pi 2030-068						
	77665532	Pi 2030-069						
450	77664881	Pi 2045-060						
	77664873	Pi 2045-056						
	77664865	Pi 2045-057						
	77664857	Pi 2045-058						
	77664923	Pi 2045-068						
	77664931	Pi 2045-069						

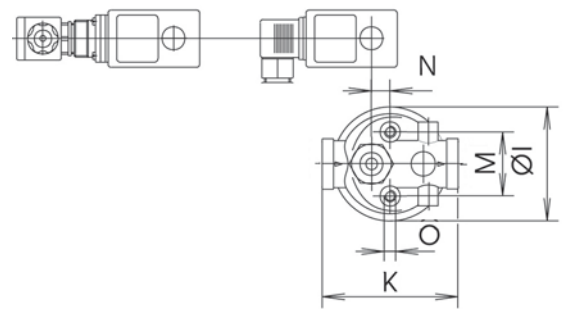
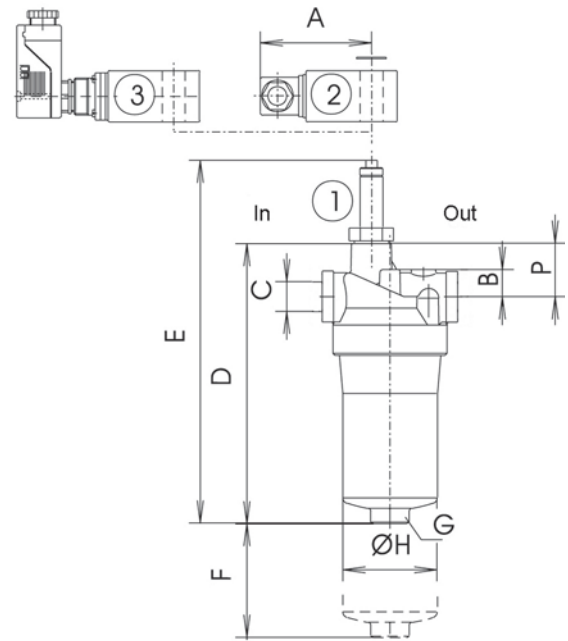
When filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

7.2 Filter elements (a wider range of element types is available on request)

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
50	77680135	Pi 2105 Sm-x 3	Sm-x 3	20	590
	77943509	Pi 5105 Sm-x 6	Sm-x 6		590
	77680325	Pi 3105 Sm-x 10	Sm-x 10		590
	77680440	Pi 4105 Sm-x 25	Sm-x 25		590
	77680192	Pi 2205 Sm-x vst 3	Sm-x vst 3	210	425
	77943533	Pi 5205 Sm-x vst 6	Sm-x vst 6		425
	77680382	Pi 3205 Sm-x vst 10	Sm-x vst 10		425
	77680507	Pi 4205 Sm-x vst 25	Sm-x vst 25		425
80	77680143	Pi 2108 Sm-x 3	Sm-x 3	20	1150
	77943517	Pi 5108 Sm-x 6	Sm-x 6		1150
	77680341	Pi 3108 Sm-x 10	Sm-x 10		1150
	77680457	Pi 4108 Sm-x 25	Sm-x 25		1150
	77680200	Pi 2208 Sm-x vst 3	Sm-x vst 3	210	850
	77943541	Pi 5208 Sm-x vst 6	Sm-x vst 6		850
	77681190	Pi 3208 Sm-x vst 10	Sm-x vst 10		850
	77680515	Pi 4208 Sm-x vst 25	Sm-x vst 25		850
110	77680150	Pi 2111 Sm-x 3	Sm-x 3	20	1700
	77943525	Pi 5111 Sm-x 6	Sm-x 6		1700
	77680333	Pi 3111 Sm-x 10	Sm-x 10		1700
	77680465	Pi 4111 Sm-x 25	Sm-x 25		1700
	77680218	Pi 2211 Sm-x vst 3	Sm-x vst 3	210	1275
	77943558	Pi 5211 Sm-x vst 6	Sm-x vst 6		1275
	77680390	Pi 3211 Sm-x vst 10	Sm-x vst 10		1275
	77680523	Pi 4211 Sm-x vst 25	Sm-x vst 25		1275
150	77680168	Pi 2115 Sm-x 3	Sm-x 3	20	2425
	77955099	Pi 5115 Sm-x 6	Sm-x 6		2425
	77680358	Pi 3115 Sm-x 10	Sm-x 10		2425
	77680473	Pi 4115 Sm-x 25	Sm-x 25		2425
	77680226	Pi 2215 Sm-x vst 3	Sm-x vst 3	210	2010
	77955123	Pi 5215 Sm-x vst 6	Sm-x vst 6		2010
	77680408	Pi 3215 Sm-x vst 10	Sm-x vst 10		2010
	77680531	Pi 4215 Sm-x vst 25	Sm-x vst 25		2010
300	77680176	Pi 2130 Sm-x 3	Sm-x 3	20	4620
	77955107	Pi 5130 Sm-x 6	Sm-x 6		4620
	77680366	Pi 3130 Sm-x 10	Sm-x 10		4620
	77680481	Pi 4130 Sm-x 25	Sm-x 25		4620
	77680234	Pi 2230 Sm-x vst 3	Sm-x vst 3	210	3800
	77955131	Pi 5230 Sm-x vst 6	Sm-x vst 6		3800
	77680416	Pi 3230 Sm-x vst 10	Sm-x vst 10		3800
	77680549	Pi 4230 Sm-x vst 25	Sm-x vst 25		3800
450	77680184	Pi 2145 Sm-x 3	Sm-x 3	20	6865
	77955115	Pi 5145 Sm-x 6	Sm-x 6		6865
	77680374	Pi 3145 Sm-x 10	Sm-x 10		6865
	77680499	Pi 4145 Sm-x 25	Sm-x 25		6865
	77680242	Pi 2245 Sm-x vst 3	Sm-x vst 3	210	5600
	77955149	Pi 5245 Sm-x vst 6	Sm-x vst 6		5600
	77680424	Pi 3245 Sm-x vst 10	Sm-x vst 10		5600
	77680556	Pi 4245 Sm-x vst 25	Sm-x vst 25		5600

8. Technical specifications

Design:	in-line filter
Nominal pressure: Pi 2005 - 2011	63 bar (910 psi)
Pi 2015 - 2045	25 bar (360 psi)
Test pressure: Pi 2005 - 2011	82 bar (1190 psi)
Pi 2015 - 2045	33 bar (480 psi)
Temperature range:	-10 °C to +120 °C
	(other temperature ranges on request)
Bypass setting:	Δp 3.5 bar \pm 10 %
Filter head material:	GDAL
Filter housing material:	AL/St
Sealing material:	NBR/AL
Maintenance indicator setting	
PiS 3098/97:	Δp 2.2 bar \pm 10 %
Electrical data of maintenance indicator PiS 3097:	
Max. voltage:	250 V AC/200 V DC
Max. current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M20x1.5



The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values and do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

- In = inlet
- Out = outlet
- 1 = Standard maintenance indicator visual PiS 3098
- 1 + 2 = Standard maintenance indicator visual/electrical PiS 3097
- 3 = For further design please refer to the maintenance indicator data sheet

Subject to technical alteration without prior notice.

9. Dimensions

All dimensions except "C" in mm.

Type	A	B	C*	D	E	F	G SW	H	I	K	M	N	O	P	Weight [kg]
Pi 2005	78	19	G $\frac{1}{2}$	177	235	80	27	66	80	95	45	13	M8x10	37.5	0.9
Pi 2008	78	19	G $\frac{3}{4}$	253	311	80	27	66	80	95	45	13	M8x10	37.5	1.0
Pi 2011	78	19	G $\frac{3}{4}$	335	393	80	27	66	80	95	45	13	M8x10	37.5	1.1
Pi 2015	78	30	G1 $\frac{1}{4}$	246	304	110	32	109	128	150	60	24.5	M12x15	43.5	2.1
Pi 2030	78	30	G1 $\frac{1}{4}$	363	421	110	32	109	128	150	60	24.5	M12x15	43.5	2.4
Pi 2045	78	30	G1 $\frac{1}{4}$	478	536	110	24	109	128	150	60	24.5	M12x15	43.5	6.5

* NPT- and SAE-connections on request

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove filter element and filter housing.

Preferably the filter should be installed with the filter housing pointing downwards.

The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2.

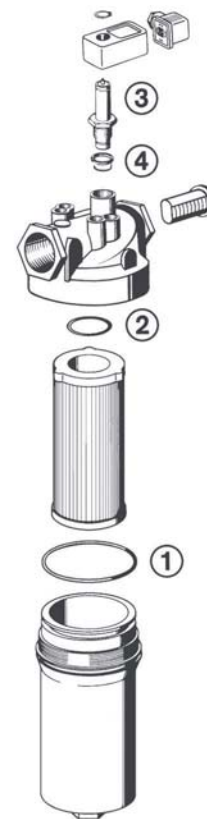
The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

10.3 When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
- Filters without maintenance indicator:
The filter element should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
- Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (Sm-x) cannot be cleaned.

10.4 Element replacement

- Stop system and relieve filter from pressure.
- Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
- Remove element by pulling down carefully.
- Check O-ring on the filter housing for damage. Replace, if necessary.
- Make sure that the order number on the spare element corresponds to the order number of the filter name-plate.
To ensure no contamination occurs during the exchange of the element first open the plastic bag and push the element over the spigot in the filter head. Now remove plastic bag.
- Lightly lubricate the thread of the filter housing and screw onto the filter head completely. After that unscrew the filter housing 1/8 to 1/2 return.



11. Spare parts list

Order numbers of spare parts		
Position	Type	Order number
① - ②	Seal kit for filter	
	Pi 2005 - Pi 2011	
	NBR	77550213
	FPM	77845795
	EPDM	77845803
	Pi 2015 - Pi2045	
	NBR	77550221
	FPM	77845811
	EPDM	77845829
④	Maintenance indicator	
	Visual PiS 3098/2.2	77669971
	Electrical PiS 3097/2.2	77669948
	Electrical upper section only	77536550
⑤	Seal kit for maintenance indicator	
	NBR	77760309
	FPM	77760317
	EPDM	77760325

MAHLE

Industrial Filtration

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industriefiltration@mahle.com
www.mahle-industriefiltration.com
78356446.07/2008

Low Pressure Filter Pi 2000

Nominal pressure 25/63 bar (360/900 psi), nominal size up to 400
according DIN 24550

1. Features

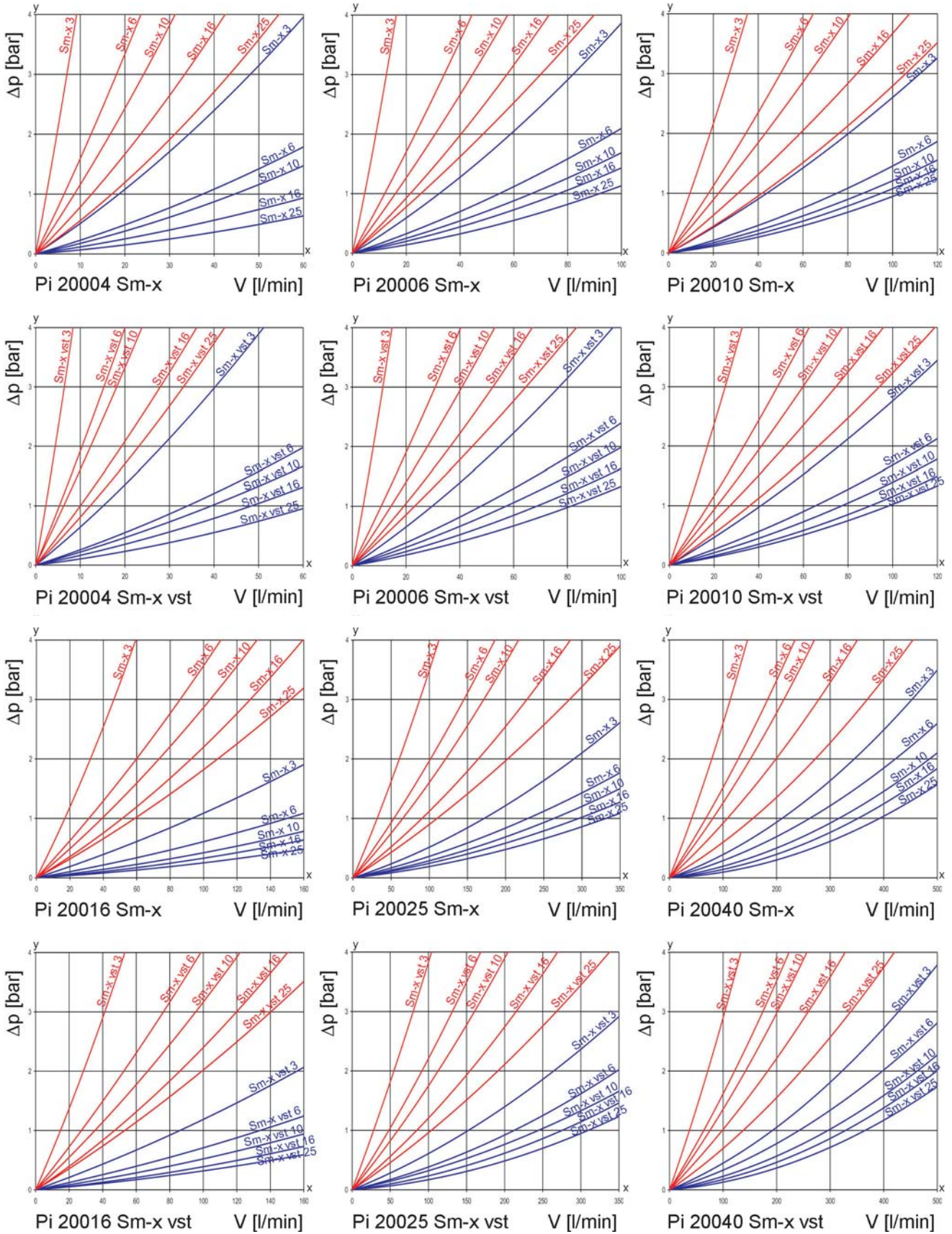
High performance filters for modern hydraulic systems

- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- NPT- and SAE-connections on request
- Worldwide distribution



2. Flow rate/pressure drop curve complete filter

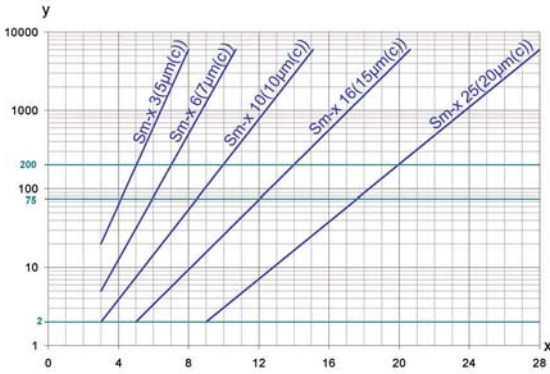
■ 190 mm²/s
■ 33 mm²/s



y = differential pressure Δp [bar]

x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particle size [μm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x elements with max.
 Δp 20 bar

Sm-x	3	$\beta_{5(C)} \geq 200$
Sm-x	6	$\beta_{7(C)} \geq 200$
Sm-x	10	$\beta_{10(C)} \geq 200$
Sm-x	16	$\beta_{15(C)} \geq 200$
Sm-x	25	$\beta_{20(C)} \geq 200$

values guaranteed up to
10 bar differential pressure

Sm-x vst elements with max.
 Δp 210 bar

Sm-x vst	3	$\beta_{5(C)} \geq 200$
Sm-x vst	6	$\beta_{7(C)} \geq 200$
Sm-x vst	10	$\beta_{10(C)} \geq 200$
Sm-x vst	16	$\beta_{15(C)} \geq 200$
Sm-x vst	25	$\beta_{20(C)} \geq 200$

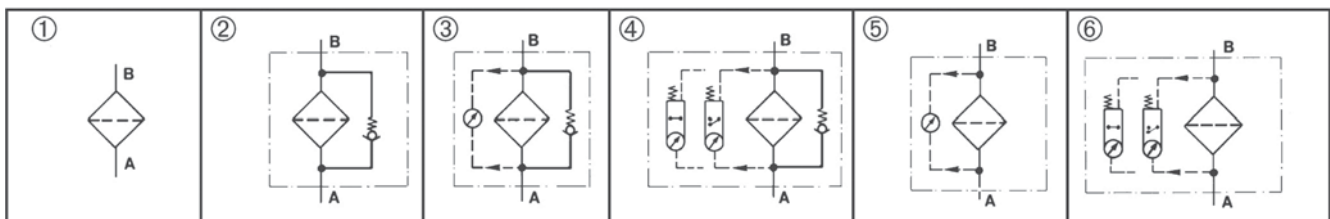
values guaranteed up to
20 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standard:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 2923	Hydraulic fluid power filter elements; method for end load test
DIN ISO 2924	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power-filters-evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters; multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Housing design	2. Filter element
V = 100 l/min with visual/electrical maintenance indicator Type: Pi 20010-069 Order number: 78265035	Sm-x vst 3 NBR Type: Pi 71010 DN Sm-x vst 3 NBR Order number: 78227480

7.1 Housing design								
Nominal size NG [l/min]	Order number	Type	① no options	② with bypass	③ with bypass valve and visual indicator	④ with bypass valve and electrical indicator	⑤ with visual indicator	⑥ with electrical indicator
40	76116974	Pi 20004-060						
	76116982	Pi 20004-056						
	79328394	Pi 20004-057						
	79328402	Pi 20004-058						
	79328410	Pi 20004-068						
	79328428	Pi 20004-069						
63	76116990	Pi 20006-060						
	76117006	Pi 20006-056						
	76117014	Pi 20006-057						
	76117022	Pi 20006-058						
	76117030	Pi 20006-068						
	76117048	Pi 20006-069						
100	76117055	Pi 20010-060						
	76117063	Pi 20010-056						
	79328436	Pi 20010-057						
	77958705	Pi 20010-058						
	79328444	Pi 20010-068						
	78265035	Pi 20010-069						
160	76117071	Pi 20016-060						
	76117089	Pi 20016-056						
	76117097	Pi 20016-057						
	79713520	Pi 20016-058						
	76114102	Pi 20016-068						
	76114110	Pi 20016-069						
250	76114128	Pi 20025-060						
	76114136	Pi 20025-056						
	79328451	Pi 20025-057						
	77958879	Pi 20025-058						
	79328469	Pi 20025-068						
	79328477	Pi 20025-069						
400	76114144	Pi 20040-060						
	76114151	Pi 20040-056						
	79714395	Pi 20040-057						
	76114169	Pi 20040-058						
	76114177	Pi 20040-068						
	76114185	Pi 20040-069						

When filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

7.2 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
40	78260929	Pi 21004 DN Sm-x 3 NBR	Sm-x 3	20	475
	77960859	Pi 22004 DN Sm-x 6 NBR	Sm-x 6		475
	77925571	Pi 23004 DN Sm-x 10 NBR	Sm-x 10		475
	78260937	Pi 24004 DN Sm-x 16 NBR	Sm-x 16		475
	78260945	Pi 25004 DN Sm-x 25 NBR	Sm-x 25		475
	78216079	Pi 71004 DN Sm-x vst 3 NBR	Sm-x vst 3	210	445
	77960156	Pi 72004 DN Sm-x vst 6 NBR	Sm-x vst 6		445
	77925654	Pi 73004 DN Sm-x vst 10 NBR	Sm-x vst 10		445
	78216087	Pi 74004 DN Sm-x vst 16 NBR	Sm-x vst 16		445
	78216095	Pi 75004 DN Sm-x vst 25 NBR	Sm-x vst 25		445
63	78260960	Pi 21006 DN Sm-x 3 NBR	Sm-x 3	20	835
	77960867	Pi 22006 DN Sm-x 6 NBR	Sm-x 6		835
	77925589	Pi 23006 DN Sm-x 10 NBR	Sm-x 10		835
	78260978	Pi 24006 DN Sm-x 16 NBR	Sm-x 16		835
	78260986	Pi 25006 DN Sm-x 25 NBR	Sm-x 25		835
	78216137	Pi 71006 DN Sm-x vst 3 NBR	Sm-x vst 3	210	780
	77960149	Pi 72006 DN Sm-x vst 6 NBR	Sm-x vst 6		780
	77925662	Pi 73006 DN Sm-x vst 10 NBR	Sm-x vst 10		780
	78216145	Pi 74006 DN Sm-x vst 16 NBR	Sm-x vst 16		780
	78216152	Pi 75006 DN Sm-x vst 25 NBR	Sm-x vst 25		780
100	78227472	Pi 21010 DN Sm-x 3 NBR	Sm-x 3	20	1375
	77960875	Pi 22010 DN Sm-x 6 NBR	Sm-x 6		1375
	77925597	Pi 23010 DN Sm-x 10 NBR	Sm-x 10		1375
	78261000	Pi 24010 DN Sm-x 16 NBR	Sm-x 16		1375
	78261018	Pi 25010 DN Sm-x 25 NBR	Sm-x 25		1375
	78227480	Pi 71010 DN Sm-x vst 3 NBR	Sm-x vst 3	210	1275
	77960131	Pi 72010 DN Sm-x vst 6 NBR	Sm-x vst 6		1275
	77925670	Pi 73010 DN Sm-x vst 10 NBR	Sm-x vst 10		1275
	78261281	Pi 74010 DN Sm-x vst 16 NBR	Sm-x vst 16		1275
	78216160	Pi 75010 DN Sm-x vst 25 NBR	Sm-x vst 25		1275

* a wider range of element types is available on request

7.2 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
160	78261034	Pi 21016 DN Sm-x 3 NBR	Sm-x 3	20	2530
	77960826	Pi 22016 DN Sm-x 6 NBR	Sm-x 6		2530
	77925605	Pi 23016 DN Sm-x 10 NBR	Sm-x 10		2530
	78261042	Pi 24016 DN Sm-x 16 NBR	Sm-x 16		2530
	78261059	Pi 25016 DN Sm-x 25 NBR	Sm-x 25		2530
	77940638	Pi 71016 DN Sm-x vst 3 NBR	Sm-x vst 3	210	1885
	77960123	Pi 72016 DN Sm-x vst 6 NBR	Sm-x vst 6		1885
	77925688	Pi 73016 DN Sm-x vst 10 NBR	Sm-x vst 10		1885
	78269797	Pi 74016 DN Sm-x vst 16 NBR	Sm-x vst 16		1885
	78216178	Pi 75016 DN Sm-x vst 25 NBR	Sm-x vst 25		1885
250	78227514	Pi 21025 DN Sm-x 3 NBR	Sm-x 3	20	4020
	77960834	Pi 22025 DN Sm-x 6 NBR	Sm-x 6		4020
	77925613	Pi 23025 DN Sm-x 10 NBR	Sm-x 10		4020
	78261075	Pi 24025 DN Sm-x 16 NBR	Sm-x 16		4020
	78261083	Pi 25025 DN Sm-x 25 NBR	Sm-x 25		4020
	77940646	Pi 71025 DN Sm-x vst 3 NBR	Sm-x vst 3	210	3090
	77960115	Pi 72025 DN Sm-x vst 6 NBR	Sm-x vst 6		3090
	77925696	Pi 73025 DN Sm-x vst 10 NBR	Sm-x vst 10		3090
	78269813	Pi 74025 DN Sm-x vst 16 NBR	Sm-x vst 16		3090
	78216186	Pi 75025 DN Sm-x vst 25 NBR	Sm-x vst 25		3090
400	78227522	Pi 21 040 DN Sm-x 3 NBR	Sm-x 3	20	6770
	77960842	Pi 22 040 DN Sm-x 6 NBR	Sm-x 6		6770
	77925621	Pi 23 040 DN Sm-x 10 NBR	Sm-x 10		6770
	78261109	Pi 24 040 DN Sm-x 16 NBR	Sm-x 16		6770
	78261117	Pi 25 040 DN Sm-x 25 NBR	Sm-x 25		6770
	77940653	Pi 71 040 DN Sm-x vst 3 NBR	Sm-x vst 3	210	5240
	77960107	Pi 72 040 DN Sm-x vst 6 NBR	Sm-x vst 6		5240
	77930829	Pi 73 040 DN Sm-x vst 10 NBR	Sm-x vst 10		5240
	78269821	Pi 74 040 DN Sm-x vst 16 NBR	Sm-x vst 16		5240
	78260903	Pi 75 040 DN Sm-x vst 25 NBR	Sm-x vst 25		5240

* a wider range of element types is available on request

8. Technical specifications

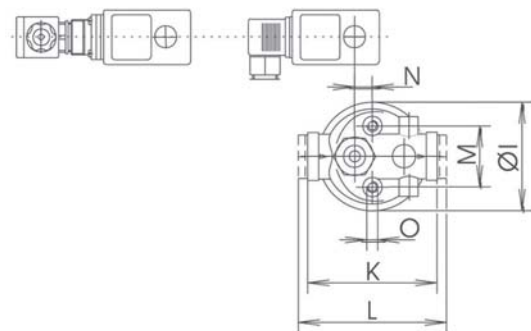
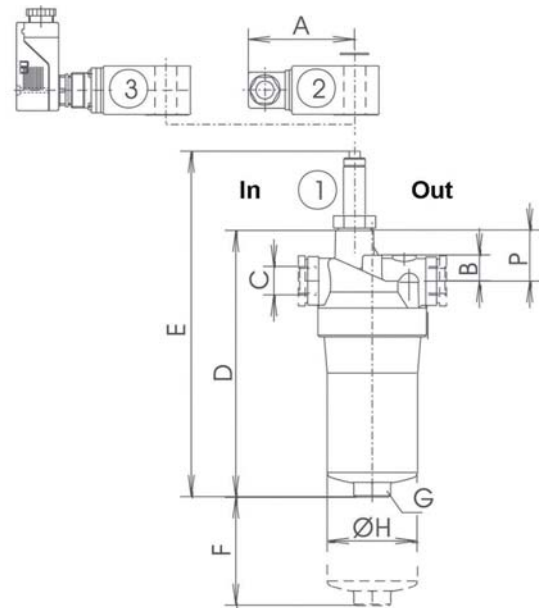
Design:	line mounting filter
Nominal pressure: Pi 20016-20040	25 bar (360 psi)
Pi 20004-20010	63 bar (900 psi)
Test pressure: Pi 20016-20040	33 bar (470 psi)
Pi 20004-20010	82 bar (1170 psi)
Temperature range:	- 10 °C to + 120 °C
	(other temperature ranges on request)
Bypass setting:	Δp 3.5 bar \pm 10 %
Filter head material:	GDAL
Filter housing material:	AL/St.
Sealing material:	NBR/AL
Maintenance indicator setting:	Δp 2.2 bar \pm 10 %
Electrical data of maintenance indicator:	
Max. voltage:	250 V AC/200 V DC
Max. current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M20x1.5

The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.



In = inlet, Out = outlet

- Pos. 1 Visual maintenance indicator
- Pos. 2 El. upper section connector according DIN EN 175301-803
Executions: PiS 3097, 3116, 3119
- Pos.3 El. upper section connector according DIN EN 175201-804
Executions: PiS 3012, 3124, 3110

Connection: M12x1

Executions: PiS 3116 M12x1, PiS 3151, 3154

9. Dimensions

All dimensions except "C" in mm.

Type	A	B	C*	D	E	F	G SW	H	I	K	L	M	N	O	P	Weight [kg]
Pi 20004	78	19	G½	182	240	80	27	66	80	-	109	45	13	M8x10	37.5	0.9
Pi 20006	78	19	G¾	242	300	80	27	66	80	95	-	45	13	M8x10	37.5	1.0
Pi 20010	78	19	G¾	335	393	80	27	66	80	95	-	45	13	M8x10	37.5	1.1
Pi 20016	78	30	G1¼	268	326	110	32	109	128	150	-	60	24.5	M12x15	43.5	2.3
Pi 20025	78	30	G1¼	363	421	110	32	109	128	150	-	60	24.5	M12x15	43.5	2.5
Pi 20040	78	30	G1¼	508	566	110	24	109	128	150	-	60	24.5	M12x15	43.5	7.4

*NPT- and SAE-connections on request.

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove filter element and filter housing.

Preferably the filter should be installed with the filter housing pointing downwards.

The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2.

The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

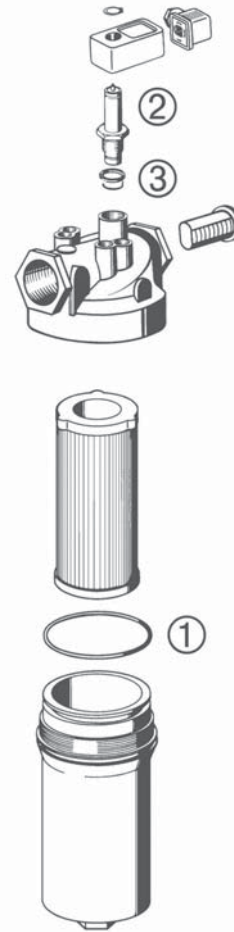
10.3 When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
- Filters without maintenance indicator:
The filter element should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
- Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (Sm-x) cannot be cleaned.

10.4 Element replacement

- Stop system and relieve filter from pressure.
- Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
- Remove element by pulling down carefully.
- Check O-ring on the filter housing for damage. Replace, if necessary.
- Make sure that the order number on the spare element corresponds to the order number of the filter name-plate.
To ensure no contamination occurs during the exchange of the element first open the plastic bag and push the element over the spigot in the filter head. Now remove plastic bag.
- Lightly lubricate the thread of the filter housing and screw onto the filter head completely. After that unscrew the filter housing 1/8 to 1/2 return.

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79784455.06/2008



11. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
①	Seal kit for filter housing	
	Pi 20004 - Pi 20010	
	NBR	79328485
	FPM	79328493
	EPDM	79357609
	Pi 20016 - Pi 20040	
	NBR	79357617
	FPM	79357625
	EPDM	79357633
②	Maintenance indicator	
	Visual PiS 3098/2.2	77669971
	Electrical PiS 3097/2.2	77669948
	Electrical upper section only	77536550
③	Seal kit for maintenance indicator	
	NBR	77760309
	FPM	77760317
	EPDM	77760325

Low Pressure Filter

Pi 2000/Pi 2200

Nominal pressure 25 bar (360 psi), nominal size 630 up to 2000
according to DIN 24550

1. Features

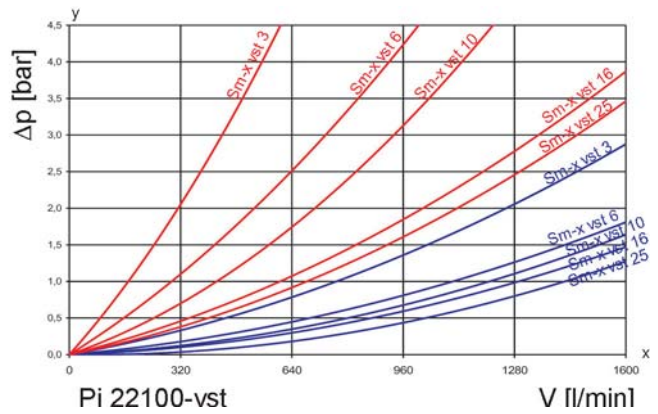
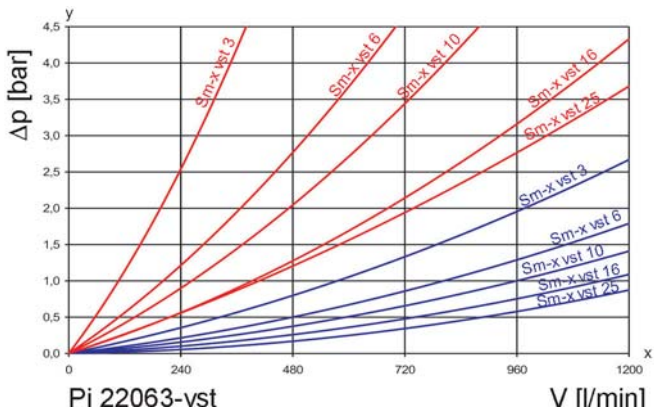
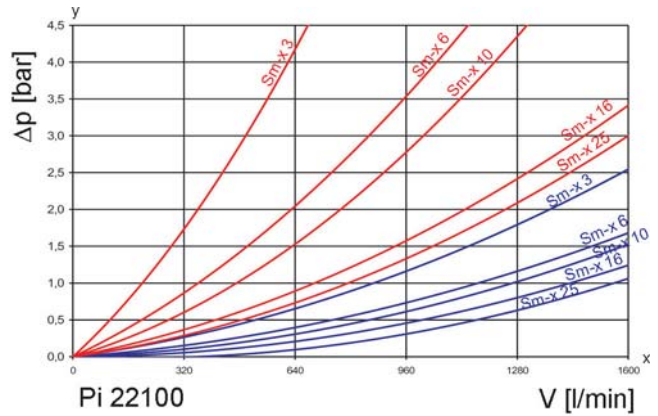
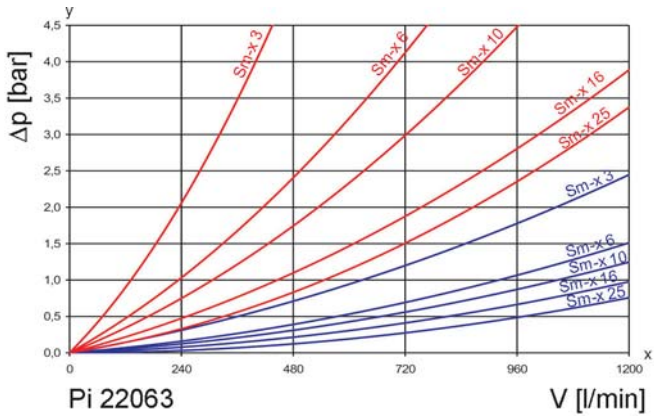
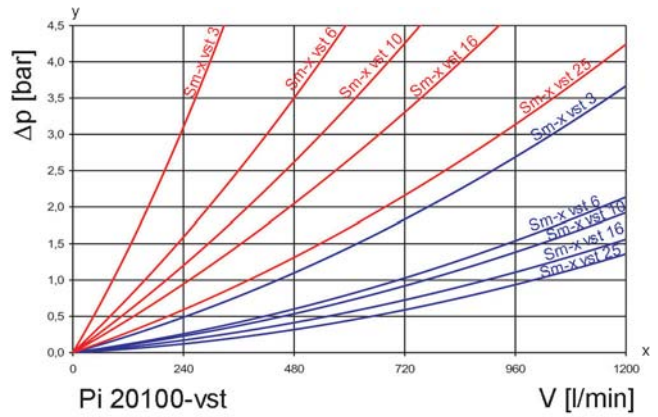
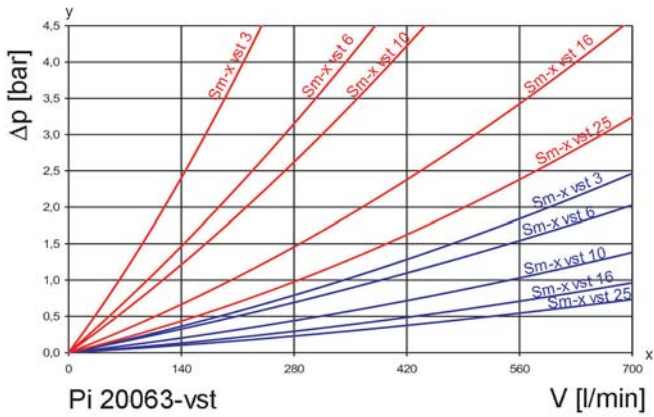
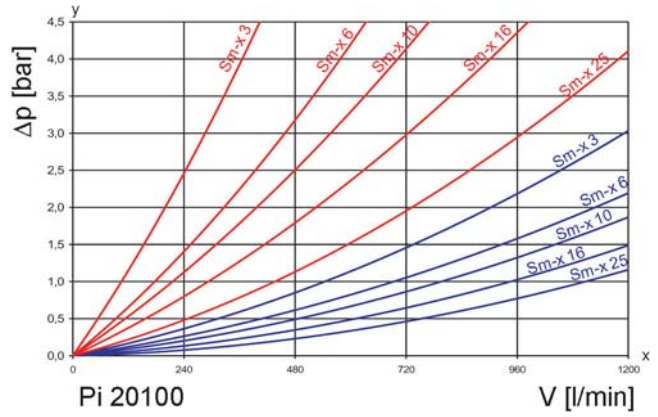
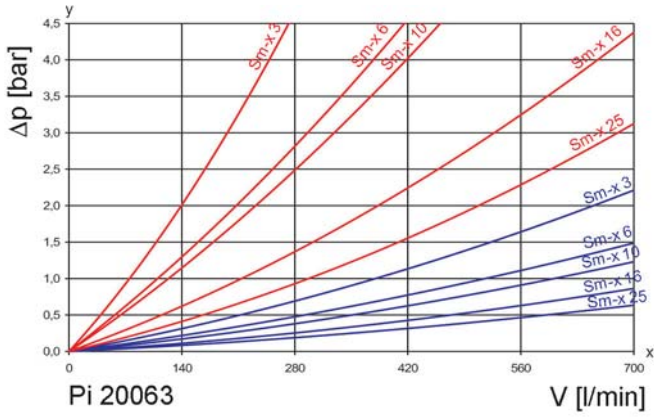
High performance filters for modern hydraulic systems

- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical, electronic maintenance indicator
- Flanged connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution



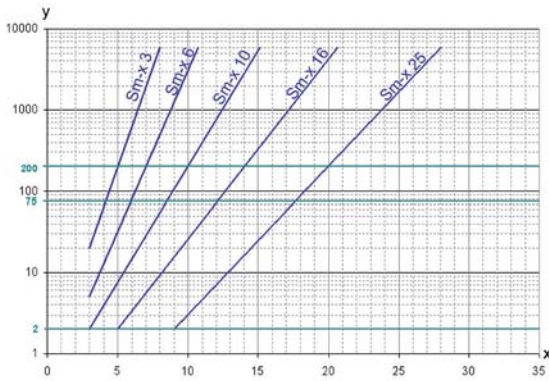
2. Flow rate/pressure drop curve complete filter

■ 190 mm²/s
■ 33 mm²/s



y = differential pressure Δp [bar]
 x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particle size [μm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x elements with
max. Δp 20 bar

Sm-x	3	$\beta_{5(C)} \geq 200$
Sm-x	6	$\beta_{7(C)} \geq 200$
Sm-x	10	$\beta_{10(C)} \geq 200$
Sm-x	16	$\beta_{15(C)} \geq 200$
Sm-x	25	$\beta_{20(C)} \geq 200$

values guaranteed at
10 bar differential pressure

Sm-x vst elements with
max. Δp 210 bar

Sm-x vst	3	$\beta_{5(C)} \geq 200$
Sm-x vst	6	$\beta_{7(C)} \geq 200$
Sm-x vst	10	$\beta_{10(C)} \geq 200$
Sm-x vst	16	$\beta_{15(C)} \geq 200$
Sm-x vst	25	$\beta_{20(C)} \geq 200$

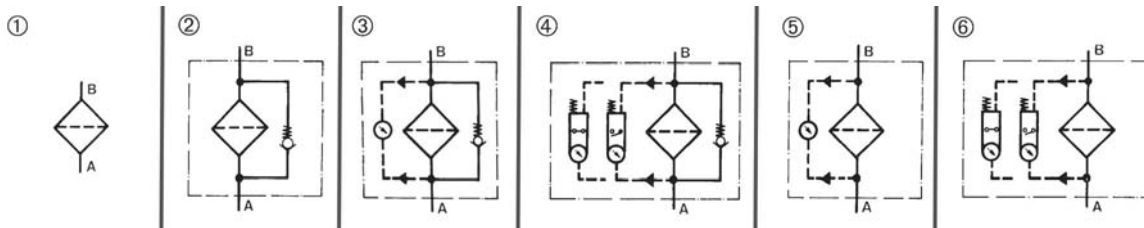
values guaranteed at
20 bar differential pressure

5. Quality assurance

MAHLE filter and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2 942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2 943	Hydraulic fluid power filter elements; verification of material compatibility
DIN ISO 3 723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3 724	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3 968	Hydraulic fluid power-filters-evaluation of pressure drop versus flow characteristics
ISO 10 771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16 889	Hydraulic fluid power filters-multi-passmethod for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Housing design	2. Filter element (2 elements required for parallel arrangement)
V =630 l/min and electrical maintenance indicator Type: Pi 20063-69 Order number: 77965510	Sm-x vst 25 Type: Pi 75063 DN Order number: 77961568

7.1 Housing design

Design	Nominal size NG [l/min]	Order number	Type	① no options	② with bypass valve	③ with bypass valve and visual indicator	④ with bypass valve and electrical indicator	⑤ with visual indicator	⑥ with electrical indicator
Line filter single	630	77965478	Pi 20063-060						
		77965486	Pi 20063-056						
		77965494	Pi 20063-057						
		77964497	Pi 20063-058						
		77965502	Pi 20063-068						
		77965510	Pi 20063-069						
	1000	77965577	Pi 20100-060						
		77965585	Pi 20100-056						
		77965593	Pi 20100-057						
		77974769	Pi 20100-058						
		77965601	Pi 20100-068						
		77965619	Pi 20100-069						
Line filter parallel	1260	77965387	Pi 22063-060						
		77965676	Pi 22063-056						
		77965684	Pi 22063-057						
		77965692	Pi 22063-058						
		77965700	Pi 22063-068						
		77965718	Pi 22063-069						
	2000	77965775	Pi 22100-060						
		77965783	Pi 22100-056						
		77965791	Pi 22100-057						
		77965809	Pi 22100-058						
		77965817	Pi 22100-068						
		77965825	Pi 22100-069						

When filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

7.2 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
630	77961519	Pi 21063 DN	Sm-x 3	20	9900
	77943699	Pi 22063 DN	Sm-x 6		9900
	77925639	Pi 23063 DN	Sm-x 10		9900
	77961527	Pi 24063 DN	Sm-x 16		9900
	77961535	Pi 25063 DN	Sm-x 25		9900
	77961543	Pi 71063 DN	Sm-x vst 3	210	7900
	77960099	Pi 72063 DN	Sm-x vst 6		7900
	77925712	Pi 73063 DN	Sm-x vst 10		7900
	77961550	Pi 74063 DN	Sm-x vst 16		7900
	77961568	Pi 75063 DN	Sm-x vst 25		7900
1000	77961618	Pi 21100 DN	Sm-x 3	20	15500
	77943723	Pi 22100 DN	Sm-x 6		15500
	77925647	Pi 23100 DN	Sm-x 10		15500
	77961626	Pi 24100 DN	Sm-x 16		15500
	77961634	Pi 25100 DN	Sm-x 25		15500
	77961642	Pi 71100 DN	Sm-x vst 3	210	12420
	77960081	Pi 72100 DN	Sm-x vst 6		12420
	77925720	Pi 73100 DN	Sm-x vst 10		12420
	77961659	Pi 74100 DN	Sm-x vst 16		12420
	77961667	Pi 75100 DN	Sm-x vst 25		12420
1260	77961519	Pi 21063 DN	Sm-x 3	20	2x9900
	77943699	Pi 22063 DN	Sm-x 6		2x9900
	77925639	Pi 23063 DN	Sm-x 10		2x9900
	77961527	Pi 24063 DN	Sm-x 16		2x9900
	77961535	Pi 25063 DN	Sm-x 25		2x9900
	77961543	Pi 71063 DN	Sm-x vst 3	210	2x7900
	77960099	Pi 71063 DN	Sm-x vst 6		2x7900
	77925712	Pi 72063 DN	Sm-x vst 10		2x7900
	77961550	Pi 73063 DN	Sm-x vst 16		2x7900
	77961568	Pi 74063 DN	Sm-x vst 25		2x7900
2000	77961618	Pi 21100 DN	Sm-x 3	20	2x15500
	77943723	Pi 22100 DN	Sm-x 6		2x15500
	77925647	Pi 23100 DN	Sm-x 10		2x15500
	77961626	Pi 24100 DN	Sm-x 16		2x15500
	77961634	Pi 25100 DN	Sm-x 25		2x15500
	77961642	Pi 71100 DN	Sm-x vst 3	210	2x12420
	77960081	Pi 72100 DN	Sm-x vst 6		2x12420
	77925720	Pi 73100 DN	Sm-x vst 10		2x12420
	77961659	Pi 74100 DN	Sm-x vst 16		2x12420
	77961667	Pi 75100 DN	Sm-x vst 25		2x12420

* a wider range of element types is available on request

8. Technical specifications

Design:	Flange filter
Nominal pressure:	25 bar (360 psi)
Test pressure:	32 bar (460 psi)
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Bypass setting:	Δp 3.5 bar \pm 10 %
Filter head material:	GAL
Filter housing material:	AL
Sealing material:	NBR/AL
Maintenance indicator setting:	Δp 2.2 bar \pm 0.3 bar
Electrical data of maintenance indicator:	
Maximum voltage:	250 V AC/200 V DC
Maximum current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M20x1.5

The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

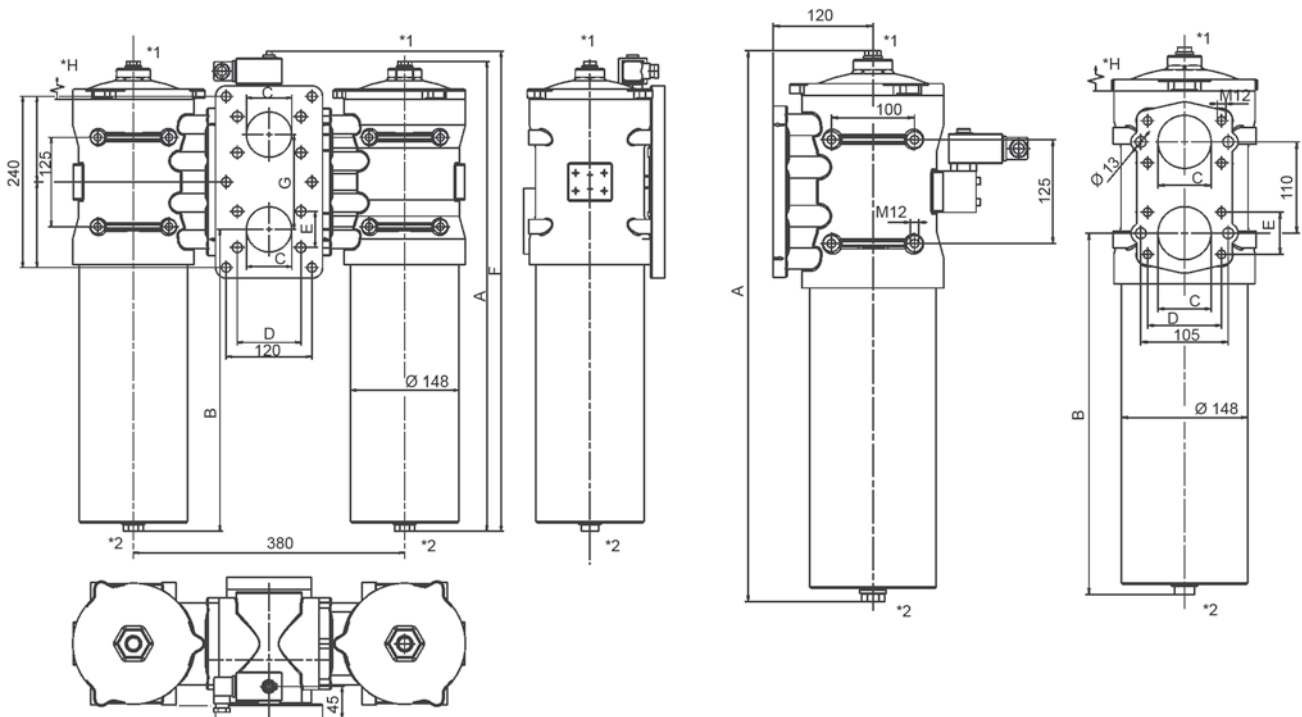
We draw attention to the fact that all values indicated are average values and do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Due to the modular system, filter can be easily converted from single type into parallel or duplex type.

Subject to technical alteration without prior notice.

9. Dimensions



- *1 = Vent screw G3/8
- *2 = Drain plug G $\frac{3}{4}$ DIN 910
- *H = Minimum clearance for filter element removal

All dimensions in mm.

Type	A	B	C	D	E	F	G	H	Weight [kg]
Pi 20063	665	439	DN64	89	50,8	-	110	400	12,5
Pi 20100	885	669	DN64	89	50,8	-	110	630	15,0
Pi 22063	665	427,5	DN76	106	61,9	695	133	400	30,0
Pi 22100	885	6575	DN76	106	61,9	915	133	630	35,0

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove filter element and filter housing.

Preferably the filter should be installed with the filter housing pointing downwards.

The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

The electrical indicator is connected via a 2-pole appliance plug according to DIN 43650 with poles marked 1 and 2.

The electrical section can be inverted to change from normally open position to normally closed position or vice versa .

10.3 When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
- Filters without maintenance indicator:
The filter element should be replaced after trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
- Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (SM-x) cannot be cleaned.

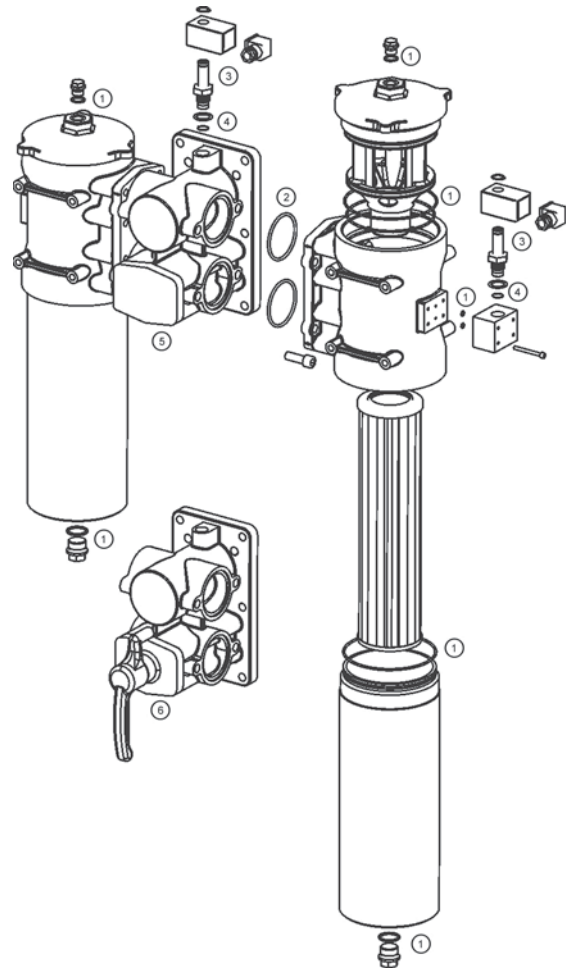
10.4 Element replacement

- Stop system and relieve filter from pressure.
- Open venting screw in filter cover (ascertain switching lever position with duplex filter and carefully check which filter housing is under pressure).
- Remove drain plug in housing bottom and drain oil.
- Unscrew filter cover (CCW).
- Lift out filter element.
- Check seal on filter cover. We recommend replacement in any case.
- Make sure that the order number on the spare element corresponds to the order number of the filter name-plate. Remove packaging and place element closed end downward into filter housing.
- Carefully insert element holding fixture of the filter cover into the open end of the element and tighten cover against stop.
- Close drain plug on housing bottom.
- Carefully vent filter prior operation. Then tighten venting screw.

Additional remark: For cleaning purposes the filter housing can be removed by unscrewing counter-clockwise.
Please change both elements at the parallel type.

11. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
①	Seal kit for filter housing (duplex or parallel filter 2 sets required)	
	NBR	77967433
	FPM	77967441
	EPDM	77967458
②	Seal kit for parallel unit	
	NBR	79350984
	FPM	79350992
	EPDM	79351008
③	Maintenance indicator	
	Visual PiS 3098/2.2 bar	77669971
	Electrical PiS 3097/2.2 bar	77669948
	Electrical upper part only	77536550
④	Seal kit for maintenance indicator	
	NBR	77760300
	FPM	77760317
	EPDM	77760325
⑤	Parallel unit (for parallel filter modification)	
⑥	Switch over unit (for duplex filter modification Pi 2100)	



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 79360611.07/2008

Low Pressure Filter/Suction Filter Pi 220

Nominal pressure 10 bar (140 psi), up to nominal size 160

1. Features

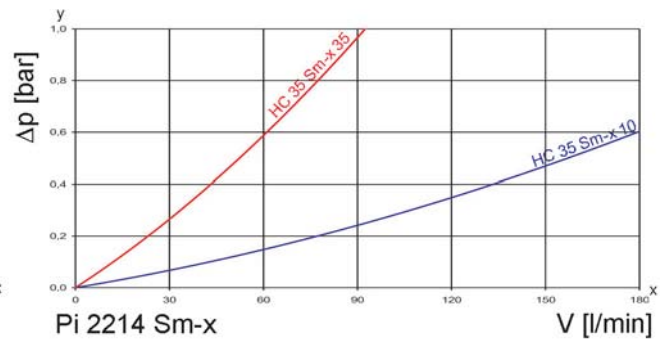
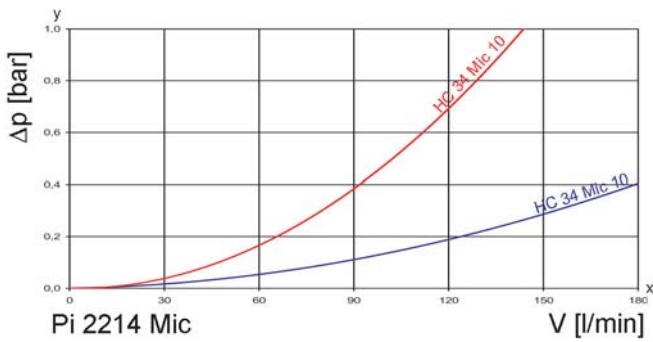
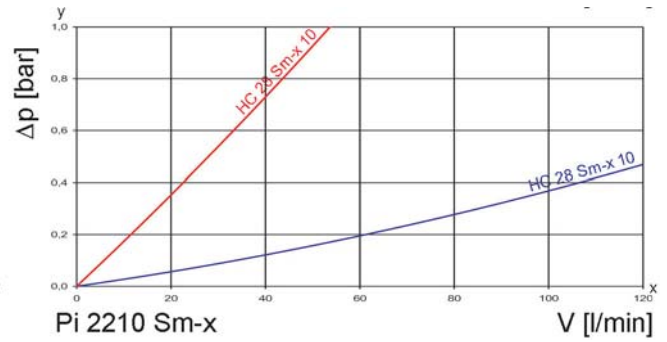
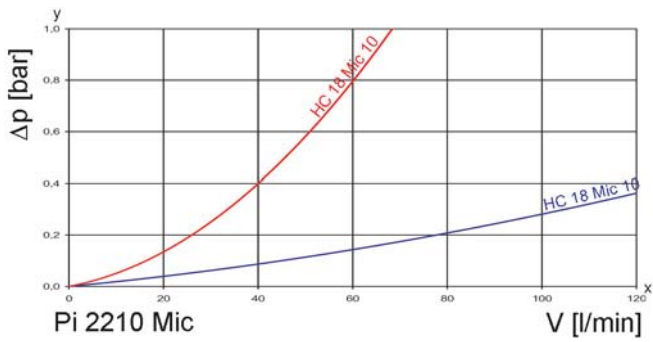
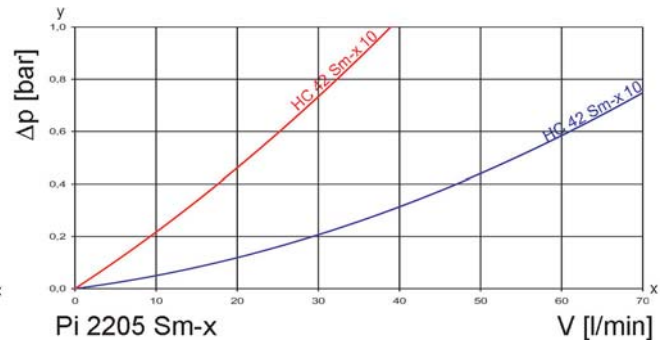
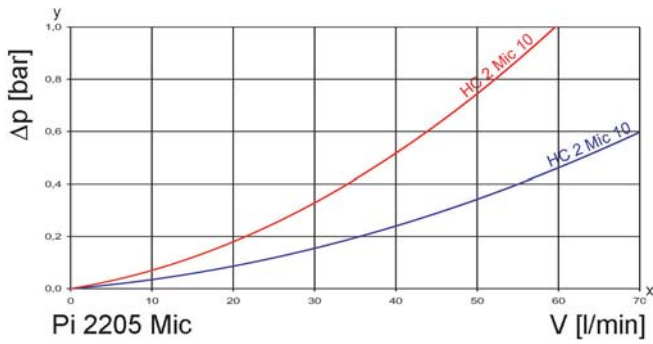
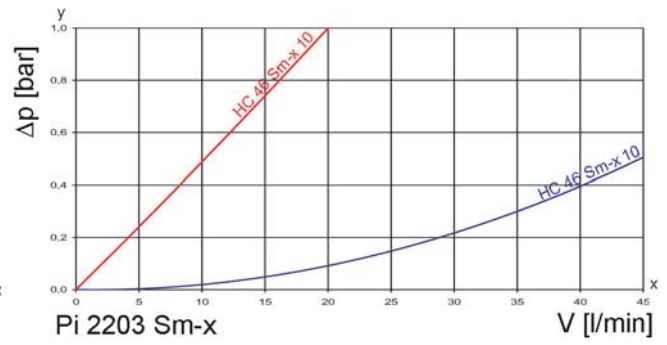
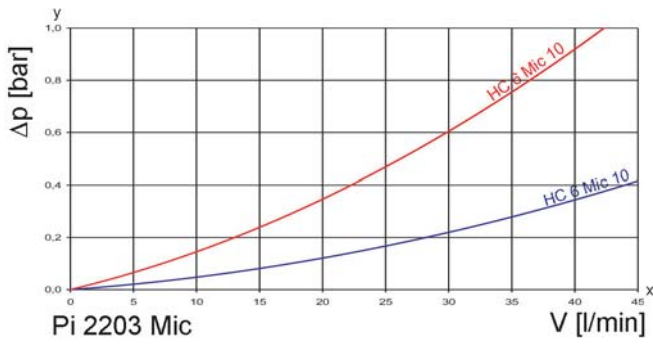
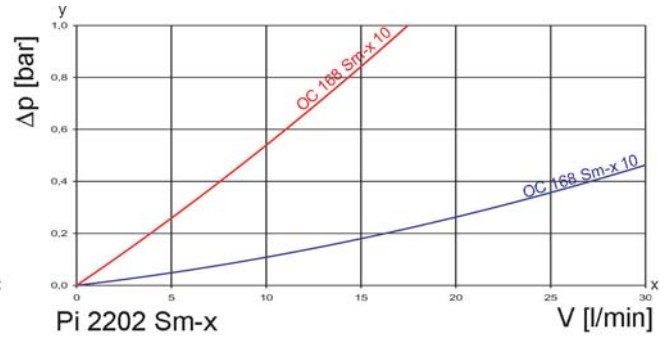
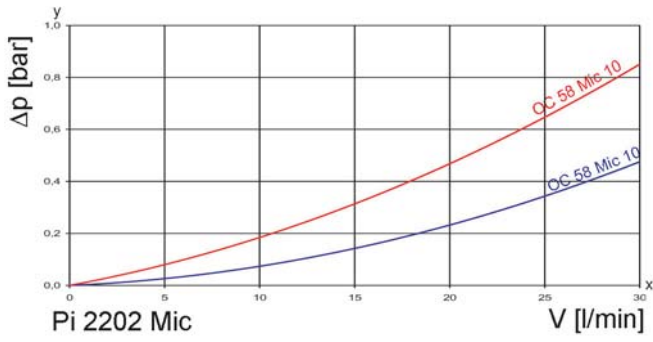
High performance filters for modern hydraulic systems

- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electronic/electrical maintenance indicator
- Threaded connections
- Quality filters, easy to service
- Equipped with highly efficient Mic or Sm-x filter elements
- Beta rated elements according to ISO 16889
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution



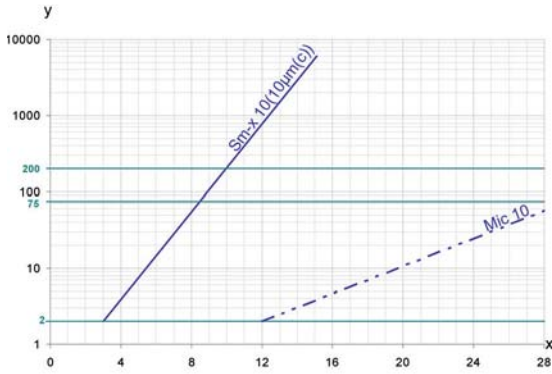
2. Flow rate/pressure drop curve complete filter

■ 190 mm²/s
■ 33 mm²/s



y = differential pressure Δp [bar]
 x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particle size [μm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x-elements with
max. Δp 5 bar

Sm-x 10 $\beta_{10(C)} \geq 200$

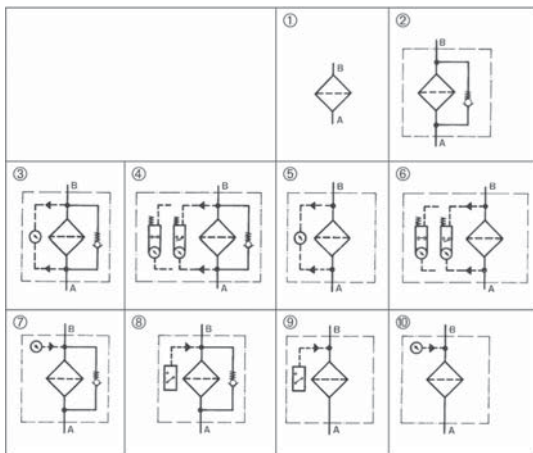
values guaranteed up to
5 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility
DIN ISO 3723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3724	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power-filters-evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters-multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Housing design	2. Spin-on cartridge
V=25 l/min, bypass, electrical maintenance indicator	Mic 10
Type: Pi 2202-058	Type: OC 58
Order number: 77665649	Order number: 77785983

7.1 Housing design/order number for pressure-side installation

Nominal size NG [l/min]	Order number	Type	① no options	② with bypass valve	③ with bypass valve and visual indicator	④ with bypass valve and electrical indicator	⑤ with visual indicator	⑥ with electrical indicator
25	77665656	Pi 2202-60						
	77665623	Pi 2202-56						
	77665631	Pi 2202-57						
	77665649	Pi 2202-58						
	77665664	Pi 2202-68						
	77665672	Pi 2202-69						
40	77665714	Pi 2203-60						
	77665680	Pi 2203-56						
	77665698	Pi 2203-57						
	77665706	Pi 2203-58						
	77665748	Pi 2203-68						
	77665755	Pi 2203-69						
63	77665813	Pi 2205-60						
	77665789	Pi 2205-56						
	77665797	Pi 2205-57						
	77665805	Pi 2205-58						
	77665847	Pi 2205-68						
	77665854	Pi 2205-69						
100	77666001	Pi 2210-60						
	77665979	Pi 2210-56						
	77665987	Pi 2210-57						
	77665995	Pi 2210-58						
	77666050	Pi 2210-68						
	77666068	Pi 2210-69						
160	77666126	Pi 2214-60						
	77666092	Pi 2214-56						
	77666100	Pi 2214-57						
	77666118	Pi 2214-58						
	77666183	Pi 2214-68						
	77666191	Pi 2214-69						

When filter with non bypass configuration is selected, the collapse pressure of the spin-on cartridge must not be exceeded.

7.2 Spin-on cartridges

Nominal size NG [l/min] Press./Suct. side	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
25/10	77785983	OC 58	Mic 10	5	1175
	77500184	OC 168	Sm-x 10		1309
40/16	77501273	HC 6	Mic 10	5	3000
	77501232	HC 46	Sm-x 10		2075
63/25	72013241	HC 2	Mic 10	5	5440
	77501372	HC 42	Sm-x 10		3360
100/40	77643331	HC 18	Mic 10	5	7000
	77643398	HC 28	Sm-x 10		3400
160/63	77504194	HC 34	Mic 10	5	14025
	77643844	HC 35	Sm-x 10		7638

7.3 Housing design/order numbers for suction-side installation

Nominal size NG [l/min]	Order number	Type	① no options	② with bypass 0.25 bar	⑦ with bypass 0.25 bar and vacuum gauge	⑥ with bypass 0.25 bar and vacuum switch	⑧ with vacuum switch	⑩ with vacuum gauge
10	77665656	Pi 2202-060						
	77736614	Pi 2202-067						
	77736622	Pi 2202-062						
	77736630	Pi 2202-061						
	77736606	Pi 2202-065						
	77736598	Pi 2202-066						
16	77665714	Pi 2203-060						
	77665730	Pi 2203-067						
	77736689	Pi 2203-062						
	77736697	Pi 2203-061						
	77736671	Pi 2203-065						
	77665722	Pi 2203-066						
25	77665813	Pi 2205-060						
	77736747	Pi 2205-067						
	77665821	Pi 2205-062						
	77736754	Pi 2205-061						
	77665839	Pi 2205-065						
	77736739	Pi 2205-066						
40	77666001	Pi 2210-060						
	77735947	Pi 2210-067						
	77666027	Pi 2210-062						
	77666019	Pi 2210-061						
	77666035	Pi 2210-065						
	77666043	Pi 2210-066						
63	77666126	Pi 2214-060						
	77666175	Pi 2214-067						
	77666142	Pi 2214-062						
	77666134	Pi 2214-061						
	77666159	Pi 2214-065						
	77666167	Pi 2214-066						

When filter with non bypass configuration is selected, the collapse pressure of the spin-on cartridge must not be exceeded.

8. Technical specifications

Design:	line mounting filter
Nominal pressure:	10 bar (140 psi)*
Test pressure:	13 bar (180 psi)
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Bypass setting:	
Pressure side:	Δp 3.5 bar \pm 10%
Suction side:	Δp 0.25 bar \pm 10%
Filter head material:	GDAL
Filter housing material:	St
Sealing material:	NBR/AL
Maintenance indicator setting:	Δp 2.2 bar \pm 0.3 bar
Indicating range vacuum meter:	-1 bar to +1.5 bar
Pressure setting vacuum switch:	200 mbar
Type of protection (suction side):	IP 54
Electrical data of maintenance indicator:	
Max. voltage:	250 V AC/200 V DC
Max. current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M20x1.5

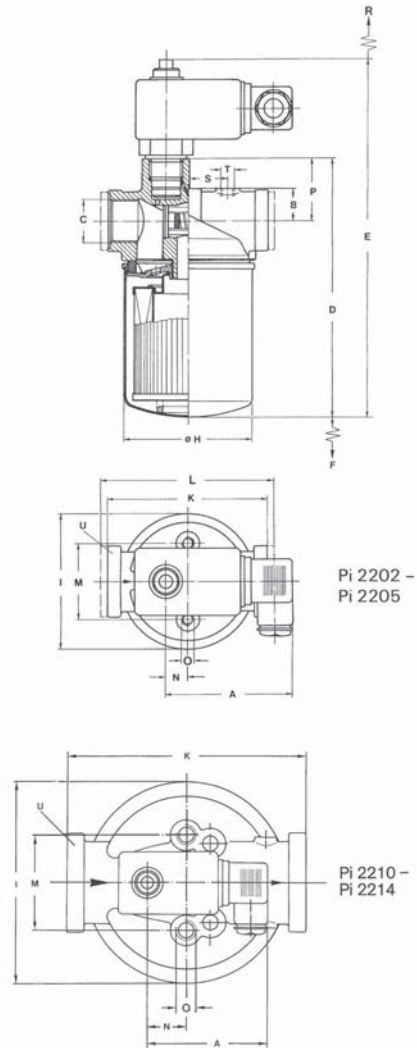
The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.

* For the contamination of the housing designs as per 7.1 with medium-pressure spin-on cartridges refer to leaflet "spin-on cartridges" for dimensions and specifications. Operating pressure on request.



9. Dimensions

All dimensions except "C" and "T" in mm.

Type	A	B	C	D	E	F	G	H	I	K	L	M	N	O	P	R	S*	T*	U	Weight [kg]
Pi 2202	78	19	G $\frac{1}{2}$	181	241	30	-	76	80	-	109	45	13	M8x10	37.5	45	23.5	G1/8	36	0.90
Pi 2203	78	19	G $\frac{1}{2}$	201	261	30	-	93	80	-	109	45	13	M8x10	37.5	45	23.5	G1/8	36	1.00
Pi 2205	78	19	G $\frac{3}{4}$	268	328	30	-	93	80	95	-	45	13	M8x10	37.5	45	23.5	G1/8	36	1.25
Pi 2210	78	30	G1 $\frac{1}{4}$	242	302	40	-	136	128	150	-	60	24,5	M12x15	43.5	45	40	G1/8	55	2.30
Pi 2214	78	30	G1 $\frac{1}{4}$	382	442	40	-	136	128	150	-	60	24,5	M12x15	43.5	45	40	G1/8	55	2.70

*with suction-side installation only.

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove spin-on cartridge. Filter should be installed with the spin-on cartridge pointing downwards.

The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2.

The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

10.3 When should the filter element be replaced?

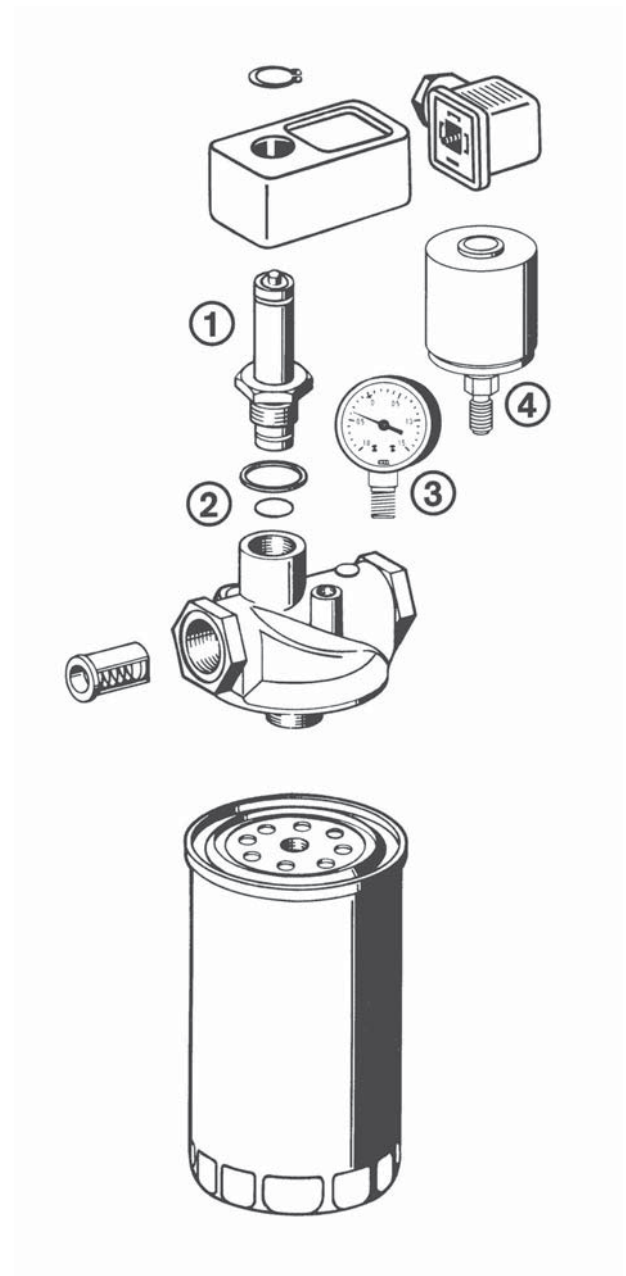
1. Filters equipped with visual and electrical maintenance indicator:

During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
2. Filters without maintenance indicator:

The filter element should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
3. Please always ensure that you have original MAHLE spare elements in stock: disposable elements (Sm-x) cannot be cleaned.

10.4 Spin-on cartridge exchange

1. Stop system and relieve filter from pressure.
2. Unscrew the spin-on cartridge with the aid of a belt spanner by turning same to the left
3. Make sure that the order number on the spin-on cartridge corresponds to the order number of the plate.
4. The seal of the screw-on cartridge should be lightly oiled.
5. Screw cartridge on in accordance with the printed-on instructions.



11. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
①	Maintenance indicator	
	Visual PiS 3098	77669971
	Electrical PiS 3097	77669948
	Electrical upper part only	77536550
②	Seal kit for maintenance indicator	
	NBR	77760309
③	Vacuum gauge	77548027
④	Vacuum switch PiS 3070	77669724

MAHLE

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www.mahle-industriefiltration.com
78356610.07/2008

Low Pressure Filter Pi 230

Nominal pressure 25/40 bar, (360/570 psi), nominal size up to 1400

1. Features

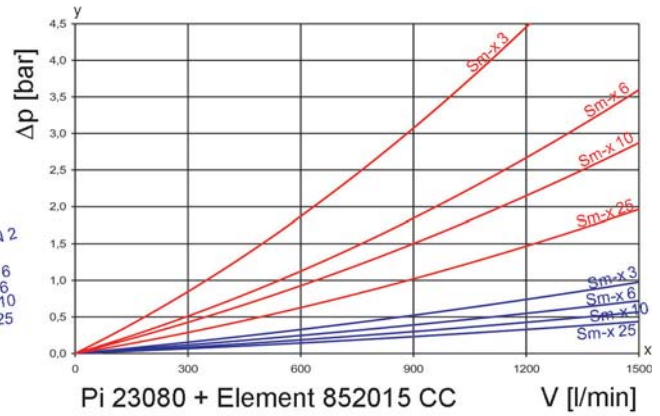
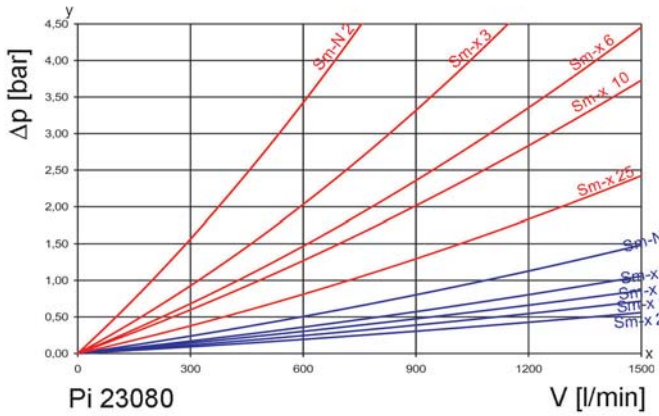
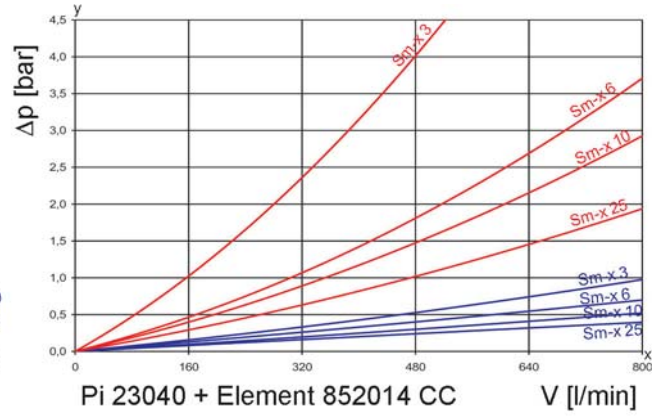
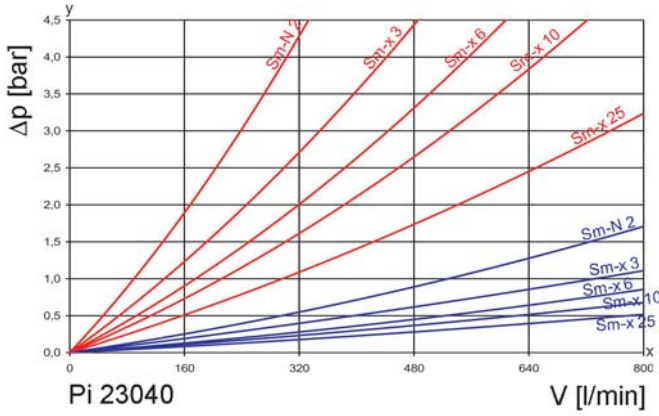
High performance filters for modern hydraulic systems

- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Quality filters, easy to service
- Equipped with highly efficient glass fibre Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution



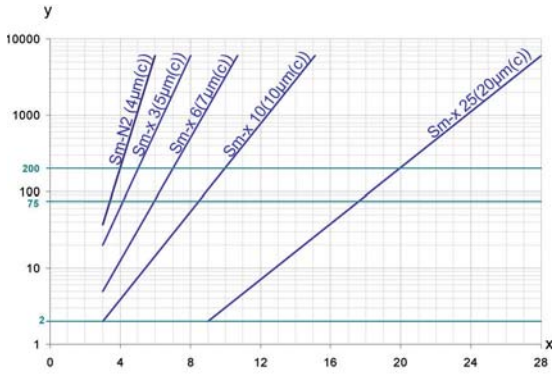
2. Flow rates/pressure drop curve complete filter

■ 190 mm²/s
■ 33 mm²/s



y = differential pressure Δp [bar]
 x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particle size [µm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x elements with
max. Δp 20 bar

Sm-x	3	$\beta_{5(C)} \geq 200$
Sm-x	6	$\beta_{7(C)} \geq 200$
Sm-x	10	$\beta_{10(C)} \geq 200$
Sm-x	16	$\beta_{15(C)} \geq 200$
Sm-x	25	$\beta_{20(C)} \geq 200$

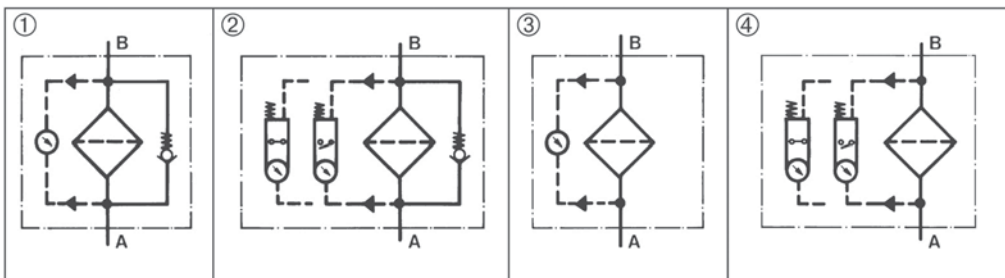
values guaranteed up to
10 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 3723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3724	Hydraulic fluid power elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power filters; evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters; multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Filter housing	2. Filter element
Nominal size: 800, with bypass, electrical maintenance indicator, inlet at the side for standard filter elements Type: Pi 23040 / 22-058 Order number: 76320972	Sm-x 10 Type: Pi 852014 SM-x 10 Order number: 76321814

7.1 Housing design standard

Nominal size NG [l/min]	Order number inlet at the bottom	Type inlet at the bottom	Order number inlet at the side	Type inlet at the side	①	②	③	④
					with bypass valve and visual indicator	with bypass valve and electrical indicator	with visual indicator	with electrical indicator
800	76334668	Pi 23040/12-057	76320931	Pi 23040/22-057				
	76320964	Pi 23040/12-058	76320972	Pi 23040/22-058				
	76321004	Pi 23040/12-068	76321012	Pi 23040/22-068				
	76321046	Pi 23040/12-069	76321053	Pi 23040/22-069				
1400	76320949	Pi 23080/12-057	76320956	Pi 23080/22-057				
	76320980	Pi 23080/12-058	76320998	Pi 23080/22-058				
	76321020	Pi 23080/12-068	76321038	Pi 23080/22-068				
	76321061	Pi 23080/12-069	76321079	Pi 23080/22-069				

When filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

7.2 Filter elements standard*

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
800	76136220	852014 Sm-N 2	Sm-N 2	20	18533
	76321830	852014 Sm-x 3	Sm-x 3		24830
	76321822	852014 Sm-x 6	Sm-x 6		24830
	76321814	852014 Sm-x 10	Sm-x 10		24830
	76321806	852014 Sm-x 25	Sm-x 25		24830
1400	76136212	852015 Sm-N 2	Sm-N 2	20	42275
	76321897	852015 Sm-x 3	Sm-x 3		57200
	76321889	852015 Sm-x 6	Sm-x 6		57200
	76321871	852015 Sm-x 10	Sm-x 10		57200
	76321863	852015 Sm-x 25	Sm-x 25		57200

* a wider range of element types is available on request

7.3 Housing design CC

Nominal size NG [l/min]	Order number inlet at the bottom	Type inlet at the bottom	Order number inlet at the side	Type inlet at the side	①	②	③	④
					with bypass valve and visual indicator	with bypass valve and electrical indicator	with visual indicator	with electrical indicator
800	79770074	Pi 23040/1C-057	79770116	Pi 23040/2C-057				
	76320642	Pi 23040/1C-058	76320659	Pi 23040/2C-058				
	76320683	Pi 23040/1C-068	76320691	Pi 23040/2C-068				
	76320725	Pi 23040/1C-069	76320733	Pi 23040/2C-069				
1400	79768854	Pi 23080/1C-057	79768862	Pi 23080/2C-057				
	76320667	Pi 23080/1C-058	76320675	Pi 23080/2C-058				
	76320709	Pi 23080/1C-068	76320717	Pi 23080/2C-068				
	76320741	Pi 23080/1C-069	76320758	Pi 23080/2C-069				

When filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

7.4 Filter elements CC*

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
800	76135859	852014 CC Sm-x 3	Sm-x 3	5	23000
	76135867	852014 CC Sm-x 6	Sm-x 6		23000
	76135875	852014 CC Sm-x 10	Sm-x 10		23000
	76135883	852014 CC Sm-x 25	Sm-x 25		23000
1400	76322028	852015 CC Sm-x 3	Sm-x 3	5	60159
	76322010	852015 CC Sm-x 6	Sm-x 6		60159
	76322002	852015 CC Sm-x 10	Sm-x 10		60159
	76321996	852015 CC Sm-x 25	Sm-x 25		60159

* a wider range of element types is available on request

8. Technical specifications

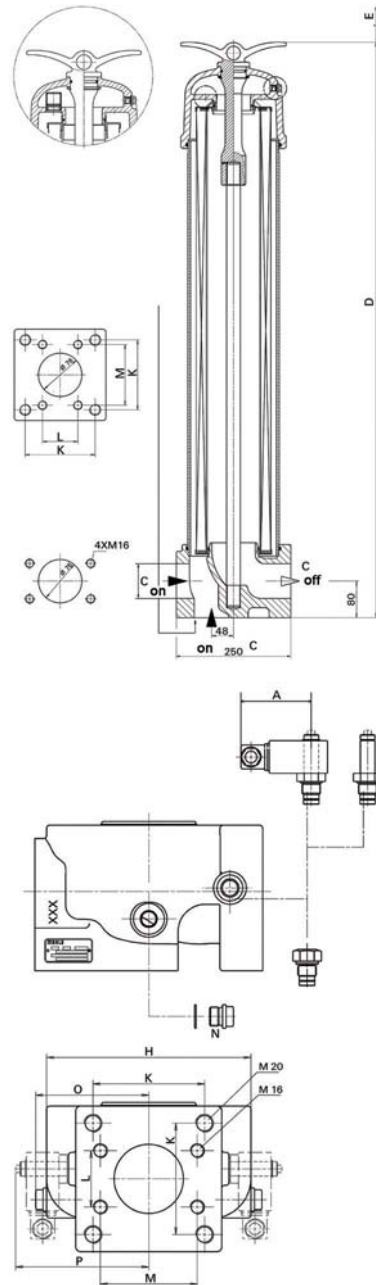
Nominal pressure (10 ⁻⁷ LW):	25 bar (360 psi)
Nominal pressure (static):	40 bar (570 psi)
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Bypass setting:	Δ 3.5 bar ± 10 %
Filter head and cap material:	GAL
Filter housing material:	AL
Sealing material:	NBR
Maintenance indicator setting:	Δ p 2.2 bar ± 0.3 bar
Electrical data of maintenance indicator:	
Maximum voltage:	250 V AC/200 V DC
Maximum current :	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable connection:	M20x1.5

The switching function can be changed by turning the electric upper part by 180 ° (normally closed contact or normally open contact). The state on delivery is normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

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Subject to technical alteration without prior notice.



9. Dimensions

All dimensions except "C" and "N" in mm.

Type	A	B	C	D	E	F	G	H
Pi 23040	78	80	SAE 3", 3000 psi	710	770	230	200	224
Pi 23080	78	80	SAE 3", 3000 psi	1260	770	230	200	224

Type	I	K	L	M	N	O	P	Weight [kg]
Pi 23040	250	122.3	61.9	106.6	G½	124	146	29
Pi 23080	250	122.3	61.9	106.6	G½	124	146	38

NPT- and SAE-connections on request.

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing filter make sure that sufficient space is available to remove spin-on cartridge. Preferably the filter should be installed with the filter housing pointing upwards.

The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

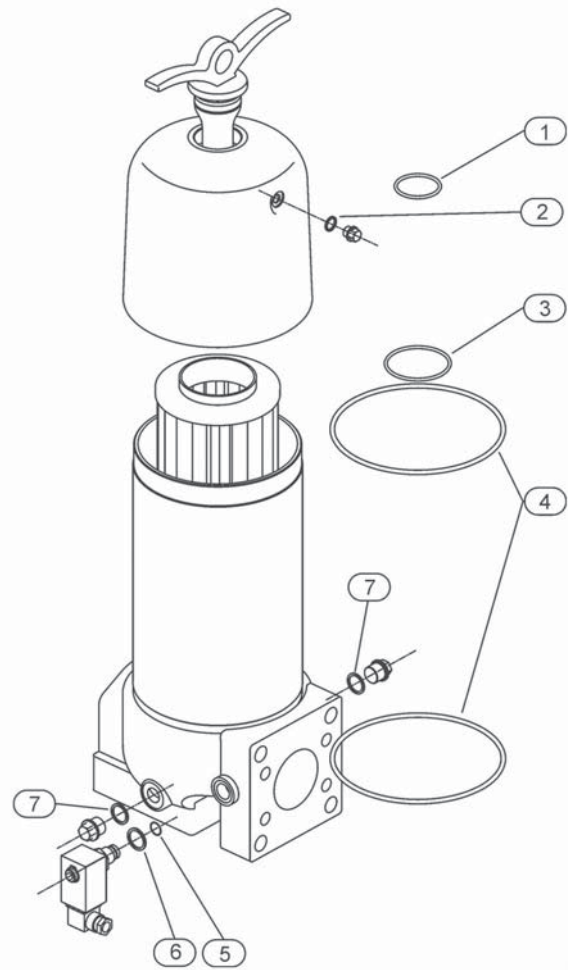
The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open to normally closed position or vice versa.

10.3 When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again and only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the spin-on cartridge must be replaced after the end of the shift.
- Filters without maintenance indicator:
The filter element should be replaced after the trial run or flushing of the system. Afterwards follow the instructions of the manufacturer.
- Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (Sm-x, Sm-N) cannot be cleaned.

10.4. Element replacement

- Stop system and relieve filter from pressure.
- Loosen quick-action clamp, remove cover and open drain valve. Housing completely vented.
- Remove filter element from filter housing.
- Check seals for damages. Replace, if necessary.
- Make sure that the order number on the spare element corresponds to the order number of the filter name-plate.
To ensure no contamination occurs during the exchange of the element first open the plastic bag and push the element over the spigot in the filter head. Now remove plastic bag.
- Close drain valve. Put the thumb screw together with the cover on the centre rod and tighten strong. Filter must be bled.



11. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
① ② ③ ④ ⑦	Seal kit	
	NBR	76321244
	FPM	76321251
	EPDM	76321269
	Maintenance indicator	
	Visual PiS 3098/2.2	77669971
	Visual/electrical PiS 3097/2.2	77669948
	Electrical upper section only	77536550
⑤ ⑥	Seal kit for maintenance indicator	
	NBR	77760309
	FPM	77760317
	EPDM	77760325

MAHLE

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76349484.07/2008

Low Pressure Filter

Pi 2300

Nominal pressure 25/140 bar (360/1990 psi), nominal size up to 1200
Filter elements according to DIN 24550

1. Features

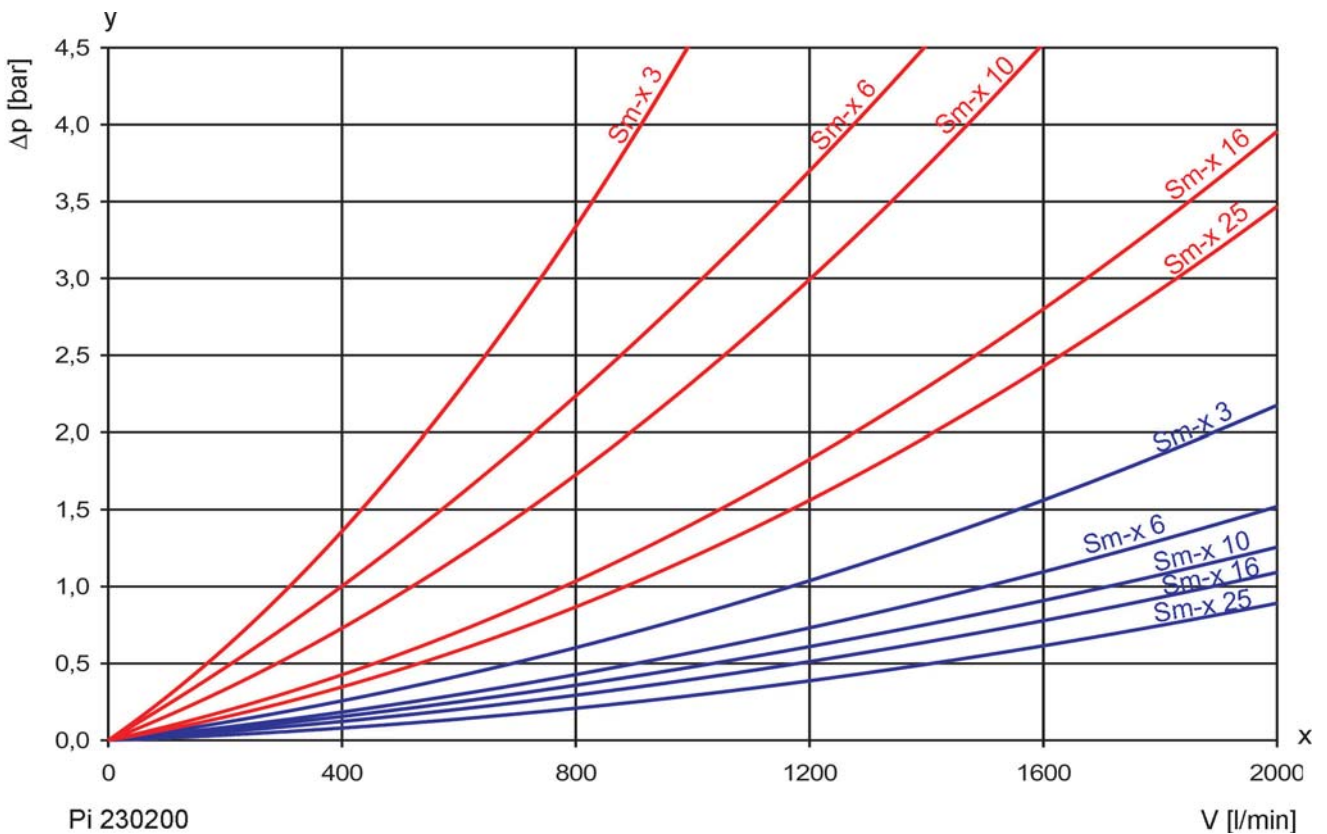
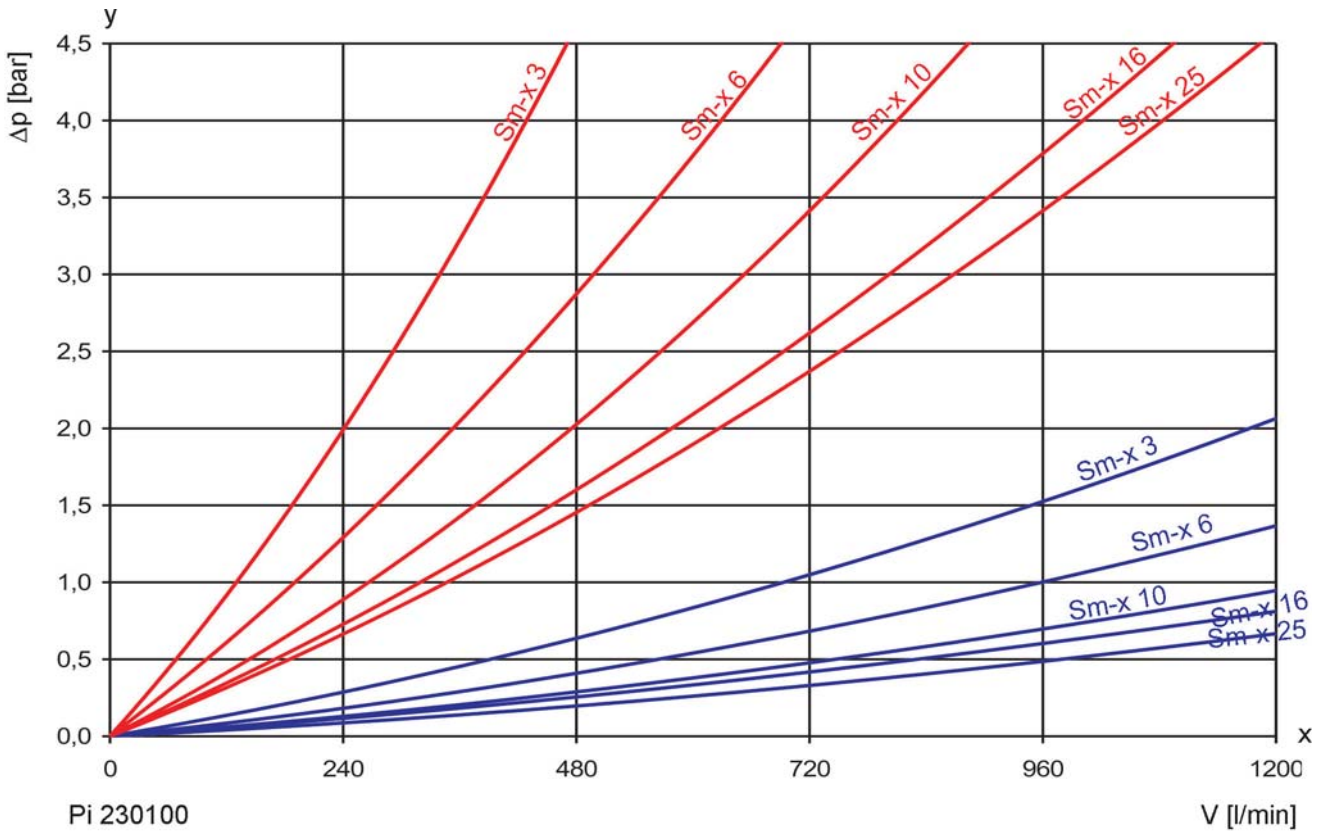
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- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical,electronic maintenance indicator
- Quality filters, easy to service
- Equipped with highly efficient Sm-x filter elements
- Beta rated elements according to ISO 16889
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution



2. Flow rate/pressure drop curve complete filter

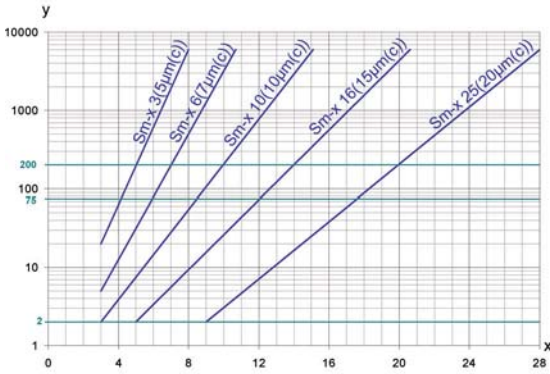
190 mm²/s
33 mm²/s



y = differential pressure Δp [bar]

x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particle size [μm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x elements with
max. Δp 10 bar

Sm-x	3	$\beta_{5(C)}$	\geq	200
Sm-x	6	$\beta_{7(C)}$	\geq	200
Sm-x	10	$\beta_{10(C)}$	\geq	200
Sm-x	16	$\beta_{15(C)}$	\geq	200
Sm-x	25	$\beta_{20(C)}$	\geq	200

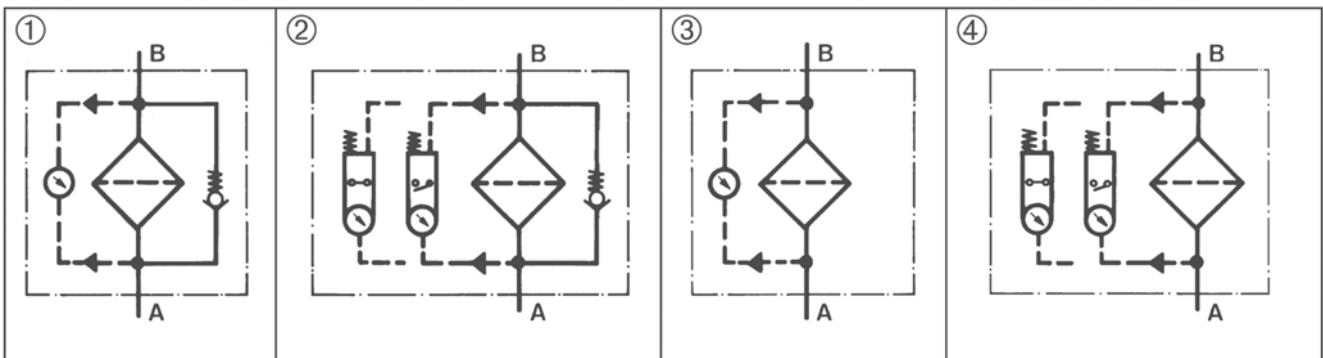
values guaranteed up to
10 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 2923	Hydraulic fluid power filter elements; method for end load test
DIN ISO 2924	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power filters; evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters; multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Housing design	2. Filter elements
Nominal size 750, with bypass, electrical maintenance indicator, inlet at the bottom Type: Pi 230100/11-058 Order number: 76321129	Sm-x 10 Type: 23100 RN Sm-x 10 Order number: 77924228 Attention: At a nominal size of 1200, 2 filter elements per housing are required

7.1 Housing design

Nominal size NG [l/min]	Order number	Type	Inlet	①	②	③	④
				with bypass valve and visual indicator	with bypass valve and electrical indicator	with visual indicator	with electrical indicator
750	76321087	Pi 230100/11-057	at the bottom				
	76321129	Pi 230100/11-058					
	76321160	Pi 230100/11-068					
	76321202	Pi 230100/11-069					
750	76321095	Pi 230100/21-057	at the sight				
	76321137	Pi 230100/21-058					
	76321178	Pi 230100/21-068					
	76321210	Pi 230100/21-069					
1200	76321103	Pi 230200/11-057	at the bottom				
	76321145	Pi 230200/11-058					
	76321186	Pi 230200/11-068					
	76321228	Pi 230200/11-069					
1200	76321111	Pi 230200/21-057	at the sight				
	76321152	Pi 230200/21-058					
	76321194	Pi 230200/21-068					
	76321236	Pi 230200/21-069					

When using filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

7.2 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter material	Collapse pressure [bar]	Filter surface [cm ²]
750	77924210	Pi 21100 RN Sm-x 3	Sm-x 3	10	18760
	77964109	Pi 22100 RN Sm-x 6	Sm-x 6		18760
	77924228	Pi 23100 RN Sm-x 10	Sm-x 10		18760
	77963689	Pi 24100 RN Sm-x 16	Sm-x 16		18760
	77960271	Pi 25100 RN Sm-x 25	Sm-x 25		18760
1200	77924210	Pi 21100 RN Sm-x 3	Sm-x 3	10	2 x 18760
	77964109	Pi 22100 RN Sm-x 6	Sm-x 6		2 x 18760
	77924228	Pi 23100 RN Sm-x 10	Sm-x 10		2 x 18760
	77963689	Pi 24100 RN Sm-x 16	Sm-x 16		2 x 18760
	77960271	Pi 25100 RN Sm-x 25	Sm-x 25		2 x 18760

* a wider range of element types is available on request

8. Technical specifications

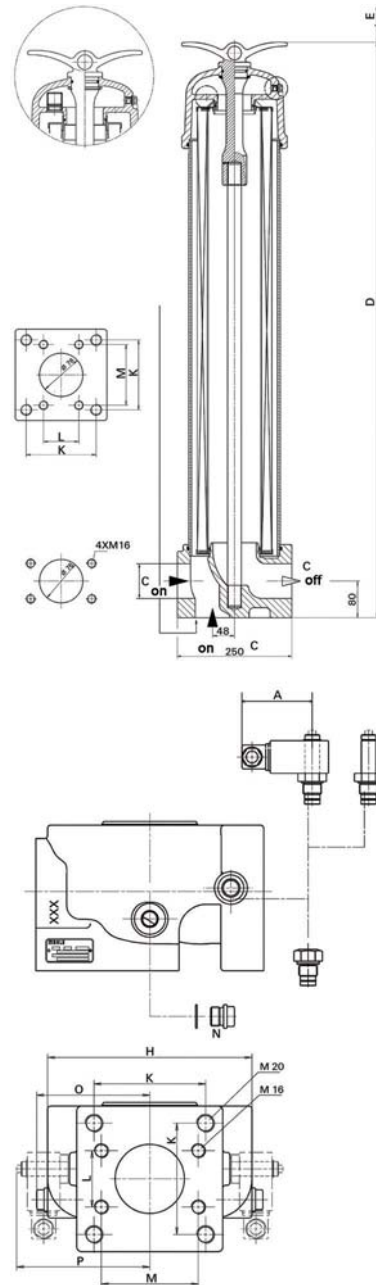
Nominal pressure (10 LW):	25 bar (360 psi)
Test pressure (statical):	40 bar (570 psi)
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Bypass setting:	Δp 3.5 bar \pm 10 %
Filter head material:	GAL
Filter housing material:	AL
Sealing material:	NBR
Maintenance indicator setting	Δp 2.2 bar \pm 0.3 bar
Electrical data of maintenance indicator:	
Max. voltage:	250 V AC/200 V DC
Max. current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M20x1.5

The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values and do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

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Subject to technical alteration without prior notice.



in = inlet
out = outlet

9. Dimensions

All dimensions except "C" and "N" in mm

Type	A	B	C	D	E	F	G	H
Pi 230100	78	80	SAE 3", 3000 psi	710	770	230	200	224
Pi 230200	78	80	SAE 3", 3000 psi	1260	770	230	200	224

Type	I	K	L	M	N	O	P	Weight [kg]
Pi 230100	250	122.3	61.9	106.6	G½	124	146	29
Pi 230200	250	122.3	61.9	106.6	G½	124	146	38

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing filter make sure that sufficient space is available to remove filter element and filter housing. Preferably the filter should be installed with the filter housing pointing upwards. The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

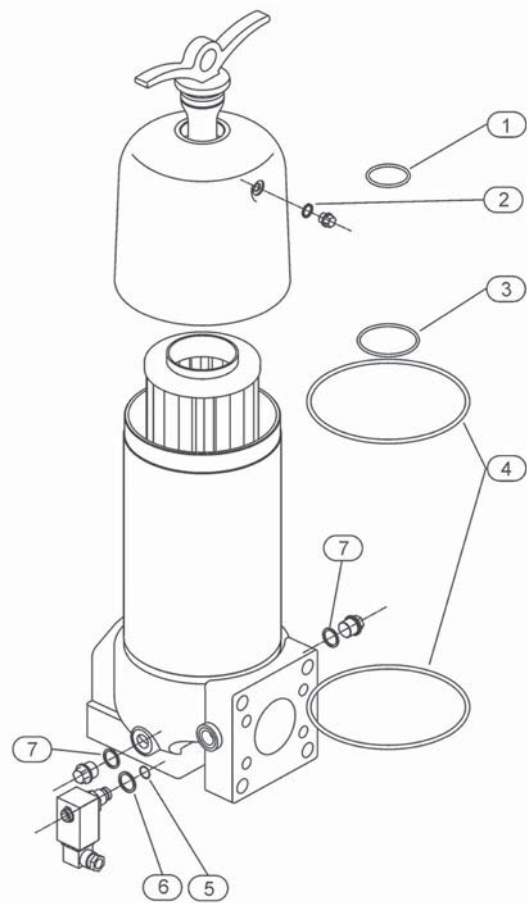
The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open to normally closed position or vice versa.

10.3 When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature. The filter element must be replaced after the end of the shift.
- Filters without maintenance indicator:
The filter element should be replaced after trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
- Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (SM-x) cannot be cleaned.

10.4 Element replacement

- Stop system and relieve filter from pressure.
- Loosen toggle, remove cover, and open drain valve. Housing completely vented.
- Remove filter element from the filter bowl. With filter type Pi 230200 remove the spacer sleeve from the elements clean and reuse.
- Check seals for damages. Replace, if necessary.
- Make sure that the part number on the spare element corresponds with the part number on the filter name-plate. With the filter type Pi 230200 always change both elements. Remove the plastic bag and push element over spigot in the filter head. With filter type Pi 230200 put the sleeve on the element. On this, telescope the second element and locate it.
- Close drain valve. Put the thumb screw together with the cover on the centre rod and tighten strong. Filter must be bled!



11. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
① ② ③ ④ ⑦	Seal kit	
	NBR	76321244
	FPM	76321251
	EPDM	76321269
	Maintenance indicator	
	Visual PiS 3098/2.2	77669971
	Visual/electrical PiS 3097/2.2	77669948
	Electrical upper section only	77536550
⑤ ⑥	Seal kit for maintenance indicator PiS 3098/2.2 + PiS 3097/2.2	
	NBR	77760300
	FPM	77760317
	EPDM	77760325
not illustrated	Adapter for elements at Pi 230200	76937791

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76349514.07/2008

Filter elements and retrofit kits

Pi 230/Pi 2300

Overview of suitable filter elements and adapters

1. Features

- High performance filter elements for hydraulic oils and lubricants
- Guaranteed retention rates for the Sm-x and Sm-N elements according to ISO 16889
- Defined cleanliness according to ISO 4402 by Sm-x and Sm-N elements
- Long service intervals because of high dirt holding capacity
- Optional design according to DIN 24550
- Optional metal-free incinerable CC design



2. Overview and order numbers

2.1 For Pi 23040../Pi 23100.. , required adapter to mount filter element

Filter housing	891 031 CC	852 014 CC	852 014	Pi 23100	P 8300 D 16
Pi 23040/..C	70315692	-	-	70315674	70315676
Pi 23040/..0	-	70315617	-	70315674	70315676
Pi 23040/..1	70315692	70315617	-	70315674	-
Pi 23040/..2	70315692	70315617	-	70315674	70315676
Pi 23100/..2	70315692	70315617	-	-	70315676

2.2 For Pi 23080../Pi 23200, required adapter for mount filter element

Filter housing	891 030 CC	852 015 CC	852 015	Pi 23200	P 8300 D 39
Pi 23080/..C	70315694	-	-	70315675	70315676
Pi 23080/..0	-	70315621	-	70315675	70315676
Pi 23080/..1	70315694	70315621	-	70315675	-
Pi 23080/..2	70315694	70315621	-	70315675	70315676
Pi 23200/..2	70315694	70315621	-	-	70315676

recommended filter element

Example: To fit filter element P 8300 D 39 into housing Pi 23080/..C, you require adapter kit 70315676 part no.. When ordering housing and elements separately, please ensure to order the suitable filter housing version.

Attention: Filter elements 891 030 CC/891 031 CC are not directly interchangeable to PALL! The original PALL coreless does not fit into our housing. To make our 891 030 CC/891031 CC elements fit into the PALL housing, special adapters are available.

3. Filter element data

Filter element	Filter surface [cm²]	Remarks
891 031 CC	18000	incinerable, metal-free, interchange for PALL HC 8304 xxx 16 x, mounting into PALL housing only with special adapter
852 014 CC	23000	incinerable, metal-free, extreme high dirt holding capacity
852 014	24830	extreme high dirt holding capacity
Pi 23100	18760	acc. DIN 24 550
P 8300 D 16	15400	interchange for PALL HC 8300 xxx 16 x
891 030 CC	48290	incinerable, metal-free, interchange for PALL HC 8304 xxx 39 x, mounting into PALL housing only with special adapter
852 015 CC	60159	incinerable, metal-free, extreme high dirt holding capacity
852 015	57200	extreme high dirt holding capacity
Pi 23200	2 x 18760	acc. DIN 24 550
P 8300 D 39	35420	interchange for PALL HC 8300 xxx 39 x

MAHLE Filtersysteme GmbH, Industriefiltration, Schleifbachweg 45, D-74613 Öhringen, Phone +49 (0) 7941/67-0, Fax +49 (0) 7941/67-23429, industriefiltration@mahle.com, www.mahle-industriefiltration.com
70343204.03/2008

Low Pressure Filter/Suction Filter Pi 270

Nominal pressure 10 bar (140 psi), up to nominal size 315

1. Features

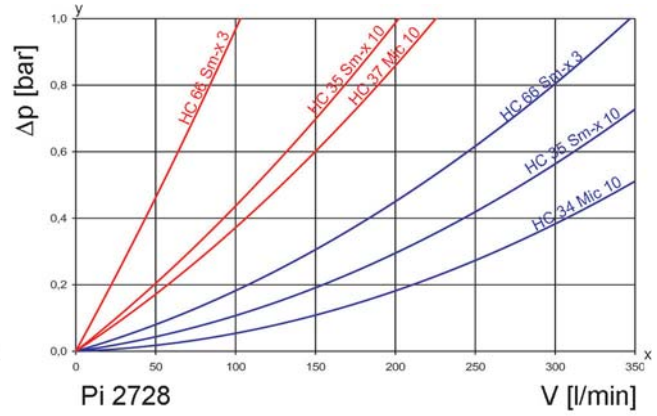
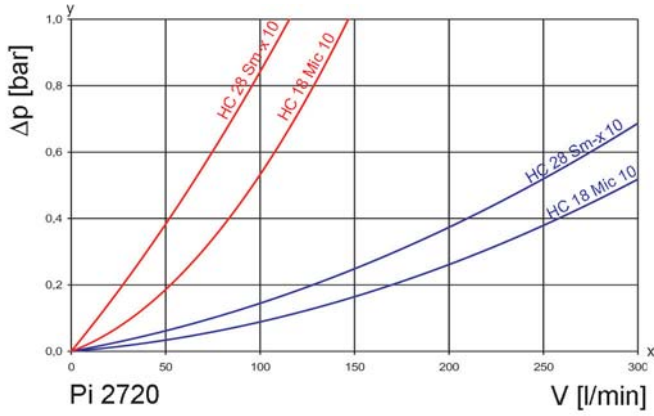
High performance filters for modern hydraulic systems

- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded connections
- Quality filters, easy to service
- Equipped with highly efficient Mic or Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution



2. Flow rate/pressure drop curve complete filter

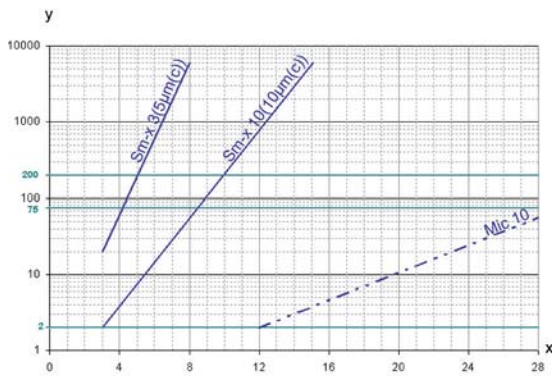
190 mm²/s
33 mm²/s



y = differential pressure Δp [bar]

x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value

x = particle size [μm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)
Sm-x elements with max. Δp 5 bar

Sm-x	3	$\beta_{5(C)}$	≥ 200
Sm-x	10	$\beta_{10(C)}$	≥ 200

values guaranteed up to 5 bar differential pressure

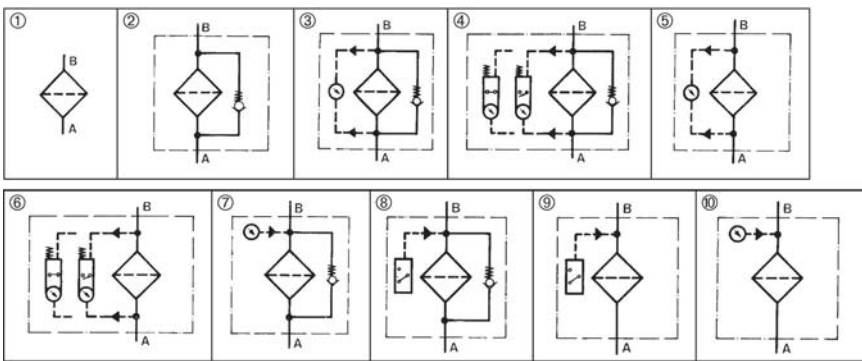
Subject to technical alteration without prior notice.

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 3723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3724	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power filters; evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters-multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Filter design	2. 2x filter elements
V = 250 l/min, bypass, electrical maintenance indicator Type: Pi 2720-058 Order number: 77694060	Mic 10 Type: HC 18 Order number: 77643331

7.1 Housing design/order numbers for pressure side installation

Nominal size NG [l/min]	Order number	Type	①	②	③	④	⑤	⑥
			no options	with bypass 3.5 bar	with bypass 3.5 bar and visual indicator	with bypass 3.5 bar and electrical indicator	with visual indicator	with electrical indicator
250	77694011	Pi 2720-060						
	77694029	Pi 2720-056						
	77694078	Pi 2720-057						
	77694060	Pi 2720-058						
	77694045	Pi 2720-068						
	77694037	Pi 2720-069						
315	77694128	Pi 2728-060						
	77694136	Pi 2728-056						
	77694185	Pi 2728-057						
	77694177	Pi 2728-058						
	77694151	Pi 2728-068						
	77694144	Pi 2728-069						

When filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

7.2 Spin-on cartridge/order numbers for pressure side installation

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
250	77643331	HC 18	Mic 10	5	7000
	77643398	HC 28	Sm-x 10		3400
315	77504194	HC 34	Mic 10	5	14025
	78714750	HC 66	Sm-x 3		7638
	77643844	HC 35	Sm-x 10		7638

7.3 Housing design/order numbers for suction side installation

Nominal size NG [l/min]	Order number	Type	① no options	② with bypass 0.25 bar	⑦ with bypass 0.25 bar + vacuum gauge	⑧ with bypass 0.25 bar + vacuum switch	⑨ with vacuum switch	⑩ with vacuum gauge
80	77694011	Pi 2720-060						
	77694094	Pi 2720-067						
	77694102	Pi 2720-062						
	77694110	Pi 2720-061						
	77694086	Pi 2720-065						
	77694052	Pi 2720-066						
125	77694128	Pi 2728-060						
	77694201	Pi 2728-067						
	77694219	Pi 2728-062						
	77694227	Pi 2728-061						
	77694193	Pi 2728-065						
	77694169	Pi 2728-066						

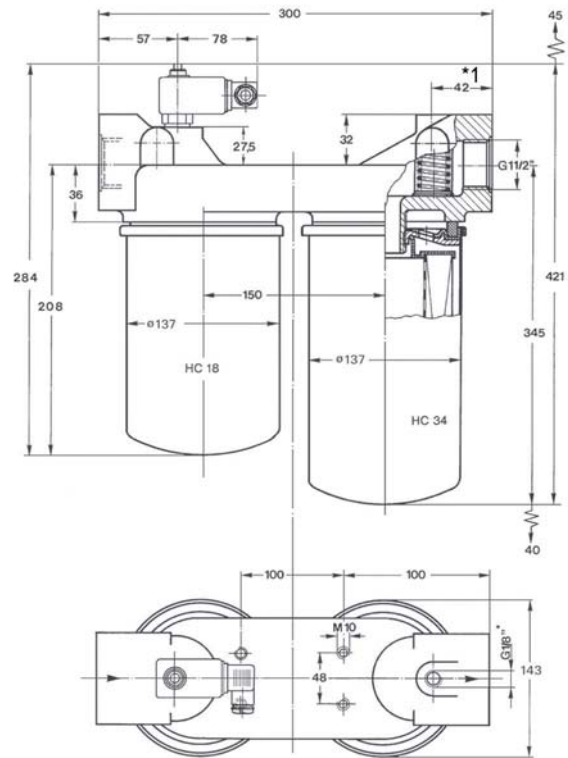
When filter with non bypass configuration is selected Δp of 5 bar may not be exceeded.

7.4 Spin-on cartridge/order numbers for suction side installation

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
80	77643331	HC 18	Mic 10	5	7000
125	77504194	HC 34	Mic 10		14025

8. Technical specifications

Design:	in-line filter
Nominal pressure:	10 bar (140 psi)
Test pressure:	13 bar (180 psi)
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Bypass setting:	
Pressure side:	Δp 3.5 bar \pm 10 %
Suction side:	Δp 0.25 bar \pm 10 %
Filter head material:	GAL
Spin-on cartridge material:	St
Sealing material:	NBR/AL
Maintenance indicator setting:	Δp 2.2 bar \pm 10 %
Indicating range vacuum gauge:	-1 bar to +1.5 bar
Pressure setting vacuum switch:	200 mbar
Type of protection (suction side):	IP 54
Electrical data of maintenance indicator:	
Maximum voltage:	250 V AC/200 V DC
Maximum current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable connection:	M20x1.5



*1 only existing at suction side design

The switching function can be changed by turning the electric upper part by 180 ° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.

9. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove spin-on cartridge. Filter should be installed with the spin-on cartridge pointing downwards. The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2.

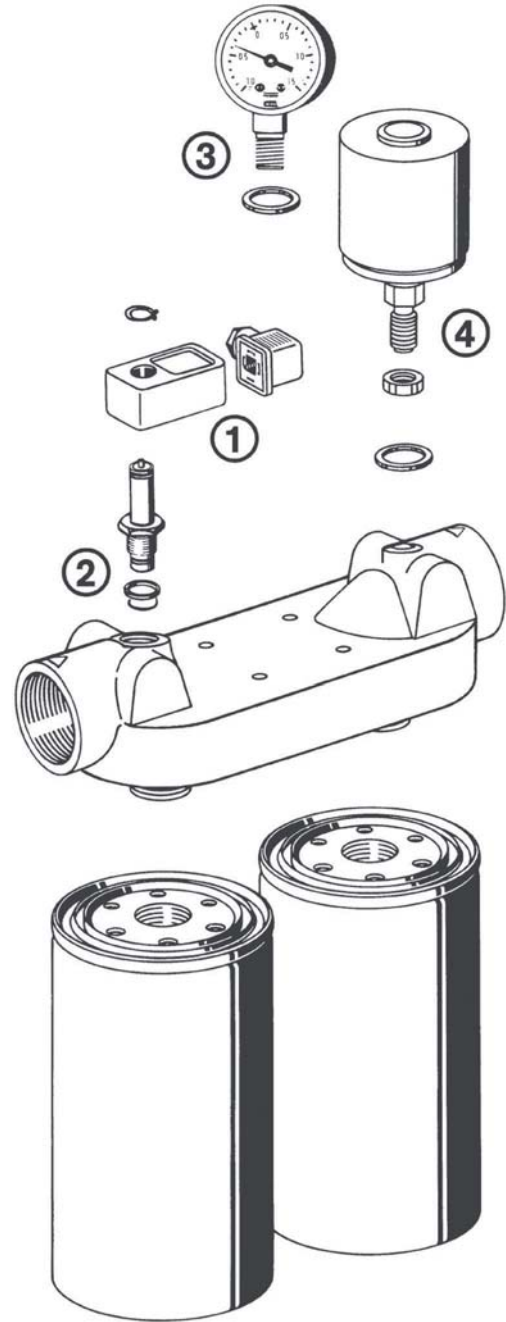
The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

10.3 When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
- Filters without maintenance indicator:
The filter element should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
- Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (Sm-x, Mic) cannot be cleaned.

10.4 Spin-on cartridge replacement

- Stop system and relieve filter from pressure.
- Unscrew the spin-on cartridge by using a filter wrench by turning counter-clockwise.
- Make sure that the order number on the spin-on cartridge corresponds to the order number of the filter plate.
- Oil the seal of the spin-on cartridge.
- Spin-on cartridge must be installed according to the printed instructions.



10. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
①	Maintenance indicator	
	Visual PiS 3098/2.2	77669971
	Electrical PiS 3097/2.2	77669948
	Electrical upper section only	77536550
②	Seal kit for maintenance indicator	
	NBR	77760309
③	Vacuum gauge	77548027
④	Vacuum switch	
	PiS 3070/200 mbar	77669724

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 www.mahle-industriefiltration.com
 78356677.06/2008

Low Pressure Filter Spin-on Cartridge

Nominal pressure 10/16/25 bar (140/230/360 psi), nominal size up to 160

1. Features

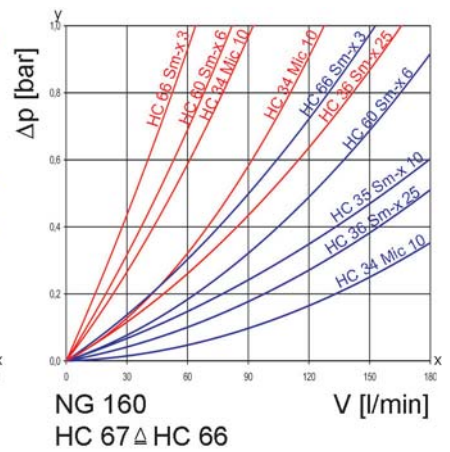
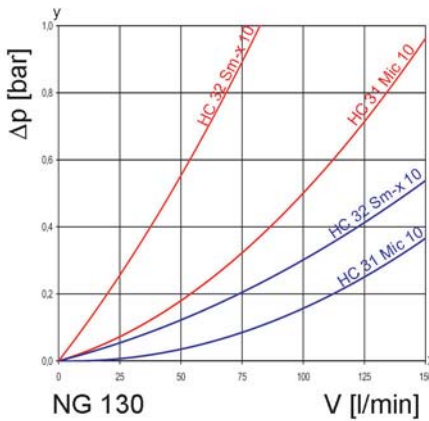
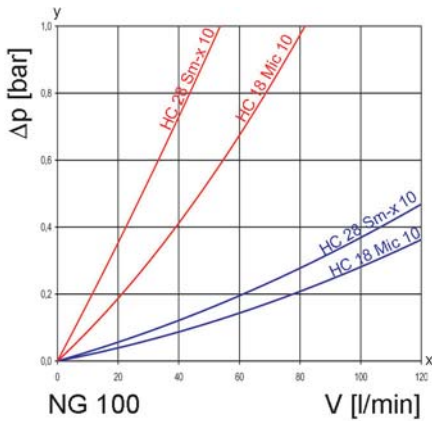
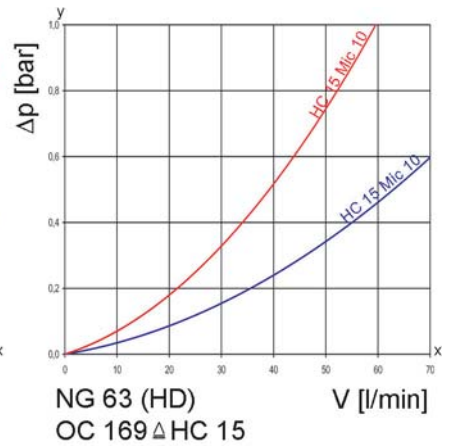
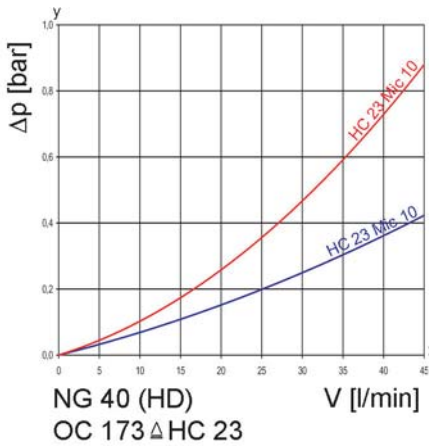
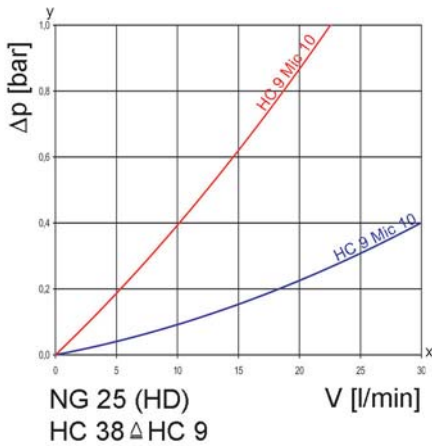
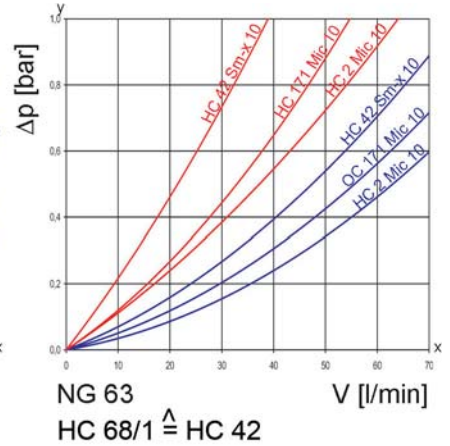
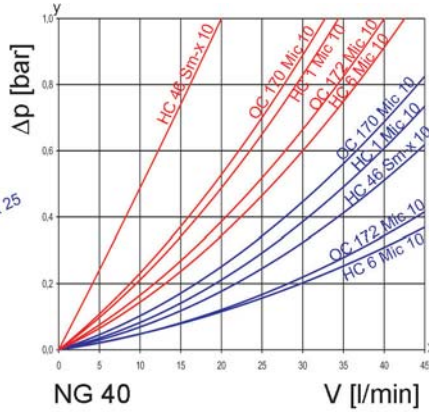
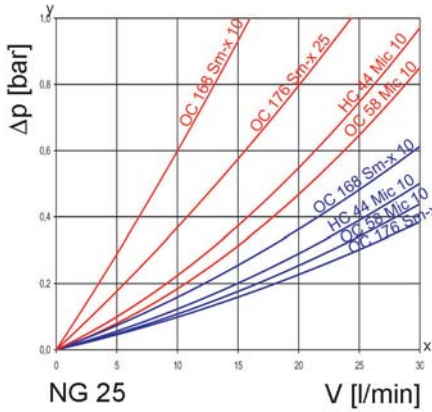
High performance filters for modern hydraulic systems

- Modular design
- Compact design
- Minimal pressure drop through optimal flow design
- Quality filters, easy to service
- Equipped with highly efficient glass fibre Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution



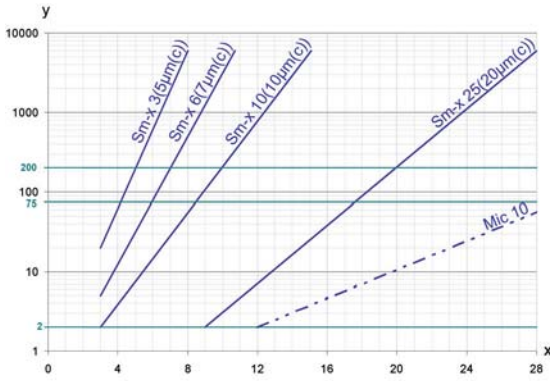
2. Flow rate/pressure drop curve complete filter

190 mm²/s
33 mm²/s



y = differential pressure Δp [bar]
x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value

x = particle-size [μm]

determined by multipass tests (ISO 16889)

calibration according to ISO 11171 (NIST)

4. Filter performance data

measured according to ISO 16889 (multipass test)

Sm-x elements with max. Δp 5 bar

Sm-x	3	$\beta_{5(C)}$	≥ 200
Sm-x	6	$\beta_{7(C)}$	≥ 200
Sm-x	10	$\beta_{10(C)}$	≥ 200
Sm-x	25	$\beta_{20(C)}$	≥ 200

values guaranteed up to 5 bar differential pressure

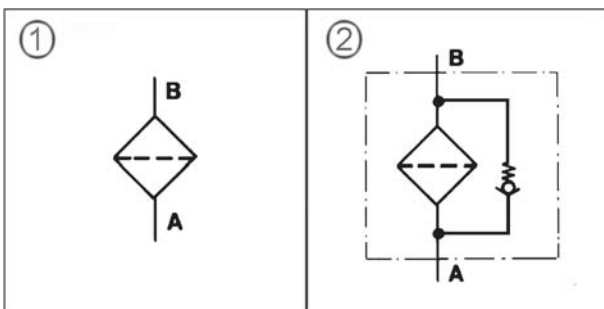
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5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power; filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power; filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power; filter elements; verification of material compatibility with fluids
DIN ISO 3723	Hydraulic fluid power; filter elements; method for end load test
DIN ISO 3724	Hydraulic fluid power; filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power filters; evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters; multipass method for evaluation filtration performance of a filter element

6. Symbols



1. without bypass

2. with bypass

7. Order numbers

7.1 Housing design

Nominal size NG [l/min]	Order number	Type	Nominal pressure [bar]	Filter material	Filter surface [cm ²]	Bypass valve [bar]	Check valve
25	77785983	OC 58	10	Mic 10	1775		
	77500184	OC 168		Sm-x 10	1309		
	77785918	OC 176		Sm-x 25	1200		
	77500341	HC 44		Mic 10	1775	2.5	x
40	77640899	HC 1		Mic 10	3000		
	77844780	OC 170		Mic 10	3000	2.5	x
	77501273	HC 6		Mic 10	3000		
	77501232	HC 46		Sm-x 10	2075		
	71348143	OC 172		Mic 10	3000	2.5	x
63	72013241	HC 2		Mic 10	5440		
	77501372	HC 42		Sm-x 10	3360		
	72013027	OC 171		Mic 10	5440	2.5	x
100	77643331	HC 18		Mic 10	7000		
	77643398	HC 28		Sm-x 10	3400		
	77727183	HC 4		Mic 10	7260		
130	77500077	HC 31		Mic 10	9755		
	77500051	HC 32	Sm-x 10	5400			
160	77504194	HC 34	16	Mic 10	14025		
	78714750	HC 66		Sm-x 3	7638		
	77478829	HC 60		Sm-x 6	7638		
	77643844	HC 35		Sm-x 10	7638		
	77643851	HC 36		Sm-x 25	7638		
	78714768	HC 67	10	Sm-x 3	7638		
25	77373020	HC 9	25	Mic 10	2050	3.5	
	77503964	HC 38		Mic 10	2050		
40	77803257	OC 173		Mic 10	4100	2.5	
	77502180	HC 23		Mic 10	4100		
63	77502511	OC 169		Mic 10	5440	2.5	
	77502628	HC 15		Mic 10	5440		
	78787921	HC 68/1		Sm-x 3	3360		

8. Technical specifications

Nominal pressure:	10/16/25 bar (140/230/360 psi)
Burst pressure:	16/35 bar (230/500 psi)
Temperature range:	- 10 °C to + 120 °C
Housing material:	steel
Sealing material:	perbunan
Opening pressure check valve:	≤ 0.12 bar
Installation:	preferably vertical
Collapse pressure of element:	$\Delta p \geq 5$ bar (70 psi)
Long time rupture strength:	min. 10^5 load alterations at nominal pressure

Spin-on cartridges are resistant against mineral oil.

We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department would be pleased to offer you advice.

We recommend to contact us concerning applications of our filters in areas governed by the EU directive 94/9 EG (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EG Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.

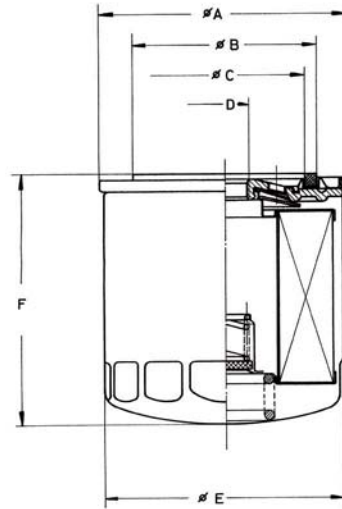


Figure shows spin-on cartridge with relief valve and check valve (optional).

9. Dimensions

All dimensions except "D" in mm.

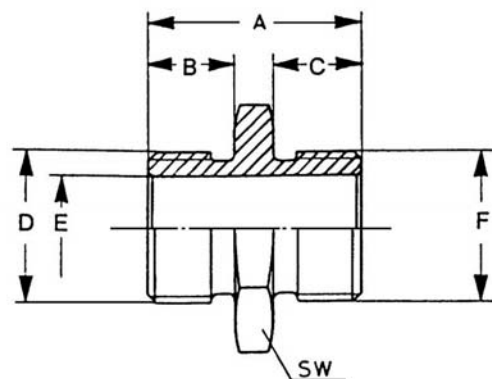
Type	Ø A	Ø B	Ø C	D	Ø E	F	Weight [kg]
OC 58	80	72	62	¾" 16 UNF 2B	76	120	0.40
OC 168	80	72	62	¾" 16 UNF 2B	76	120	0.55
OC 176	80	72	62	¾" 16 UNF 2B	76	120	0.55
HC 44	80	72	62	¾" 16 UNF 2B	76	120	0.40
HC 1	95	72	62	¾" 16 UNF 2B	93	141	0.55
OC 170	95	72	62	¾" 16 UNF 2B	93	141	0.55
HC 6	95	72	62	1" 12 UNF 2B	93	141	0.55
HC 46	95	72	62	1" 12 UNF 2B	93	141	0.75
OC 172	95	72	62	1" 12 UNF 2B	93	141	0.55
HC 2	95	72	62	1" 12 UNF 2B	93	210	0.75
HC 42	95	72	62	1" 12 UNF 2B	93	210	0.75
OC 171	95	72	62	1" 12 UNF 2B	93	210	0.75
HC 18	143	111	100	1½" 16 UN 2B	136	172	1.50
HC 28	143	111	100	1½" 16 UN 2B	136	172	1.80
HC 4	143	111	100	G 1¼	136	172	1.50
HC 31	143	111	100	1½" 16 UN 2B	136	240	1.70
HC 32	143	111	100	1½" 16 UN 2B	136	240	2.20
HC 34	143	111	100	1½" 16 UN 2B	136	310	1.95
HC 66	143	111	100	1½" 16 UN 2B	136	310	2.65
HC 60	143	111	100	1½" 16 UN 2B	136	310	2.65
HC 35	143	111	100	1½" 16 UN 2B	136	310	2.65
HC 36	143	111	100	1½" 16 UN 2B	136	310	2.65
HC 67	143	111	100	G 1¼	136	310	2.65
HC 9	80	72	62	¾" 16 UNF 2B	76	140	0.55
HC 38	80	72	62	¾" 16 UNF 2B	76	140	0.55
OC 173	95	72	62	1" 12 UNF 2B	93	180	0.80
HC 23	95	72	62	1" 12 UNF 2B	93	180	0.80
OC 169	95	72	62	1" 12 UNF 2B	93	215	0.90
HC 15	95	72	62	1" 12 UNF 2B	93	215	0.90
HC 68/1	95	72	62	1" 12 UNF 2B	93	215	1.20

10. Accessories

All dimensions except "D" in mm.

Order number	Adapter			D	E	SW	F
	A	B	C				
77802382	32	15	12	¾" 16 UNF 2A	13	27	M18x1.5
77802390	35	15	15	1" 12 UNF 2A	17	27	M24x1.5
77893860	27	15	10	1" 12 UNF 2A	16	27	M22x1.5
77802408	35	15	15	1½" 16 UNF 2A	25	41	M38x1.5

The sealing surface for block mounting should be in accordance with ISO 6415.



MAHLE Filtersysteme GmbH, Industriefiltration, Schleifbachweg 45, D-74613 Öhringen, Phone +49 (0) 7941/67-0
 Fax +49 (0) 7941/67-23429, industriefiltration@mahle.com, www.mahle-industriefiltration.com
 78356719.08/2008

MEDIUM PRESSURE FILTERS

Medium Pressure Filter Pi 3000

Nominal pressure 200/315 bar (2850/4480 psi), nominal size up to 400
according to DIN 24550

1. Features

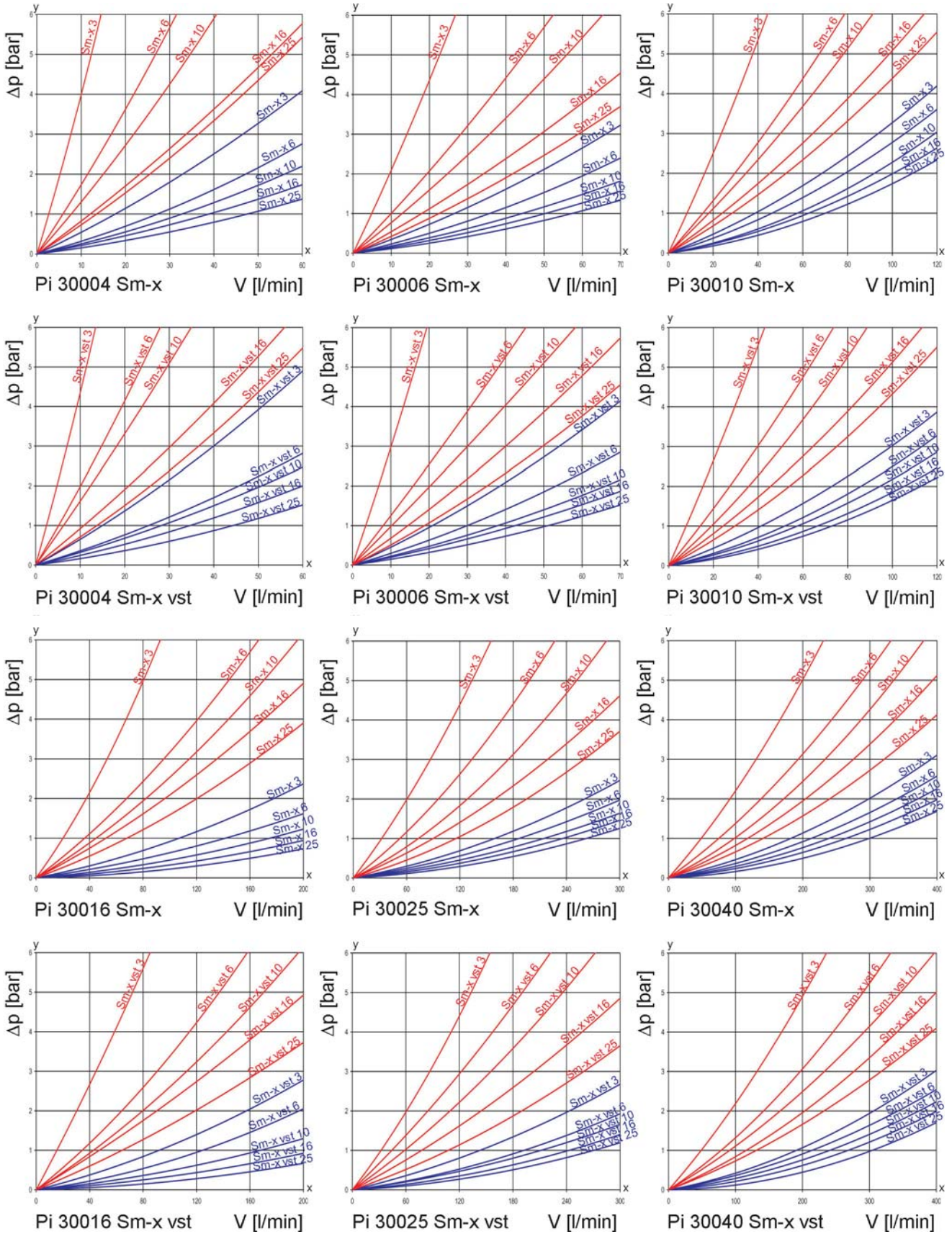
High performance filters for modern hydraulic systems

- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre Sm-x filter elements
- Beta rated elements according to ISO 16889
- Elements with high differential pressure stability and dirt holding capacity
- NPT- and SAE-connections on request
- Worldwide distribution



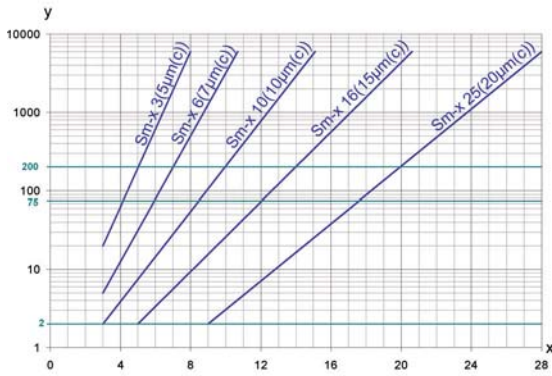
2. Flow rate/pressure drop curve complete filter

190 mm²/s
33 mm²/s



y = differential pressure Δp [bar]
x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particle size [μm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x elements with
max. Δp 20 bar

Sm-x	3	$\beta_{5(C)} \geq 200$
Sm-x	6	$\beta_{7(C)} \geq 200$
Sm-x	10	$\beta_{10(C)} \geq 200$
Sm-x	16	$\beta_{15(C)} \geq 200$
Sm-x	25	$\beta_{20(C)} \geq 200$

values guaranteed up to
10 bar differential pressure

Sm-x vst elements with
max. Δp 210 bar

Sm-x vst	3	$\beta_{5(C)} \geq 200$
Sm-x vst	6	$\beta_{7(C)} \geq 200$
Sm-x vst	10	$\beta_{10(C)} \geq 200$
Sm-x vst	16	$\beta_{15(C)} \geq 200$
Sm-x vst	25	$\beta_{20(C)} \geq 200$

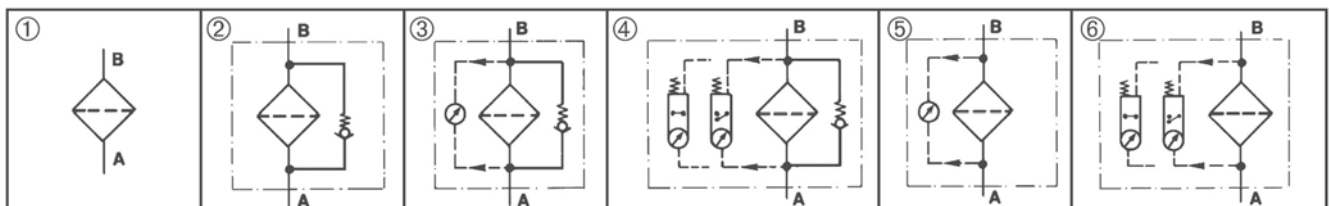
values guaranteed up to
20 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 2923	Hydraulic fluid power filter elements; method for end load test
DIN ISO 2924	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power filters; evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters; multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Filter housing	2. Filter element
V = 100l/min and electrical maintenance indicator Type: Pi 30010-015 Order number: 78208084	Sm-x vst 3 Type: Pi 71010 DN Sm-x vst 3 Order number: 78227480

7.1 Housing design								
Nominal size NG [l/min]	Order number	Type	① with indicator cavity	② with bypass valve and indicator cavity	③ with bypass valve and visual indicator	④ with bypass valve and electrical indicator	⑤ with visual indicator	⑥ with electrical indicator
40	78207896	Pi 30004-010						
	78207904	Pi 30004-011						
	78337388	Pi 30004-012						
	78304206	Pi 30004-013						
	78207938	Pi 30004-014						
	78207946	Pi 30004-015						
63	78207961	Pi 30006-010						
	78207979	Pi 30006-011						
	78207987	Pi 30006-012						
	78304214	Pi 30006-013						
	78208001	Pi 30006-014						
	78208019	Pi 30006-015						
100	78208035	Pi 30010-010						
	78208043	Pi 30010-011						
	78208050	Pi 30010-012						
	78304222	Pi 30010-013						
	78208076	Pi 30010-014						
	78208084	Pi 30010-015						
160	78208100	Pi 30016-010						
	78208118	Pi 30016-011						
	78208126	Pi 30016-012						
	78259970	Pi 30016-013						
	78208142	Pi 30016-014						
	78208159	Pi 30016-015						
250	78208167	Pi 30025-010						
	78208175	Pi 30025-011						
	78208183	Pi 30025-012						
	78259988	Pi 30025-013						
	78208209	Pi 30025-014						
	78208217	Pi 30025-015						
400	78208225	Pi 30040-010						
	78208233	Pi 30040-011						
	78208241	Pi 30040-012						
	78259996	Pi 30040-013						
	78208266	Pi 30040-014						
	78208274	Pi 30040-015						

When filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

7.2 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
40	78260929	Pi 21004 DN Sm-x 3 NBR	Sm-x 3	20	475
	77960859	Pi 22004 DN Sm-x 6 NBR	Sm-x 6		475
	77925571	Pi 23004 DN Sm-x 10 NBR	Sm-x 10		475
	78260937	Pi 24004 DN Sm-x 16 NBR	Sm-x 16		475
	78260945	Pi 25004 DN Sm-x 25 NBR	Sm-x 25		475
	78216079	Pi 71004 DN Sm-x vst 3 NBR	Sm-x vst 3	210	445
	77960156	Pi 72004 DN Sm-x vst 6 NBR	Sm-x vst 6		445
	77925654	Pi 73004 DN Sm-x vst 10 NBR	Sm-x vst 10		445
	78216087	Pi 74004 DN Sm-x vst 16 NBR	Sm-x vst 16		445
	78216095	Pi 75004 DN Sm-x vst 25 NBR	Sm-x vst 25		445
63	78260960	Pi 21006 DN Sm-x 3 NBR	Sm-x 3	20	835
	77960867	Pi 22006 DN Sm-x 6 NBR	Sm-x 6		835
	77925589	Pi 23006 DN Sm-x 10 NBR	Sm-x 10		835
	78260978	Pi 24006 DN Sm-x 16 NBR	Sm-x 16		835
	78260986	Pi 25006 DN Sm-x 25 NBR	Sm-x 25		835
	78216137	Pi 71006 DN Sm-x vst 3 NBR	Sm-x vst 3	210	780
	77960149	Pi 72006 DN Sm-x vst 6 NBR	Sm-x vst 6		780
	77925662	Pi 73006 DN Sm-x vst 10 NBR	Sm-x vst 10		780
	78216145	Pi 74006 DN Sm-x vst 16 NBR	Sm-x vst 16		780
	78216152	Pi 75006 DN Sm-x vst 25 NBR	Sm-x vst 25		780
100	78227472	Pi 21010 DN Sm-x 3 NBR	Sm-x 3	20	1375
	77960875	Pi 22010 DN Sm-x 6 NBR	Sm-x 6		1375
	77925597	Pi 23010 DN Sm-x 10 NBR	Sm-x 10		1375
	78261000	Pi 24010 DN Sm-x 16 NBR	Sm-x 16		1375
	78261018	Pi 25010 DN Sm-x 25 NBR	Sm-x 25		1375
	78227480	Pi 71010 DN Sm-x vst 3 NBR	Sm-x vst 3	210	1275
	77960131	Pi 72010 DN Sm-x vst 6 NBR	Sm-x vst 6		1275
	77925670	Pi 73010 DN Sm-x vst 10 NBR	Sm-x vst 10		1275
	78261281	Pi 74010 DN Sm-x vst 16 NBR	Sm-x vst 16		1275
	78216160	Pi 75010 DN Sm-x vst 25 NBR	Sm-x vst 25		1275

* a wider range of element types is available on request

7.2 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
160	78261034	Pi 21016 DN Sm-x 3 NBR	Sm-x 3	20	2530
	77960826	Pi 22016 DN Sm-x 6 NBR	Sm-x 6		2530
	77925605	Pi 23016 DN Sm-x 10 NBR	Sm-x 10		2530
	78261042	Pi 24016 DN Sm-x 16 NBR	Sm-x 16		2530
	78261059	Pi 25016 DN Sm-x 25 NBR	Sm-x 25		2530
	77940638	Pi 71016 DN Sm-x vst 3 NBR	Sm-x vst 3	210	1885
	77960123	Pi 72016 DN Sm-x vst 6 NBR	Sm-x vst 6		1885
	77925688	Pi 73016 DN Sm-x vst 10 NBR	Sm-x vst 10		1885
	78269797	Pi 74016 DN Sm-x vst 16 NBR	Sm-x vst 16		1885
	78216178	Pi 75016 DN Sm-x vst 25 NBR	Sm-x vst 25		1885
250	78227514	Pi 21025 DN Sm-x 3 NBR	Sm-x 3	20	4020
	77960834	Pi 22025 DN Sm-x 6 NBR	Sm-x 6		4020
	77925613	Pi 23025 DN Sm-x 10 NBR	Sm-x 10		4020
	78261075	Pi 24025 DN Sm-x 16 NBR	Sm-x 16		4020
	78261083	Pi 25025 DN Sm-x 25 NBR	Sm-x 25		4020
	77940646	Pi 71025 DN Sm-x vst 3 NBR	Sm-x vst 3	210	3090
	77960115	Pi 72025 DN Sm-x vst 6 NBR	Sm-x vst 6		3090
	77925696	Pi 73025 DN Sm-x vst 10 NBR	Sm-x vst 10		3090
	78269813	Pi 74025 DN Sm-x vst 16 NBR	Sm-x vst 16		3090
	78216186	Pi 75025 DN Sm-x vst 25 NBR	Sm-x vst 25		3090
400	78227522	Pi 21 040 DN Sm-x 3 NBR	Sm-x 3	20	6770
	77960842	Pi 22 040 DN Sm-x 6 NBR	Sm-x 6		6770
	77925621	Pi 23 040 DN Sm-x 10 NBR	Sm-x 10		6770
	78261109	Pi 24 040 DN Sm-x 16 NBR	Sm-x 16		6770
	78261117	Pi 25 040 DN Sm-x 25 NBR	Sm-x 25		6770
	77940653	Pi 71 040 DN Sm-x vst 3 NBR	Sm-x vst 3	210	5240
	77960107	Pi 72 040 DN Sm-x vst 6 NBR	Sm-x vst 6		5240
	77930829	Pi 73 040 DN Sm-x vst 10 NBR	Sm-x vst 10		5240
	78269821	Pi 74 040 DN Sm-x vst 16 NBR	Sm-x vst 16		5240
	78260903	Pi 75 040 DN Sm-x vst 25 NBR	Sm-x vst 25		5240

* a wider range of element types is available on request

8. Technical specifications

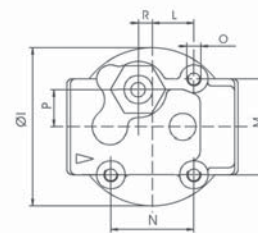
Design:	in-line filter
Nominal pressure: Pi 30016-30040	210 bar (2990 psi)
Pi 30004, 30006, 30010	315 bar (4480 psi)
Test pressure: Pi 30016-30040	275 bar (3910 psi)
Pi 30004, 30006, 30010	410 bar (5830 psi)
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Bypass setting:	Δp 7 bar \pm 10 %
Filter head material:	GGG
Filter housing material:	St
Sealing material:	NBR/PTFE
Maintenance indicator setting:	Δp 5 bar \pm 10 %
Electrical data of maintenance indicator:	
Maximum voltage:	250 V AC/200 V DC
Maximum current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M20x1.5

The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

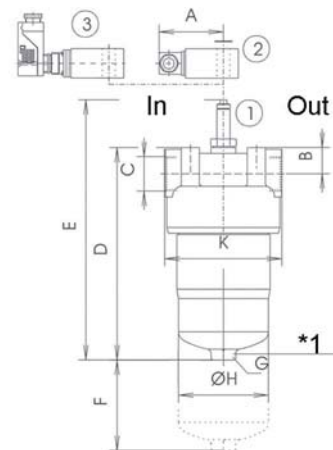
We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

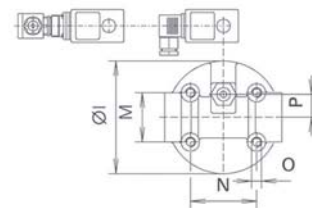
Subject to technical alteration without prior notice.



NG 40 - 100



NG 160 - 400



In = inlet

Out = outlet

*1 NG 250, 400 with drain screw G ¼ DIN 910

Pos. 1 Visual maintenance indicator

Pos. 2 Electrical upper section connector according DIN EN 175301-803
Version: PiS 3092, 3105, 3115

Pos. 3 Electrical upper section connector according DIN EN 175301-804
Version: PiS 3102, 3122, 3132

9. Dimensions

All dimensions except "C" in mm.

Type	A	B	C*	D	E	F	G SW	H	I	K	L	M	N	O	P	R	Weight [kg]
Pi 30004	78	31	G½	194	252	80	27	66	90	92	23.5	54	47	M8x16	21	8	4.2
Pi 30006	78	31	G¾	254	312	80	27	66	90	92	23.5	54	47	M8x16	21	8	4.9
Pi 30010	78	31	G1	344	402	80	27	66	90	92	23.5	54	47	M8x16	21	8	5.8
Pi 30016	78	32	G1¼	268	326	110	30	109	137	142	-	60	80	M12x16	28	-	10.0
Pi 30025	78	32	G1¼	368	426	110	30	109	137	142	-	60	80	M12x16	28	-	12.0
Pi 30040	78	32	G1¼	518	576	110	30	109	137	142	-	60	80	M12x16	28	-	15.6

* NPT- and SAE- port connections on request

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove filter element and filter housing. Preferably the filter should be installed with the filter housing pointing downwards. The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

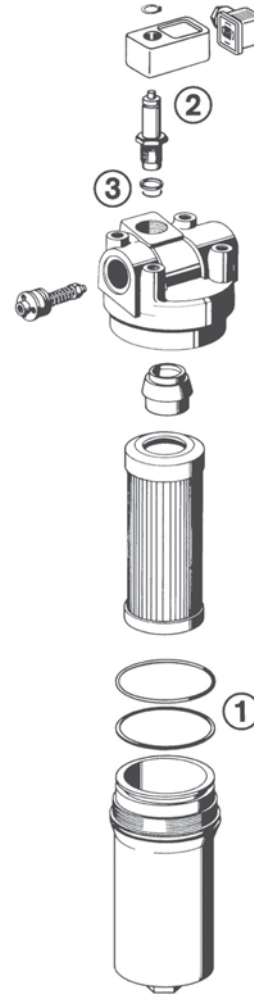
The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

10.3 When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
- Filters without maintenance indicator:
The filter element should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
- Please always ensure that you have Original MAHLE spare elements in stock: Disposable elements (Sm-x) cannot be cleaned.

10.4 Element replacement

- Stop system and relieve filter from pressure.
- Unscrew the filter housing by turning counter-clockwise. Clean the bowl using a suitable cleaning solvent.
- Remove element by pulling down carefully.
- Check O-ring and spigot for damage. Replace, if necessary.
- Make sure that the order number on the spare element corresponds to the order number of the filter name-plate. Remove the plastic bag and push element over the spigot in the filter head.
- Complete installation by screwing on the housing, turning clockwise until it comes to a full stop. Back off the bowl 1/8 to 1/2 turn.



11. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
①	Seal kit for filter	
	Pi 30004 - Pi 30010	
	NBR	78383747
	FPM	78383754
	EPDM	78383762
	Pi 30016 - Pi 30040	
	NBR	78383770
	FPM	78383788
	EPDM	78383796
②	Maintenance indicator	
	Visual PiS 3093/5	77669914
	Electrical PiS 3092/5	77669864
	Electrical upper section only	77536550
③	Seal kit for maintenance indicator	
	NBR	77760275
	FPM	77760283
	EPDM	77760291

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industriefiltration@mahle.com
www.mahle-industriefiltration.com
78396012.07/2008

Medium Pressure Filter

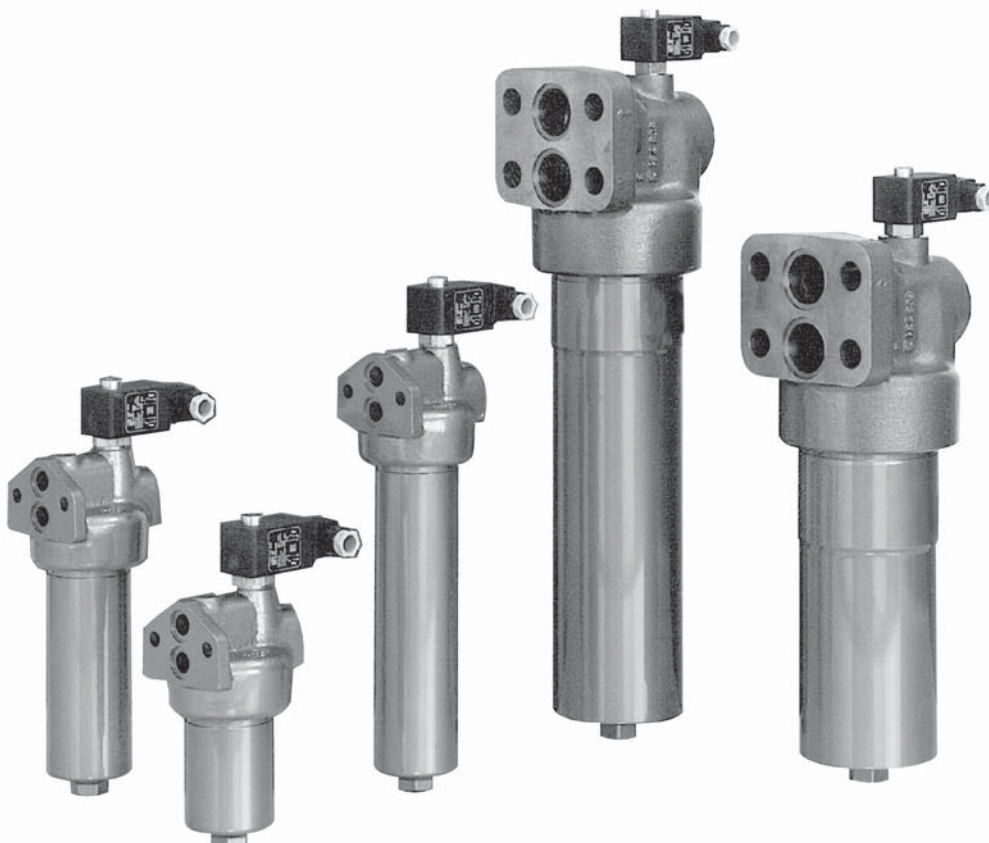
Pi 340

Nominal pressure 250/315/350 bar (3560/4480/4980 psi), nominal size up to 450
(also available with filter elements acc. to DIN 24550)

1. Features

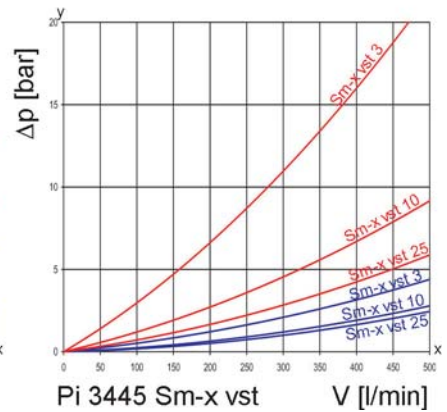
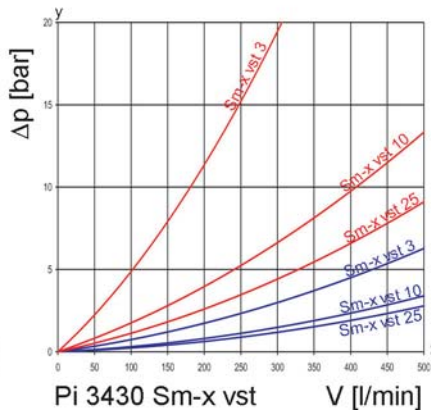
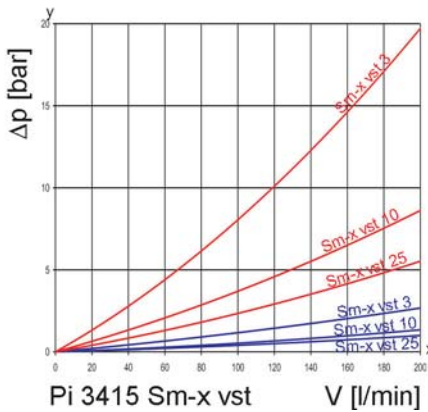
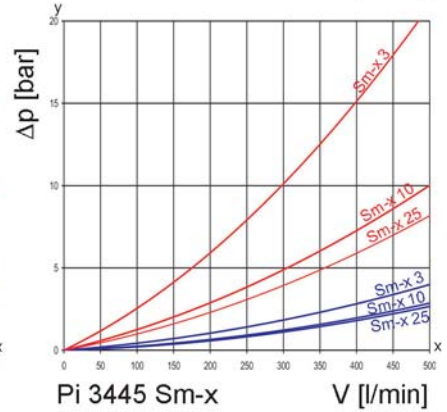
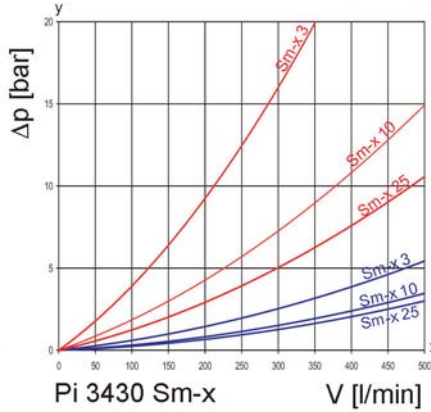
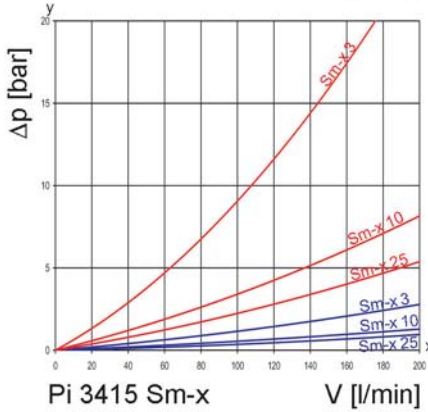
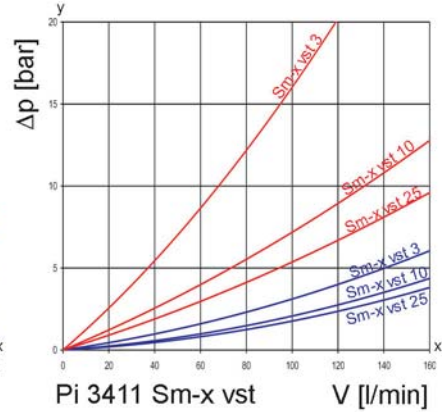
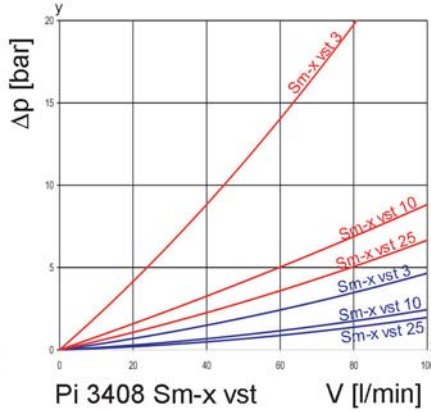
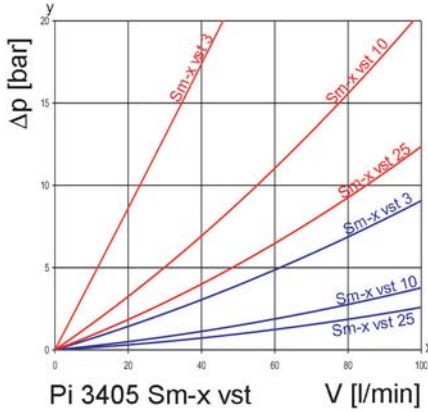
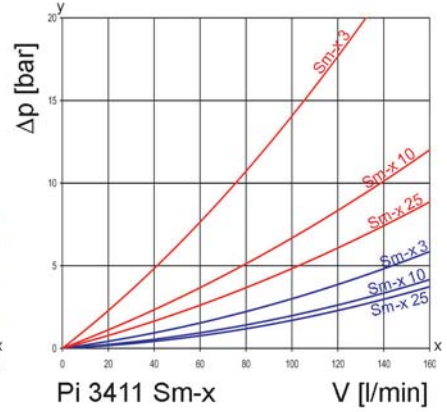
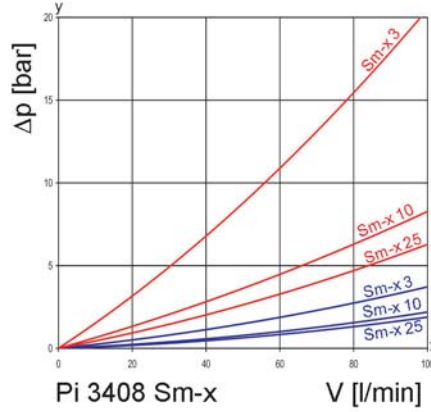
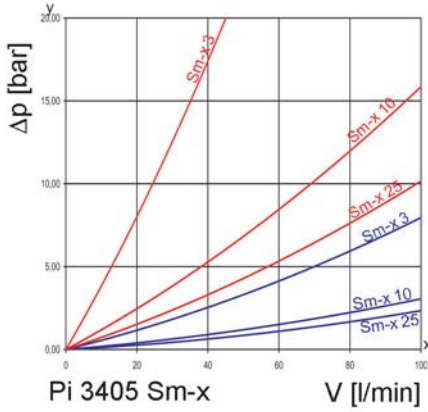
High performance filters for modern hydraulic systems

- Designed for control block mounting
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Equipped with highly efficient glass fibre Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution



2. Flow rate/pressure drop curve complete filter

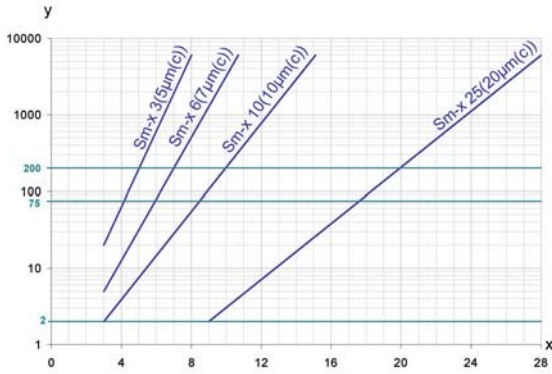
190 mm²/s
33 mm²/s



y = differential pressure Δp [bar]

x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particle size [µm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x elements with
max. Δp 20 bar

Sm-x	3	$\beta_{5(C)} \geq 200$
Sm-x	6	$\beta_{7(C)} \geq 200$
Sm-x	10	$\beta_{10(C)} \geq 200$
Sm-x	25	$\beta_{20(C)} \geq 200$

values guaranteed up to
10 bar differential pressure

Sm-x vst elements with
max. Δp 210 bar

Sm-x vst	3	$\beta_{5(C)} \geq 200$
Sm-x vst	6	$\beta_{7(C)} \geq 200$
Sm-x vst	10	$\beta_{10(C)} \geq 200$
Sm-x vst	25	$\beta_{20(C)} \geq 200$

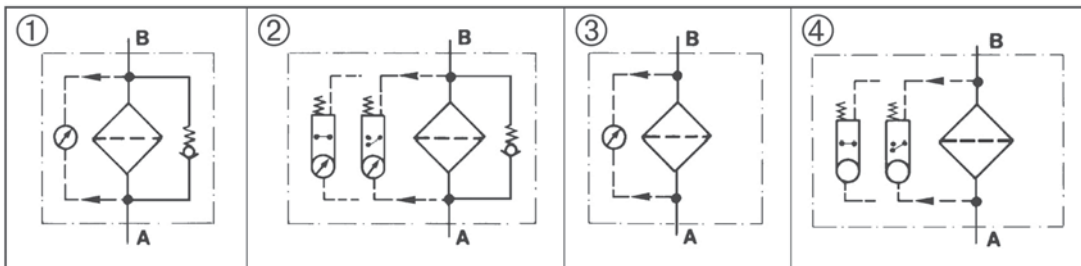
values guaranteed up to
20 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 3723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3724	Hydraulic fluid power filter elements; verification flow fatigue characteristics
ISO 3968	Hydraulic fluid power filters; evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters; multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Filter housing	2. Filter element
V = 80 l/min and electrical maintenance indicator Type: Pi 3408-015 Order number: 77874415	Sm-x vst 3 Type: Pi 2208 Sm-x vst 3 Order number: 77680200

7.1 Housing design

Nominal size NG [l/min]	Order number	Type	① with bypass valve and visual indicator	② with bypass valve and electrical indicator	③ with visual indicator	④ with electrical indicator
50	77874324	Pi 3405-012				
	77874332	Pi 3405-013				
	77874340	Pi 3405-014				
	77874357	Pi 3405-015				
80	77874381	Pi 3408-012				
	78274136	Pi 3408-013				
	77874407	Pi 3408-014				
	77874415	Pi 3408-015				
110	77874449	Pi 3411-012				
	77874456	Pi 3411-013				
	77874464	Pi 3411-014				
	77874472	Pi 3411-015				
150	77921919	Pi 3415-012				
	77921927	Pi 3415-013				
	77921935	Pi 3415-014				
	77921943	Pi 3415-015				
300	77921968	Pi 3430-012				
	77921976	Pi 3430-013				
	77921984	Pi 3430-014				
	77921992	Pi 3430-015				
450	77922008	Pi 3445-012				
	77922016	Pi 3445-013				
	77922024	Pi 3445-014				
	77922032	Pi 3445-015				

When filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

7.2 Filter elements (a wider range of element types is available on request)

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
50	77680135	Pi 2105 Sm-x 3	Sm-x 3	20	590
	77943509	Pi 5105 Sm-x 6	Sm-x 6		590
	77680325	Pi 3105 Sm-x 10	Sm-x 10		590
	77680440	Pi 4105 Sm-x 25	Sm-x 25		590
	77680192	Pi 2205 Sm-x vst 3	Sm-x vst 3	210	425
	77943533	Pi 5205 Sm-x vst 6	Sm-x vst 6		425
	77680382	Pi 3205 Sm-x vst 10	Sm-x vst 10		425
	77680507	Pi 4205 Sm-x vst 25	Sm-x vst 25		425
80	77680143	Pi 2108 Sm-x 3	Sm-x 3	20	1150
	77943517	Pi 5108 Sm-x 6	Sm-x 6		1150
	77680341	Pi 3108 Sm-x 10	Sm-x 10		1150
	77680457	Pi 4108 Sm-x 25	Sm-x 25		1150
	77680200	Pi 2208 Sm-x vst 3	Sm-x vst 3	210	850
	77943541	Pi 5208 Sm-x vst 6	Sm-x vst 6		850
	77681190	Pi 3208 Sm-x vst 10	Sm-x vst 10		850
	77680515	Pi 4208 Sm-x vst 25	Sm-x vst 25		850
110	77680150	Pi 2111 Sm-x 3	Sm-x 3	20	1700
	77943525	Pi 5111 Sm-x 6	Sm-x 6		1700
	77680333	Pi 3111 Sm-x 10	Sm-x 10		1700
	77680465	Pi 4111 Sm-x 25	Sm-x 25		1700
	77680218	Pi 2211 Sm-x vst 3	Sm-x vst 3	210	1275
	77943558	Pi 5211 Sm-x vst 6	Sm-x vst 6		1275
	77680390	Pi 3211 Sm-x vst 10	Sm-x vst 10		1275
	77680523	Pi 4211 Sm-x vst 25	Sm-x vst 25		1275
150	77680168	Pi 2115 Sm-x 3	Sm-x 3	20	2425
	77955099	Pi 5115 Sm-x 6	Sm-x 6		2425
	77680358	Pi 3115 Sm-x 10	Sm-x 10		2425
	77680473	Pi 4115 Sm-x 25	Sm-x 25		2425
	77680226	Pi 2215 Sm-x vst 3	Sm-x vst 3	210	2010
	77955123	Pi 5215 Sm-x vst 6	Sm-x vst 6		2010
	77680408	Pi 3215 Sm-x vst 10	Sm-x vst 10		2010
	77680531	Pi 4215 Sm-x vst 25	Sm-x vst 25		2010
300	77680176	Pi 2130 Sm-x 3	Sm-x 3	20	4620
	77955107	Pi 5130 Sm-x 6	Sm-x 6		4620
	77680366	Pi 3130 Sm-x 10	Sm-x 10		4620
	77680481	Pi 4130 Sm-x 25	Sm-x 25		4620
	77680234	Pi 2230 Sm-x vst 3	Sm-x vst 3	210	3800
	77955131	Pi 5230 Sm-x vst 6	Sm-x vst 6		3800
	77680416	Pi 3230 Sm-x vst 10	Sm-x vst 10		3800
	77680549	Pi 4230 Sm-x vst 25	Sm-x vst 25		3800
450	77680184	Pi 2145 Sm-x 3	Sm-x 3	20	6865
	77955115	Pi 5145 Sm-x 6	Sm-x 6		6865
	77680374	Pi 3145 Sm-x 10	Sm-x 10		6865
	77680499	Pi 4145 Sm-x 25	Sm-x 25		6865
	77680242	Pi 2245 Sm-x vst 3	Sm-x vst 3	210	5600
	77955149	Pi 5245 Sm-x vst 6	Sm-x vst 6		5600
	77680424	Pi 3245 Sm-x vst 10	Sm-x vst 10		5600
	77680556	Pi 4245 Sm-x vst 25	Sm-x vst 25		5600

8. Technical specifications

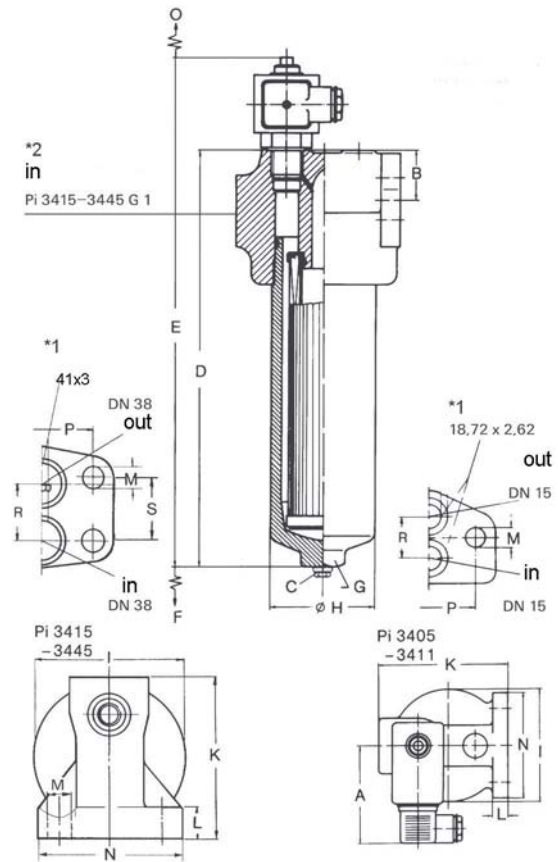
Design:	flange filter
Nominal pressure:	250 bar (3560 psi)
Pi 3405-3411	350 bar (4980 psi)
Pi 3415-3445 without bypass	315 bar (4480 psi)
Test pressure:	325 bar (4620 psi)
Pi 3405-3411	450 bar (6400 psi)
Pi 3415-3445 without bypass	410 bar (5830 psi)
Temperature range:	-10 °C to +120 °C
	(other temperature ranges on request)
Bypass setting:	Δp 7 bar \pm 10 %
Filter head material:	GGG
Filter housing material:	St
Sealing material:	NBR/PTFE
Maintenance indicator setting:	Δp 5 bar \pm 10 %
Electrical data of maintenance indicator:	
Maximum voltage:	250 V AC/200 V DC
Maximum current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M20x1.5

The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By the inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance data sheet.

We draw attention to the fact that all values indicated are average values and do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.



in = inlet
out = outlet

*1 seal

*2 second inlet for installation of coupling hole

Attachment screws (property class 12.9) are not included in the delivery.

9. Dimensions

All dimensions except "C" in mm.

Type	A	B	C	D	E	F	G SW	H	I	K	L	M	N	O	P	R	S	Weight [kg]
Pi 3405	78	29	-	181	241	80	27	66	90	101	13	11	83	45	58	26	-	3.7
Pi 3408	78	29	-	259	319	80	27	66	90	101	13	11	83	45	58	26	-	4.7
Pi 3411	78	29	-	335	395	80	27	66	90	101	13	11	83	45	58	26	-	5.5
Pi 3415	78	60	-	308	368	110	30	109	140	150	30	22	135	45	95	52	58	14.4
Pi 3430	78	60	G¼	433	493	110	30	109	140	150	30	22	135	45	95	52	58	17.3
Pi 3445	78	60	G¼	550	610	110	30	109	140	150	30	22	135	45	95	52	58	19.4

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove filter element and filter housing. Preferably the filter should be installed with the filter housing pointing downwards. The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

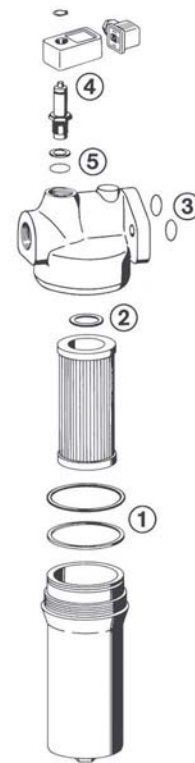
The electrical connection is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

10.3 When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
- Filters without maintenance indicator:
The filter element should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
- Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (Sm-x) cannot be cleaned.

10.4 Element replacement

- Stop system and relieve filter from pressure.
- Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
- Remove element by pulling down carefully.
- Check O-ring on the filter housing for damage. Replace, if necessary.
- Make sure that the order number on the spare element corresponds to the order number of the filter name-plate.
To ensure no contamination occurs during the exchange of the element first open the plastic bag and push the element over the spigot in the filter head. Now remove plastic bag.
- Lightly lubricate the thread of the filter housing and screw onto the filter head completely. After that unscrew the filter housing 1/8 to 1/2 return.



11. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
① - ③	Seal kit for filter	
	Pi 3405 - Pi 3411	
	NBR	77850381
	FPM	77850399
	EPDM	77850407
	Pi 3415 - Pi 3445	
	NBR	77936206
	FPM	77936214
	EPDM	77936222
④	Maintenance indicator	
	Visual 5 bar PiS 3093/5	77669914
	Electrical 5 bar PiS 3092/5	77669864
	Electrical upper section only	77536550
⑤	Seal kit for maintenance indicator	
	NBR	77760275
	FPM	77760283
	EPDM	77760291

MAHLE

Industrial Filtration

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industriefiltration@mahle.com
www.mahle-industriefiltration.com
78356750.07/2008

HIGH PRESSURE FILTERS

High Pressure Filter

Pi 4000

Nominal pressure 400 bar (5690 psi), nominal size up to 400
according DIN 24550

1. Features

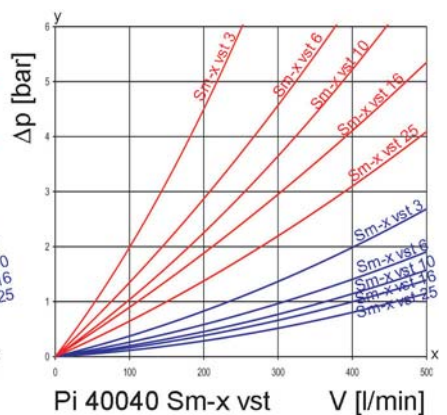
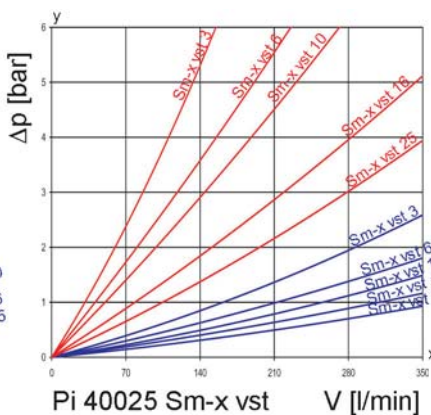
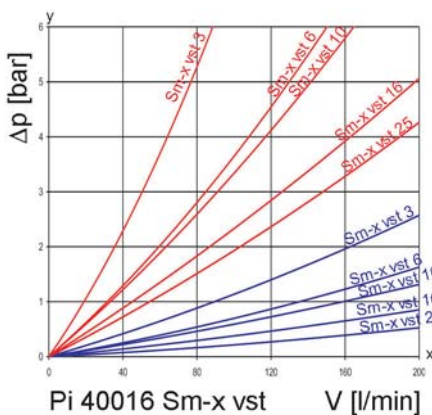
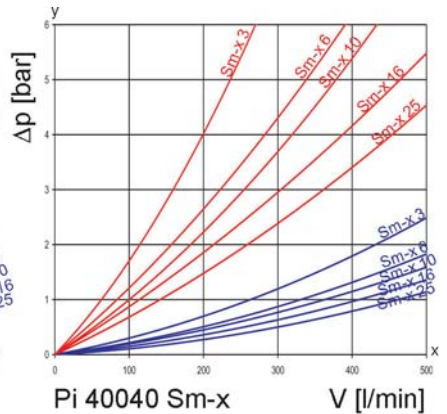
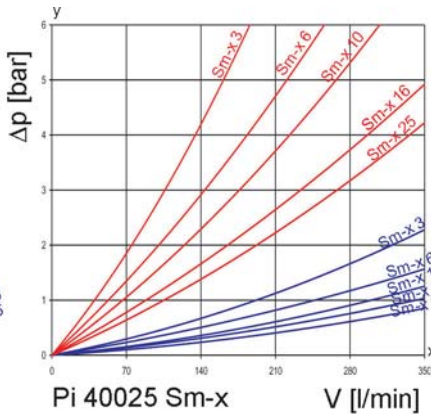
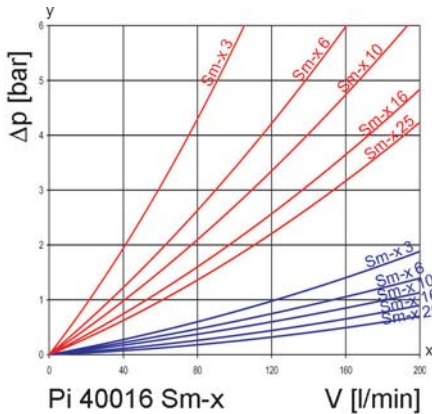
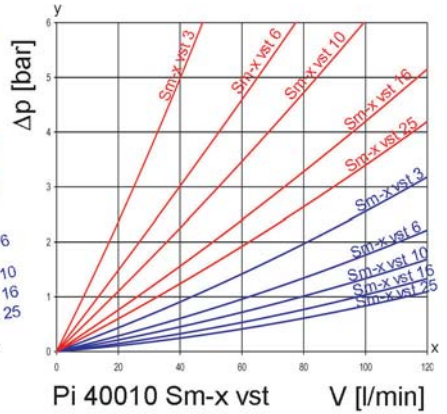
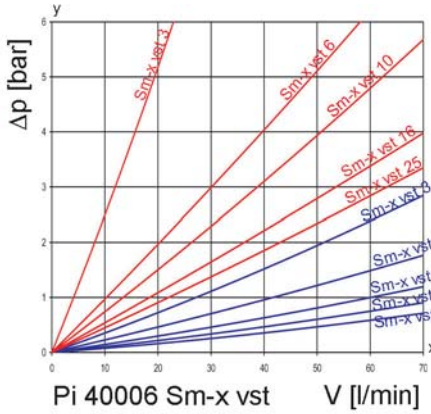
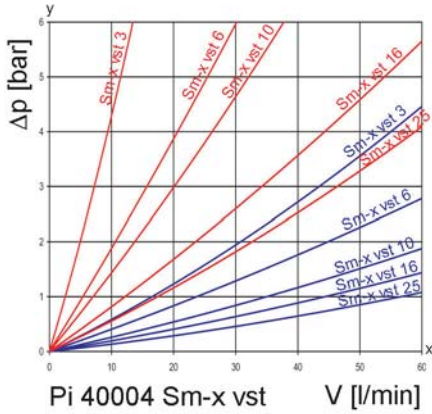
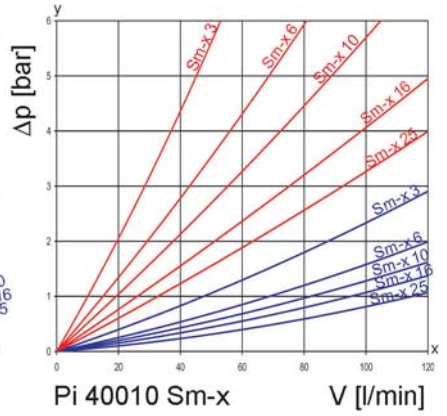
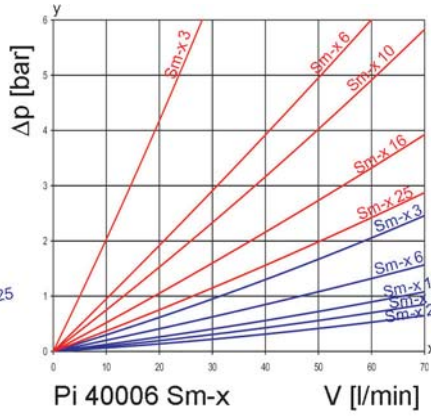
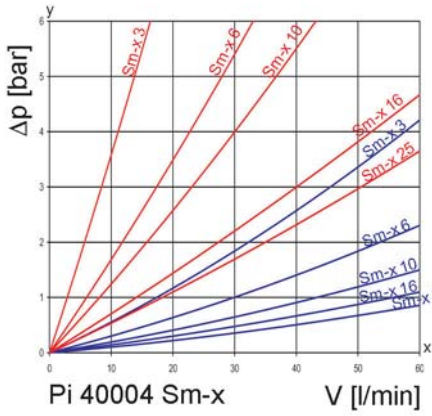
High performance filters for modern hydraulic systems

- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Quality filters, easy to service
- Equipped with highly efficient glass fibre Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- NPT- and SAE-connections on request
- Worldwide distribution



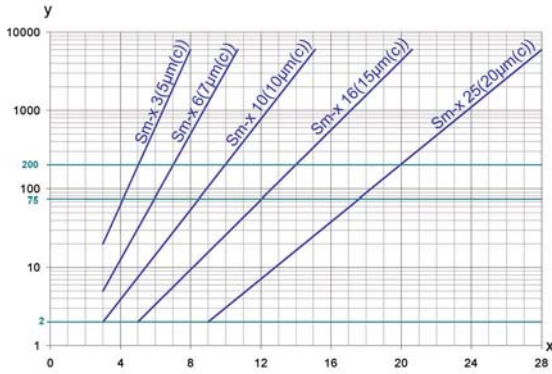
2. Flow rate/pressure drop curve complete filter

190 mm²/s
33 mm²/s



y = differential pressure Δp [bar]
x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particle size [µm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x elements with
max. Δ p 20 bar

Sm-x	3	$\beta_{5(C)} \geq 200$
Sm-x	6	$\beta_{7(C)} \geq 200$
Sm-x	10	$\beta_{10(C)} \geq 200$
Sm-x	16	$\beta_{15(C)} \geq 200$
Sm-x	25	$\beta_{20(C)} \geq 200$

values guaranteed up to
10 bar differential pressure

Sm-x vst elements with
max. Δ p 210 bar

Sm-x vst	3	$\beta_{5(C)} \geq 200$
Sm-x vst	6	$\beta_{7(C)} \geq 200$
Sm-x vst	10	$\beta_{10(C)} \geq 200$
Sm-x vst	16	$\beta_{15(C)} \geq 200$
Sm-x vst	25	$\beta_{20(C)} \geq 200$

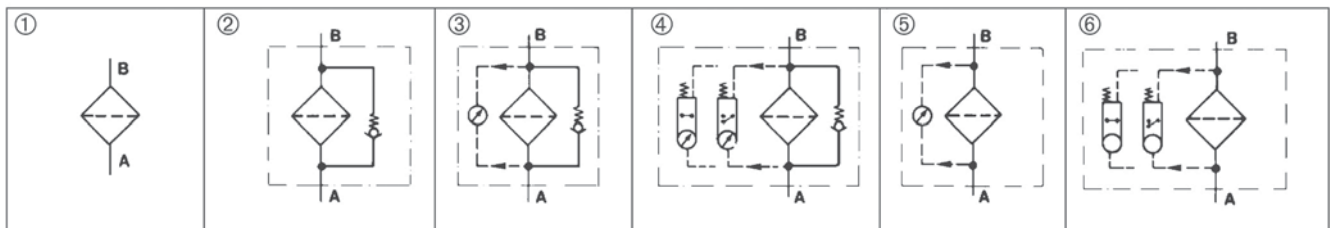
values guaranteed up to
20 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 2923	Hydraulic fluid power filter elements; method for end load test
DIN ISO 2924	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power filters; evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters; multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Filter housing	2. Filter element
V = 100 l/min and electrical maintenance indicator Type: Pi 40010-015, Order number: 77978448	Sm-x vst 3 Type: Pi 71010 DN Sm-x vst 3, Order number: 78227480

7.1 Housing design

Nominal size NG [l/min]	Order number	Type	①	②	③	④	⑤	⑥
			with indicator cavity	with bypass valve and indicator cavity	with bypass valve and visual indicator	with bypass valve and electrical indicator	with visual indicator	with electrical indicator
40	78207201	Pi 40004-010						
	78207219	Pi 40004-011						
	78207227	Pi 40004-012						
	78304156	Pi 40004-013						
	78207243	Pi 40004-014						
	77978463	Pi 40004-015						
63	78207268	Pi 40006-010						
	78207276	Pi 40006-011						
	78207284	Pi 40006-012						
	78304164	Pi 40006-013						
	78207300	Pi 40006-014						
	77978455	Pi 40006-015						
100	78207326	Pi 40010-010						
	78207334	Pi 40010-011						
	78207342	Pi 40010-012						
	78304172	Pi 40010-013						
	78207367	Pi 40010-014						
	77978448	Pi 40010-015						
160	78207383	Pi 40016-010						
	78207391	Pi 40016-011						
	78207409	Pi 40016-012						
	78304107	Pi 40016-013						
	78207425	Pi 40016-014						
	78207433	Pi 40016-015						
250	78207458	Pi 40025-010						
	78207466	Pi 40025-011						
	78207474	Pi 40025-012						
	78304115	Pi 40025-013						
	78207490	Pi 40025-014						
	78207813	Pi 40025-015						
400	78207821	Pi 40040-010 FL						
	78207839	Pi 40040-011 FL						
	78207847	Pi 40040-012 FL						
	78304123	Pi 40040-013 FL						
	78207862	Pi 40040-014 FL						
	78207870	Pi 40040-015 FL						

When filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

7.2 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
40	78260929	Pi 21004 DN Sm-x 3	Sm-x 3	20	475
	77960859	Pi 22004 DN Sm-x 6	Sm-x 6		475
	77925571	Pi 23004 DN Sm-x 10	Sm-x 10		475
	78260937	Pi 24004 DN Sm-x 16	Sm-x 16		475
	78260945	Pi 25004 DN Sm-x 25	Sm-x 25		475
	78216079	Pi 71004 DN Sm-x vst 3	Sm-x vst 3	210	445
	77960156	Pi 72004 DN Sm-x vst 6	Sm-x vst 6		445
	77925654	Pi 73004 DN Sm-x vst 10	Sm-x vst 10		445
	78216087	Pi 74004 DN Sm-x vst 16	Sm-x vst 16		445
	78216095	Pi 75004 DN Sm-x vst 25	Sm-x vst 25		445
63	78260960	Pi 21006 DN Sm-x 3	Sm-x 3	20	835
	77960867	Pi 22006 DN Sm-x 6	Sm-x 6		835
	77925589	Pi 23006 DN Sm-x 10	Sm-x 10		835
	78260978	Pi 24006 DN Sm-x 16	Sm-x 16		835
	78260986	Pi 25006 DN Sm-x 25	Sm-x 25		835
	78216137	Pi 71006 DN Sm-x vst 3	Sm-x vst 3	210	780
	77960149	Pi 72006 DN Sm-x vst 6	Sm-x vst 6		780
	77925662	Pi 73006 DN Sm-x vst 10	Sm-x vst 10		780
	78216145	Pi 74006 DN Sm-x vst 16	Sm-x vst 16		780
	78216152	Pi 75006 DN Sm-x vst 25	Sm-x vst 25		780
100	78227472	Pi 21010 DN Sm-x 3	Sm-x 3	20	1375
	77960875	Pi 22010 DN Sm-x 6	Sm-x 6		1375
	77925597	Pi 23010 DN Sm-x 10	Sm-x 10		1375
	78261000	Pi 24010 DN Sm-x 16	Sm-x 16		1375
	78261018	Pi 25010 DN Sm-x 25	Sm-x 25		1375
	78227480	Pi 71010 DN Sm-x vst 3	Sm-x vst 3	210	1275
	77960131	Pi 72010 DN Sm-x vst 6	Sm-x vst 6		1275
	77925670	Pi 73010 DN Sm-x vst 10	Sm-x vst 10		1275
	78261281	Pi 74010 DN Sm-x vst 16	Sm-x vst 16		1275
	78216160	Pi 75010 DN Sm-x vst 25	Sm-x vst 25		1275

* a wider range of element types is available on request

7.2 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
160	78261034	Pi 21016 DN Sm-x 3	Sm-x 3	20	2530
	77960826	Pi 22016 DN Sm-x 6	Sm-x 6		2530
	77925605	Pi 23016 DN Sm-x 10	Sm-x 10		2530
	78261042	Pi 24016 DN Sm-x 16	Sm-x 16		2530
	78261059	Pi 25016 DN Sm-x 25	Sm-x 25		2530
	77940638	Pi 71016 DN Sm-x vst 3	Sm-x vst 3	210	1885
	77960123	Pi 72016 DN Sm-x vst 6	Sm-x vst 6		1885
	77925688	Pi 73016 DN Sm-x vst 10	Sm-x vst 10		1885
	78269797	Pi 74016 DN Sm-x vst 16	Sm-x vst 16		1885
	78216178	Pi 75016 DN Sm-x vst 25	Sm-x vst 25		1885
250	78227514	Pi 21025 DN Sm-x 3	Sm-x 3	20	4020
	77960834	Pi 22025 DN Sm-x 6	Sm-x 6		4020
	77925613	Pi 23025 DN Sm-x 10	Sm-x 10		4020
	78261075	Pi 24025 DN Sm-x 16	Sm-x 16		4020
	78261083	Pi 25025 DN Sm-x 25	Sm-x 25		4020
	77940646	Pi 71025 DN Sm-x vst 3	Sm-x vst 3	210	3090
	77960115	Pi 72025 DN Sm-x vst 6	Sm-x vst 6		3090
	77925696	Pi 73025 DN Sm-x vst 10	Sm-x vst 10		3090
	78269813	Pi 74025 DN Sm-x vst 16	Sm-x vst 16		3090
	78216186	Pi 75025 DN Sm-x vst 25	Sm-x vst 25		3090
400	78227522	Pi 21040 DN Sm-x 3	Sm-x 3	20	6770
	77960842	Pi 22040 DN Sm-x 6	Sm-x 6		6770
	77925621	Pi 23040 DN Sm-x 10	Sm-x 10		6770
	78261109	Pi 24040 DN Sm-x 16	Sm-x 16		6770
	78261117	Pi 25040 DN Sm-x 25	Sm-x 25		6770
	77940653	Pi 71040 DN Sm-x vst 3	Sm-x vst 3	210	5240
	77960107	Pi 72040 DN Sm-x vst 6	Sm-x vst 6		5240
	77930829	Pi 73040 DN Sm-x vst 10	Sm-x vst 10		5240
	78269821	Pi 74040 DN Sm-x vst 16	Sm-x vst 16		5240
	78260903	Pi 75040 DN Sm-x vst 25	Sm-x vst 25		5240

* a wider range of element types is available on request

8. Technical specifications

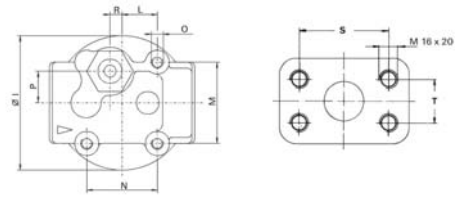
Design:	in-line filter
Nominal pressure:	400 bar (5690 psi)
Test pressure:	520 bar (7400 psi)
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Bypass setting:	Δp 7 bar \pm 10 %
Filter head material:	GGG
Filter housing material:	St
Sealing material:	NBR/PTFE
Maintenance indicator setting:	Δp 5 bar \pm 10 %
Electrical data of maintenance indicator:	
Maximum voltage:	250 V AC/200 V DC
Maximum current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M20x1.5

The switching function can be changed by turning the electric upper part by 180 ° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values and not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

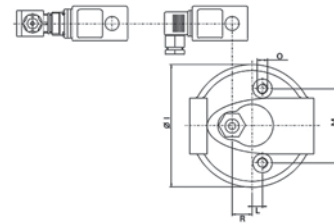
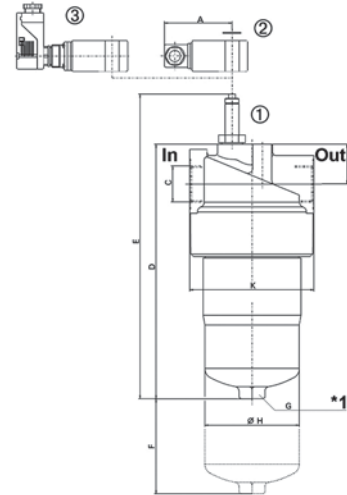
We recommend to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EG (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EG Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.



NG 40 - 100

DN 38 according to SAE 1 1/2" 6000 psi
flanges, bolts, o-rings not
included in delivery



In = inlet

Out = outlet

*1 NG 250, 400 with drain screw G 1/4 DIN 910

Pos. 1 Visual maintenance indicator

Pos. 2 Electrical upper section connector according
DIN EN 175301-803

Versions: PiS 3092, 9105, 3115

Pos. 3 Electrical upper section connector according
DIN EN 175301-804

Versions: PiS 3102, 3122, 3110

9. Dimensions

All dimensions except "C" in mm.

Type	A	B	C*	D	E	F	G	H	I	K	L	M	N	O	P	R	S	T	Weight [kg]
Pi 40004	78	31	G1/2	194	252	80	27	66	90	92	23.5	54	47	M8x16	21	8	-	-	4.2
Pi 40006	78	31	G3/4	254	313	80	27	66	90	92	23.5	54	47	M8x16	21	8	-	-	4.9
Pi 40010	78	31	G1	344	402	80	27	66	90	92	23.5	54	47	M8x16	21	8	-	-	5.8
Pi 40016	78	46	G1 1/4	294	352	110	30	109	142	143.5	12	86	-	M12x15	-	23	-	-	12.6
Pi 40025	78	46	G1 1/2	394	452	110	30	109	142	143.5	12	86	-	M12x15	-	23	-	-	14.2
Pi 40040 FL	78	46	DN 38	544	602	110	30	109	142	143.5	12	86	-	M12x15	-	23	79.4	36.5	18.4

* NPT- and SAE-connections on request

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove filter element and filter housing. Preferably the filter should be installed with the filter housing pointing downwards. The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

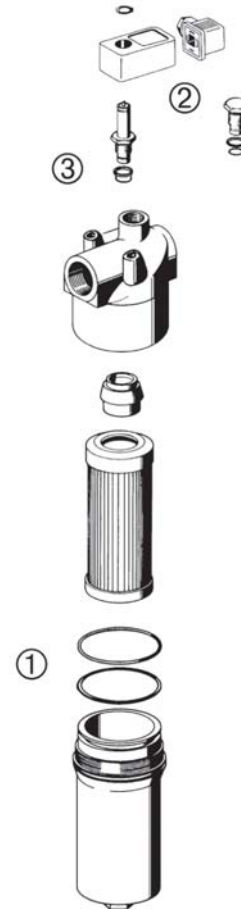
The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

10.3 When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
- Filters without maintenance indicator:
The filter element should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
- Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (Sm-x) cannot be cleaned.

10.4 Element replacement

- Stop system and relieve filter from pressure.
- Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
- Remove element by pulling down carefully.
- Check o-ring and spigot for damage. Replace, if necessary.
- Make sure that the order number on the spare element corresponds to the order number of the filter name-plate. To ensure no contamination occurs during the exchange of the element first open the plastic bag and push the element over the spigot in the filter head. Now remove plastic bag.
- Lightly lubricate the thread of the filter housing and screw onto the filter head completely. After that unscrew the filter housing 1/8 to 1/2 return.



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78396038.07/2008

11. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
①	Seal kit	
	Pi 40004 - Pi 40010	
	NBR	78383804
	FPM	78383812
	EPDM	78383820
	Pi 40016 - Pi 40040	
	NBR	78383838
	FPM	78383846
	EPDM	78383853
②	Maintenance indicator	
	Visual PiS 3093/5	77669914
	Electrical PiS 3092/5	77669864
③	Electrical upper section only	77536550
	Seal kit for maintenance indicator	
	NBR	77760275
	FPM	77760283
	EPDM	77760291

High Pressure Filter

Pi 410

Nominal pressure 315 bar (4480 psi), nominal size 20-63

1. Features

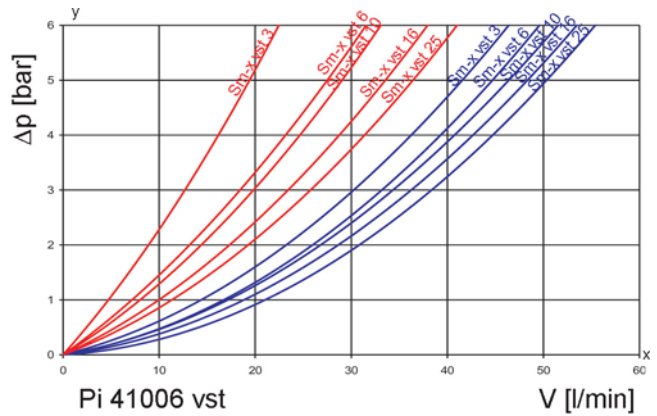
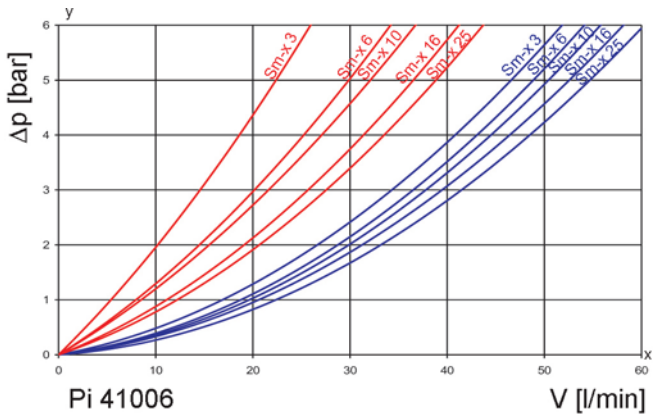
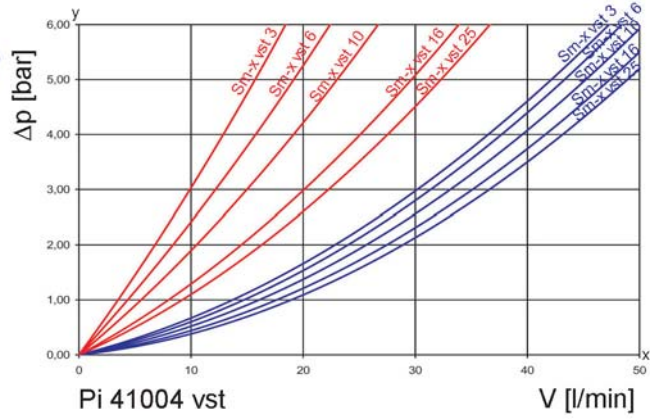
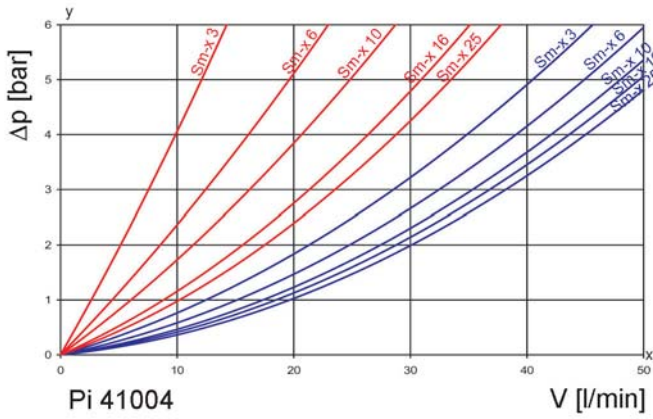
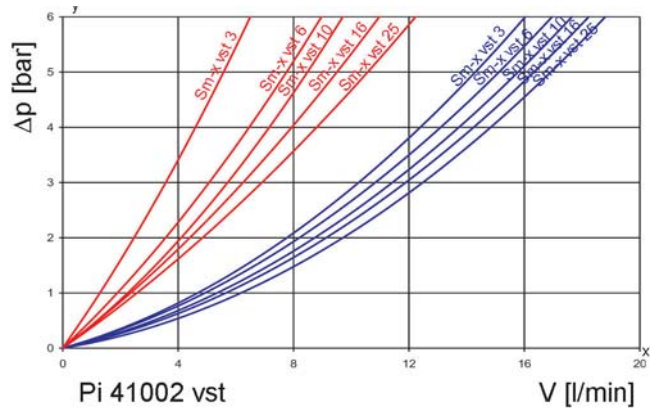
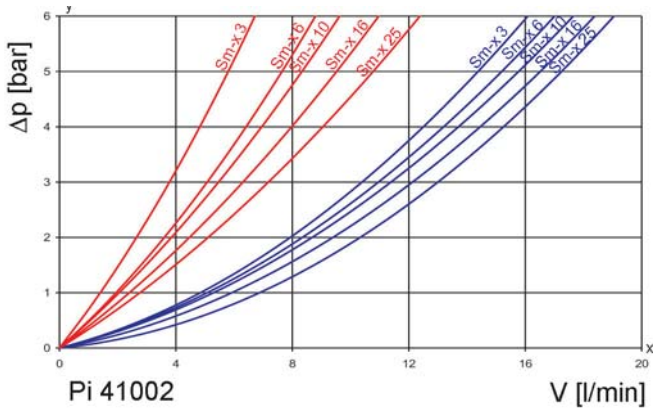
High performance filters for modern hydraulic systems

- Provided for valve block installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Connections according DIN 24340
- Quality filters, easy to service
- Equipped with highly efficient glass fibre Sm-x filter elements
- Nominal sizes 40 and 63 equipped with filter elements according to DIN 24550
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution



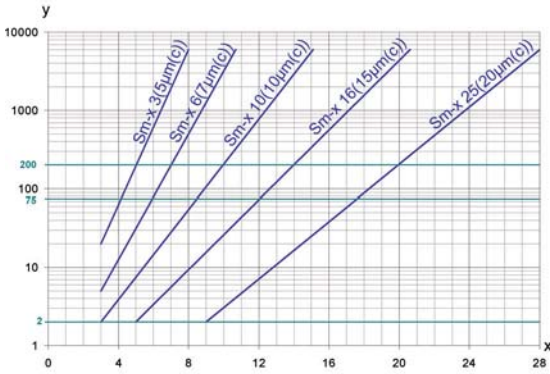
2. Flow rate/pressure drop curve complete filter

■ 190 mm²/s
■ 33 mm²/s



y = differential pressure Δp [bar]
 x = flow rate V [l/min]

3. Separation grade characteristics



y = beta -value
x = particle size [μm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x elements with
max. Δp 20 bar

Sm-x	3	$\beta_{5(C)} \geq 200$
Sm-x	6	$\beta_{7(C)} \geq 200$
Sm-x	10	$\beta_{10(C)} \geq 200$
Sm-x	16	$\beta_{15(C)} \geq 200$
Sm-x	25	$\beta_{20(C)} \geq 200$

values guaranteed up to
10 bar differential pressure

Sm-x vst elements with
max. Δp 210 bar

Sm-x vst	3	$\beta_{5(C)} \geq 200$
Sm-x vst	6	$\beta_{7(C)} \geq 200$
Sm-x vst	10	$\beta_{10(C)} \geq 200$
Sm-x vst	16	$\beta_{15(C)} \geq 200$
Sm-x vst	25	$\beta_{20(C)} \geq 200$

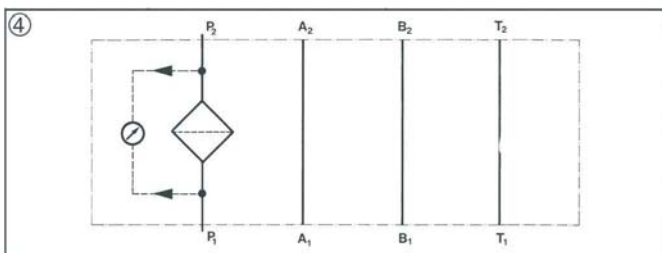
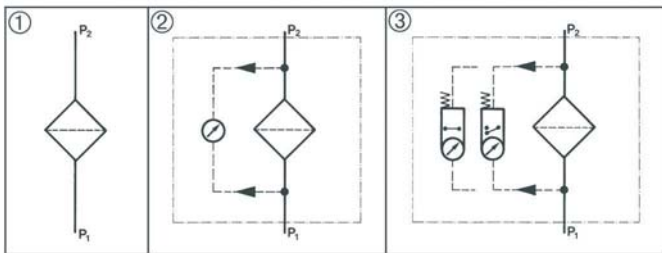
values guaranteed up to
20 bar differential pressure

5. Quality assurance

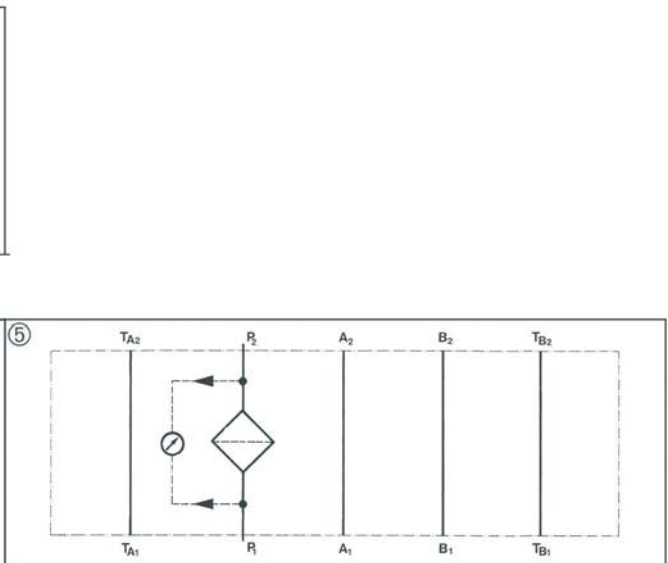
MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 3723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3724	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power filters; evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters; multipass method for evaluation filtration performance of a filter element

6. Symbols



NG 20



NG 40-63

7. Order numbers

Example for ordering filters:

1. Filter housing	2. Filter element
V = 40 l/min, visual/electrical indicator Type: Pi 41004-015/Order number: 77937600	Sm-x 3 Type: Pi 21004 DN Sm-x 3/Order number: 78260929

7.1 Housing design

NG [l/min]	Order number	Type	①with indicator cavity	②with visual indicator	③with electrical indicator
20	77937543	Pi 41002-046			
	77937550	Pi 41002-014			
	77937568	Pi 41002-015			
40	77937618	Pi 41004-046			
	77937592	Pi 41004-014			
	77937600	Pi 41004-015			
63	77937642	Pi 41006-046			
	77937626	Pi 41006-014			
	77937634	Pi 41006-015			

The collapse pressure of the element must not be exceeded.

7.2 Filter elements (a wider range of element types is available on request)

NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
20	77685407	852 243 Sm-x 3	Sm-x 3	20	305
	78216038	852 243 Sm-x 6	Sm-x 6		305
	77740327	852 243 Sm-x 10	Sm-x 10		305
	78216053	852 243 Sm-x 16	Sm-x 16		305
	77685415	852 243 Sm-x 25	Sm-x 25		305
	77685423	852 243 Sm-x vst 3	Sm-x vst 3	160	275
	78216046	852 243 Sm-x vst 6	Sm-x vst 6		275
	77685431	852 243 Sm-x vst 10	Sm-x vst 10		275
	78216061	852 243 Sm-x vst 16	Sm-x vst 16		275
	77685449	852 243 Sm-x vst 25	Sm-x vst 25		275
40	78260929	Pi 21004 DN Sm-x 3	Sm-x 3	20	475
	77960859	Pi 22004 DN Sm-x 6	Sm-x 6		475
	77925571	Pi 23004 DN Sm-x 10	Sm-x 10		475
	78260937	Pi 24004 DN Sm-x 16	Sm-x 16		475
	78260945	Pi 25004 DN Sm-x 25	Sm-x 25		475
	78216079	Pi 71004 DN Sm-x vst 3	Sm-x vst 3	210	445
	77960156	Pi 72004 DN Sm-x vst 6	Sm-x vst 6		445
	77925654	Pi 73004 DN Sm-x vst 10	Sm-x vst 10		445
	78216087	Pi 74004 DN Sm-x vst 16	Sm-x vst 16		445
	78216095	Pi 75004 DN Sm-x vst 25	Sm-x vst 25		445
63	78260960	Pi 21006 DN Sm-x 3	Sm-x 3	20	835
	77960867	Pi 22006 DN Sm-x 6	Sm-x 6		835
	77925589	Pi 23006 DN Sm-x 10	Sm-x 10		835
	78260978	Pi 24006 DN Sm-x 16	Sm-x 16		835
	78260986	Pi 25006 DN Sm-x 25	Sm-x 25		835
	78216137	Pi 71006 DN Sm-x vst 3	Sm-x vst 3	210	780
	77960149	Pi 72006 DN Sm-x vst 6	Sm-x vst 6		780
	77925662	Pi 73006 DN Sm-x vst 10	Sm-x vst 10		780
	78216145	Pi 74006 DN Sm-x vst 16	Sm-x vst 16		780
	78216152	Pi 75006 DN Sm-x vst 25	Sm-x vst 25		780

8. Technical specifications

Design:	installation in vertical interlink
Nominal pressure:	315 bar (4480 psi)
Test pressure:	410 bar (5830 psi)
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Filter head material:	steel
Filter housing material:	steel
Sealing material:	NBR/PTFE
Maintenance indicator setting:	Δp 5 bar \pm 0.5 bar
Electrical data of maintenance indicator:	
Maximum voltage:	250 V AC/200 V DC
Maximum current on contact:	1 A
Inrush current:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M20x1.5

The switching function can be changed by turning the electric upper part by 180 ° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

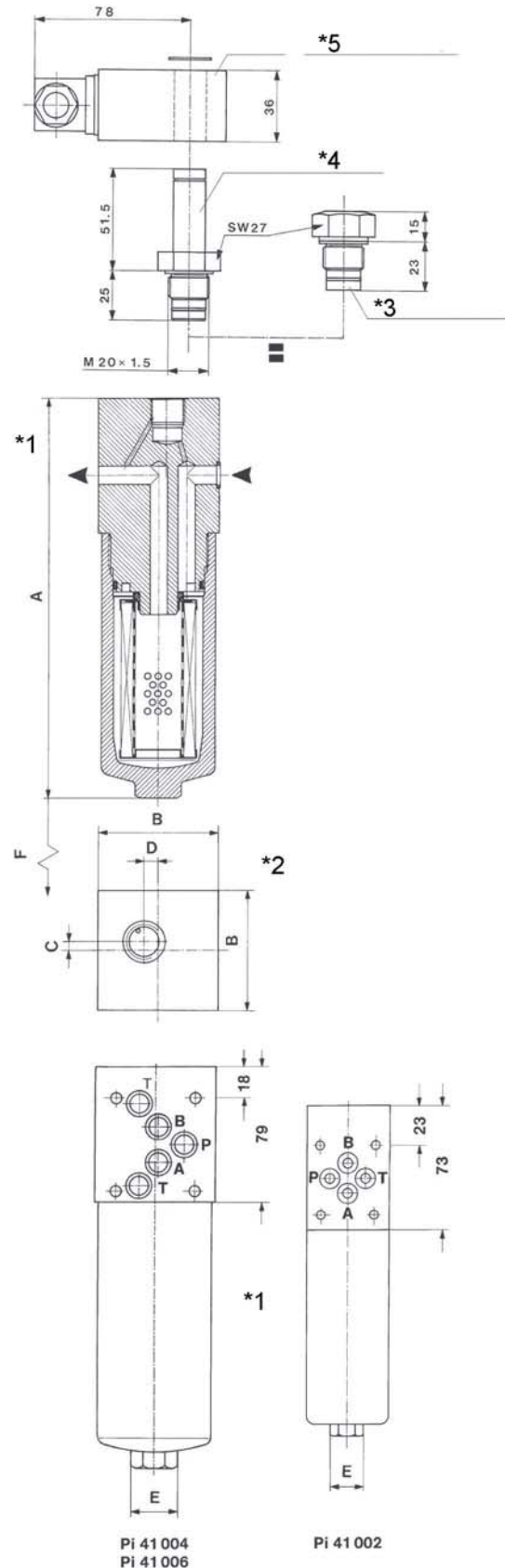
We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EG (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EG Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.

9. Dimensions

Dimension	Pi 41002	Pi 41004	Pi 41006
A	241	235	295
B	48	70	70
C	3	5	5
D	2	8	8
E	SW 17	SW 27	SW 27
F	50	50	50
Master gauge for holes DIN 24340	A6	A10	A10
O-ring for connecting plate \varnothing	9.25x1.78	12x2	12x2
Weight [kg]	2.65	5.00	5.70



*1 View A

*2 View B

*3 Screw plug

*4 Visual maintenance indicator

*5 Electrical upper section for maintenance indicator

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove filter element and filter bowl. Preferably the filter should be installed with the filter housing pointing downwards.

The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2.

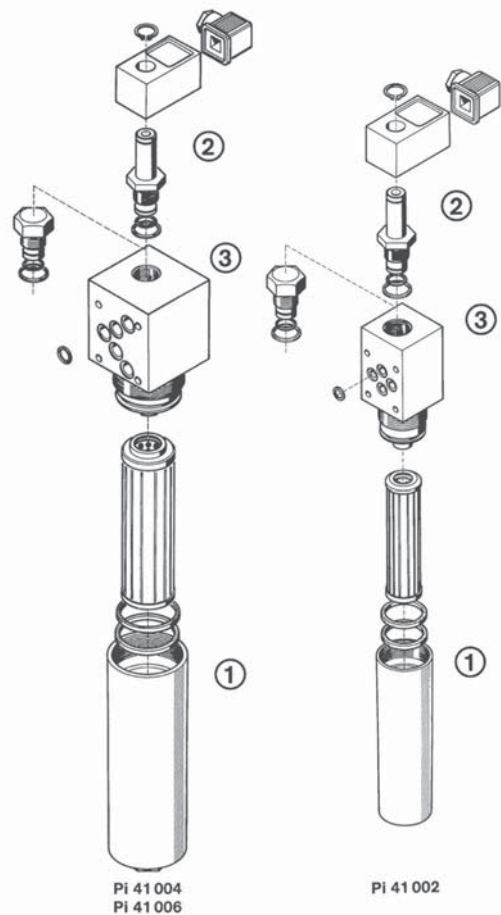
The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

10.3 When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
- Filters without maintenance indicator:
The filter element should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
- Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (Sm-x) cannot be cleaned.

10.4 Element replacement

- Stop system and relieve filter from pressure.
- Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
- Remove the filter element by pulling down carefully.
- Check O-ring and spigot for damage. Replace, if necessary.
- Make sure that the order number on the spare element corresponds to the order number of the filter name-plate. To ensure no contamination occurs during the exchange of the element first open the plastic bag and push the element over the spigot in the filter head. Now remove plastic bag.
- Lightly lubricate the thread of the filter housing and screw onto the filter head completely. After that unscrew the filter housing 1/8 to 1/2 return.



11. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
①	Seal kit	
	Pi 41002	
	NBR	77996861
	FPM	77996879
	EPDM	77996887
	Pi 41004 - Pi 41006	
	NBR	77996895
	FPM	77996903
	EPDM	77996911
②	Maintenance indicator	
	Visual PiS 3093/5	77669914
	Electrical PiS 3092/5	77669864
	Electrical upper section only	77536550
③	Seal kit for maintenance indicator	
	NBR	77760275
	FPM	77760283
	EPDM	77760291

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 78356966.07/2008

High Pressure Filter

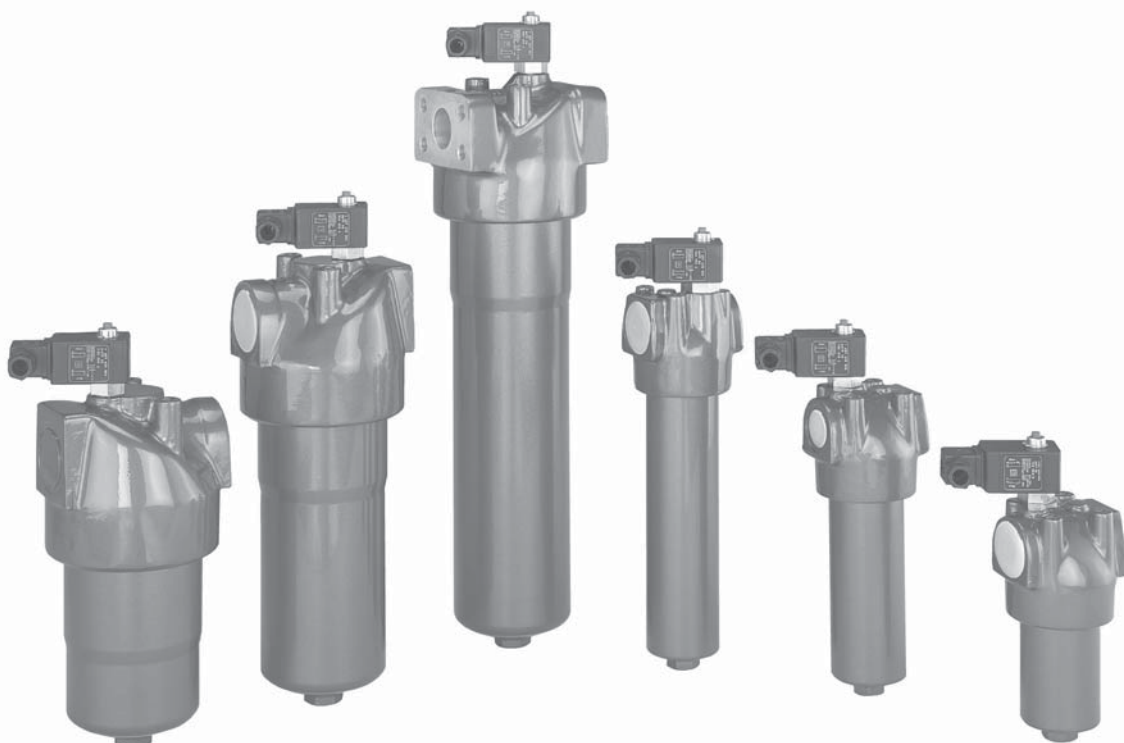
Pi 420

Nominal pressure 400 bar (5690 psi), nominal size up to 450
optional with reverse flow valve

1. Features

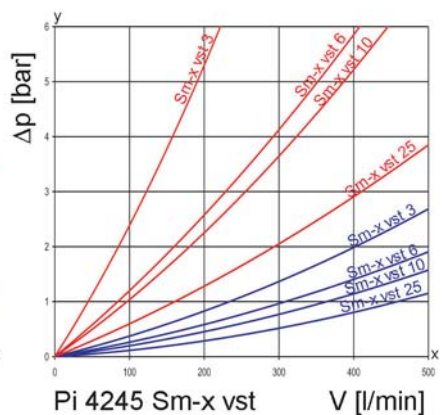
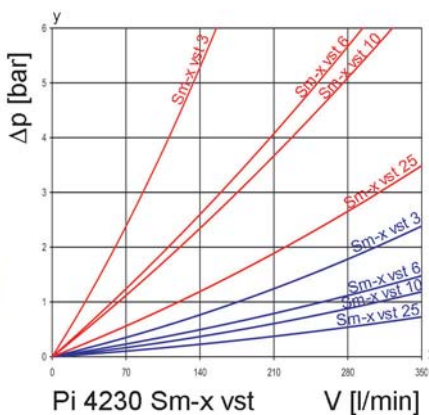
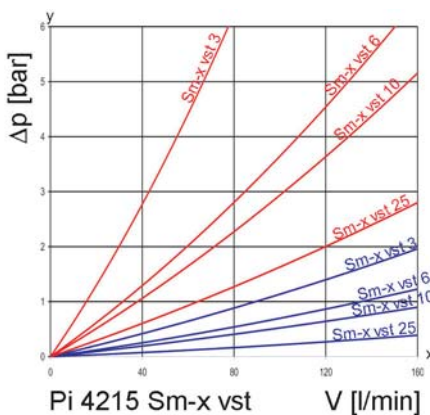
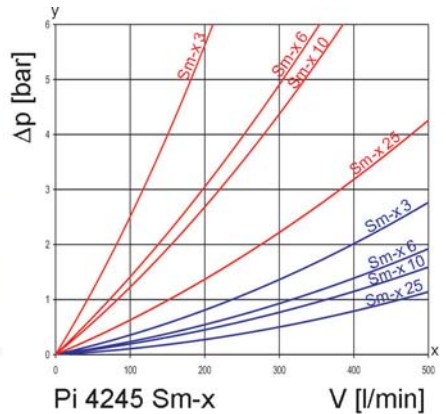
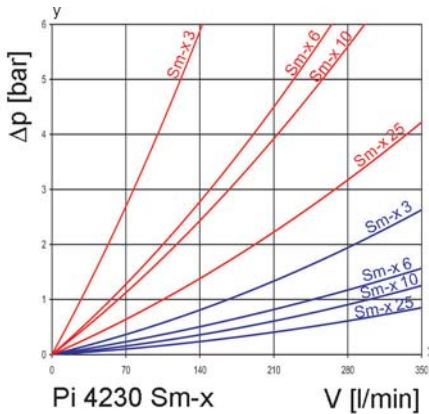
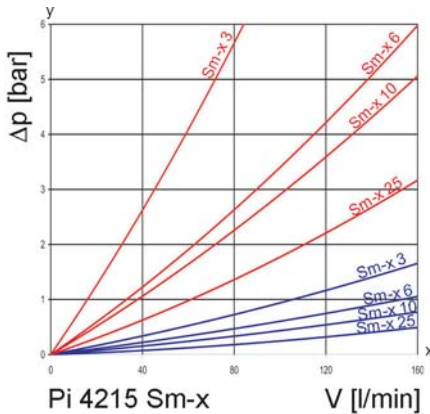
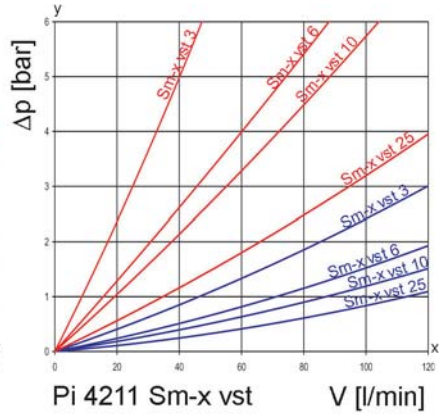
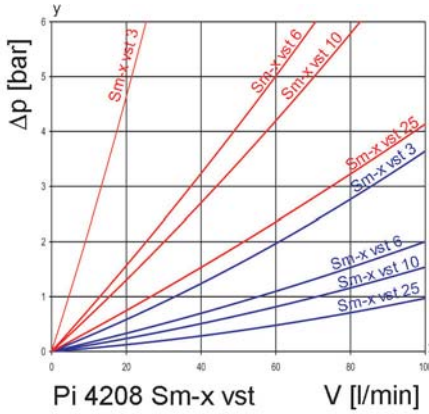
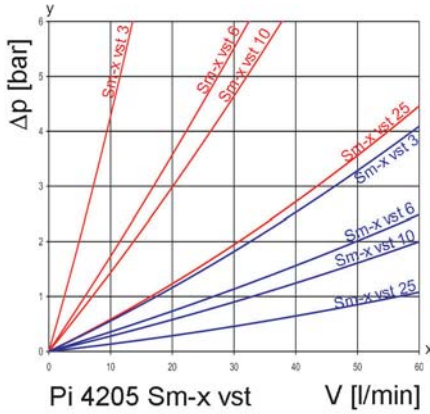
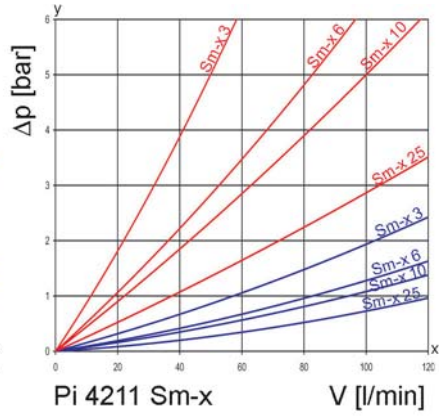
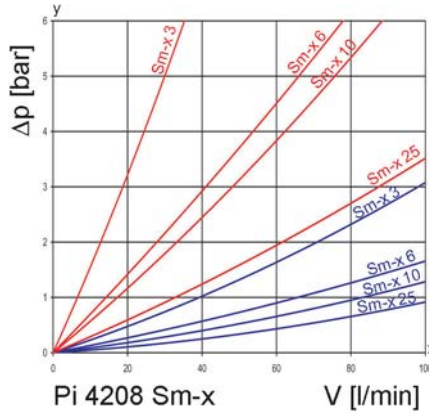
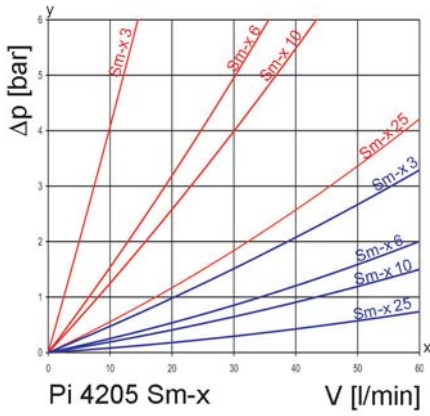
High performance filters for modern hydraulic systems

- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded or flanged connections
- Equipped with highly efficient glass fibre Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- NPT- and SAE-connections on request
- Worldwide distribution



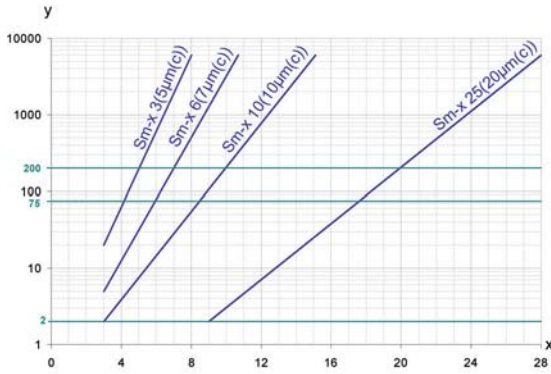
2. Flow rate/pressure drop curve complete filter

190 mm²/s
33 mm²/s



y = differential pressure Δp [bar]
x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particle-size [µm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x elements with
max. Δp 20 bar

Sm-x	3	$\beta_{5(C)} \geq 200$
Sm-x	6	$\beta_{7(C)} \geq 200$
Sm-x	10	$\beta_{10(C)} \geq 200$
Sm-x	25	$\beta_{20(C)} \geq 200$

values guaranteed up to
10 bar differential pressure

Sm-x vst elements with
max. Δp 210 bar

Sm-x vst	3	$\beta_{5(C)} \geq 200$
Sm-x vst	6	$\beta_{7(C)} \geq 200$
Sm-x vst	10	$\beta_{10(C)} \geq 200$
Sm-x vst	25	$\beta_{20(C)} \geq 200$

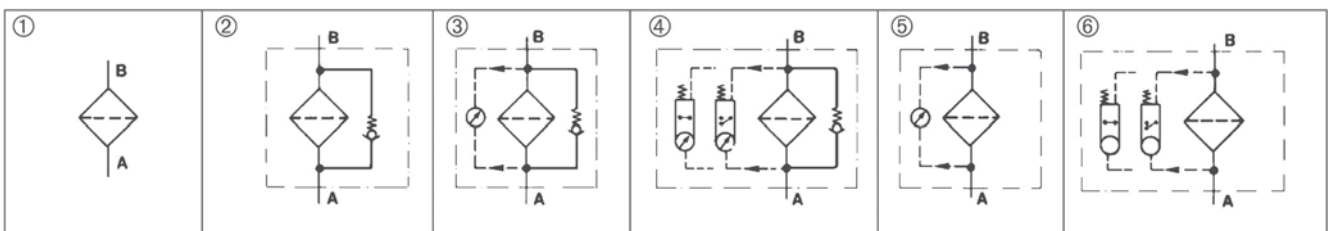
values guaranteed up to
20 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 3723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3724	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power-filters-evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters-multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Housing design	2. Filter elements
Housing design V = 80 l/min, electrical maintenance indicator Type: Pi 4208-015 Order number: 77666472	Sm-x vst 3 Type: Pi 2208 Sm-x vst 3 Order number: 77680200

7.1 Housing design										
Nomi- nal size NG [l/ min]	Order number thread version	Type thread version	Order number flange version	Type flange version	① with indicator cavity	② with bypass valve and indicator cavity	③ with bypass valve and visual indicator	④ with bypass valve and electrical indicator	⑤ with visual indicator	⑥ with electrical indicator
50	77666357	Pi 4205-010	77967714	Pi 4205-010 FL						
	77666365	Pi 4205-011	77967722	Pi 4205-011 FL						
	77666373	Pi 4205-012	77967730	Pi 4205-012 FL						
	77666381	Pi 4205-013	77967748	Pi 4205-013 FL						
	77666399	Pi 4205-014	77967755	Pi 4205-014 FL						
	77666415	Pi 4205-015	77967763	Pi 4205-015 FL						
80	77666423	Pi 4208-010	77967771	Pi 4208-010 FL						
	77666431	Pi 4208-011	77967789	Pi 4208-011 FL						
	77666449	Pi 4208-012	77967797	Pi 4208-012 FL						
	77666456	Pi 4208-013	77967805	Pi 4208-013 FL						
	77666464	Pi 4208-014	77967813	Pi 4208-014 FL						
	77666472	Pi 4208-015	77967821	Pi 4208-015 FL						
110	77666480	Pi 4211-010	77967839	Pi 4211-010 FL						
	77666498	Pi 4211-011	77967847	Pi 4211-011 FL						
	77666506	Pi 4211-012	77967854	Pi 4211-012 FL						
	77666514	Pi 4211-013	77967862	Pi 4211-013 FL						
	77666522	Pi 4211-014	77967870	Pi 4211-014 FL						
	77666530	Pi 4211-015	77967888	Pi 4211-015 FL						
150	77666548	Pi 4215-010	77978596	Pi 4215-010 FL						
	77666555	Pi 4215-011	77978604	Pi 4215-011 FL						
	77666563	Pi 4215-012	77978612	Pi 4215-012 FL						
	77666571	Pi 4215-013	77978620	Pi 4215-013 FL						
	77666589	Pi 4215-014	77978638	Pi 4215-014 FL						
	77666597	Pi 4215-015	77978646	Pi 4215-015 FL						
300	77666613	Pi 4230-010	77978653	Pi 4230-010 FL						
	77666621	Pi 4230-011	77978661	Pi 4230-011 FL						
	77666639	Pi 4230-012	77978679	Pi 4230-012 FL						
	77666647	Pi 4230-013	77978687	Pi 4230-013 FL						
	77666654	Pi 4230-014	77978695	Pi 4230-014 FL						
	77666662	Pi 4230-015	77964505	Pi 4230-015 FL						
450	77666688	Pi 4245-010	77978703	Pi 4245-010 FL						
	77666696	Pi 4245-011	77978711	Pi 4245-011 FL						
	77666704	Pi 4245-012	77978729	Pi 4245-012 FL						
	77666712	Pi 4245-013	77978737	Pi 4245-013 FL						
	77666720	Pi 4245-014	77978745	Pi 4245-014 FL						
	77666746	Pi 4245-015	77978752	Pi 4245-015 FL						

When filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

7.2 Filter elements (a wider range of element types is available on request)

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
50	77680135	Pi 2105 Sm-x 3	Sm-x 3	20	590
	77943509	Pi 5105 Sm-x 6	Sm-x 6		590
	77680325	Pi 3105 Sm-x 10	Sm-x 10		590
	77680440	Pi 4105 Sm-x 25	Sm-x 25		590
	77680192	Pi 2205 Sm-x vst 3	Sm-x vst 3	210	425
	77943533	Pi 5205 Sm-x vst 6	Sm-x vst 6		425
	77680382	Pi 3205 Sm-x vst 10	Sm-x vst 10		425
	77680507	Pi 4205 Sm-x vst 25	Sm-x vst 25		425
80	77680143	Pi 2108 Sm-x 3	Sm-x 3	20	1150
	77943517	Pi 5108 Sm-x 6	Sm-x 6		1150
	77680341	Pi 3108 Sm-x 10	Sm-x 10		1150
	77680457	Pi 4108 Sm-x 25	Sm-x 25		1150
	77680200	Pi 2208 Sm-x vst 3	Sm-x vst 3	210	850
	77943541	Pi 5208 Sm-x vst 6	Sm-x vst 6		850
	77681190	Pi 3208 Sm-x vst 10	Sm-x vst 10		850
	77680515	Pi 4208 Sm-x vst 25	Sm-x vst 25		850
110	77680150	Pi 2111 Sm-x 3	Sm-x 3	20	1700
	77943525	Pi 5111 Sm-x 6	Sm-x 6		1700
	77680333	Pi 3111 Sm-x 10	Sm-x 10		1700
	77680465	Pi 4111 Sm-x 25	Sm-x 25		1700
	77680218	Pi 2211 Sm-x vst 3	Sm-x vst 3	210	1275
	77943558	Pi 5211 Sm-x vst 6	Sm-x vst 6		1275
	77680390	Pi 3211 Sm-x vst 10	Sm-x vst 10		1275
	77680523	Pi 4211 Sm-x vst 25	Sm-x vst 25		1275
150	77680168	Pi 2115 Sm-x 3	Sm-x 3	20	2425
	77955099	Pi 5115 Sm-x 6	Sm-x 6		2425
	77680358	Pi 3115 Sm-x 10	Sm-x 10		2425
	77680473	Pi 4115 Sm-x 25	Sm-x 25		2425
	77680226	Pi 2215 Sm-x vst 3	Sm-x vst 3	210	2010
	77955123	Pi 5215 Sm-x vst 6	Sm-x vst 6		2010
	77680408	Pi 3215 Sm-x vst 10	Sm-x vst 10		2010
	77680531	Pi 4215 Sm-x vst 25	Sm-x vst 25		2010
300	77680176	Pi 2130 Sm-x 3	Sm-x 3	20	4620
	77955107	Pi 5130 Sm-x 6	Sm-x 6		4620
	77680366	Pi 3130 Sm-x 10	Sm-x 10		4620
	77680481	Pi 4130 Sm-x 25	Sm-x 25		4620
	77680234	Pi 2230 Sm-x vst 3	Sm-x vst 3	210	3800
	77955131	Pi 5230 Sm-x vst 6	Sm-x vst 6		3800
	77680416	Pi 3230 Sm-x vst 10	Sm-x vst 10		3800
	77680549	Pi 4230 Sm-x vst 25	Sm-x vst 25		3800
450	77680184	Pi 2145 Sm-x 3	Sm-x 3	20	6865
	77955115	Pi 5145 Sm-x 6	Sm-x 6		6865
	77680374	Pi 3145 Sm-x 10	Sm-x 10		6865
	77680499	Pi 4145 Sm-x 25	Sm-x 25		6865
	77680242	Pi 2245 Sm-x vst 3	Sm-x vst 3	210	5600
	77955149	Pi 5245 Sm-x vst 6	Sm-x vst 6		5600
	77680424	Pi 3245 Sm-x vst 10	Sm-x vst 10		5600
	77680556	Pi 4245 Sm-x vst 25	Sm-x vst 25		5600

8. Technical specifications

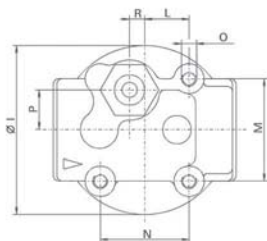
Design:	line mounting filter
Nominal pressure:	400 bar (5690 psi)
Test pressure:	520 bar (7400 psi)
Temperature range:	-10 °C to +120 °C
	(other temperature ranges on request)
Bypass setting:	Δp 7 bar \pm 10 %
Filter head material:	GGG
Filter housing material:	St
Sealing material:	NBR/PTFE
Maintenance indicator setting:	Δp 5 bar \pm 10 %
Electrical data of maintenance indicator:	
Maximum voltage:	250 V AC/200 V DC
Maximum current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable connection:	M20x1.5

The switching function can be changed by turning the electric upper part by 180 ° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

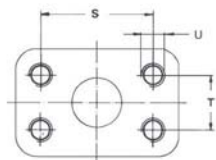
We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EG (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EG Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration.



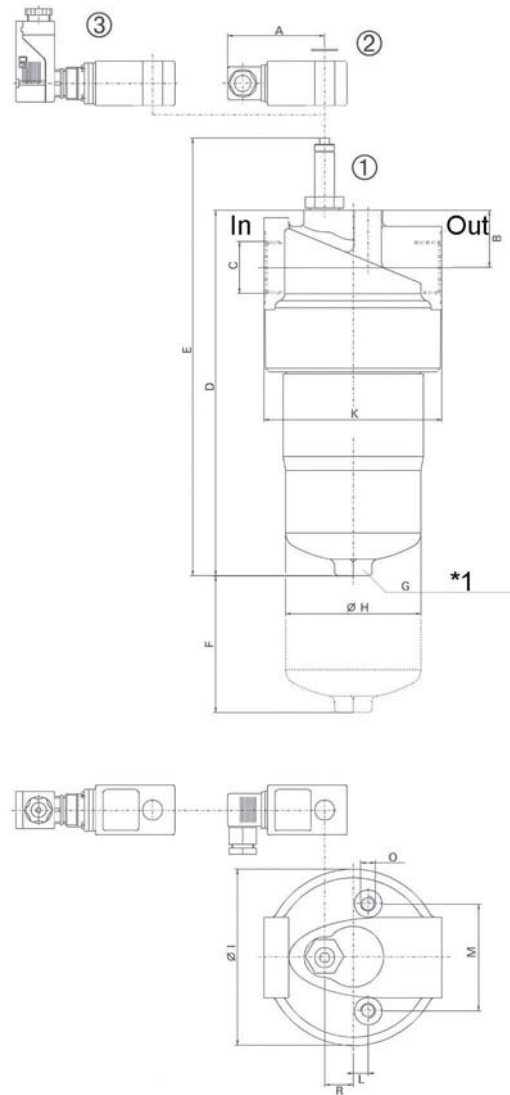
NG 50 - 110



*1

*1

DN 25 according to SAE 1" 6000psi
 DN 38 according to SAE 1½" 6000psi
 Flange, screw, o-ring not included in delivery



NG 150 - 450

In = inlet

Out = outlet

- 1 = Visual maintenance indicator
- 2 = Electrical upper section connector according DIN EN 175301-803, Version: 3092, 3105, 3115
- 3 = Electrical upper section connector according DIN EN 175201-804, Version: 3102, 3122, 3110

*1

NG 300, 450 with drain screw G¼ DIN 910

9. Dimensions

All dimensions except "C" in mm.

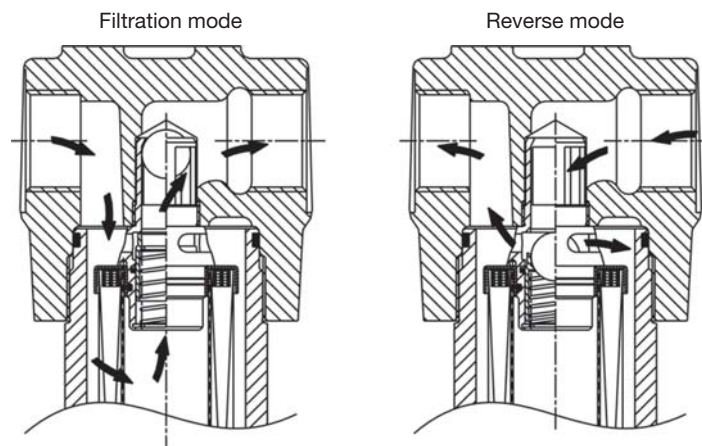
Type	A	B	C*	D	E	F	G SW	H	I	K
Pi 4205	78	31	G1/2	189	247	80	27	66	90	92.0
Pi 4205 FL		28	DN 25	204	262				85	95.0
Pi 4208	78	31	G1	267	325	80	27	66	90	92.0
Pi 4208 FL		28	DN 25	282	340				85	95.0
Pi 4211	78	31	G1	343	401	80	27	66	90	92.0
Pi 4211 FL		28	DN 25	358	416				85	95.0
Pi 4215	78	46	G1 1/4	284	342	110	30	109	142	143.5
Pi 4215 FL		40	DN 38							
Pi 4230	78	46	G1 1/4	409	467	110	30	109	142	143.5
Pi 4230 FL		40	DN 38							
Pi 4245	78	46	G1 1/2	525	583	110	30	109	142	143.5
Pi 4245 FL		40	DN 38							

* NPT- und SAE-connections on request

Type	L	M	N	O	P	R	S	T	U	Weight [kg]
Pi 4205	23.5	54	47	M8x14	21	8	57.1	27,8	M12x20	4.1
Pi 4205 FL	10		-			12				4.6
Pi 4208	23.5	54	47	M8x14	21	8	57.1	27,8	M12x20	4.9
Pi 4208 FL	10		-			12				5.3
Pi 4211	23.5	54	47	M8x14	21	8	57.1	27,8	M12x20	5.8
Pi 4211 FL	10		-			12				6.2
Pi 4215	12	86	-	M12x15	-	23	79.4	36.5	M16x20	12.3
Pi 4215 FL										13.3
Pi 4230	12	86	-	M12x15	-	23	79.4	36.5	M16x20	14.8
Pi 4230 FL										15.9
Pi 4245	12	86	-	M12x15	-	23	79.4	36.5	M16x20	17.1
Pi 4245 FL										18.6

10. Execution with reverse flow valve

Filters are normally designed for single- direction flow only. Reverse flows result in destruction of the cartridge. Some applications can require the medium to flow through the filter in both directions, however. The Pi 420 with a reverse flow valve can be used here. It allows medium flows in both directions, although it only filters in one. The liquid is not filtered in reverse mode. The reverse flow valve can be supplied with or without a bypass function.



11. Installation, operating and maintenance instructions

11.1 Filter installation

When installing the filter make sure that sufficient space is available to remove filter element and filter housing. Preferably the filter should be installed with the filter housing pointing downwards. The maintenance indicator must be visible.

11.2 Connecting the electrical maintenance indicator

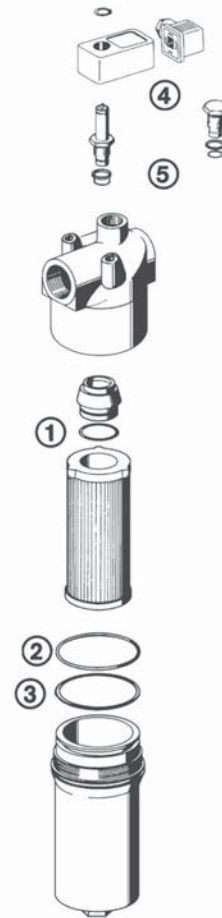
The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

11.3 When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
- Filters without maintenance indicator:
The filter element should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
- Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (Sm-x) cannot be cleaned.

11.4 Element replacement

- Stop system and relieve filter from pressure.
- Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
- Remove the filter element by pulling down carefully.
- Check O-ring and spigot for damage. Replace, if necessary.
- Make sure that the order number on the spare element corresponds to the order number of the filter name-plate. To ensure no contamination occurs during the exchange of the element first open the plastic bag and push the element over the spigot in the filter head. Now remove plastic bag.
- Lightly lubricate the thread of the filter housing and screw onto the filter head completely. After that unscrew the filter housing 1/8 to 1/2 turn.



12. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
① - ③	Seal kit	
	Pi 4205 - Pi 4211	
	NBR	77544851
	FPM	77544869
	EPDM	77544877
	Pi 4215 - Pi 4245	
	NBR	77544885
	FPM	77544893
	EPDM	77544901
④	Maintenance indicator	
	Visual PiS 3093/5	77669914
	Electrical PiS 3092/5	77669864
	Electrical upper section only	77536550
⑤	Seal kit for maintenance indicator	
	NBR	77760275
	FPM	77760283
	EPDM	77760291

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 industriefiltration@mahle.com
 www.mahle-industriefiltration.com
 78356990.07/2008

High Pressure Filter Pi 420 KV/Pi 4000 KV

Nominal pressure 400 bar (5690 psi), NG 50, 80, 110/NG 40, 63, 100
according to DIN 24 550

1. Features

High pressure filter with differential pressure controlled cold-start valve

The filterhead contains a cold-start valve which guarantees under all operating conditions that the hydraulic system is provided only with filtered fluid.

When the differential pressure rises above the opening pressure of the cold-start valve (e.g. due to high cold-start viscosity or due to a not serviced filter element), a partial flow is returned to the tank via the filter heads' tank connection.

- The system is provided only with filter fluids
- A reduction of the flow rate indicates an outstanding filter element change
- Performance curves as per leaflet Pi 420 respectively Pi 4000
- Worldwide distribution



2. Technical specifications

Design:	line mounting filter
Nominal pressure:	400 bar (5690 psi)
Test pressure:	520 bar (7400 psi)
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Bypass setting:	Δ p 8 bar
Filter head material:	GGG
Filter housing material:	St
Sealing material:	NBR
Maintenance indicator setting:	Δ p 5 bar

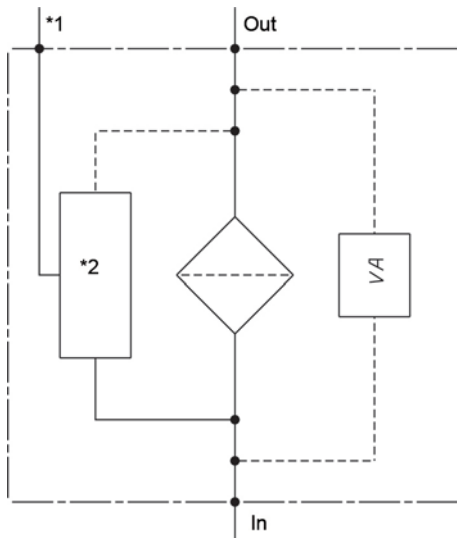
Electrical data of maintenance indicator

Max. voltage:	250 V AC/200 V DC
Max. current:	1 A
Contact load:	70 W
Type of protection:	IP 65 when inserted and secured
Contact:	normally open/normally closed
Cable connection:	M20x1.5

The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

3. Symbols



*1 Tank G $\frac{1}{2}$

*2 Cold start valve

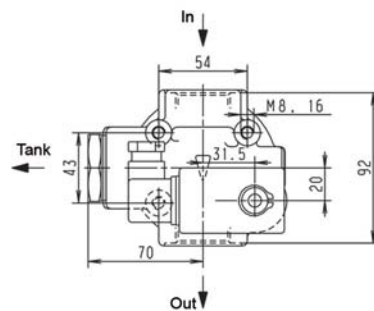
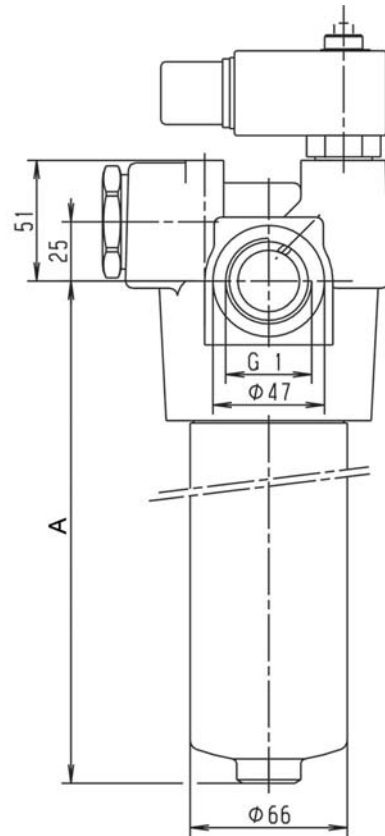
VA = Maintenance indicator

In = G1

Out = G1

We recommend to contact us concerning applications of our filters in areas governed by the Eu Directive 94/9 EC (ATEX). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.



4. Dimensions

Pi 420 KV	A	Pi 4000 KV	A
NG 50	158	NG 40	158
NG 80	236	NG 63	236
NG 110	312	NG 100	312

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Schleifbachweg 45, D-74613 Öhringen,
Phone +49 (0) 7941/67-0, Fax +49 (0) 7941/67-23429,
industriefiltration@mahle.com, www.mahle-industriefiltration.com
70328627.07/2008

Stainless steel-high pressure filter

Pi 480

Nominal pressure 450/250 bar (6425/3570 psi), nominal size 40 up to 250

1. Features

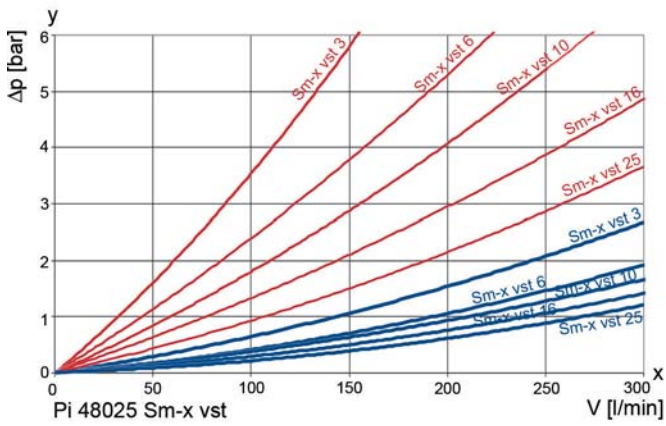
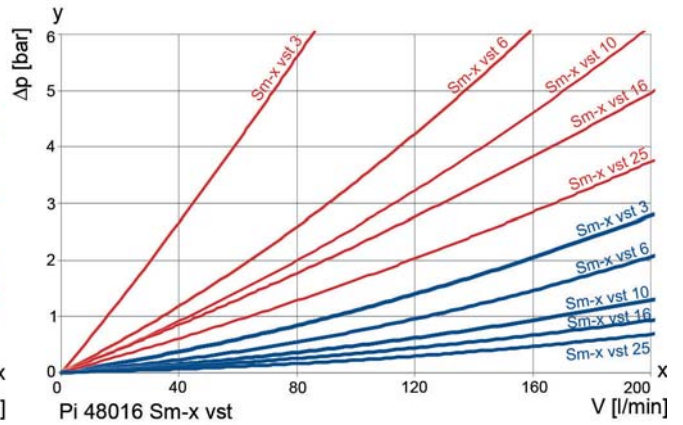
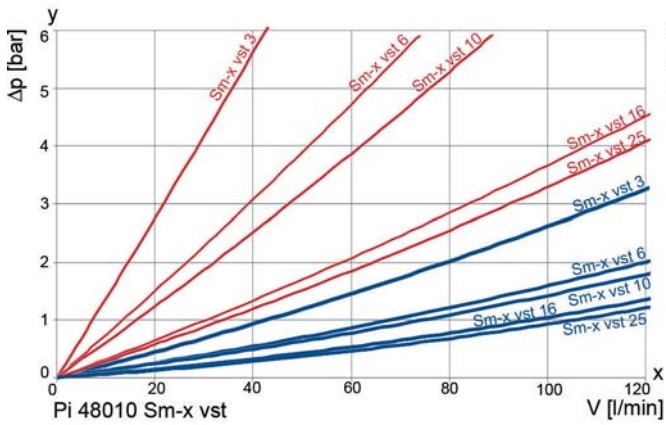
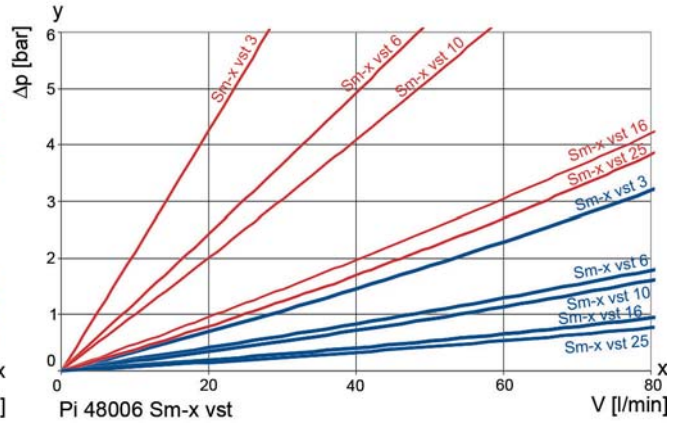
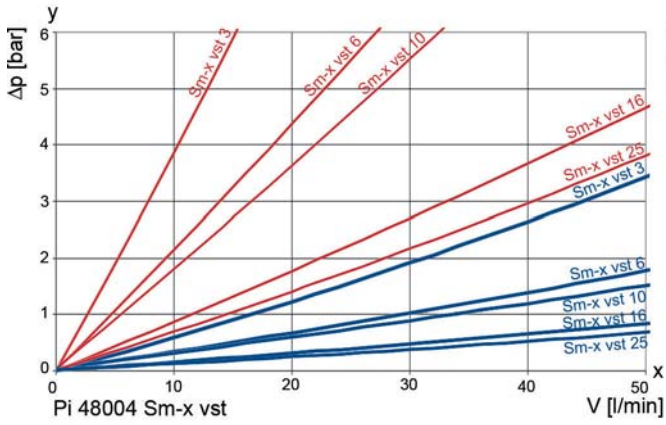
High performance filters for modern hydraulic systems

- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre Sm-x filter elements according to DIN 24550
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- NPT- and SAE-connections on request
- Worldwide distribution



2. Flow rate/pressure drop curve complete filter

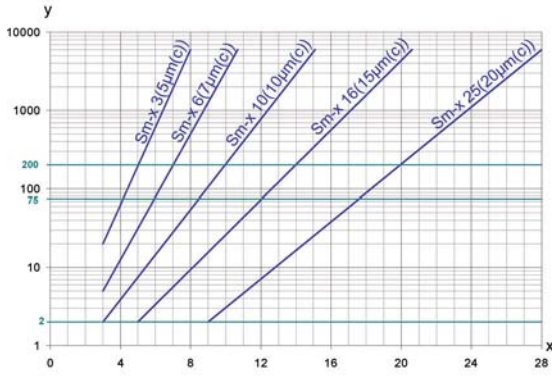
■ 190 mm²/s
■ 33 mm²/s



y = differential pressure Δp [bar]

x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value

x = particle size [μm]

determined by multipass tests (ISO 16889)

calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x- vst elements with
max. Δp 210 bar

Sm-x vst 3 $\beta_{5(C)} \geq 200$

Sm-x vst 6 $\beta_{7(C)} \geq 200$

Sm-x vst 10 $\beta_{10(C)} \geq 200$

Sm-x vst 16 $\beta_{15(C)} \geq 200$

Sm-x vst 25 $\beta_{20(C)} \geq 200$

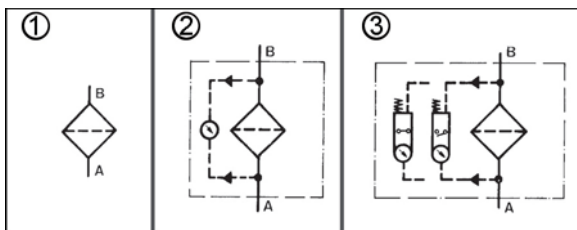
values guaranteed up to 20 bar
differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 3723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3724	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power-filters-evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters-multi-passmethod for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Filter housing	2. Filter element
V = 100 l/min and electrical maintenance indicator Type: Pi 48010-015 Order number: 79324583	Sm-x vst 6 Type: Pi 71010 DN Sm-x vst 6 Order number: 77960131

7.1 Housing design					
Nominal size NG [l/min]	Order number	Type	① no options	② with visual indicator	③ with electrical indicator
40	78397556	Pi 48004-060			
	78306607	Pi 48004-014			
	79343351	Pi 48004-015			
63	79762295	Pi 48006-060			
	79702325	Pi 48006-014			
	70368277	Pi 48006-015			
100	78308660	Pi 48010-060			
	79353236	Pi 48010-014			
	79324553	Pi 48010-015			
160	70368297	Pi 48016-060			
	70368298	Pi 48016-014			
	79353160	Pi 48016-015			
250	70368299	Pi 48025-060			
	70368302	Pi 48025-014			
	76109284	Pi 48025-015			

7.2 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
40	78216079	Pi 71004 DN Sm-x vst 3	Sm-x vst 3	210	445
	77960156	Pi 72004 DN Sm-x vst 6	Sm-x vst 6		445
	77925654	Pi 73004 DN Sm-x vst 10	Sm-x vst 10		445
	78216087	Pi 74004 DN Sm-x vst 16	Sm-x vst 16		445
	78216095	Pi 75004 DN Sm-x vst 25	Sm-x vst 25		445
63	78216137	Pi 76006 DN Sm-x vst 3	Sm-x vst 3	210	780
	77960149	Pi 72006 DN Sm-x vst 6	Sm-x vst 6		780
	77925662	Pi 73006 DN Sm-x vst 10	Sm-x vst 10		780
	78216145	Pi 74006 DN Sm-x vst 16	Sm-x vst 16		780
	78216152	Pi 75006 DN Sm-x vst 25	Sm-x vst 25		780
100	78227480	Pi 71010 DN Sm-x vst 3	Sm-x vst 3	210	1275
	77960131	Pi 72010 DN Sm-x vst 6	Sm-x vst 6		1275
	77925670	Pi 73010 DN Sm-x vst 10	Sm-x vst 10		1275
	78261281	Pi 74010 DN Sm-x vst 16	Sm-x vst 16		1275
	78216160	Pi 75010 DN Sm-x vst 25	Sm-x vst 25		1275
160	77940638	Pi 71016 DN Sm-x vst 3	Sm-x vst 3	210	1885
	77960123	Pi 72016 DN Sm-x vst 6	Sm-x vst 6		1885
	77925688	Pi 73016 DN Sm-x vst 10	Sm-x vst 10		1885
	78269797	Pi 74016 DN Sm-x vst 16	Sm-x vst 16		1885
	78216178	Pi 75016 DN Sm-x vst 25	Sm-x vst 25		1885
250	77940646	Pi 71025 DN Sm-x vst 3	Sm-x vst 3	210	3090
	77960115	Pi 72025 DN Sm-x vst 6	Sm-x vst 6		3090
	77925696	Pi 73025 DN Sm-x vst 10	Sm-x vst 10		3090
	78269813	Pi 74025 DN Sm-x vst 16	Sm-x vst 16		3090
	78216186	Pi 75025 DN Sm-x vst 25	Sm-x vst 25		3090

*a wider range of element types is available on request

8. Technical specifications

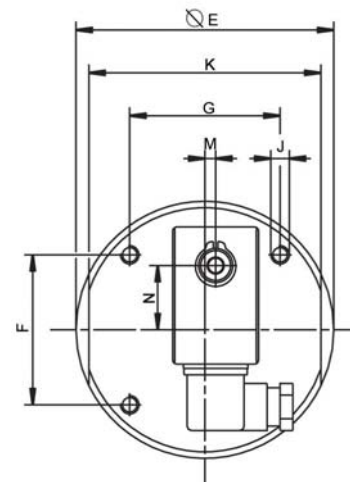
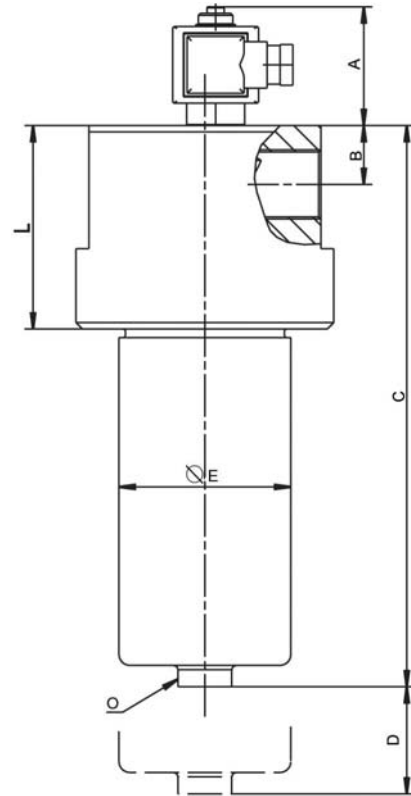
Design:	in-line filter
Nominal pressure:	
NG 40 up to 100	450 bar (6425 psi)
NG 160 and 250	250 bar (3570 psi)
Test pressure:	
NG 40 up to 100	700 bar (10000 psi)
NG 160 and 250	325 bar (4640 psi)
Connections:	
NG 40 up to 100	G1
NG 160 and 250	G1½
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Filter head and housing material:	TP 316/TP 316 L (1.4401/1.4404) (other materials on request)
Sealing material:	NBR/PTFE
Maintenance indicator setting:	Δp 5 bar \pm 10 %
Electrical data of maintenance indicator:	
Maximum voltage:	250 V AC/200 V DC
Maximum current:	1 A
Contact load:	70 W IP 65 in inserted and secured status
Type of protection:	
Contact:	normally open/closed
Cable sleeve:	M20x1.5

The switching function can be changed by turning the electric upper part by 180 ° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values and not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EG (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EG Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.



9. Dimensions

All dimensions in mm.

Type	A	B	C	D	E	F	G	H	J	K	L	M	N	O (SW)
Pi 48004	60	27,5	192	100	80	70	70	120	M8	108	95	5	30,0	25
Pi 48006	60	27,5	252	100	80	70	70	120	M8	108	95	5	30,0	25
Pi 48010	60	27,5	342	100	80	70	70	120	M8	108	95	5	30,0	25
Pi 48016	60	42,0	310	130	120	78	78	150	M10	135	145	-	35,5	36
Pi 48025	60	42,0	400	130	120	78	78	150	M10	135	145	-	35,5	36

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove filter element and filter housing. Preferably the filter should be installed with the filter housing pointing downwards.

The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2.

The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

10.3 When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:

During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
- Filters without maintenance indicator:

The filter element should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
- Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (Sm-x) cannot be cleaned.

10.4 Element replacement

- Stop system and relieve filter from pressure.
- Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
- Remove element by pulling down carefully.
- Check o-ring and spigot for damage. Replace, if necessary.
- Make sure that the order number on the spare element corresponds to the order number of the filter name-plate. To ensure no contamination occurs during the exchange of the element first open the plastic bag and push the element over the spigot in the filter head. Now remove plastic bag.
- Lightly lubricate the thread of the filter housing and screw onto the filter head completely. After that unscrew the filter housing 1/8 to 1/2 turn.

11. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
①	Seal kit	
	Pi 48004 - 48010	
	NBR	79767443
	FPM	70315096
	EPDM	70303334
	Pi 48016 - 48025	
	NBR	70315097
	FPM	70315098
	EPDM	70368303
	②	Maintenance indicator
Visual PiS 3193		78308538
Electrical PiS 3192		78308546
Electrical upper section only		77536550
③	Seal kit for maintenance indicator	
	NBR	77760275
	FPM	77760283
	EPDM	77760291

MAHLE

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79323668.07/2008

DUPLEX FILTERS

Duplex Filter Pi 210

Nominal pressure 25/63 bar (360/900 psi), nominal size up to 450

1. Features

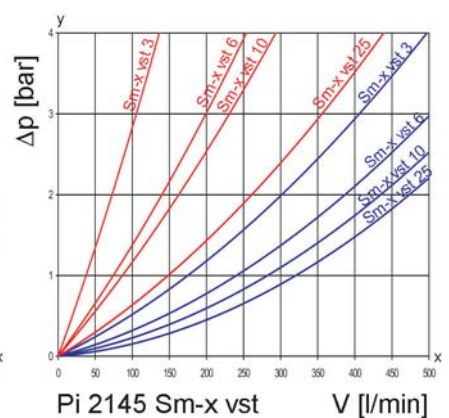
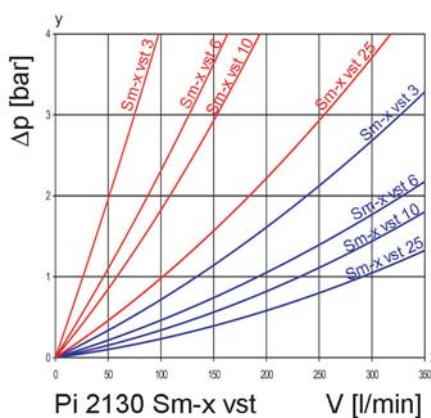
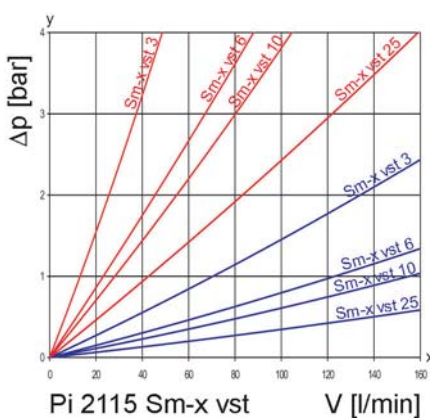
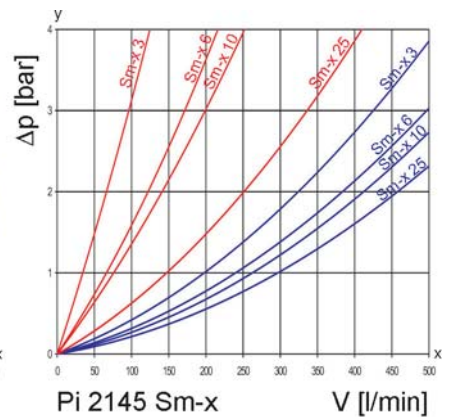
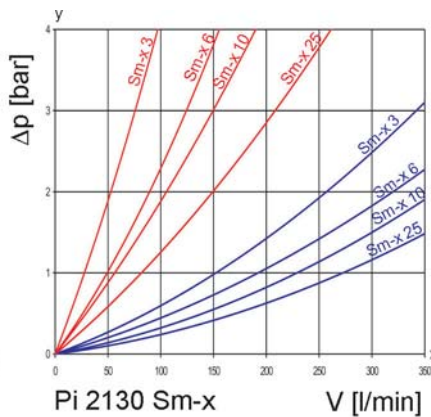
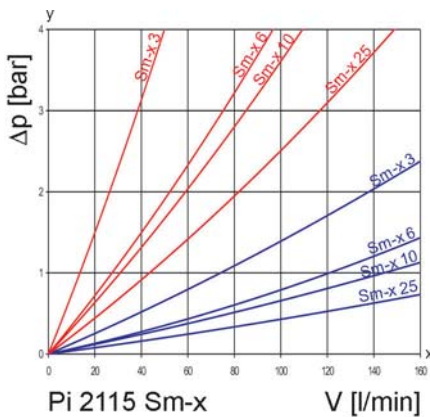
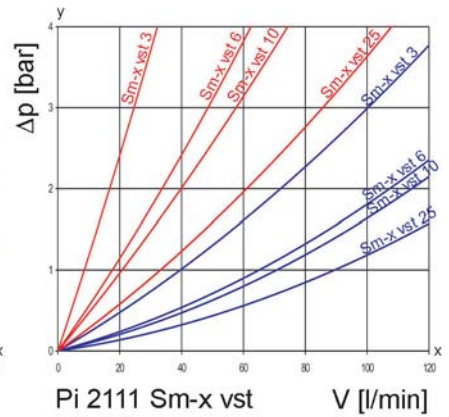
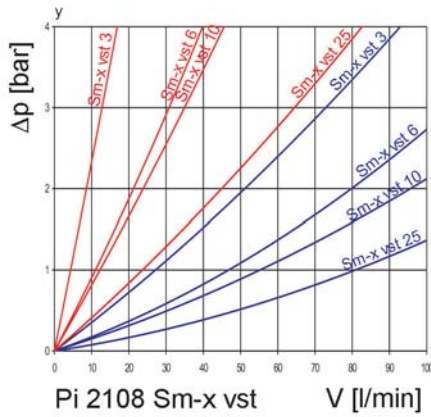
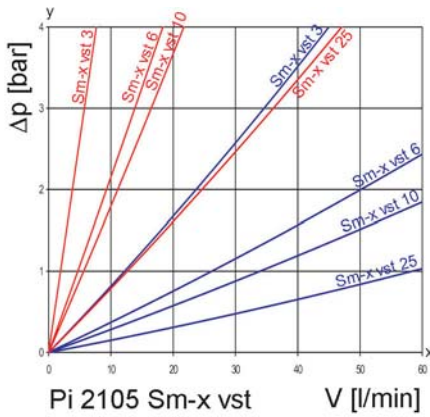
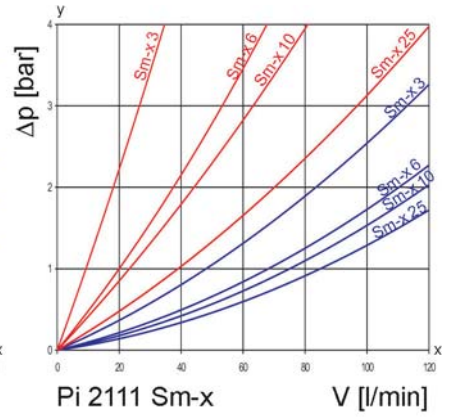
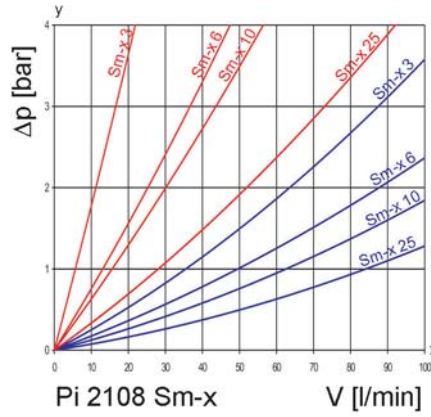
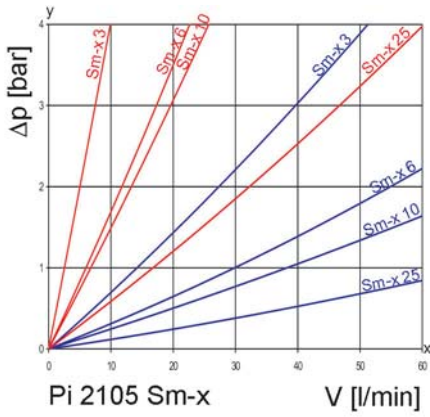
High performance filters for modern hydraulic systems

- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded connections
- Change over valve on upstream side
- Ergonomic switch-over handle with safety lock and pressure compensation
- User-optimized one-hand-operation
- Equipped with highly efficient glass fibre Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- NPT- and SAE-connections on request
- Worldwide distribution



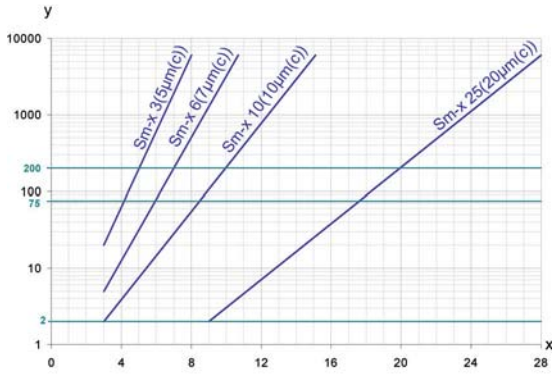
2. Flow rate/pressure drop curve complete filter

■ 190 mm²/s
■ 33 mm²/s



y = differential pressure Δp [bar]
 x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particle size [µm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x elements with
max. Δ p 20 bar

Sm-x 3 β_{5(C)} ≥200
Sm-x 6 β_{7(C)} ≥200
Sm-x 10 β_{10(C)} ≥200
Sm-x 25 β_{20(C)} ≥200

values guaranteed up to
10 bar differential pressure

Sm-x vst elements with
max. Δ p 210 bar

Sm-x 3 β_{5(C)} ≥200
Sm-x 6 β_{7(C)} ≥200
Sm-x 10 β_{10(C)} ≥200
Sm-x 25 β_{20(C)} ≥200

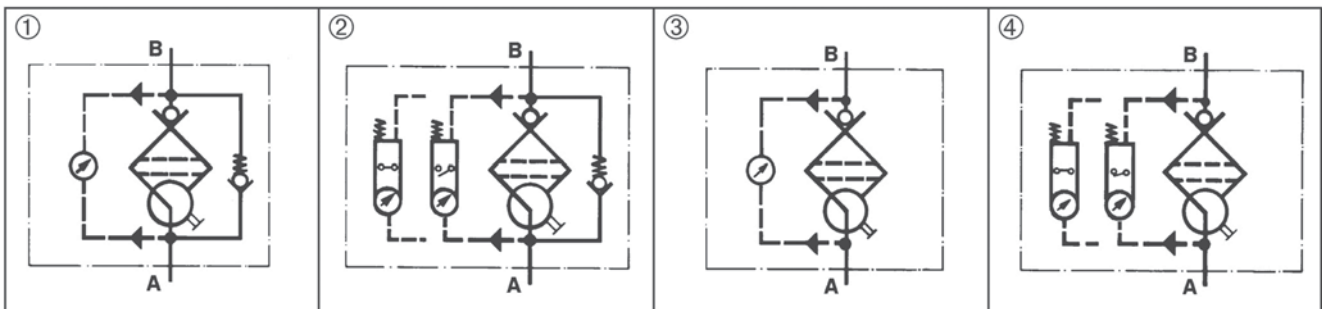
values guaranteed up to
20 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 3723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3724	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power filters; evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters; multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Housing design	2. Filter element
V=80 l/min, electrical indicator Type: Pi 2108-069 Order number: 77810286	Sm-x vst 3 Type: Pi 2208 Sm-x vst 3 Order number: 77680200

7.1 Housing design						
Nominal size NG [l/min]	Order number	Type	① with bypass valve and visual indicator	② with bypass valve and electrical indicator	③ with visual indicator	④ with electrical indicator
50	77810211	Pi 2105-057				
	77810229	Pi 2105-058				
	77810237	Pi 2105-068				
	77810245	Pi 2105-069				
80	77810252	Pi 2108-057				
	77810260	Pi 2108-058				
	77810278	Pi 2108-068				
	77810286	Pi 2108-069				
110	78204083	Pi 2111-057				
	78204091	Pi 2111-058				
	78204109	Pi 2111-068				
	78204117	Pi 2111-069				
150	77774573	Pi 2115-057				
	77774565	Pi 2115-058				
	77774557	Pi 2115-068				
	77774540	Pi 2115-069				
300	77774532	Pi 2130-057				
	77774524	Pi 2130-058				
	77774516	Pi 2130-068				
	77774508	Pi 2130-069				
450	77774490	Pi 2145-057				
	77774482	Pi 2145-058				
	77774474	Pi 2145-068				
	77774466	Pi 2145-069				

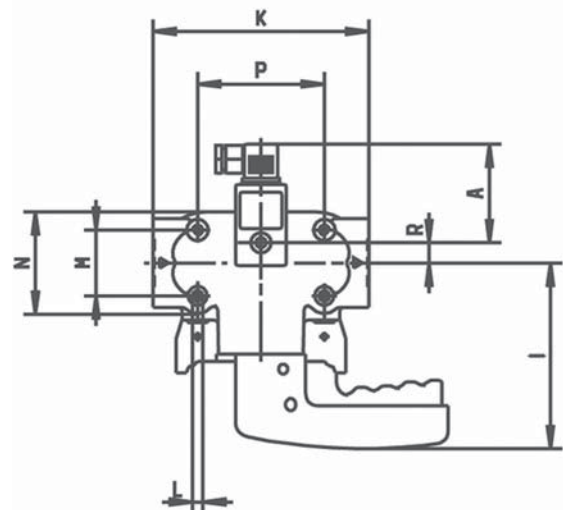
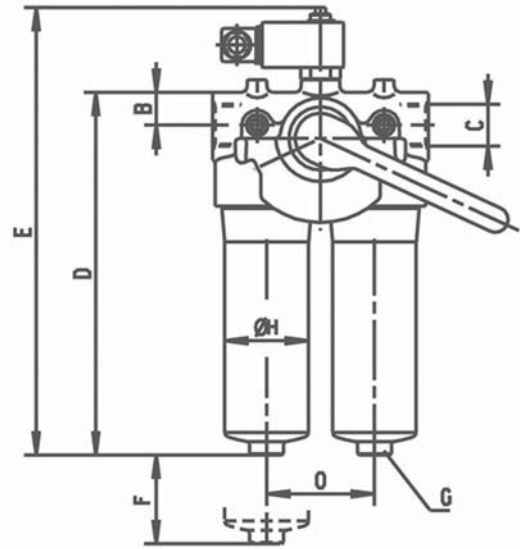
When filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

7.2 Filter elements (a wider range of element types is available on request)

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
50	77680135	Pi 2105 Sm-x 3	Sm-x 3	20	590
	77943509	Pi 5105 Sm-x 6	Sm-x 6		590
	77680325	Pi 3105 Sm-x 10	Sm-x 10		590
	77680440	Pi 4105 Sm-x 25	Sm-x 25		590
	77680192	Pi 2205 Sm-x vst 3	Sm-x vst 3	210	425
	77943533	Pi 5205 Sm-x vst 6	Sm-x vst 6		425
	77680382	Pi 3205 Sm-x vst 10	Sm-x vst 10		425
	77680507	Pi 4205 Sm-x vst 25	Sm-x vst 25		425
80	77680143	Pi 2108 Sm-x 3	Sm-x 3	20	1150
	77943517	Pi 5108 Sm-x 6	Sm-x 6		1150
	77680341	Pi 3108 Sm-x 10	Sm-x 10		1150
	77680457	Pi 4108 Sm-x 25	Sm-x 25		1150
	77680200	Pi 2208 Sm-x vst 3	Sm-x vst 3	210	850
	77943541	Pi 5208 Sm-x vst 6	Sm-x vst 6		850
	77681190	Pi 3208 Sm-x vst 10	Sm-x vst 10		850
	77680515	Pi 4208 Sm-x vst 25	Sm-x vst 25		850
110	77680150	Pi 2111 Sm-x 3	Sm-x 3	20	1700
	77943525	Pi 5111 Sm-x 6	Sm-x 6		1700
	77680333	Pi 3111 Sm-x 10	Sm-x 10		1700
	77680465	Pi 4111 Sm-x 25	Sm-x 25		1700
	77680218	Pi 2211 Sm-x vst 3	Sm-x vst 3	210	1275
	77943558	Pi 5211 Sm-x vst 6	Sm-x vst 6		1275
	77680390	Pi 3211 Sm-x vst 10	Sm-x vst 10		1275
	77680523	Pi 4211 Sm-x vst 25	Sm-x vst 25		1275
150	77680168	Pi 2115 Sm-x 3	Sm-x 3	20	2425
	77955099	Pi 5115 Sm-x 6	Sm-x 6		2425
	77680358	Pi 3115 Sm-x 10	Sm-x 10		2425
	77680473	Pi 4115 Sm-x 25	Sm-x 25		2425
	77680226	Pi 2215 Sm-x vst 3	Sm-x vst 3	210	2010
	77955123	Pi 5215 Sm-x vst 6	Sm-x vst 6		2010
	77680408	Pi 3215 Sm-x vst 10	Sm-x vst 10		2010
	77680531	Pi 4215 Sm-x vst 25	Sm-x vst 25		2010
300	77680176	Pi 2130 Sm-x 3	Sm-x 3	20	4620
	77955107	Pi 5130 Sm-x 6	Sm-x 6		4620
	77680366	Pi 3130 Sm-x 10	Sm-x 10		4620
	77680481	Pi 4130 Sm-x 25	Sm-x 25		4620
	77680234	Pi 2230 Sm-x vst 3	Sm-x vst 3	210	3800
	77955131	Pi 5230 Sm-x vst 6	Sm-x vst 6		3800
	77680416	Pi 3230 Sm-x vst 10	Sm-x vst 10		3800
	77680549	Pi 4230 Sm-x vst 25	Sm-x vst 25		3800
450	77680184	Pi 2145 Sm-x 3	Sm-x 3	20	6865
	77955115	Pi 5145 Sm-x 6	Sm-x 6		6865
	77680374	Pi 3145 Sm-x 10	Sm-x 10		6865
	77680499	Pi 4145 Sm-x 25	Sm-x 25		6865
	77680242	Pi 2245 Sm-x vst 3	Sm-x vst 3	210	5600
	77955149	Pi 5245 Sm-x vst 6	Sm-x vst 6		5600
	77680424	Pi 3245 Sm-x vst 10	Sm-x vst 10		5600
	77680556	Pi 4245 Sm-x vst 25	Sm-x vst 25		5600

8. Technical specifications

Design:	line mounting filter
Nominal pressure: Pi 2115 - Pi 2145	25 bar (360 psi)
Pi 2105 - Pi 2111	63 bar (900 psi)
Test pressure: Pi 2115 - Pi 2145	33 bar (470 psi)
Pi 2105 - Pi 2111	82 bar (1170 psi)
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Bypass setting:	Δp 3.5 bar \pm 10 %
Filter head material:	GAL
Filter housing material:	AL/St
Sealing material:	NBR/AL
Maintenance indicator setting:	Δp 2.2 bar \pm 10 %
Electrical data of maintenance indicator:	
Maximum voltage:	250 V AC/200 V DC
Maximum current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M20x1.5



The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.

9. Dimensions

All dimensions except "C" in mm.

Type	A	B	C*	D	E	F	G SW	H	I	K	L	M	N	O	P	R	Weight [kg]
Pi 2105	78	38	G1	200	258	80	27	66	139	168	M8x16	52	81	85	100	16	2.6
Pi 2108	78	38	G1	276	334	80	27	66	139	168	M8x16	52	81	85	100	16	2.9
Pi 2111	78	38	G1	358	416	80	27	66	139	168	M8x16	52	81	85	100	16	2.6
Pi 2115	78	40	G1½	269	327	110	32	109	165	280	M10x20	62	140	140	210	19	7.1
Pi 2130	78	40	G1½	386	444	110	32	109	165	280	M10x20	62	140	140	210	19	8.0
Pi 2145	78	40	G1½	501	559	110	24	109	165	280	M10x20	62	140	140	210	19	16.0

*SAE flange connections (3000 PSI) on request

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove filter element and filter housing. Preferably the filter should be installed with the filter housing pointing downwards. The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

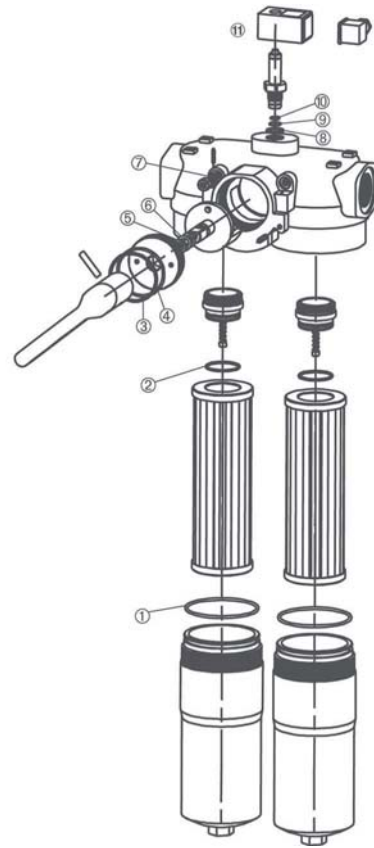
10.3 When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
- Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (Sm-x) cannot be cleaned.

10.4 Element replacement

Note: The maintenance indicator monitors the filter side in operation, which is identified by the position of the switching lever catch. The flow transfer valve must be switched prior to filter servicing. Now the signal of the maintenance indicator is cancelled and the red button can be depressed again.

- Operate and hold pressure equalizing lever located in the switching lever. Swivel switching lever. Engage the catch. Place through or drip pan underneath to collect leaking oil.
- Loosen vent screw of the filter side not in use by 2-3 turns; maximum back out against safety stop.
- Unscrew filter bowl by rotating same counter clockwise and clean with a suitable medium.
- Remove filter element with a side-to-side motion.
- Check o-ring on the filter housing and the spigot for damage. Replace, if necessary.
- Make sure that the order number on the spare element corresponds to the order number of the filter name-plate. Remove the plastic bag and push element over the spigot in the filter head.
- Complete installation by screwing on the housing, turning clockwise until it comes to a full stop. Back off the housing 1/8 to 1/2 turn.
- To refill the filter chamber, operate only the pressure equalizing lever long enough for the medium to emerge bubblefree from the vent bore. Tighten vent screw. Check filter for leaks by operating the pressure equalizing lever once again.



11. Spare parts list

Order number for spare parts		
Position	Type	Order number
① - ⑦	Seal kit for housing	
	Pi 2105 - Pi 2111	
	NBR	79761271
	FPM	79761289
	EPDM	79761297
	Pi 2115 - Pi 2145	
	NBR	79761230
	FPM	79761248
	EPDM	79761255
⑧ - ⑩	Seal kit for maintenance indicator	
	NBR	77760309
	FPM	77760317
	EPDM	77760325
⑪	Maintenance indicator	
	Visual PiS 3098/2.2	77669971
	Electrical PiS 3097/2.2	77669948
	Electrical upper section only	77536550

MAHLE

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industriefiltration@mahle.com
www.mahle-industriefiltration.com
78356552.08/2008

Duplex Filter

Pi 2100

Nominal pressure 25/63 bar (360/900 psi), nominal size up to 400
according to DIN 24550

1. Features

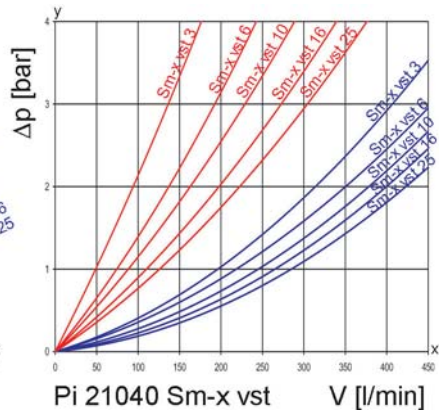
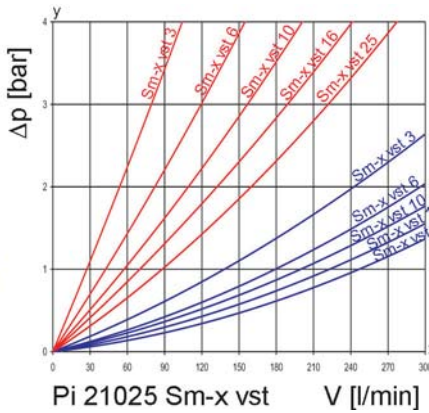
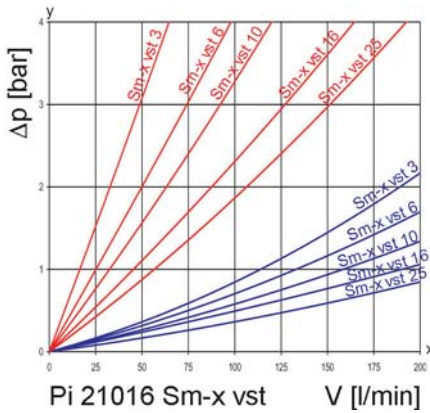
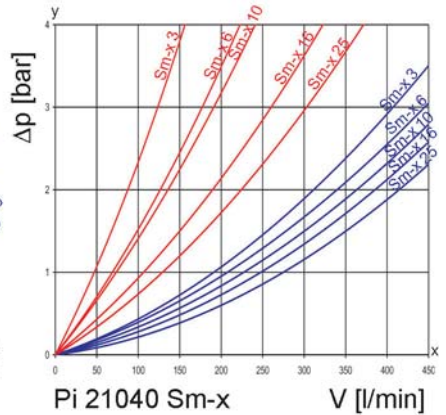
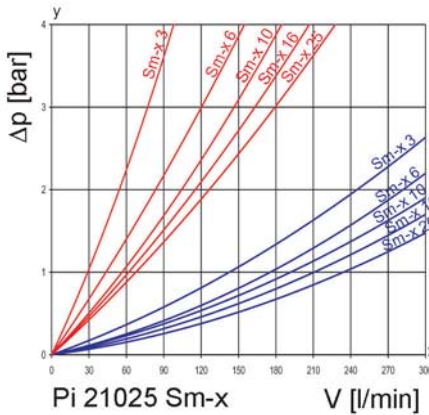
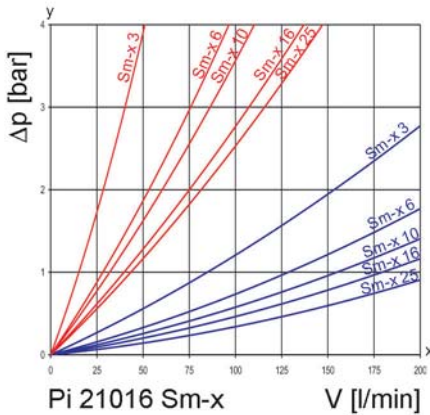
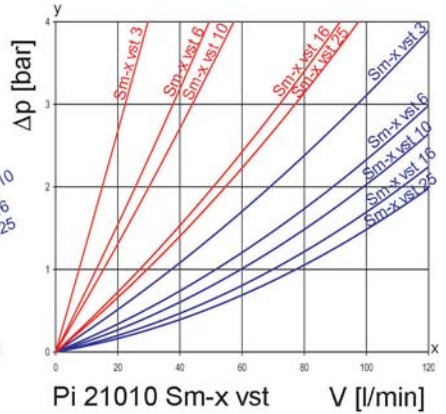
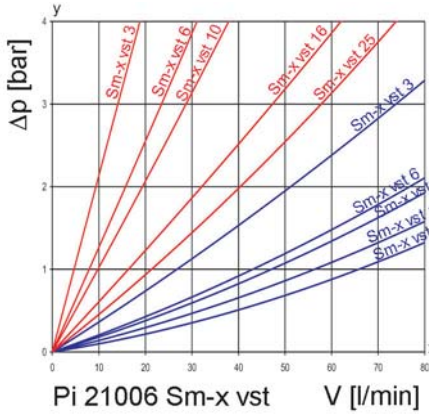
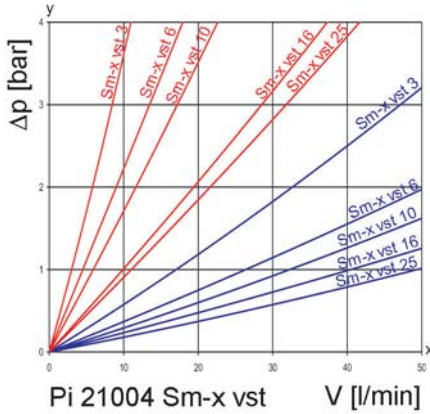
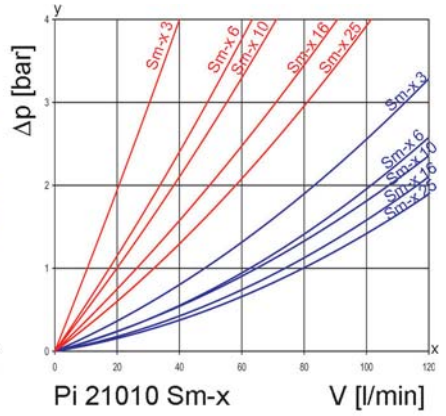
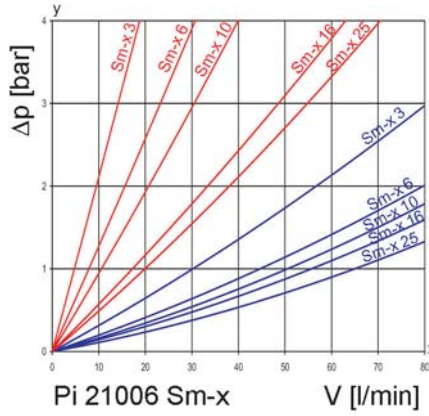
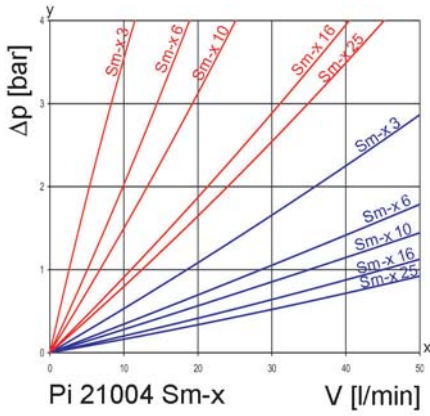
High performance filters for modern hydraulic systems

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- Worldwide distribution



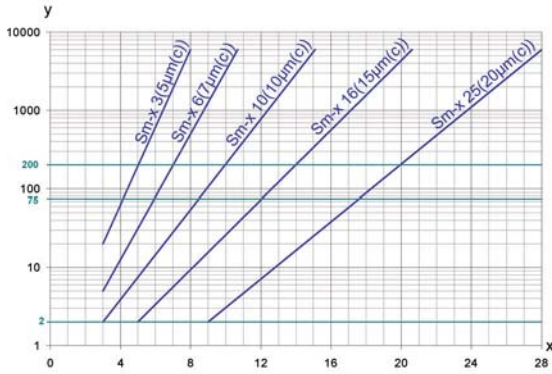
2. Flow rate/ pressure drop curve complete filter

190 mm²/s
33 mm²/s



y = differential pressure Δp [bar]
x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particle size [μm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x elements with
max. Δp 20 bar

Sm-x	3	$\beta_{5(C)} \geq 200$
Sm-x	6	$\beta_{7(C)} \geq 200$
Sm-x	10	$\beta_{10(C)} \geq 200$
Sm-x	16	$\beta_{15(C)} \geq 200$
Sm-x	25	$\beta_{20(C)} \geq 200$

values guaranteed up to
10 bar differential pressure

Sm-x vst elements with
max. Δp 210 bar

Sm-x vst	3	$\beta_{5(C)} \geq 200$
Sm-x vst	6	$\beta_{7(C)} \geq 200$
Sm-x vst	10	$\beta_{10(C)} \geq 200$
Sm-x vst	16	$\beta_{15(C)} \geq 200$
Sm-x vst	25	$\beta_{20(C)} \geq 200$

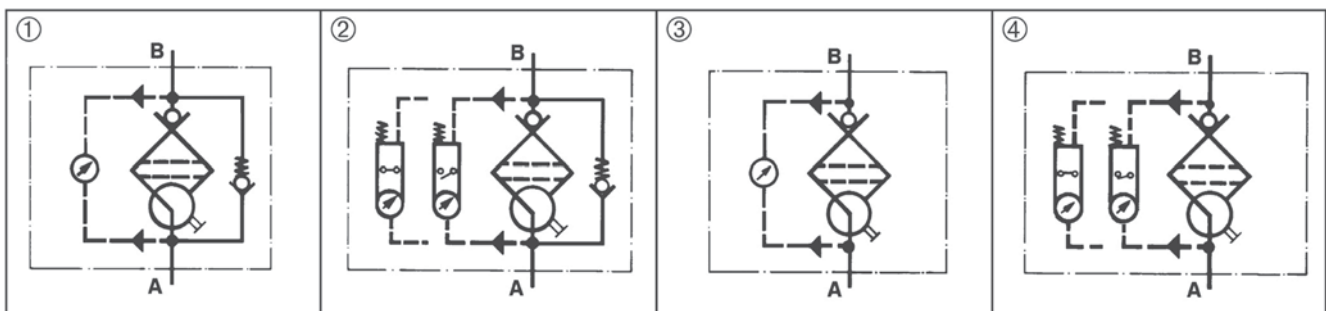
values guaranteed up to
20 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 2923	Hydraulic fluid power filter elements; method for end load test
DIN ISO 2924	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power filters; evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters-multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filter:

1. Housing design	2. 2 x Filter elements
V = 100 l/min and electrical maintenance indicator Type: Pi 21010-069 Order number: 78204158	Sm-x vst 3 Type: Pi 71010 DN Sm-x vst 3 Order number: 78227480

7.1 Housing design						
Nominal size NG [l/min]	Order number	Type	① with bypass valve and visual indicator	② with bypass valve and electrical indicator	③ with visual indicator	④ with electrical indicator
40	79328261	Pi 21004-057				
	78304263	Pi 21004-058				
	79328279	Pi 21004-068				
	79328287	Pi 21004-069				
63	79715905	Pi 21006-057				
	78304271	Pi 21006-058				
	79715913	Pi 21006-068				
	79715921	Pi 21006-069				
100	78204125	Pi 21010-057				
	78204133	Pi 21010-058				
	78204141	Pi 21010-068				
	78204158	Pi 21010-069				
160	79715939	Pi 21016-057				
	79715947	Pi 21016-058				
	79715954	Pi 21016-068				
	79715962	Pi 21016-069				
250	79328295	Pi 21025-057				
	79328303	Pi 21025-058				
	79328311	Pi 21025-068				
	79328329	Pi 21025-069				
400	79715970	Pi 21040-057				
	79715988	Pi 21040-058				
	79715996	Pi 21040-068				
	79716002	Pi 21040-069				

When filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

7.2 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
40	78260929	Pi 21004 DN Sm-x 3 NBR	Sm-x 3	20	475
	77960859	Pi 22004 DN Sm-x 6 NBR	Sm-x 6		475
	77925571	Pi 23004 DN Sm-x 10 NBR	Sm-x 10		475
	78260937	Pi 24004 DN Sm-x 16 NBR	Sm-x 16		475
	78260945	Pi 25004 DN Sm-x 25 NBR	Sm-x 25		475
	78216079	Pi 71004 DN Sm-x vst 3 NBR	Sm-x vst 3	210	445
	77960156	Pi 72004 DN Sm-x vst 6 NBR	Sm-x vst 6		445
	77925654	Pi 73004 DN Sm-x vst 10 NBR	Sm-x vst 10		445
	78216087	Pi 74004 DN Sm-x vst 16 NBR	Sm-x vst 16		445
	78216095	Pi 75004 DN Sm-x vst 25 NBR	Sm-x vst 25		445
63	78260960	Pi 21006 DN Sm-x 3 NBR	Sm-x 3	20	835
	77960867	Pi 22006 DN Sm-x 6 NBR	Sm-x 6		835
	77925589	Pi 23006 DN Sm-x 10 NBR	Sm-x 10		835
	78260978	Pi 24006 DN Sm-x 16 NBR	Sm-x 16		835
	78260986	Pi 25006 DN Sm-x 25 NBR	Sm-x 25		835
	78216137	Pi 71006 DN Sm-x vst 3 NBR	Sm-x vst 3	210	780
	77960149	Pi 72006 DN Sm-x vst 6 NBR	Sm-x vst 6		780
	77925662	Pi 73006 DN Sm-x vst 10 NBR	Sm-x vst 10		780
	78216145	Pi 74006 DN Sm-x vst 16 NBR	Sm-x vst 16		780
	78216152	Pi 75006 DN Sm-x vst 25 NBR	Sm-x vst 25		780
100	78227472	Pi 21010 DN Sm-x 3 NBR	Sm-x 3	20	1375
	77960875	Pi 22010 DN Sm-x 6 NBR	Sm-x 6		1375
	77925597	Pi 23010 DN Sm-x 10 NBR	Sm-x 10		1375
	78261000	Pi 24010 DN Sm-x 16 NBR	Sm-x 16		1375
	78261018	Pi 25010 DN Sm-x 25 NBR	Sm-x 25		1375
	78227480	Pi 71010 DN Sm-x vst 3 NBR	Sm-x vst 3	210	1275
	77960131	Pi 72010 DN Sm-x vst 6 NBR	Sm-x vst 6		1275
	77925670	Pi 73010 DN Sm-x vst 10 NBR	Sm-x vst 10		1275
	78261281	Pi 74010 DN Sm-x vst 16 NBR	Sm-x vst 16		1275
	78216160	Pi 75010 DN Sm-x vst 25 NBR	Sm-x vst 25		1275

*a wider range of elements is available on request

7.2 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
160	78261034	Pi 21016 DN Sm-x 3 NBR	Sm-x 3	20	2530
	77960826	Pi 22016 DN Sm-x 6 NBR	Sm-x 6		2530
	77925605	Pi 23016 DN Sm-x 10 NBR	Sm-x 10		2530
	78261042	Pi 24016 DN Sm-x 16 NBR	Sm-x 16		2530
	78261059	Pi 25016 DN Sm-x 25 NBR	Sm-x 25		2530
	77940638	Pi 71016 DN Sm-x vst 3 NBR	Sm-x vst 3	210	1885
	77960123	Pi 72016 DN Sm-x vst 6 NBR	Sm-x vst 6		1885
	77925688	Pi 73016 DN Sm-x vst 10 NBR	Sm-x vst 10		1885
	78269797	Pi 74016 DN Sm-x vst 16 NBR	Sm-x vst 16		1885
	78216178	Pi 75016 DN Sm-x vst 25 NBR	Sm-x vst 25		1885
250	78227514	Pi 21025 DN Sm-x 3 NBR	Sm-x 3	20	4020
	77960834	Pi 22025 DN Sm-x 6 NBR	Sm-x 6		4020
	77925613	Pi 23025 DN Sm-x 10 NBR	Sm-x 10		4020
	78261075	Pi 24025 DN Sm-x 16 NBR	Sm-x 16		4020
	78261083	Pi 25025 DN Sm-x 25 NBR	Sm-x 25		4020
	77940646	Pi 71025 DN Sm-x vst 3 NBR	Sm-x vst 3	210	3090
	77960115	Pi 72025 DN Sm-x vst 6 NBR	Sm-x vst 6		3090
	77925696	Pi 73025 DN Sm-x vst 10 NBR	Sm-x vst 10		3090
	78269813	Pi 74025 DN Sm-x vst 16 NBR	Sm-x vst 16		3090
	78216186	Pi 75025 DN Sm-x vst 25 NBR	Sm-x vst 25		3090
400	78227522	Pi 21 040 DN Sm-x 3 NBR	Sm-x 3	20	6770
	77960842	Pi 22 040 DN Sm-x 6 NBR	Sm-x 6		6770
	77925621	Pi 23 040 DN Sm-x 10 NBR	Sm-x 10		6770
	78261109	Pi 24 040 DN Sm-x 16 NBR	Sm-x 16		6770
	78261117	Pi 25 040 DN Sm-x 25 NBR	Sm-x 25		6770
	77940653	Pi 71 040 DN Sm-x vst 3 NBR	Sm-x vst 3	210	5240
	77960107	Pi 72 040 DN Sm-x vst 6 NBR	Sm-x vst 6		5240
	77930829	Pi 73 040 DN Sm-x vst 10 NBR	Sm-x vst 10		5240
	78269821	Pi 74 040 DN Sm-x vst 16 NBR	Sm-x vst 16		5240
	78260903	Pi 75 040 DN Sm-x vst 25 NBR	Sm-x vst 25		5240

*a wider range of elements is available on request

8. Technical specifications

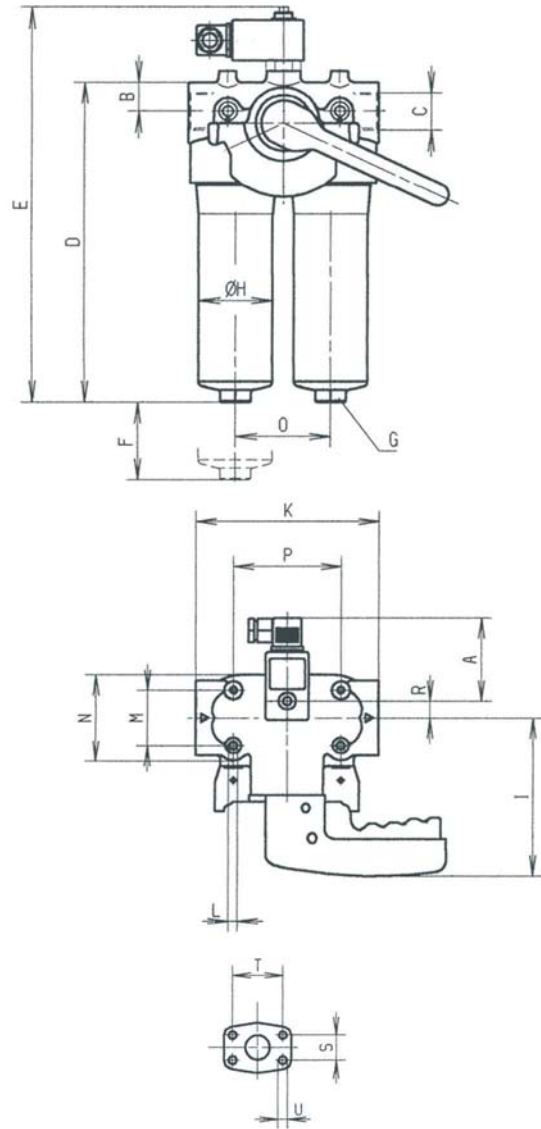
Design:	line mounting filter
Nominal pressure: Pi 21016-21040	25 bar (360 psi)
Pi 21004-21010	63 bar (900 psi)
Test pressure: Pi 21016-21040	33 bar (470 psi)
Pi 21004-21010	82 bar (1170 psi)
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Bypass setting:	Δp 3.5 bar \pm 10 %
Filter head material:	GAL
Filter housing material:	AL/St.
Sealing material:	NBR/AL
Maintenance indicator setting:	Δp 2.2 bar \pm 10 %
Electrical data of maintenance indicator:	
Max. voltage:	250 V AC/200 V DC
Max. current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable connection:	M20x1.5

The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Goup 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.



9. Dimensions

All dimensions except "C" in mm.

Type	A	B	C*	D	E	F	G SW	H	I	K	L	M	N	O	P	R	S	T	U	Weight [kg]
Pi 21004	78	38	G1	205	263	80	27	66	139	168	M8x16	52	81	85	100	16	26.2	52.4	M10x20	2.6
Pi 21006	78	38	G1	265	323	80	27	66	139	168	M8x16	52	81	85	100	16	26.2	52.4	M10x20	2.9
Pi 21010	78	38	G1	358	416	80	27	66	139	168	M8x16	52	81	85	100	16	26.2	52.4	M10x20	3.3
Pi 21016	78	40	G1½	291	349	110	32	109	165	280	M10x20	62	140	140	210	19	35.7	69.9	M12x20	7.1
Pi 21025	78	40	G1½	386	444	110	32	109	165	280	M10x20	62	140	140	210	19	35.7	69.9	M12x20	8.0
Pi 21040	78	40	G1½	530	588	110	24	109	165	280	M10x20	62	140	140	210	19	35.7	69.9	M12x20	16.3

* SAE-flange connections (3000 PSI) on request.

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing filter make sure that sufficient space is available to remove filter element and filter housing.

Preferably the filter should be installed with the filter housing pointing downwards.

The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open to normally closed position or vice versa.

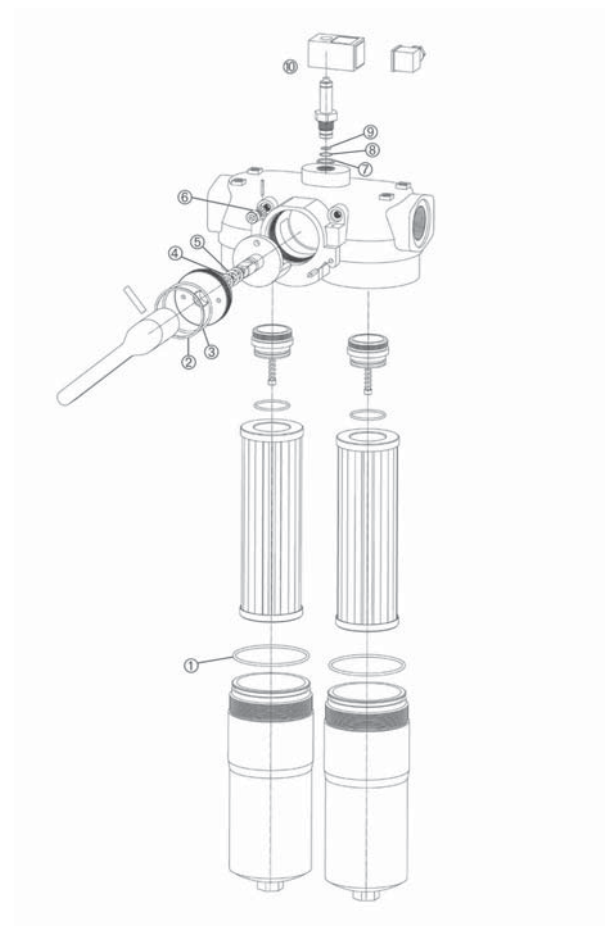
10.3 When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature the filter element must be replaced after the end of the shift.
- Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (Sm-x) cannot be cleaned.

10.4 Element replacement

Note: The maintenance indicator monitors the filter side in operation, which is identified by the position of the switching lever catch. The change-over transfer valve must be switched prior filter servicing. Now the signal of the maintenance indicators cancelled and the red button can be repressed again:

- Operate and hold pressure equalizing lever located behind switching lever. Pull catch knob and swivel switching lever. Engage the catch on the clear filter side. Place through or drip pan underneath to collect leaving oil.
- Loosen vent screw of the filter side not in use by 2-3 turns; max. until contact is made with the safety stop.
- Unscrew filter housing by rotating same counter-clockwise and clean with a suitable medium.
- Remove filter element with a side-to-side motion.
- Check O-ring on the filter house for damage. Replace, if necessary.
- Make sure that the order number on the spare element corresponds to the order number of the filter name-plate.
- Complete installation by screwing on the housing, turning clockwise until it comes to a full stop. Back off the bowl 1/8 to 1/2 turn.
- To refill the filter chamber, operate only the pressure equalizing lever (leave the switching lever arrested in its catch) long enough for the medium to emerge bubble-free from the vent bore.
- Tighten vent screw. Check filter for leaks by operating the pressure equalizing lever once again.



11. Spare parts list

Order number for spare parts		
Position	Type	Order number
① to ⑥	Seal kit for housing	
	Pi 21004 - Pi 21010	
	NBR	79774258
	FPM	79774266
	EPDM	79774274
	Pi 21016 - Pi 21040	
	NBR	79774282
	FPM	79774290
	EPDM	79774308
⑦ to ⑨	Seal kit for maintenance indicator	
	NBR	77760309
	FPM	77760317
	EPDM	77760325
⑩	Maintenance indicator	
	Visual PiS 3098/2.2	77669971
	Electrical PiS 3097/2.2	77669948
	Electrical upper section only	77536550

Duplex Filter

Pi 2110

Nominal pressure 40 bar (570 psi), nominal size 630 and 1000
according DIN 24550

1. Features

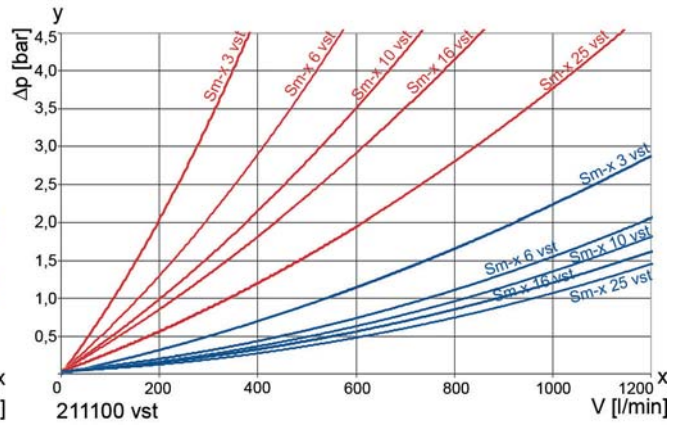
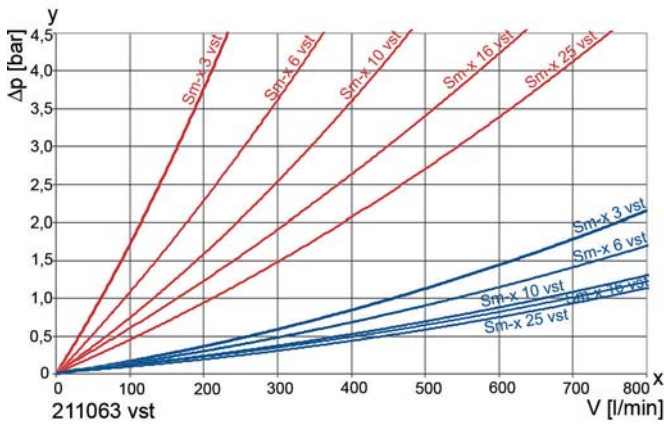
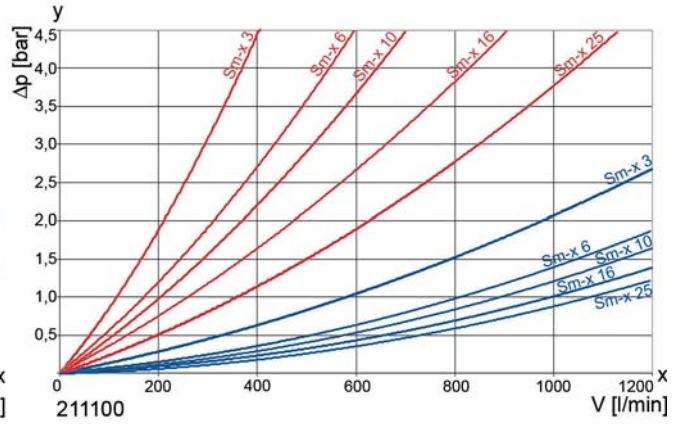
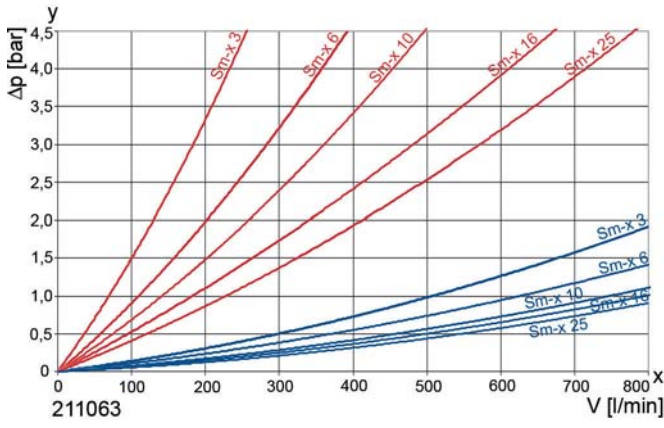
High performance filters for modern hydraulic systems

- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Flanged connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution



2. Flow rate/pressure drop curve complete filter

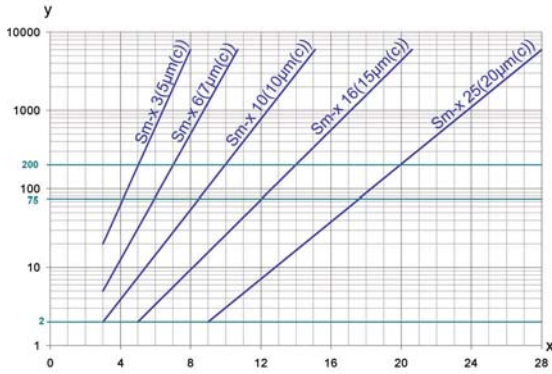
■ 190 mm²/s
■ 33 mm²/s



y = differential pressure Δp [bar]

x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particle size [μm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x elements with
max. Δp 20 bar

Sm-x	3	$\beta_{5(C)} \geq 200$
Sm-x	6	$\beta_{7(C)} \geq 200$
Sm-x	10	$\beta_{10(C)} \geq 200$
Sm-x	16	$\beta_{15(C)} \geq 200$
Sm-x	25	$\beta_{20(C)} \geq 200$

values guaranteed up to
10 bar differential pressure

Sm-x vst elements with
max. Δp 210 bar

Sm-x vst	3	$\beta_{5(C)} \geq 200$
Sm-x vst	6	$\beta_{7(C)} \geq 200$
Sm-x vst	10	$\beta_{10(C)} \geq 200$
Sm-x vst	16	$\beta_{15(C)} \geq 200$
Sm-x vst	25	$\beta_{20(C)} \geq 200$

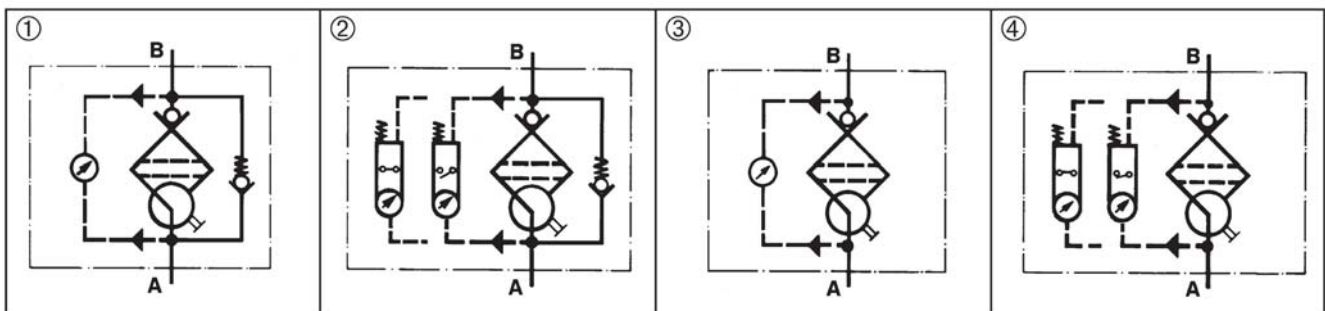
values guaranteed up to
20 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements, verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements, verification of material compatibility with fluids
DIN ISO 2923	Hydraulic fluid power filter elements, methods for end load test
DIN ISO 2924	Hydraulic fluid power filter elements, verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power filters; evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters; multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Housing design	2. 2 x Filter element
V = 630 l/min and visual/electrical maintenance indicator Type: Pi 211063-069 Order number: 70316223	Sm-x vst 25 Type: Pi 75063 DN Sm-x vst 25 Order number: 77961568

7.1 Housing design

Nominal size NG [l/min]	Order number	Type	①	②	③	④
			with bypass valve and visual indicator	with bypass valve and electrical indicator	with visual indicator	with electrical indicator
630	70316221	Pi 211063-057				
	70316207	Pi 211063-058				
	70316222	Pi 211063-068				
	70316223	Pi 211063-069				
1000	70316224	Pi 211100-057				
	70316226	Pi 211100-058				
	70316227	Pi 211100-068				
	70316228	Pi 211100-069				

When filter with non bypass configuration is selected the collapse pressure must not be exceeded!

7.2 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
630	77961519	Pi 21063 DN Sm-x 3	Sm-x 3	20	9300
	77943699	Pi 22063 DN Sm-x 6	Sm-x 6		9300
	77925639	Pi 23063 DN Sm-x 10	Sm-x 10		9300
	77961527	Pi 24063 DN Sm-x 16	Sm-x 16		9300
	77961535	Pi 25063 DN Sm-x 25	Sm-x 25		9300
	77961543	Pi 71063 DN Sm-x vst 3	Sm-x vst 3	210	7230
	77960099	Pi 72063 DN Sm-x vst 6	Sm-x vst 6		7230
	77925712	Pi 73063 DN Sm-x vst 10	Sm-x vst 10		7230
	77961550	Pi 74063 DN Sm-x vst 16	Sm-x vst 16		7230
	77961568	Pi 75063 DN Sm-x vst 25	Sm-x vst 25		7230
1000	77961618	Pi 21100 DN Sm-x 3	Sm-x 3	20	14500
	77943723	Pi 22100 DN Sm-x 6	Sm-x 6		14500
	77925647	Pi 23100 DN Sm-x 10	Sm-x 10		14500
	77961626	Pi 24100 DN Sm-x 16	Sm-x 16		14500
	77961634	Pi 25100 DN Sm-x 25	Sm-x 25		14500
	77961642	Pi 71100 DN Sm-x vst 3	Sm-x vst 3	210	11450
	77960081	Pi 72100 DN Sm-x vst 6	Sm-x vst 6		11450
	77925720	Pi 73100 DN Sm-x vst 10	Sm-x vst 10		11450
	77961659	Pi 74100 DN Sm-x vst 16	Sm-x vst 16		11450
	77961667	Pi 75100 DN Sm-x vst 25	Sm-x vst 25		11450

* A wider range of element types is available on request.

8. Technical specifications

Design:	line mounting filter
Nominal pressure:	40 bar (570 psi)
Test pressure:	60 bar (850 psi)
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Bypass setting:	Δp 3.5 bar \pm 10 %
Filter head material:	GGG
Filter housing material:	St
Filter cover material:	GGG
Sealing material:	NBR
Maintenance indicator setting:	Δp 2.2 bar \pm 0.3 bar
Electrical data of maintenance indicator:	
Max. voltage:	250 V AC/200 V DC
Max. current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M20x1.5

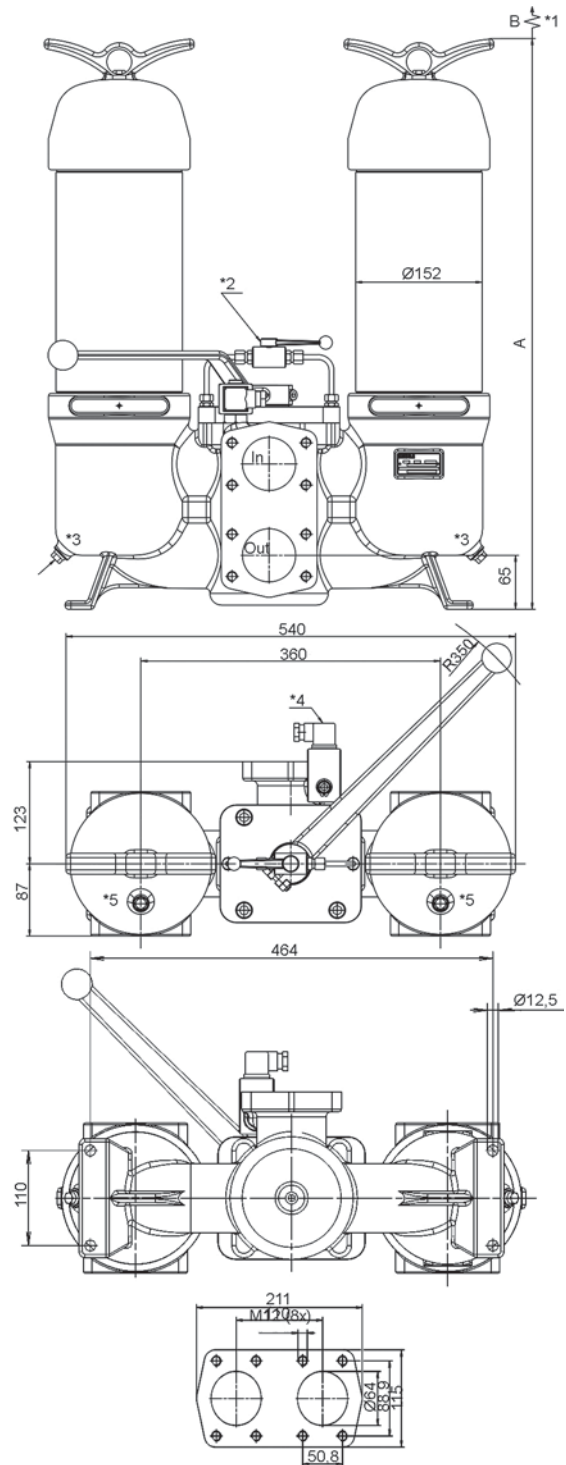
The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Goup 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.

In = Inlet	*1 Clearance B
Out = Outlet	*2 Pressure equalization valve
	*3 Drain screw G $\frac{1}{4}$
	*4 Maintenance indicator
	*5 Vent screw



9. Dimensions

All dimensions in mm.

Type	Connection	A	B	Weight [kg]
Pi 211063	DN 64	687	300	80
Pi 211100	DN 64	917	530	96

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove filter element and filter housing. The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open to normally closed position or vice versa.

10.3 When should the filter element be replaced?

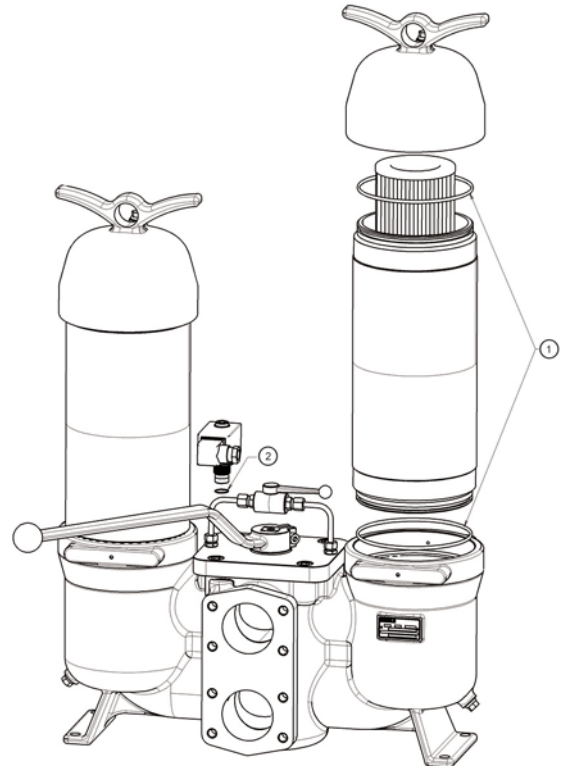
- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature the filter element must be replaced after the end of the shift.
- Filters without maintenance indicator:
The filter element should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
- Please always ensure that you have original MAHLE spare elements in stock: disposable elements (Sm-x) cannot be cleaned.

10.4 Element replacement

Note: The maintenance indicator monitors the filter side in operation, which is identified by the position of the switching lever catch. The change-over transfer valve must be switched prior filter servicing. Now the signal of the maintenance indicators cancelled and the red button can be repressed again.

- Operate and hold pressure equalizing lever located behind switching lever. Pull catch knob and swivel switching lever. Place through or drip pan underneath to collect leaving oil. Close pressure equalization valve.
- Loosen vent screw of the filter side not in use by 2-3 turns; max. until contact is made with the safety stop.
- Remove drain plug in housing bottom and drain oil.
- Unscrew filter cover counter-clockwise.
- Lift out filter element.
- Check seal on filter cover. We recommend replacement in any case.
- Make sure that the order number on the spare element corresponds to the order number of the filter name-plate. To ensure no contamination occurs during the exchange of the element first open the plastic bag and push the element over the spigot in the filter head. Now remove plastic bag.

- Push the element carefully over the spigot and tight cover until full stop. Back off the cover 1/8 turn.
- Tighten drain plug housing bottom.
- To refill the filter chamber, operate only the pressure equalizing lever, until fluid emerges bubble-free from the drain cavity.
- Tight vent screw. Check for leakage by actuating the equalizing lever again.



11. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
①	Seal kit for housing	
	NBR	70318468
	FPM	70318469
	EPDM	70318471
	Maintenance indicator	
	Visual PiS 3098/2,2	77669971
	Visual/electrical PiS 3097/2,2	77669948
	Electrical upper section only	77536550
②	Seal kit for maintenance indicator	
	NBR	77760309
	FPM	77760317
	EPDM	77760325

Duplex Filter

Pi 281

Nominal pressure 10/16 bar (140/230 psi), nominal size 1250 up to 8000

1. Features

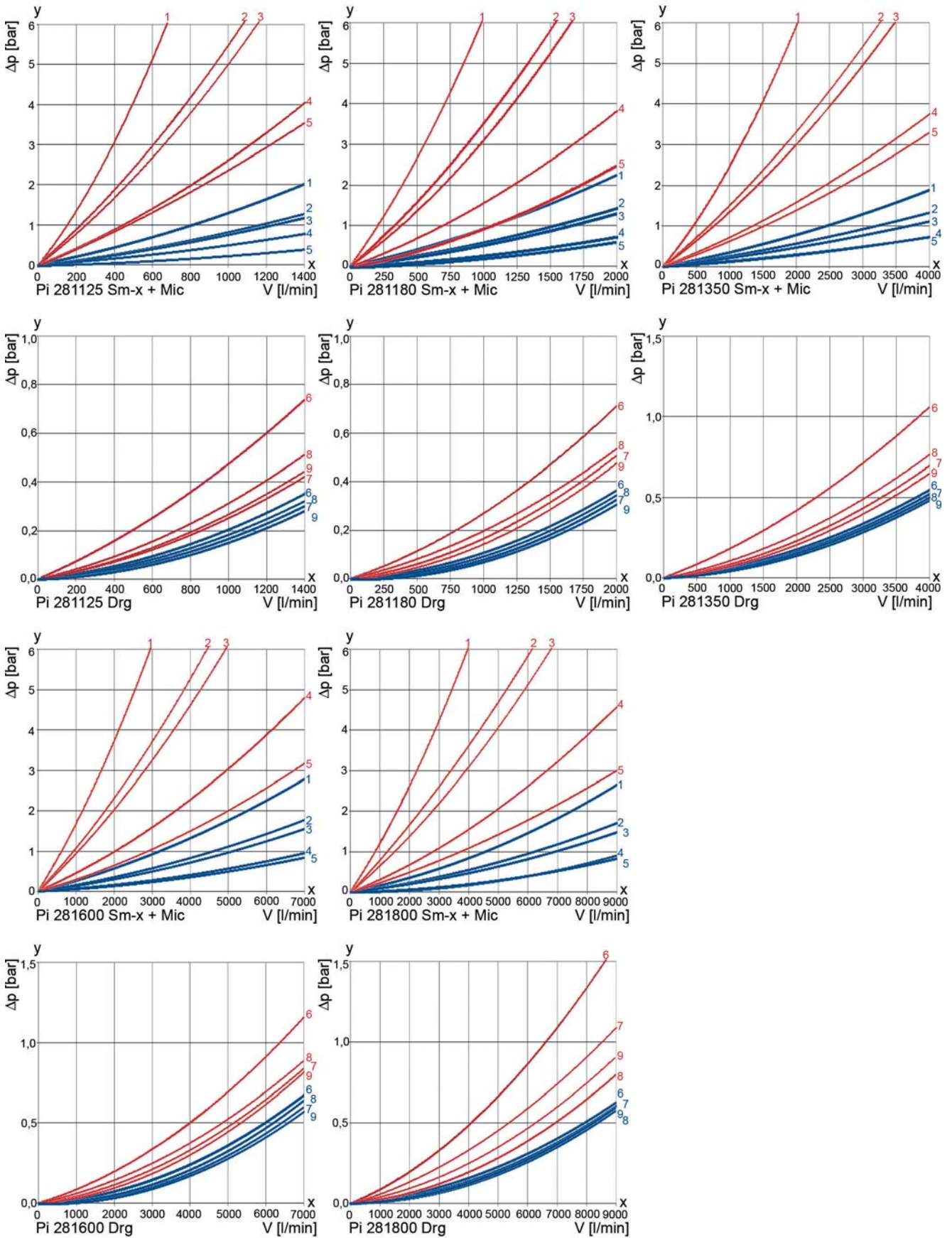
High performance filters for modern hydraulic systems

- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Flanged connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution



2. Flow rate/pressure drop curve complete filter

190 mm²/s
33 mm²/s



y = differential pressure Δp [bar]

x = flow rate V [l/min]

1 = Sm-x 3

3 = Sm-x 10

5 = Mic 10

7 = Drg 40

9 = Drg 100

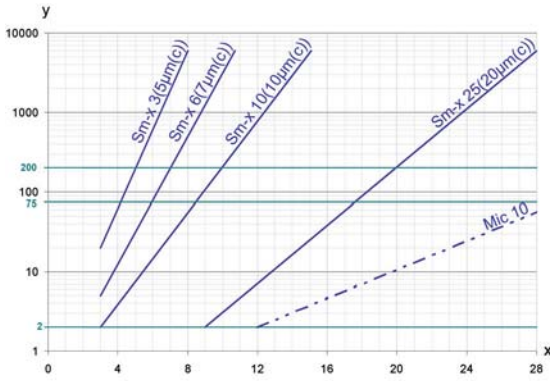
2 = Sm-x 6

4 = Sm-x 25

6 = Drg 25

8 = Drg 60

3. Separation grade characteristics



y = beta-value
x = particle size [µm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x elements with
max. Δp 10 bar

Sm-x	3	$\beta_{5(C)} \geq 200$
Sm-x	6	$\beta_{7(C)} \geq 200$
Sm-x	10	$\beta_{10(C)} \geq 200$
Sm-x	25	$\beta_{20(C)} \geq 200$

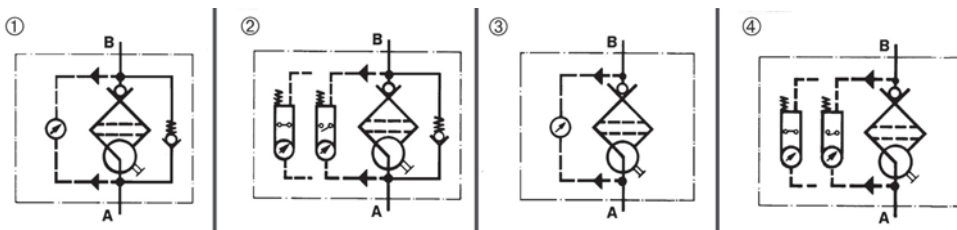
values guaranteed at
5 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power; filter elements, verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power; filter elements, verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power; filter elements, verification of material compatibility with fluids
DIN ISO 3723	Hydraulic fluid power; filter elements, method for end load test
DIN ISO 3724	Hydraulic fluid power; filter elements, verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power-filters-evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters-multi-passmethod for evaluation filtration performance of a filter element

6. Symbols



7. Type code and order numbers

Pi 281125/21-058/852 888 Sm-x 10

Pi 281	125	/2	1	-058	/825 888 Sm-x 10
1	2	3	4	5	6

1 Filter type

2 Size/Connections 125 = 1250 l/min - DN 100

Connection flange 180 = 1800 l/min - DN 125

(IN, OUT): DIN 2633 350 = 3500 l/min - DN 150

600 = 6000 l/min - DN 200

800 = 8000 l/min - DN 250

3 Nominal pressure 1 = 10 bar

2 = 16 bar

4 Number of elements 1 per filter side from NG 1250 up to NG 1800,

3 per filter side from NG 3500 up to NG 6000,

4 per filter side at NG 8000

5 Housing design 058 = with bypass valve and electrical maintenance indicator

069 = electrical maintenance indicator

6 Filter element Filter element type and filter rating

Filters DN 100 and DN 125 optional, DN 150 up to DN 250 standard with cover lifting device.

7.1 Housing design

Nominal size NG [l/min]	Type	Number of elements per filter side and element type	Pressure [bar]	③	
				with bypass valve and electrical indicator	④ with electrical indicator
1250	281125/11-058	1x 852 888	10		
	281125/11-069				
	281125/21-058		16		
	281125/21-069				
1800	281180/11-058	1x 852 884	10		
	281180/11-069				
	281180/21-058		16		
	281180/21-069				
3500	281350/13-058	3x 852 888	10		
	281350/13-069				
	281350/23-058		16		
	281350/23-069				
6000	281600/13-058	3x 852 884	10		
	281600/13-069				
	281600/23-058		16		
	281600/23-069				
8000	281800/14-058	4x 852 888	10		
	281800/14-069				
	281800/24-058		16		
	281800/24-069				

7.2 Filter elements (a wider range of element types is available on request)

Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
78263295	852 888 Sm-x 3	Sm-x 3	10	21850
78354029	852 888 Sm-x 6	Sm-x 6		21850
78226813	852 888 Sm-x 10	Sm-x 10		21850
78226821	852 888 Sm-x 25	Sm-x 25		21850
78207664	852 888 Mic 10	Mic 10		21850
78228017	852 888 Drg 25	Drg 25		16500
78228025	852 888 Drg 40	Drg 40		16500
78303026	852 888 Drg 60	Drg 60		16500
78228470	852 888 Drg 100	Drg 100		16500
78227431	852 884 Sm-x 3	Sm-x 3		10
79337916	852 884 Sm-x 6	Sm-x 6	28500	
78226797	852 884 Sm-x 10	Sm-x 10	28500	
78226805	852 884 Sm-x 25	Sm-x 25	28500	
70366315	852 884 Mic 10	Mic 10	28500	
79337460	852 884 Drg 25	Drg 25	23450	
78261653	852 884 Drg 40	Drg 40	23450	
79700402	852 884 Drg 60	Drg 60	23450	
79327750	852 884 Drg 100	Drg 100	23450	

8. Technische specifications

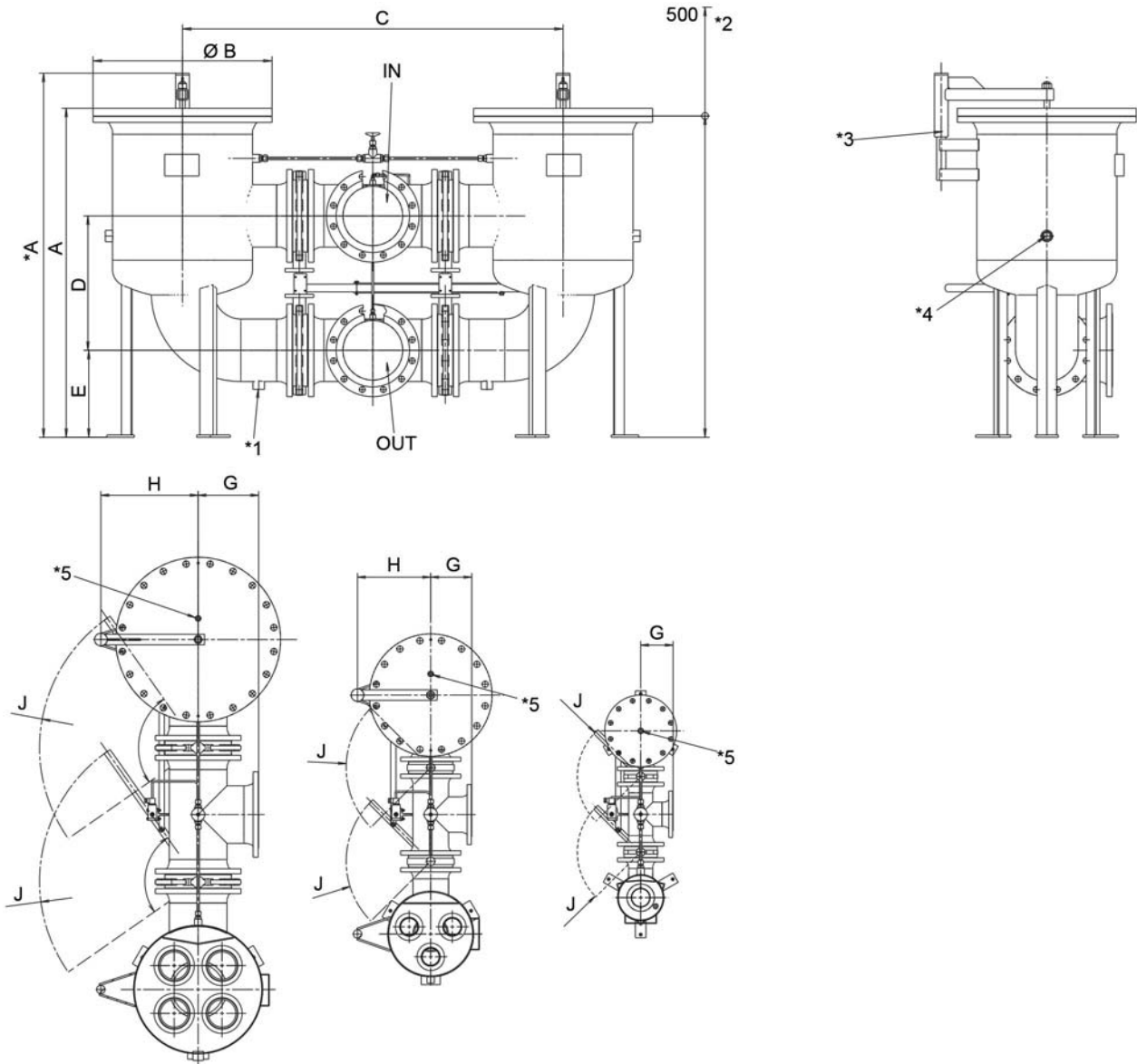
Design:	line mounting filter, mounting via through holes at supporting stands
Fitting position:	upright
Butterfly valve switch over device	
Temperature range:	- 10 °C to + 100 °C (other temperature ranges on request)
Filter housing material:	steel welded construction
Material of seals:	NBR (other materials on request)
Bypass opening pressure:	Δp 3.5 bar +/- 10 %
Activating pressure of optical/electrical contamination indicator:	Δp 2.2 bar +/- 10 %
Electrical data of contamination indicator:	
Maximum voltage:	230 V AC/200 V DC
Maximum current on contact:	1 A
Maximum contact load:	70 W
Type of protection:	IP 65 when inserted and secured
Contact:	bistable
Cable connection:	M20x1.5
Please contact us in case of using other media.	

The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.

9. Dimensions



A for Pi 281125 up to 281180
 *A for Pi 281350 up to 281800

*1 drain connection G $\frac{1}{2}$
 *2 minimum clearance

*3 cover lifting device
 *4 drain connection G $\frac{1}{2}$

*5 vent screw G $\frac{1}{2}$ IN = inlet
 OUT = outlet

All dimensions in mm.

Nominal size NG [l/min]	Connection DN	Nominal pressure PN [bar]	A ± 10	B	C ± 10	D ± 1	E ± 1	F	G	H	J
1250	100	16	984	340	790	365	250	960	153	-	378
1800	125		1091	405	922	391	250	975	175	250	378
3500	150		1346	580	1132	435	332	1200	194	340	396
6000	200		1466	715	1332	483	350	1300	236	400	421
8000	250		1610	840	1654	587	380	1403	279	490	726
3500	150	10	1346	565	1132	435	332	1200	194	340	396
6000	200		1450	670	1332	483	350	1300	236	380	421
8000	250		1590	780	1654	587	380	1403	279	460	726

MAHLE Filtersysteme GmbH, Industriefiltration, Schleifbachweg 45, D-74613 Öhringen, Phone +49 (0) 7941/67-0, Fax +49 (0) 7941/67-23429, industriefiltration@mahle.com, www.mahle-industriefiltration.com, 70366830.09/2008

Duplex Filter

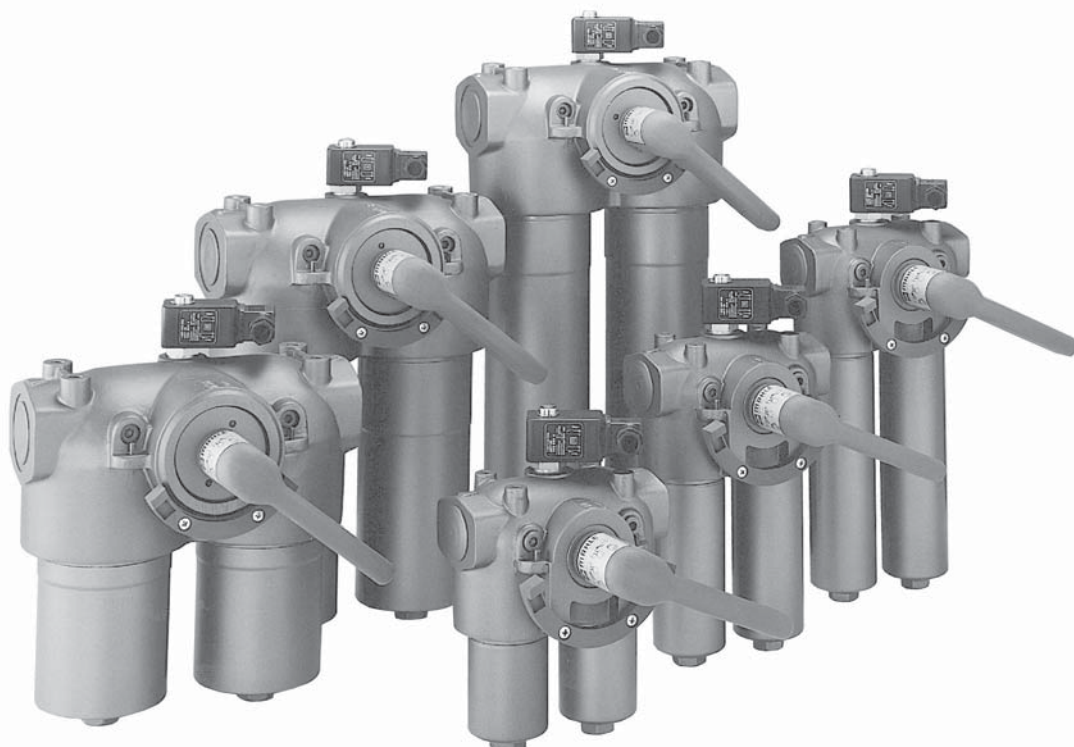
Pi 370

Nominal pressure 200/250 bar (2850/3560 psi), nominal size up to 450

1. Features

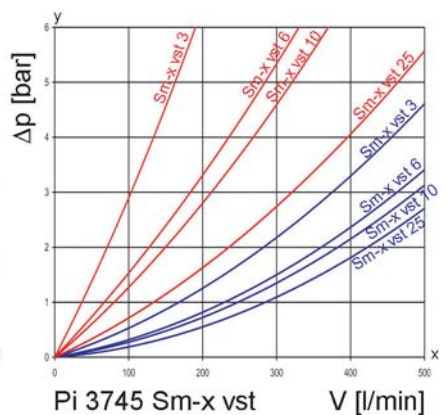
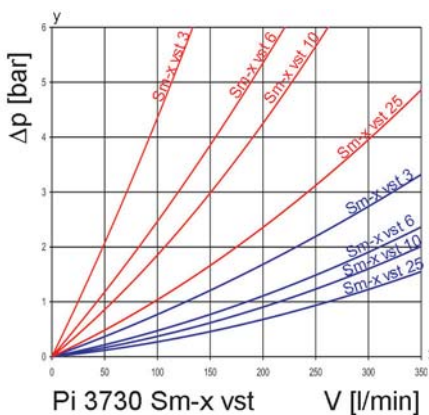
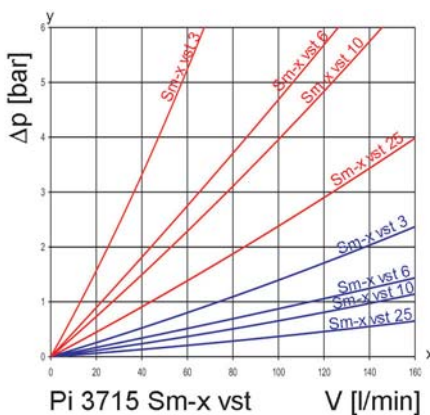
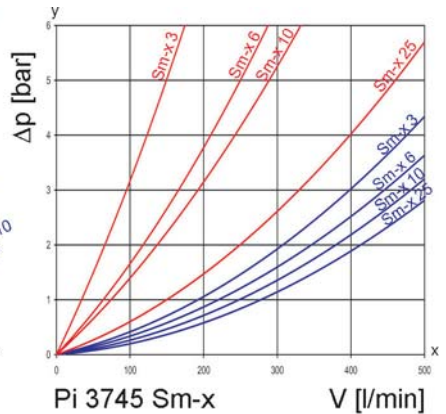
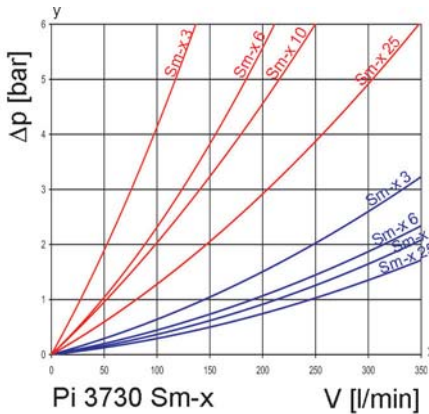
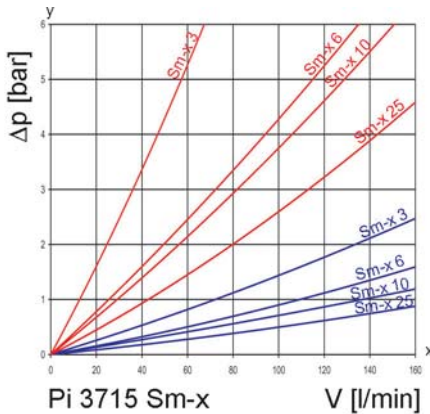
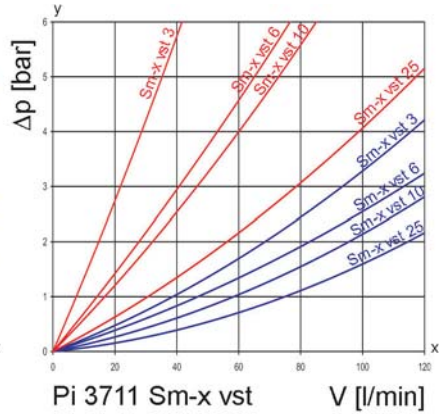
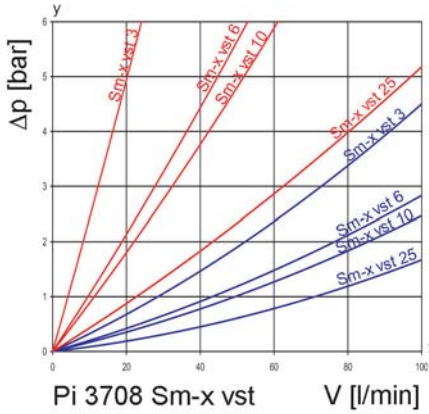
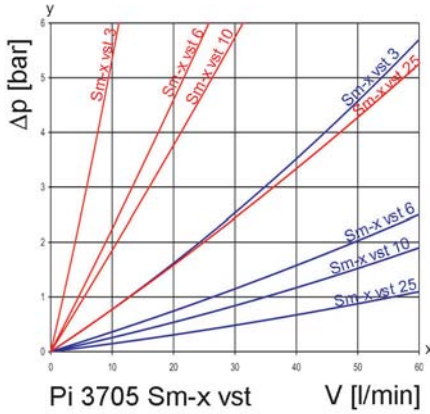
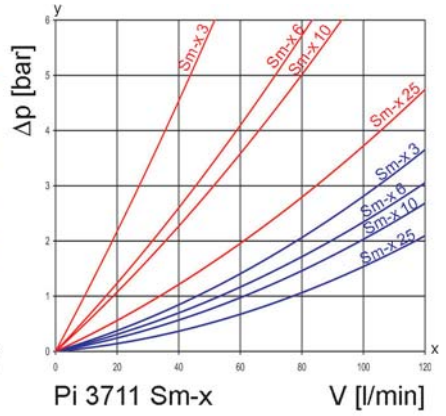
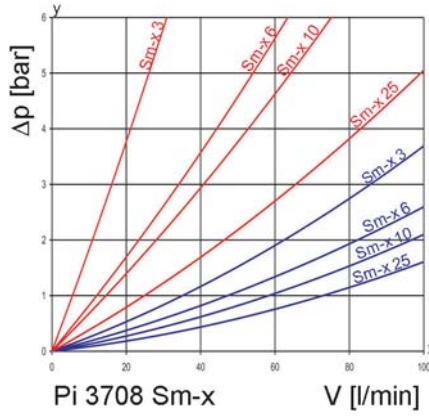
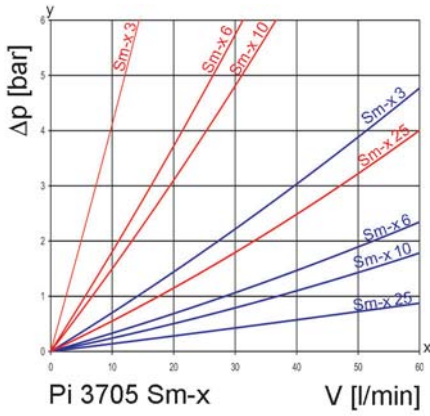
High performance filters for modern hydraulic systems

- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded connections
- Change over valve on upstream side
- Ergonomic switch-over handle with safety lock and pressure compensation
- User-optimized one-hand-operation
- Equipped with highly efficient glass-fibre Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- NPT- and SAE-connections on request
- Worldwide distribution



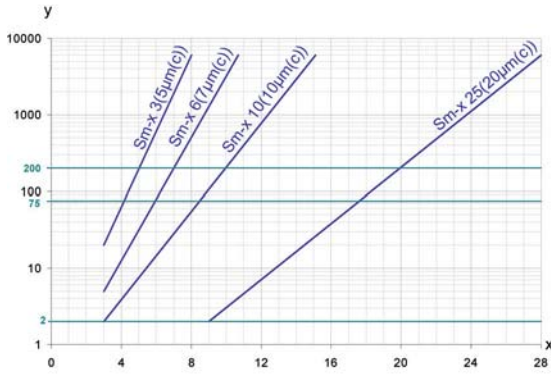
2. Flow rate/pressure drop curve complete filter

190 mm²/s
33 mm²/s



y = differential pressure Δp [bar]
x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particle size [µm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x elements with
max. Δp 20 bar

Sm-x	3	$\beta_{5(C)} \geq 200$
Sm-x	6	$\beta_{7(C)} \geq 200$
Sm-x	10	$\beta_{10(C)} \geq 200$
Sm-x	25	$\beta_{20(C)} \geq 200$

values guaranteed up to
10 bar differential pressure

Sm-x vst elements with
max. Δp 210 bar

Sm-x vst	3	$\beta_{5(C)} \geq 200$
Sm-x vst	6	$\beta_{7(C)} \geq 200$
Sm-x vst	10	$\beta_{10(C)} \geq 200$
Sm-x vst	25	$\beta_{20(C)} \geq 200$

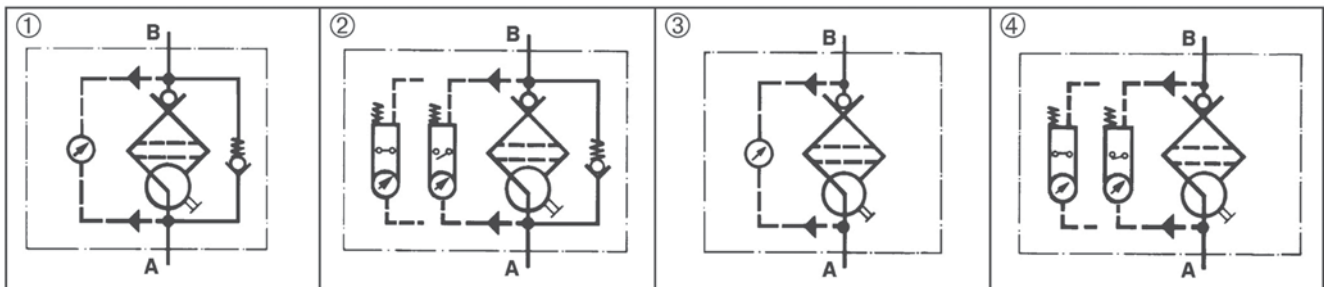
values guaranteed up to
20 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst pressure
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 3723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3724	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power filter; evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters; multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Filter housing	2. 2x Filter elements
V = 80 l/min and electrical maintenance indicator Type: Pi 3708-015 Order number: 77810369	Sm-x vst 3 Type: Pi 2208 Sm-x vst 3 Order number: 77680200

7.1 Housing design

Nominal size NG [l/min]	Order number	Type	① with bypass valve and visual indicator	② with bypass valve and electrical indicator	③ with visual indicator	④ with electrical indicator
50	77810294	Pi 3705-012				
	77810302	Pi 3705-013				
	77810310	Pi 3705-014				
	77810328	Pi 3705-015				
80	77810336	Pi 3708-012				
	77810344	Pi 3708-013				
	77810351	Pi 3708-014				
	77810369	Pi 3708-015				
110	77810377	Pi 3711-012				
	77810385	Pi 3711-013				
	77810393	Pi 3711-014				
	77810401	Pi 3711-015				
150	77810419	Pi 3715-012				
	77810427	Pi 3715-013				
	77810435	Pi 3715-014				
	77810443	Pi 3715-015				
300	77810450	Pi 3730-012				
	77810468	Pi 3730-013				
	77810476	Pi 3730-014				
	77810484	Pi 3730-015				
450	77810492	Pi 3745-012				
	77814403	Pi 3745-013				
	77814411	Pi 3745-014				
	77814429	Pi 3745-015				

When filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

7.2 Filter elements (a wider range of element types is available on request)

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
50	77680135	Pi 2105 Sm-x 3	Sm-x 3	20	590
	77943509	Pi 5105 Sm-x 6	Sm-x 6		590
	77680325	Pi 3105 Sm-x 10	Sm-x 10		590
	77680440	Pi 4105 Sm-x 25	Sm-x 25		590
	77680192	Pi 2205 Sm-x vst 3	Sm-x vst 3	210	425
	77943533	Pi 5205 Sm-x vst 6	Sm-x vst 6		425
	77680382	Pi 3205 Sm-x vst 10	Sm-x vst 10		425
	77680507	Pi 4205 Sm-x vst 25	Sm-x vst 25		425
80	77680143	Pi 2108 Sm-x 3	Sm-x 3	20	1150
	77943517	Pi 5108 Sm-x 6	Sm-x 6		1150
	77680341	Pi 3108 Sm-x 10	Sm-x 10		1150
	77680457	Pi 4108 Sm-x 25	Sm-x 25		1150
	77680200	Pi 2208 Sm-x vst 3	Sm-x vst 3	210	850
	77943541	Pi 5208 Sm-x vst 6	Sm-x vst 6		850
	77681190	Pi 3208 Sm-x vst 10	Sm-x vst 10		850
	77680515	Pi 4208 Sm-x vst 25	Sm-x vst 25		850
110	77680150	Pi 2111 Sm-x 3	Sm-x 3	20	1700
	77943525	Pi 5111 Sm-x 6	Sm-x 6		1700
	77680333	Pi 3111 Sm-x 10	Sm-x 10		1700
	77680465	Pi 4111 Sm-x 25	Sm-x 25		1700
	77680218	Pi 2211 Sm-x vst 3	Sm-x vst 3	210	1275
	77943558	Pi 5211 Sm-x vst 6	Sm-x vst 6		1275
	77680390	Pi 3211 Sm-x vst 10	Sm-x vst 10		1275
	77680523	Pi 4211 Sm-x vst 25	Sm-x vst 25		1275
150	77680168	Pi 2115 Sm-x 3	Sm-x 3	20	2425
	77955099	Pi 5115 Sm-x 6	Sm-x 6		2425
	77680358	Pi 3115 Sm-x 10	Sm-x 10		2425
	77680473	Pi 4115 Sm-x 25	Sm-x 25		2425
	77680226	Pi 2215 Sm-x vst 3	Sm-x vst 3	210	2010
	77955123	Pi 5215 Sm-x vst 6	Sm-x vst 6		2010
	77680408	Pi 3215 Sm-x vst 10	Sm-x vst 10		2010
	77680531	Pi 4215 Sm-x vst 25	Sm-x vst 25		2010
300	77680176	Pi 2130 Sm-x 3	Sm-x 3	20	4620
	77955107	Pi 5130 Sm-x 6	Sm-x 6		4620
	77680366	Pi 3130 Sm-x 10	Sm-x 10		4620
	77680481	Pi 4130 Sm-x 25	Sm-x 25		4620
	77680234	Pi 2230 Sm-x vst 3	Sm-x vst 3	210	3800
	77955131	Pi 5230 Sm-x vst 6	Sm-x vst 6		3800
	77680416	Pi 3230 Sm-x vst 10	Sm-x vst 10		3800
	77680549	Pi 4230 Sm-x vst 25	Sm-x vst 25		3800
450	77680184	Pi 2145 Sm-x 3	Sm-x 3	20	6865
	77955115	Pi 5145 Sm-x 6	Sm-x 6		6865
	77680374	Pi 3145 Sm-x 10	Sm-x 10		6865
	77680499	Pi 4145 Sm-x 25	Sm-x 25		6865
	77680242	Pi 2245 Sm-x vst 3	Sm-x vst 3	210	5600
	77955149	Pi 5245 Sm-x vst 6	Sm-x vst 6		5600
	77680424	Pi 3245 Sm-x vst 10	Sm-x vst 10		5600
	77680556	Pi 4245 Sm-x vst 25	Sm-x vst 25		5600

8. Technical specifications

Design:	line mounting filter
Operating pressure:	200 bar*
Test pressure:	260 bar
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Bypass opening pressure:	Δp 7 bar \pm 10 %
Filter head material:	GGG
Filter bowl material:	St
Sealing material:	NBR/PTFE
Activating pressure of optical/ electrical differential pressure in- dicator:	Δp 5 bar \pm 10 %
Electrical data of contamination indicator:	
Maximum voltage:	250 V AC/200 V DC
Maximum current on contact:	1 A
Inrush current:	70 W
Type of protection:	IP 65 when inserted and secured
Contact:	bistable
Cable connection:	M20x1.5

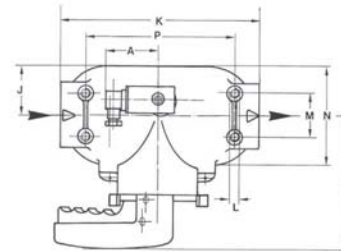
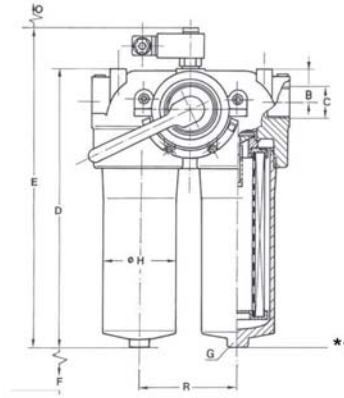
The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. The use of quenching circuits must be checked in the case of inductivity in the DC current circuit. The contamination indicator data sheet contains further information and additional contamination indicator versions.

We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

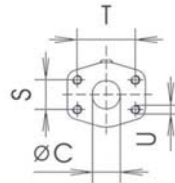
We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.

* Types Pi 3705-.. bis Pi 3711-.. have an operating pressure of 250 bar (test pressure 325 bar).



*1 Pi 3730-Pi 3745 with drain screw G $\frac{1}{4}$ DIN 910



9. Dimensions

All dimensions except "C" in mm.

Type	A	B	C*	D	E	F	Weight [kg]
Pi 3705	78	38	G1	219	271	80	11.0
Pi 3708	78	38	G1	294	346	80	12.0
Pi 3711	78	38	G1	370	422	80	15.0
Pi 3715	78	50	G1 $\frac{1}{2}$	302	354	110	31.5
Pi 3730	78	50	G1 $\frac{1}{2}$	427	479	110	37.0
Pi 3745	78	50	G1 $\frac{1}{2}$	543	554	110	41.5

* SAE flange connection on request.

Type	G SW	H	I	J	K	L	M	N	O	P	R	S	T	U	Weight [kg]
Pi 3705	27	65	144	45	182	M8x15	55	90	45	100	86	-	-	-	11.0
Pi 3708	27	65	144	45	182	M8x15	55	90	45	100	86	-	-	-	12.0
Pi 3711	27	65	144	45	182	M8x15	55	90	45	100	86	-	-	-	15.0
Pi 3715	30	110	175	70	280	M12x18	62	140	45	210	136	-	-	-	31.5
Pi 3730	30	110	175	70	280	M12x18	62	140	45	210	136	-	-	-	37.0
Pi 3745	30	110	175	70	280	M12x18	62	140	45	210	136	35,7	69.85	M12x20	41.5

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove filter element and filter housing. Preferably the filter should be installed with the filter housing pointing downwards. The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open to normally closed position or vice versa.

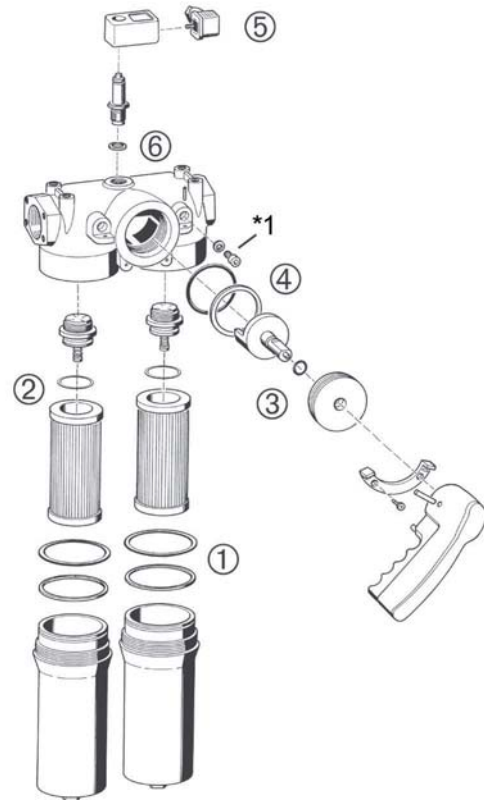
10.3 When should the filter element be replaced?

1. Filters equipped with visual and electrical maintenance indicator: During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature the filter element must be replaced after the end of the shift.
2. Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (Sm-x) cannot be cleaned.

10.4 Element replacement

Note: The maintenance indicator monitors the filter side in operation, which is identified by the position of the switching lever catch. The change-over transfer valve must be switched prior filter servicing. Now the signal of the maintenance indicator is cancelled and the red button can be repressed again:

1. Operate and hold pressure equalizing lever located behind switching lever. Pull catch knob and swivel switching lever. Engage the catch on the clear filter side. Place through or drip pan underneath to collect leaving oil.
2. Loosen vent screw of the filter side not in use by 2-3 turns; max. until contact is made with the safety stop.
3. Unscrew filter housing by rotating same counter-clockwise and clean with a suitable medium.
4. Remove filter element with a side-to-side motion.
5. Check O-ring on the filter house for damage. Replace, if necessary.
6. Make sure that the order number on the spare element corresponds to the order number of the filter name-plate. Remove the plastic bag and push element over the spigot in the filter head.
7. Lightly lubricate the thread of the filter housing and screw onto the filter head completely. After that unscrew the filter housing 1/8 to 1/2 return.
8. To refill the filter chamber, operate only the pressure equalizing lever (leave the switching lever arrested in its catch) long enough for the medium to emerge bubble-free from the vent bore.
9. Tighten vent screw. Check filter for leaks by operating the pressure equalizing lever once again.



*1 vent screw

11. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
① - ④	Seal kit	
	Pi 3705 - Pi 3711	
	NBR	78305062
	FPM	78305054
	EPDM	78305047
	Pi 3715 - Pi 3745	
	NBR	79375056
	FPM	79375064
	EPDM	79375072
⑤	Maintenance indicator	
	Visual PiS 3093/5	77669914
	Electrical PiS 3092/5	77669864
	Electrical upper section only	77536550
⑥	Seal kit for maintenance indicator	
	NBR	77760275
	FPM	77760283
	EPDM	77760291

MAHLE

Industrial Filtration

MAHLE Filtersysteme GmbH
Industriefiltration
Schleifbachweg 45
D-74613 Öhringen
Phone +49 (0) 7941/67-0
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industriefiltration@mahle.com
www.mahle-industriefiltration.com
78356909.07/2008

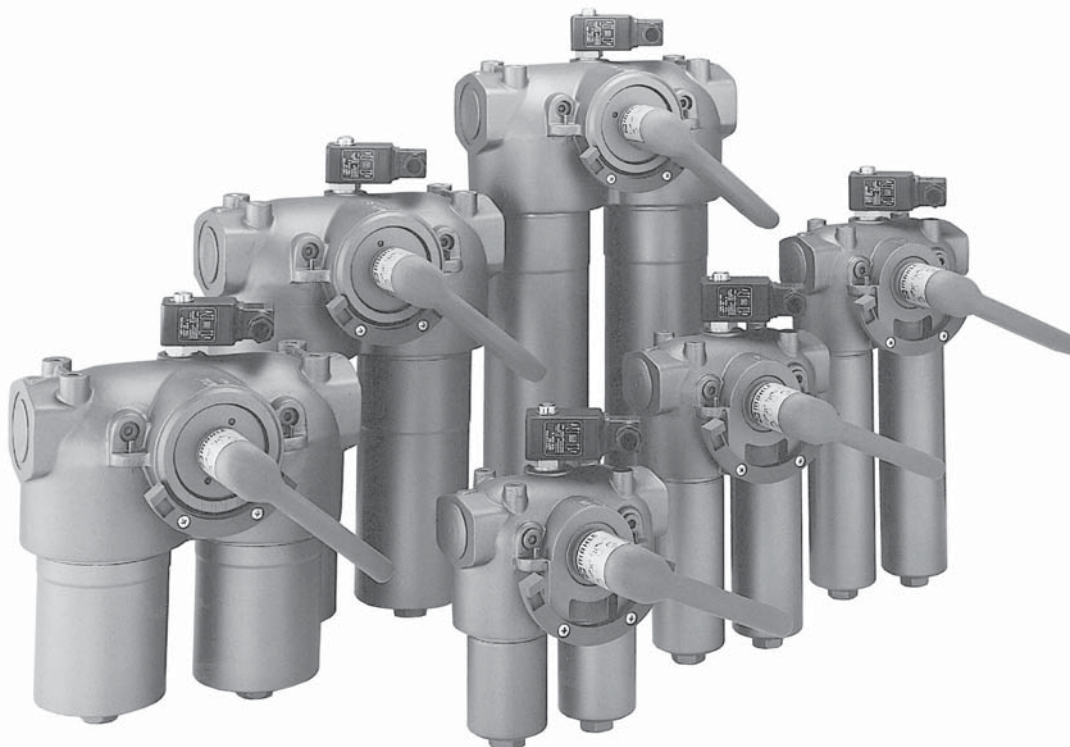
Duplex Filter Pi 3700

Nominal pressure 200/250 bar (2850/3560 psi), nominal size up to 400
according DIN 24550

1. Features

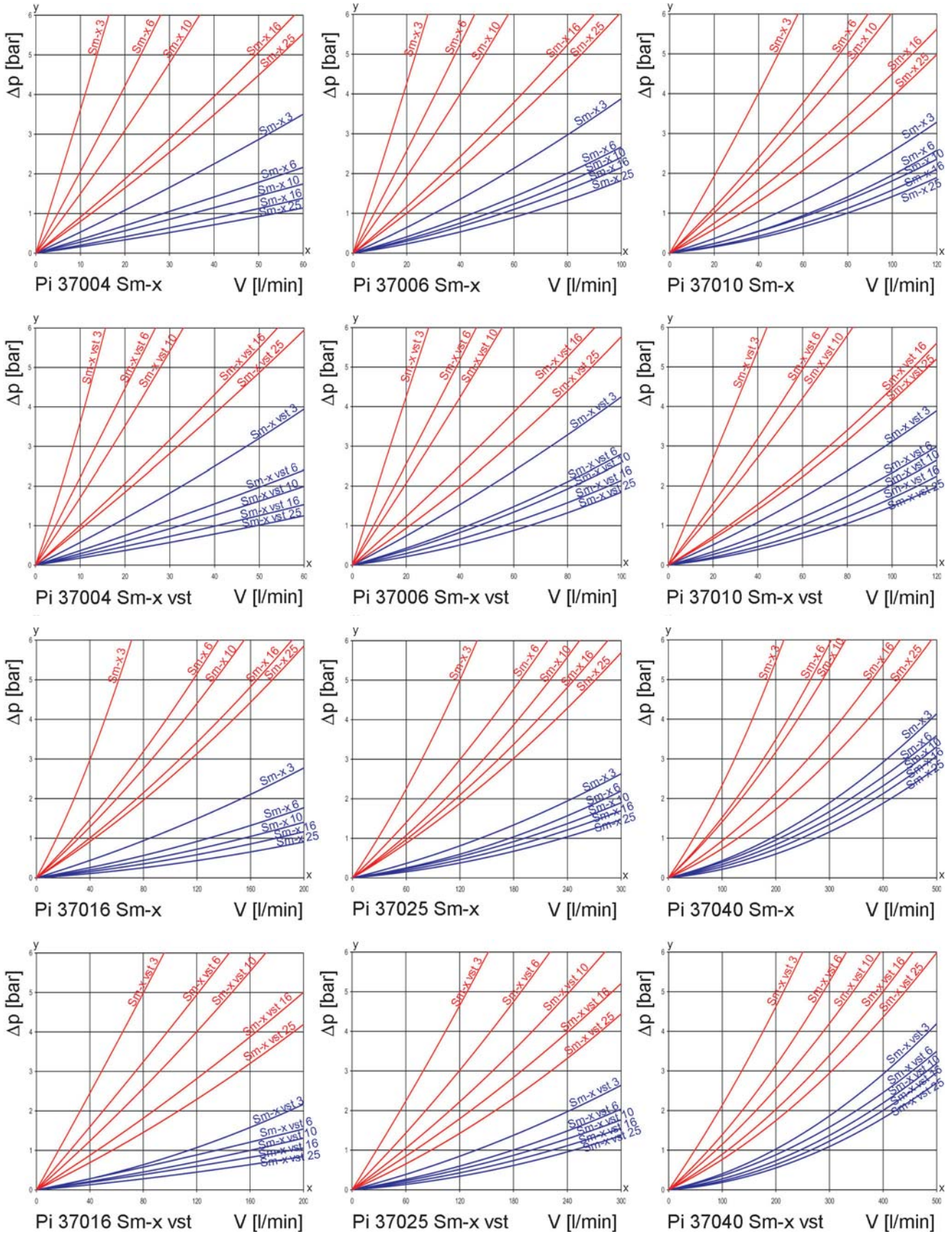
High performance filters for modern hydraulic systems

- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded connections
- Change over valve on upstream side
- Ergonomic switch-over handle with safety lock and pressure compensation
- User-optimized one-hand-operation
- Equipped with highly efficient glass fibre Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- NPT- and SAE-connections on request
- Worldwide distribution



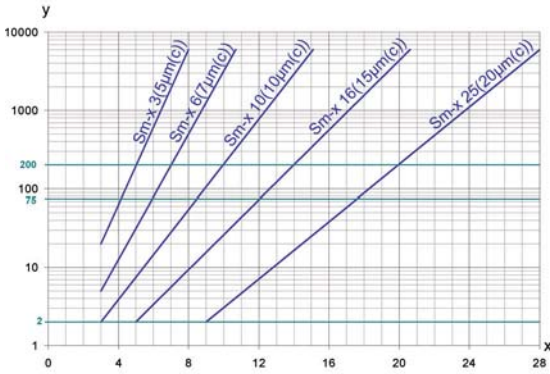
2. Flow rate/pressure drop curve complete filter

■ 190 mm²/s
■ 33 mm²/s



y = differential pressure Δp [bar]
 x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particle size [µm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x elements with
max. Δ p 20 bar

Sm-x	3	$\beta_{5(C)} \geq 200$
Sm-x	6	$\beta_{7(C)} \geq 200$
Sm-x	10	$\beta_{10(C)} \geq 200$
Sm-x	16	$\beta_{15(C)} \geq 200$
Sm-x	25	$\beta_{20(C)} \geq 200$

values guaranteed up to
10 bar differential pressure

Sm-x vst elements with
max. Δ p 210 bar

Sm-x vst	3	$\beta_{5(C)} \geq 200$
Sm-x vst	6	$\beta_{7(C)} \geq 200$
Sm-x vst	10	$\beta_{10(C)} \geq 200$
Sm-x vst	16	$\beta_{15(C)} \geq 200$
Sm-x vst	25	$\beta_{20(C)} \geq 200$

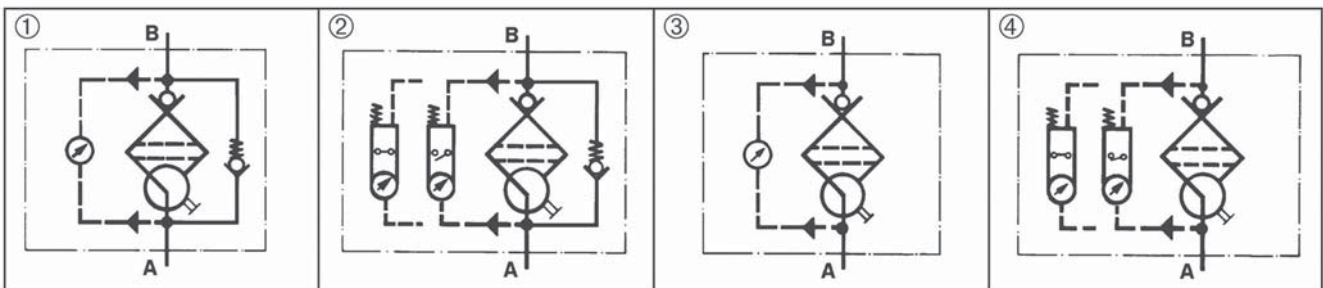
values guaranteed up to
20 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 2923	Hydraulic fluid power filter elements; method for end load test
DIN ISO 2924	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power filters; evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters; multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Filter housing	2. 2 x Filter element
V = 100 l/min and electrical maintenance indicator Type: Pi 37010-015 Order number: 78208423	Sm-x vst 3 Type: Pi 71010 DN Sm-x vst 3 Order number: 78227480

7.1 Housing design

Nominal size NG [l/min]	Order number	Type	①	②	③	④
			with bypass valve and visual indicator	with bypass valve and electrical indicator	with visual indicator	with electrical indicator
40	78208290	Pi 37004-012				
	78259889	Pi 37004-013				
	78208316	Pi 37004-014				
	78208324	Pi 37004-015				
63	78208340	Pi 37006-012				
	78259897	Pi 37006-013				
	78208365	Pi 37006-014				
	78208373	Pi 37006-015				
100	78208399	Pi 37010-012				
	78259905	Pi 37010-013				
	78208415	Pi 37010-014				
	78208423	Pi 37010-015				
160	78208449	Pi 37016-012				
	78259913	Pi 37016-013				
	78208464	Pi 37016-014				
	78208472	Pi 37016-015				
250	78208498	Pi 37025-012				
	78259921	Pi 37025-013				
	78208514	Pi 37025-014				
	78259863	Pi 37025-015				
400	78208530	Pi 37040-012 FL				
	78259939	Pi 37040-013 FL				
	78208555	Pi 37040-014 FL				
	78208563	Pi 37040-015 FL				

When filter with non bypass configuration is selected the collapse pressure of the element must not be exceeded.

7.2 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
40	78260929	Pi 21004 DN Sm-x 3 NBR	Sm-x 3	20	475
	77960859	Pi 22004 DN Sm-x 6 NBR	Sm-x 6		475
	77925571	Pi 23004 DN Sm-x 10 NBR	Sm-x 10		475
	78260937	Pi 24004 DN Sm-x 16 NBR	Sm-x 16		475
	78260945	Pi 25004 DN Sm-x 25 NBR	Sm-x 25		475
	78216079	Pi 71004 DN Sm-x vst 3 NBR	Sm-x vst 3	210	445
	77960156	Pi 72004 DN Sm-x vst 6 NBR	Sm-x vst 6		445
	77925654	Pi 73004 DN Sm-x vst 10 NBR	Sm-x vst 10		445
	78216087	Pi 74004 DN Sm-x vst 16 NBR	Sm-x vst 16		445
	78216095	Pi 75004 DN Sm-x vst 25 NBR	Sm-x vst 25		445
63	78260960	Pi 21006 DN Sm-x 3 NBR	Sm-x 3	20	835
	77960867	Pi 22006 DN Sm-x 6 NBR	Sm-x 6		835
	77925589	Pi 23006 DN Sm-x 10 NBR	Sm-x 10		835
	78260978	Pi 24006 DN Sm-x 16 NBR	Sm-x 16		835
	78260986	Pi 25006 DN Sm-x 25 NBR	Sm-x 25		835
	78216137	Pi 71006 DN Sm-x vst 3 NBR	Sm-x vst 3	210	780
	77960149	Pi 72006 DN Sm-x vst 6 NBR	Sm-x vst 6		780
	77925662	Pi 73006 DN Sm-x vst 10 NBR	Sm-x vst 10		780
	78216145	Pi 74006 DN Sm-x vst 16 NBR	Sm-x vst 16		780
	78216152	Pi 75006 DN Sm-x vst 25 NBR	Sm-x vst 25		780
100	78227472	Pi 21010 DN Sm-x 3 NBR	Sm-x 3	20	1375
	77960875	Pi 22010 DN Sm-x 6 NBR	Sm-x 6		1375
	77925597	Pi 23010 DN Sm-x 10 NBR	Sm-x 10		1375
	78261000	Pi 24010 DN Sm-x 16 NBR	Sm-x 16		1375
	78261018	Pi 25010 DN Sm-x 25 NBR	Sm-x 25		1375
	78227480	Pi 71010 DN Sm-x vst 3 NBR	Sm-x vst 3	210	1275
	77960131	Pi 72010 DN Sm-x vst 6 NBR	Sm-x vst 6		1275
	77925670	Pi 73010 DN Sm-x vst 10 NBR	Sm-x vst 10		1275
	78261281	Pi 74010 DN Sm-x vst 16 NBR	Sm-x vst 16		1275
	78216160	Pi 75010 DN Sm-x vst 25 NBR	Sm-x vst 25		1275

*a wider range of element types is available on request

7.2 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
160	78261034	Pi 21016 DN Sm-x 3 NBR	Sm-x 3	20	2530
	77960826	Pi 22016 DN Sm-x 6 NBR	Sm-x 6		2530
	77925605	Pi 23016 DN Sm-x 10 NBR	Sm-x 10		2530
	78261042	Pi 24016 DN Sm-x 16 NBR	Sm-x 16		2530
	78261059	Pi 25016 DN Sm-x 25 NBR	Sm-x 25		2530
	77940638	Pi 71016 DN Sm-x vst 3 NBR	Sm-x vst 3	210	1885
	77960123	Pi 72016 DN Sm-x vst 6 NBR	Sm-x vst 6		1885
	77925688	Pi 73016 DN Sm-x vst 10 NBR	Sm-x vst 10		1885
	78269797	Pi 74016 DN Sm-x vst 16 NBR	Sm-x vst 16		1885
	78216178	Pi 75016 DN Sm-x vst 25 NBR	Sm-x vst 25		1885
250	78227514	Pi 21025 DN Sm-x 3 NBR	Sm-x 3	20	4020
	77960834	Pi 22025 DN Sm-x 6 NBR	Sm-x 6		4020
	77925613	Pi 23025 DN Sm-x 10 NBR	Sm-x 10		4020
	78261075	Pi 24025 DN Sm-x 16 NBR	Sm-x 16		4020
	78261083	Pi 25025 DN Sm-x 25 NBR	Sm-x 25		4020
	77940646	Pi 71025 DN Sm-x vst 3 NBR	Sm-x vst 3	210	3090
	77960115	Pi 72025 DN Sm-x vst 6 NBR	Sm-x vst 6		3090
	77925696	Pi 73025 DN Sm-x vst 10 NBR	Sm-x vst 10		3090
	78269813	Pi 74025 DN Sm-x vst 16 NBR	Sm-x vst 16		3090
	78216186	Pi 75025 DN Sm-x vst 25 NBR	Sm-x vst 25		3090
400	78227522	Pi 21 040 DN Sm-x 3 NBR	Sm-x 3	20	6770
	77960842	Pi 22 040 DN Sm-x 6 NBR	Sm-x 6		6770
	77925621	Pi 23 040 DN Sm-x 10 NBR	Sm-x 10		6770
	78261109	Pi 24 040 DN Sm-x 16 NBR	Sm-x 16		6770
	78261117	Pi 25 040 DN Sm-x 25 NBR	Sm-x 25		6770
	77940653	Pi 71 040 DN Sm-x vst 3 NBR	Sm-x vst 3	210	5240
	77960107	Pi 72 040 DN Sm-x vst 6 NBR	Sm-x vst 6		5240
	77930829	Pi 73 040 DN Sm-x vst 10 NBR	Sm-x vst 10		5240
	78269821	Pi 74 040 DN Sm-x vst 16 NBR	Sm-x vst 16		5240
	78260903	Pi 75 040 DN Sm-x vst 25 NBR	Sm-x vst 25		5240

* a wider range of element types is available on request

8. Technical specifications

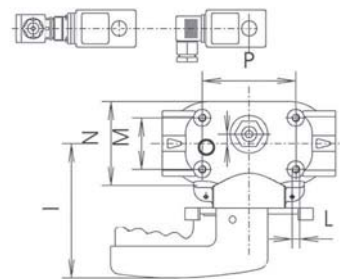
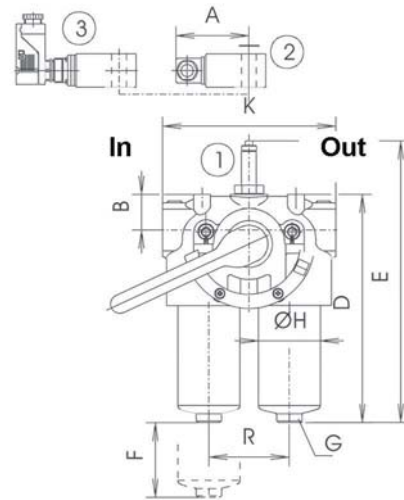
Design:	line mounting filter
Nominal: Pi 37016-37040	200 bar (2850 psi)
Pi 37004-37010	250 bar (3560 psi)
Test pressure: Pi 37016-37040	260 bar (3700 psi)
Pi 37004-37010	325 bar (4620 psi)
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Bypass setting:	Δp 7 bar \pm 10 %
Filter head material:	GGG
Filter housing material:	St
Sealing material:	NBR/PTFE
Maintenance indicator setting:	Δp 5 bar \pm 10 %
Electrical data of maintenance indicator:	
Max. voltage:	250 V AC/200 V DC
Max. current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M20x1.5

The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

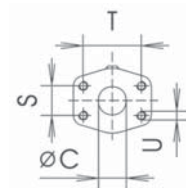
We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.



- In = inlet
- Out = outlet
- Pos. 1 Visual maintenance indicator
- Pos. 2 Electrical upper section
Connector acc. DIN EN 175301-803
Version: PiS 3092, 3105, 3115
- Pos. 3 Electrical upper section
Connector acc. DIN EN 175301-804
Version: PiS 3102, 3122, 3110
- Pos. 4 NG 250, 400 with drain plug G ¼ DIN 910



DN 38 \geq SAE 11/2" 6000 psi flange,
Bolts and O-rings not included in delivery

9. Dimensions

All dimensions except "C" in mm.

Type	A	B	C*	D	E	F	G				L	M	N	O	P	R	S	T	U	Weight [kg]
							SW	H	I	K										
Pi 37004	78	38	G1	228	285	80	27	66	144	182	M8x15	55	90	10	100	86	-	-	-	10.5
Pi 37006	78	38	G1	288	345	80	27	66	144	182	M8x15	55	90	10	100	86	-	-	-	12.0
Pi 37010	78	38	G1	370	427	80	27	66	144	182	M8x15	55	90	10	100	86	-	-	-	14.0
Pi 37016	78	50	G1½	311	363	110	30	110	160	280	M12x18	62	140	28	210	136	-	-	-	30.0
Pi 37025	78	50	G1½	412	463	110	30	110	160	280	M12x18	62	140	28	210	136	-	-	-	35.0
Pi 37040	78	50	DN 38	562	614	110	20	110	160	280	M12x18	62	140	28	210	136	35,7	69,85	M12x20	41.0

* SAE-connections on request

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove filter element and filter housing. Preferably the filter should be installed with the filter housing pointing downwards. The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open to normally closed position or vice versa.

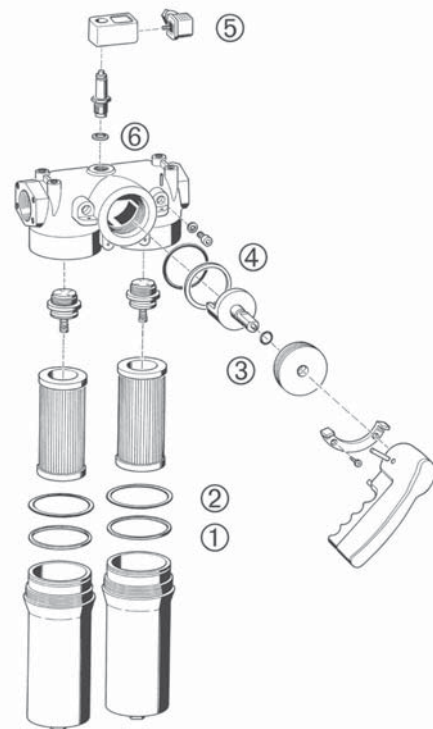
10.3 When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature the filter element must be replaced after the end of the shift.
- Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (Sm-x) cannot be cleaned.

10.4 Element replacement

Note: The maintenance indicator monitors the filter side in operation, which is identified by the position of the switching lever catch. The change-over transfer valve must be switched prior filter servicing. Now the signal of the maintenance indicators cancelled and the red button can be repressed again:

- Operate and hold pressure equalizing lever located behind switching lever. Pull catch knob and swivel switching lever. Engage the catch on the clear filter side. Place through or drip pan underneath to collect leaving oil.
- Loosen vent screw of the filter side not in use by 2-3 turns; max. until contact is made with the safety stop.
- Unscrew filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
- Remove filter element by pulling down carefully.
- Check o-ring on the filter housing for damage. Replace, if necessary.
- Make sure that the order number on the spare element corresponds to the order number of the filter name-plate.
To ensure no contamination occurs during the exchange of the element first open the plastic bag and push the element over the spigot in the filter head. Now remove plastic bag.
- Lightly lubricate the thread of the filter housing and screw onto the filter head completely. After that unscrew the filter housing 1/8 to 1/2 return.
- To refill the filter chamber, operate only the pressure equalizing lever (leave the switching lever arrested in its catch) long enough for the medium to emerge bubble-free from the vent bore.
- Tighten vent screw. Check filter for leaks by operating the pressure equalizing lever once again.



11. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
① - ④	Seal kit	
	Pi 37004 - Pi 37010	
	NBR	79322009
	FPM	79322017
	EPDM	79322025
	Pi 37016 - Pi 37040	
	NBR	79375213
	FPM	79375221
	EPDM	79375239
⑤	Maintenance indicator	
	Visual PiS 3093/5	77669914
	Electrical PiS 3092/5	77669864
	Electrical upper section only	77536550
⑥	Seal kit for maintenance indicator	
	NBR	77760275
	FPM	77760283
	EPDM	77760291

MAHLE Filtersysteme GmbH Industriefiltration
Schleifbachweg 45, D-74613 Öhringen
Phone +49 (0) 7941/67-0, Fax +49 (0) 7941/67-23429
industriefiltration@mahle.com, www.mahle-industriefiltration.com
78368631.07/2008

Duplex Filter

Pi 4700

Nominal pressure up to 315/350 bar (4570/4980 psi), nominal size 40 up to 400
according to DIN 24550

1. Features

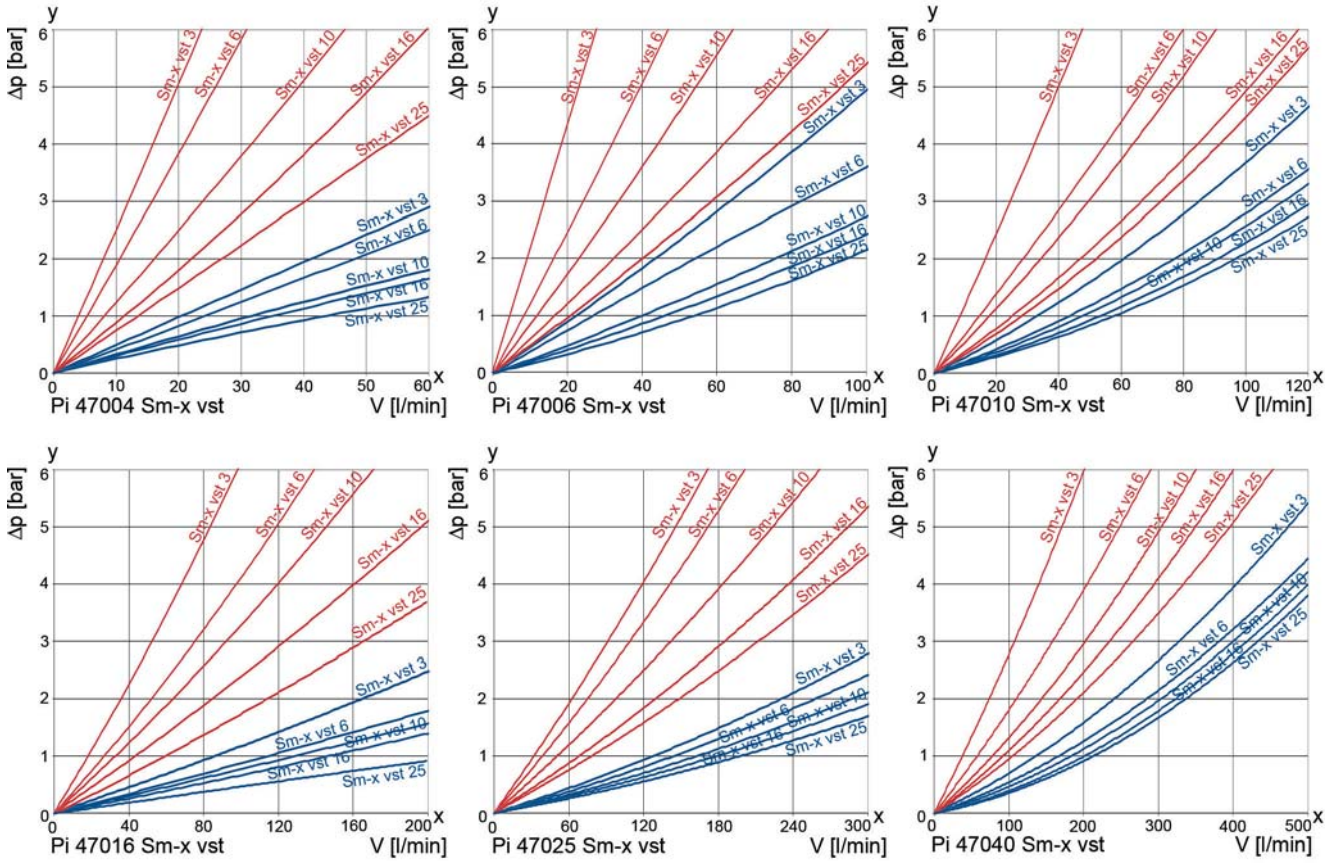
High performance filters for modern hydraulic systems

- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded connections
- Ergonomic switch-over handle with safety lock user-optimized one-hand-operation
- Quality filters, easy to service
- Equipped with highly efficient glass fibre Sm-x filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- NPT- and SAE-connections on request
- Worldwide distribution



2. Flow rate/pressure drop curve complete filter

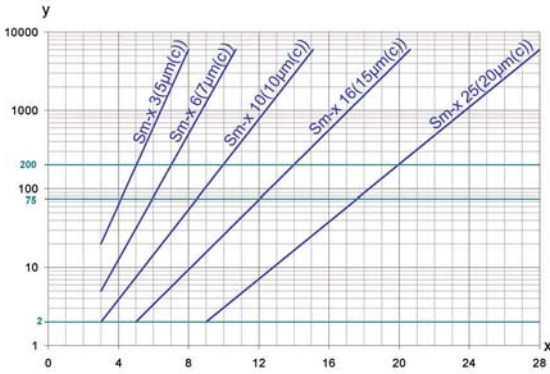
190 mm²/s
33 mm²/s



y = differential pressure Δp [bar]

x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value

x = particle size [μm]

determined by multipass tests (ISO 16889)

calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x vst-Elemente with
max. Δp 210 bar

Sm-x vst 3 $\beta_{5(C)} \geq 200$

Sm-x vst 6 $\beta_{7(C)} \geq 200$

Sm-x vst 10 $\beta_{10(C)} \geq 200$

Sm-x vst 16 $\beta_{15(C)} \geq 200$

Sm-x vst 25 $\beta_{20(C)} \geq 200$

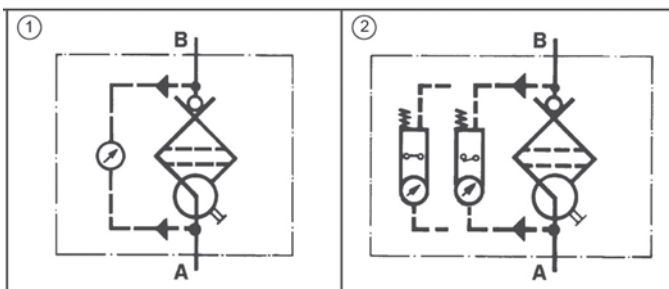
values guaranteed up to
20 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 2923	Fluidtechnik-Hydraulik Filterelemente, method for end load test
DIN ISO 2924	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power-filters-evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters-multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Order numbers

Example for ordering filters:

1. Housing design	2. Filter element
V = 100 l/min and visual/electrical maintenance indication Type: Pi 47010-015 Order number: 70304308	Sm-x vst 10 Type: Pi 73010 DN Sm-x vst 10 Order number: 77925670

7.1 Housing design

Nominal size NG [l/min]	Order number	Type	with indicator cavity	①	②
				with visual indication	with electrical indication
40	70304318	Pi 47004-010			
	70304300	Pi 47004-014			
	70304306	Pi 47004-015			
63	70304319	Pi 47006-010			
	70304301	Pi 47006-014			
	70304307	Pi 47006-015			
100	70304320	Pi 47010-010			
	70304302	Pi 47010-014			
	70304308	Pi 47010-015			
160	70304338	Pi 47016-010			
	70304340	Pi 47016-014			
	70304341	Pi 47016-015			
250	70304332	Pi 47025-010			
	70304335	Pi 47025-014			
	70304331	Pi 47025-015			
400	70304333	Pi 47040-010			
	70304336	Pi 47040-014			
	70304337	Pi 47040-015			

When filter with non bypass configuration is selected the max. Δp pressure of the element must not be exceeded.

7.2 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
40	78216079	Pi 71004 DN Sm-x vst 3	Sm-x vst 3	210	445
	77960156	Pi 72004 DN Sm-x vst 6	Sm-x vst 6		
	77925654	Pi 73004 DN Sm-x vst 10	Sm-x vst 10		
	78216087	Pi 74004 DN Sm-x vst 16	Sm-x vst 16		
	78216095	Pi 75004 DN Sm-x vst 25	Sm-x vst 25		
63	78216137	Pi 71006 DN Sm-x vst 3	Sm-x vst 3		780
	77960149	Pi 72006 DN Sm-x vst 6	Sm-x vst 6		
	77925662	Pi 73006 DN Sm-x vst 10	Sm-x vst 10		
	78216145	Pi 74006 DN Sm-x vst 16	Sm-x vst 16		
	78216152	Pi 75006 DN Sm-x vst 25	Sm-x vst 25		
100	78227480	Pi 71010 DN Sm-x vst 3	Sm-x vst 3		1275
	77960131	Pi 72010 DN Sm-x vst 6	Sm-x vst 6		
	77925670	Pi 73010 DN Sm-x vst 10	Sm-x vst 10		
	78261281	Pi 74010 DN Sm-x vst 16	Sm-x vst 16		
	78216160	Pi 75010 DN Sm-x vst 25	Sm-x vst 25		

*a wider range of element types is available on request

7.2 Filter elements*

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
160	77940638	Pi 71016 DN Sm-x vst 3	Sm-x vst 3	210	1885
	77960123	Pi 72016 DN Sm-x vst 6	Sm-x vst 6		
	77925688	Pi 73016 DN Sm-x vst 10	Sm-x vst 10		
	78269797	Pi 74016 DN Sm-x vst 16	Sm-x vst 16		
	78216178	Pi 75016 DN Sm-x vst 25	Sm-x vst 25		
250	77940646	Pi 71025 DN Sm-x vst 3	Sm-x vst 3	210	3090
	77960115	Pi 72025 DN Sm-x vst 6	Sm-x vst 6		
	77925696	Pi 73025 DN Sm-x vst 10	Sm-x vst 10		
	78269813	Pi 74025 DN Sm-x vst 16	Sm-x vst 16		
	78216186	Pi 75025 DN Sm-x vst 25	Sm-x vst 25		
400	77940653	Pi 71040 DN Sm-x vst 3	Sm-x vst 3	210	5240
	77960107	Pi 72040 DN Sm-x vst 6	Sm-x vst 6		
	77930829	Pi 73040 DN Sm-x vst 10	Sm-x vst 10		
	78269821	Pi 74040 DN Sm-x vst 16	Sm-x vst 16		
	78260903	Pi 75040 DN Sm-x vst 25	Sm-x vst 25		

* a wider range of element types is available on request

8. Technical specifications

Design:	line mounting filter
Nominal pressure: Pi 47016-47040	315 bar (4480 psi)
Pi 47004-Pi 47010	350 bar (4980 psi)
Test pressure: Pi 47016-47040	410 bar (5830 psi)
Pi 47004-Pi 47010	455 bar (6470 psi)
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Filter head material:	St
Filter housing material:	St
Sealing material:	NBR/PTFE
Maintenance indicator setting:	Δp 5 bar \pm 10 %
Electrical data of maintenance indicator:	
Max. voltage:	250 V AC/200 V DC
Max. current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M20 x1.5

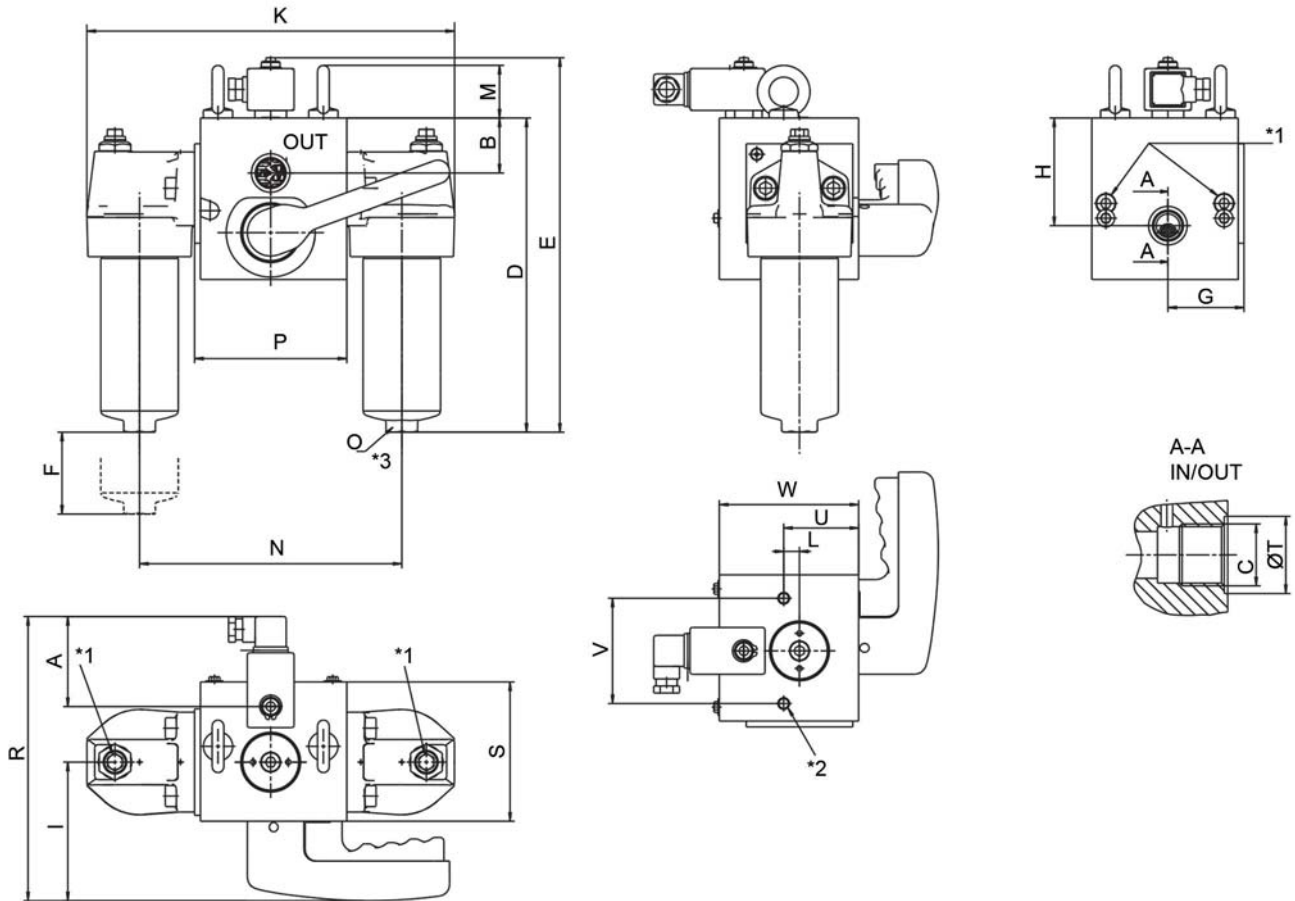
The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values and do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.

9. Dimensions



*1 Vent screw

*2 Mounting cavity
M10x20 for Pi 47004 up to Pi 47010
M16x20 for Pi 47016 up to Pi 47040

*3 Drain screw Pi 47016 up to Pi 47040

All dimensions except "C" in mm.

Type	A	B	C	D	E	F	G	H	I	K	L
Pi 47004	78	47	G $\frac{3}{4}$	269	320	110	65	92	119	314	14
Pi 47006	78	47	G $\frac{3}{4}$	347	398	110	65	92	119	314	14
Pi 47010	78	47	G $\frac{3}{4}$	423	474	110	65	92	119	314	14
Pi 47016	78	53	G1 $\frac{1}{2}$	334	396	110	75	125	135	450	23
Pi 47025	78	53	G1 $\frac{1}{2}$	424	486	110	75	125	135	450	23
Pi 47040	78	53	G1 $\frac{1}{2}$	574	636	110	75	125	135	450	23

Type	M	N	O	P	R	S	T	U	V	W	Weight [kg]
Pi 47004	45	224	SW27	130	243	119	33	64	90	119	22
Pi 47006	45	224	SW27	130	243	119	33	64	90	119	23
Pi 47010	45	224	SW27	130	243	119	33	64	90	119	25
Pi 47016	62	300	SW30	150	271	150	65	90	100	150	56
Pi 47025	62	300	SW30	150	271	150	65	90	100	150	61
Pi 47040	62	300	SW30	150	271	150	65	90	100	150	66

10. Installation, operating and maintenance instructions

10.1 Filter installation

Install filter in accordance with the identified flow direction. The filter head is provided with threaded holes for mounting the filters. Ascertain that the required underclearance is provided so that the filter element and the filter housing can be removed. Preferably the filter should be installed with the filter housing pointing downwards. The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open to normally closed position or vice versa.

10.3 When should the filter element be replaced?

1. Filters equipped with visual and electrical maintenance indicator: During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature the filter element must be replaced after the end of the shift.
2. Filters without maintenance indicator:
The filter element should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
3. Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (Sm-x) cannot be cleaned.

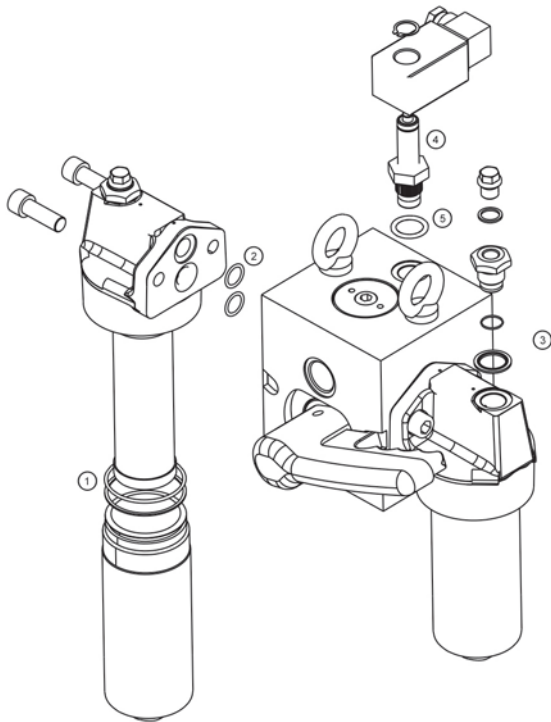
10.4 Element replacement

Note: The maintenance indicator monitors the filter side in operation, which is identified by the position of the switching lever catch. The change-over transfer valve must be switched prior filter servicing. Now the signal of the contamination indicator is cancelled and the red button can be pressed again:

1. Operate and hold pressure equalizing lever located behind switching lever. Pull catch knob and swivel switching lever. Engage the catch on the clear filter side. Place through or drip pan underneath to collect leaving oil.
2. Loosen vent screw of the filter side not in use by 2 to 3 turns.
3. Unscrew filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
4. Remove filter element by pulling down carefully.
5. Check O-ring on the filter housing for damage. Replace, if necessary.
6. Make sure that the order number on the spare element corresponds to the order number of the filter name-plate. Open the plastic bag and push element over the spigot in the filter head. Now remove plastic bag.

7. Complete installation by screwing on the housing, turning clockwise until it comes to a full stop. Back off the bowl 1/8 to 1/2 turn.
8. To refill the filter chamber, operate only the pressure equalizing lever (leave the switching lever arrested in its catch) long enough for the medium to emerge bubble-free from the vent bore.
9. Tighten vent screw. Check filter for leaks by operating the pressure equalizing lever once again.

11. Spare parts



Order number for spare parts		
Position	Type	Order number
① - ③	Seal kit for housing	
	Pi 47004-47010	
	NBR	70304944
	FPM	70304945
	EPDM	70304946
	Pi 47016-47040	
	NBR	70304922
	FPM	70304924
④	Maintenance indicator	
	Visual PiS 3093/5	77669914
	Electrical PiS 3092/5	77669864
	Electrical upper part only	77536550
⑤	Seal kit for maintenance indicator	
	NBR	77760275
	FPM	77760283
	EPDM	77760291

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MAINTENANCE INDICATORS

Maintenance Indicators

1. Features

Filter elements are economically used only if their dirt holding capacity is fully exploited. This is achieved by using filter housings with a maintenance indicator.

MAHLE manufactures maintenance indicators of the following designs:

- Differential pressure indicators
- Pressure indicators/switches/gauges
- Vacuum switches/gauges

With any filter element the collection of dirt particles continuously reduces the number of open pores or, in other words: The open cross section for allowing the liquid to flow is continuously reduced. Thus the pressure on the upstream side of the element (dirt side) increases continuously.

With pressure filters, the pressure is measured upstream and downstream of the filter element (differential pressure). With return line filters the pressure is measured only on the upstream side because, depending on the tank design, atmospheric pressure exits on the downstream side of the filter element is measured analog. With suction filters the vacuum is measured downstream.

A piston with attached magnet is moved against the force of a spring, with which the indicating point is determined by the piston surface. A homopolar poled magnet is fitted in the outer part in the indicating button.

The closer the pole-springs move towards each other, the stronger is the force with the magnets mutually repel, until finally the red button on the indicator pops out.

This red button remains visible until it is pushed in during the daily check which is to be performed while the plant is at operating temperature. If the button pops out immediately after being pushed in, the filter element must be replaced latest at the end of the shift.

This optical function may also be used for generating contactless electrical signals. For this purpose an electrical upper part is pushed over the hydraulic/optical part. This upper part incorporates all electrical switching elements.

- Optical and electrical indicator with standard check function
- Normally open/normally closed combination - standard feature
- Electrical function, easy to install at a later time
- Two-step indication, at 75 % and 100 % optional
- Signal lock out up to approx. 30 °C optional
- Rugged, non-bypass design
- Optimal element exploitation
- Worldwide distribution



2. Differential pressure indicators

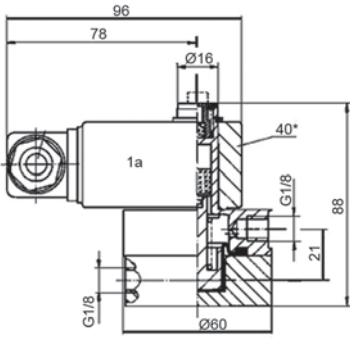


Fig. 1

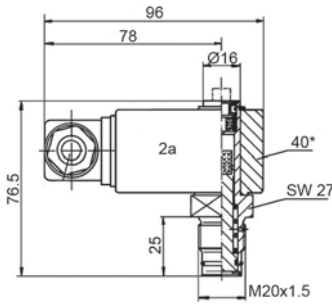


Fig. 2

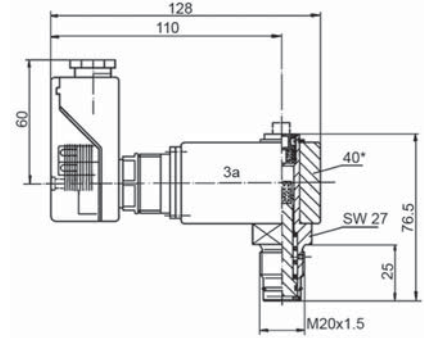


Fig. 3

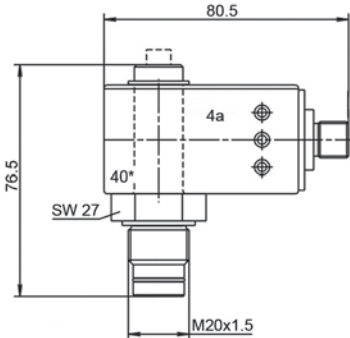


Fig. 4

40° = 40 mm wide

Differential pressure indicators

Nominal pressure [bar]	Temperature [°C]	Type	Order number	Indicator setting [bar]	Indication	Contact type*	Fig.	Material lower section	Material upper section
10	-10 - +120	PiS 3087	77738990	1.2	visual	-	1	Al	PA 6
		PiS 3086	77737513		visual/electr.	1	1 + 1a		
		PiS 3104	78236994		visual/electr.	4	1 + 3a		
160	-10 - +120	PiS 3098	77669971	2.2	visual	-	2	Al	PA 6
		PiS 3097	77669948		visual/electr.	1	2 + 2a		
		PiS 3116	78308074		visual/electr.	3	2 + 2a		
		PiS 3116	79764028		visual/electr.	10	4 + 4a		
160	-10 - +120	PiS 3119	78309122	1.7/2.2	visual/electr.	2	2 + 2a	Al	PA 6
		PiS 3012	78308454		visual/electr.	4	3 + 3a		
		PiS 3131	79760869		visual/electr.	5	3 + 3a		
		PiS 3141	79761859		visual/electr.	6	3 + 3a		
		PiS 3151	79761909		visual/electr.	8	4 + 4a		
		PiS 3154	76300339		visual/electr.	9	4 + 4a		
160	-10 - +120	PiS 3157	76326706	3.5	visual/electr.	11	4 + 4a	Al	PA 6
		PiS 3098	77938582		visual	-	2		
160	-10 - +120	PiS 3097	78236648	5.0	visual/electr.	1	2 + 2a	Al	PA 6
		PiS 3098	77669989		visual	-	2		
		PiS 3116	78308082		visual/electr.	3	2 + 2a		
160	-10 - +120	PiS 3119	78309130	3.7/5.0	visual/electr.	2	2 + 2a	Al	PA 6
		PiS 3012	78308447		visual/electr.	4	3 + 3a		
		PiS 3157	76326714		visual/electr.	11	4 + 4a		
		PiS 3131	79760877		visual/electr.	5	3 + 3a		
		PiS 3141	79761867		visual/electr.	6	3 + 3a		
		PiS 3151	79761917		visual/electr.	8	4 + 4a		
		PiS 3154	76300321		visual/electr.	9	4 + 4a		

Differential pressure indicators									
Nominal pressure [bar]	Temperature [°C]	Type	Order number	Indicator setting [bar]	Indication	Contact-type*	Fig.	Material lower section	Material upper section
400	-10 - +120	PiS 3093	77669898	2.2	visual	-	2	CuZn	PA 6
		PiS 3092	77669856		visual/electr.	1	2 + 2a		
		PiS 3115	78308041		visual/electr.	3	2 + 2a		
400	-10 - +120	PiS 3105	77970387	1.7/2.2	visual/electr.	2	2 + 2a	CuZn	PA 6
		PiS 3102	77942139		visual/electr.	4	3 + 3a		
		PiS 3132	79760919		visual/electr.	5	3 + 3a		
		PiS 3142	79761875		visual/electr.	6	3 + 3a		
		PiS 3152	79761925		visual/electr.	8	4 + 4a		
		PiS 3155	76300354		visual/electr.	9	4 + 4a		
		PiS 3158	76326722		visual/electr.	11	4 + 4a		
400	-10 - +120	PiS 3093	77669914	5.0	visual	-	2	CuZn	PA 6
		PiS 3092	77669864		visual/electr.	1	2 + 2a		
		PiS 3115	78308058		visual/electr.	3	2 + 2a		
		PiS 3115	79764010		visual/electr.	10	4 + 4a		
400	-10 - +120	PiS 3105	77970395	3.7/5.0	visual/electr.	2	2 + 2a	CuZn	PA 6
		PiS 3102	77942147		visual/electr.	4	3 + 3a		
		PiS 3155	76300362		visual/electr.	9	4 + 4a		
		PiS 3132	79760919		visual/electr.	5	3 + 3a		
		PiS 3142	79761883		visual/electr.	6	3 + 3a		
		PiS 3152	79761933		visual/electr.	8	4 + 4a		
		PiS 3158	76326730		visual/electr.	11	4 + 4a		
400	-10 - +120	PiS 3093	77669880	8	visual	-	2	CuZn	PA 6
		PiS 3092	77669872		visual/electr.	1	2 + 2a		
		PiS 3115	78308066		visual/electr.	3	2 + 2a		
450	-10 - +120	PiS 3193	77844061	2.2	visual	-	2	1.4301	PA 6
		PiS 3192	78308488		visual/electr.	1	2 + 2a		
		PiS 3110	79353574		visual/electr.	7	3 + 3a		
450	-10 - +120	PiS 3193	78308538	5.0	visual	-	2	1.4301	PA 6
		PiS 3192	78308546		visual/electr.	1	2 + 2a		
		PiS 3110	79353582		electrical	7	3 + 3a		

*Contact type

- 1 Normally open/normally closed; 1 setting point; wiring box DIN EN 175301-803; max. 250 V AC/200 V DC; max. 1 A
- 2 Normally closed; 2 setting points; wiring box DIN EN 175301-803; max. 150 V; max. 1 A
- 3 Change-over contact; 1 setting point; wiring box DIN EN 175301-803; max. 150 V; max. 1 A
- 4 Change-over contact; 2 setting points; LED; Mercedes Benz Norm DBL 9666 EA; wiring box DIN EN 175201-804; max. 10-30 V; max. 1 A
- 5 Change-over contact; 2 setting points; LED; signal suppression; time delay; wiring box DIN EN 175201-804; 10-30 V; max. 1 A
- 6 Change-over contact; 2 setting points; LED; signal suppression; wiring box DIN EN 175201-804; 10-30 V; max. 1 A
- 7 Analog signal 4-20 mA; 2 setting points; LED; signal cold start; wiring box DIN EN 175201-804; 24 V; max. 1 A
- 8 Normally open/normally closed; 2 setting points; LED; signal suppression; plug connection M12x1; 10-30 V; max. 1 A
- 9 Normally open/normally closed; 2 setting points; LED; plug connection M12x1; 10-30 V; max. 1 A
- 10 Change-over contact; 1 setting point; plug connection M12x1; 150 V; max. 1 A
- 11 Normally closed/normally closed; 2 setting points; LED; plug connection M12x1; 150 V; max. 1 A

3. Pressure indicators/pressure switches

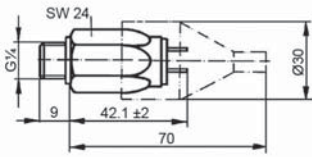


Fig. 5

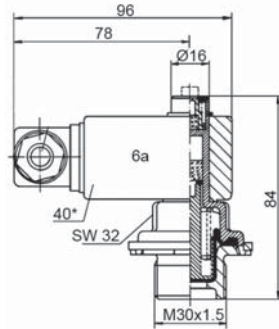


Fig. 6

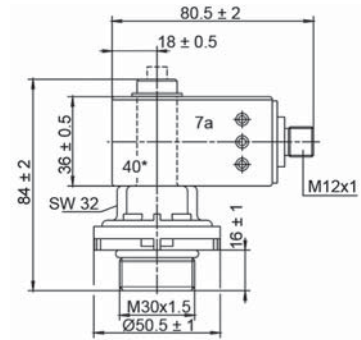


Fig. 7

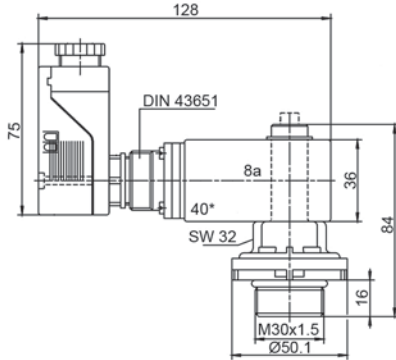


Fig. 8

40* = 40 mm wide

Pressure indicators/pressure switches									
Nominal pressure [bar]	Temperature [°C]	Type	Order number	Indicator setting [bar]	Indication	Contact type*	Fig.	Material lower section	Material upper section
10	-10 - +80	PiS 3084	77669781	1.2	visual	-	6	PA 66	PA 6
		PiS 3085	77669807		visual/electr.	1	6 + 6a		
		PiS 3125	78308033		visual/electr.	3	6 + 6a		
10	-10 - +80	PiS 3106	78309155	0.9/1.2	visual/electr.	2	6 + 6a	PA 66	PA 6
		PiS 3103	77942170		visual/electr.	4	8 + 8a		
10	-10 - +80	PiS 3084	77737802	2.2	visual	-	6	PA 66	PA 6
		PiS 3085	77738032		visual/electr.	1	6 + 6a		
		PiS 3125	78308108		visual/electr.	3	6 + 6a		
		PiS 3125	79764747		visual/electr.	10	7 + 7a		
10	-10 - +80	PiS 3156	76300370	1.7/2.2	opt./elektr.	9	7 + 7a	PA 66	PA 6
		PiS 3159	76326748		visual/electr.	11	7 + 7a		
		PiS 3143	79761891		visual/electr.	6	6 + 3a		
		PiS 3153	79761941		visual/electr.	8	7 + 7a		
		PiS 3133	79760927		visual/electr.	5	6 + 3a		
		PiS 3106	78308850		visual/electr.	2	6 + 6a		
		PiS 3103	77970429		visual/electr.	4	8 + 8a		
10	-25 - +85	DSS/1.2	77863814	1.2	electrical	norm. open	5	galvanized steel	delivered with protection cap
		DSO/1.2	77870587		electrical	n. closed	5		
10	-25 - +85	DSS/2.2	77845845	2.2	electrical	norm. open	5		
		DSO/2.2	77870595		electrical	n. closed	5		
10	-25 - +85	DSS/5	77863822	5.0	electrical	norm. open	5		
		DSO/5	77870603		electrical	n. closed	5		

*Contact type

see remarks below 2. Differential pressure indicators

4. Vacuum/pressure gauges

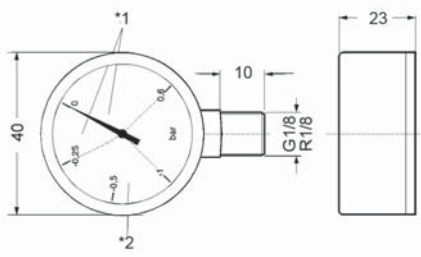


Fig. 9

*1 = Green area/*2 = Red area

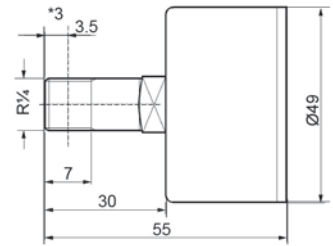


Fig. 10



Fig. 11

*3 = Metering level



Vacuum/pressure gauges

Nominal size [NG]	Type	Order number	Indicating range [bar]	Connection size	Fig.	Class	Dial face
40	Vacuum gauge	76345763	-1 - +0.6	R1/8 conical	9	min. 2.5	Red/Green area sep. line -0.25 bar
		77545908		G1/8	9		white
50		77617558	-1 - 0	R¼ conical	10		
50	Pressure gauge	78381998	0 - 6	R¼ conical	11		Red/Green area sep. line 2.2 bar

5. Vacuum switches

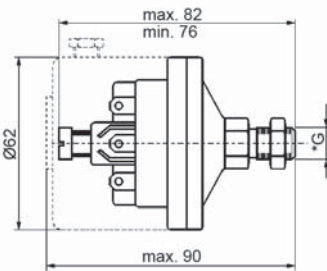


Fig. 12

*G = Connection

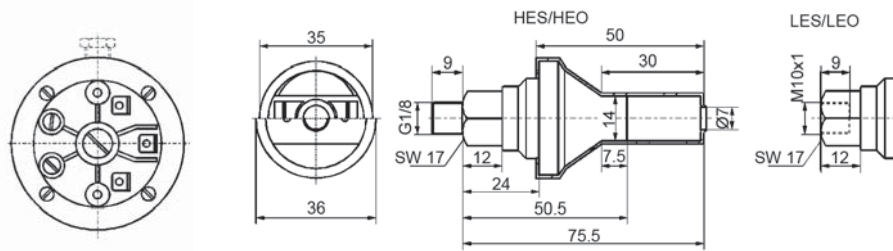


Fig. 12

HES/HEO only for fluids, LES/LEO only for air

Vacuum switches

Permissible over-pressure [bar]	Temperature [°C]	Type	Order number	Switch setting [mbar]	Contact type	Fig.	Connection *G	Material lower section	Material upper section
0.5	-10 - +70	PiS 3070	77669690	-15 - -80	single pole change-over switch, snap-in joint	12	G¼	GD-Al	PA 6
1			77669724	-50 - -600					
0.1	-20 - +80 short-term +120	HES 2200 BP	78308892	-200 ±10	normally open	13	G1/8 outside	GD-ZnAl	PC
		HEO 2200 BP	78308900		normally closed				
		LES 250 I	78308918	-50 ±4	normally open		M10x1 inside		
		LEO 250 I	78308926		normally closed				

6. Vacuum indicators/air filters

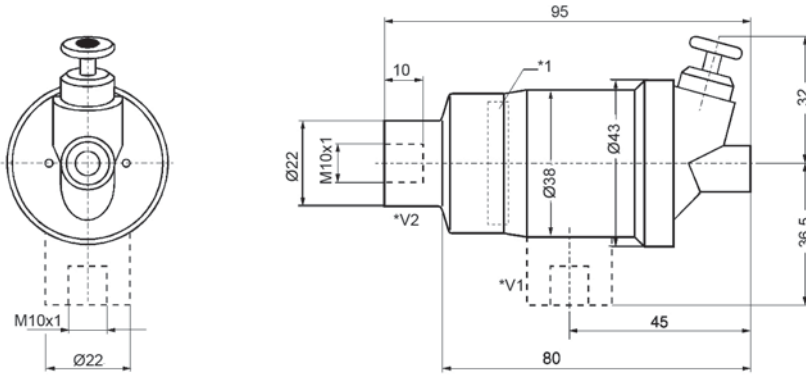


Fig. 14

*1 = Indication: position of display in mbar

*V1 = Version 1

*V2 = Version 2

Vacuum indicators/air filters						
Temperature [°C]	Type	Order number	Indicator setting ±10 % [mbar]	Indication type	Fig.	Version
-40 - +110	TB 745	78309056	-50	optical self locking	14	1
	TB 745/1	78309064	-50			2
	TB 746/1	78309049	-65			2

7. Accessories

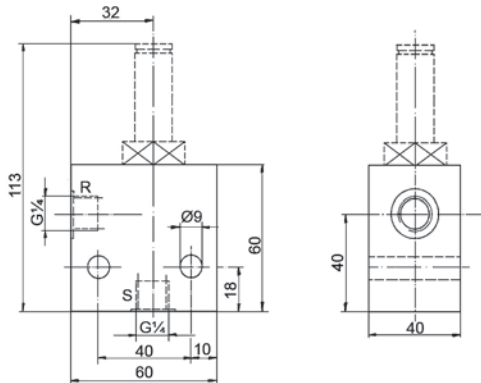
7.1 Seal kits				
Type	NBR	FPM	EPDM	Order number
PiS 3092, 3093, 3102, 3105, 3115, 3132, 3142, 3152, 3155, 3192, 3193, 3158	77760275	77760283	77760291	
PiS 3012, 3097, 3098, 3116, 3119, 3131, 3141, 3151, 3154, 3157	77760309	77760317	77760325	
PiS 3084, 3085, 3103, 3106, 3125, 3133, 3143, 3153, 3156, 3159	78383382	78383390	78383408	
PiS 3086, 3087, 3104	77760242	77760259	-	

7.2 Electrical expansion kit/spare parts	
Designation	Order number
Electrical upper section normally open/closed for PiS 3084, 3087, 3093, 3098, 3193 (contact type 1)	77536550
Wiring box with lamp insert 12 - 230 V for electrical upper section normally open (acc. to DIN EN 175301-803)	78307548
Electrical upper section change-over contact for PiS 3084, 3087, 3093, 3098, 3193 (contact type 3)	78308017
Wiring box with 2 LEDs 10 - 30 V for electrical upper section change over contact (acc. to DIN EN 175301-803)	78308025

Designation	Order number
Electrical upper section normally closed with signal suppression PiS 3003, 3087, 3098, 3093, 3193 (acc. to DIN EN 175301-803)	77765357
Electrical upper section change-over contact M12x1 für PiS 3084, 3087, 3093, 3098, 3193 (contact type 10)	79764036
Electrical upper section 2SP-LED-M12x1-SU (contact type 8) spare part for 2 setting points indicator!	76116651
Electrical upper section 2SP-LED-M12x1 (contact type 9) spare part for 2 setting points indicator!	76300412
Electrical upper section W-2SP-LED-SU-VERZ (contact type 5) spare part for 2 setting points indicator!	79760943
Electrical upper section W-2SP-LED-SU (contact type 6) spare part for 2 setting points indicator!	76118590
Electrical upper section W-2SP/Ö-LED-M12x1 (contact type 11) spare part for 2 setting points indicator!	76326755
Electrical upper section normally closed with signal suppression PiS 3003	77765357
Electrical upper section normally open with signal suppression PiS 3002	77765365

7.3 Mounting block for differential pressure indicators (M20x1.5)

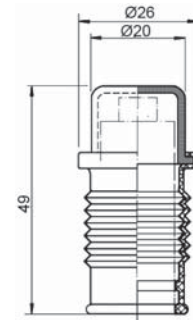
Designation	Order number
Mounting block (St)	77809098
Mounting block (1.4301), 450 bar	77698517



R = clean side
S = dirt side

7.4 Protection cap

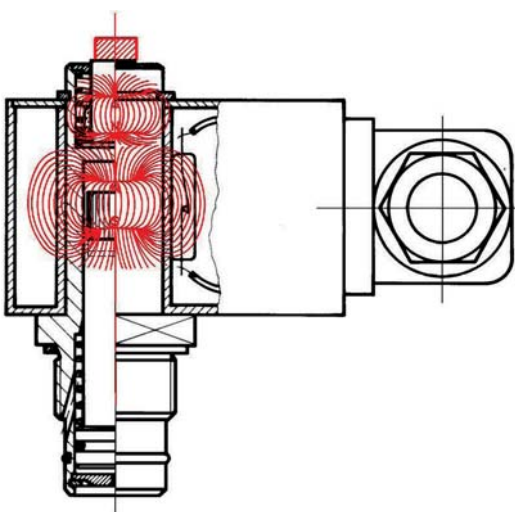
Designation	Order number
Protection cap for all visual pressure and differential pressure indicators, -20 °C to +80 °C Resistant to: gasoil, purifying agent, insolation, dust, salt, water, concret	78285330



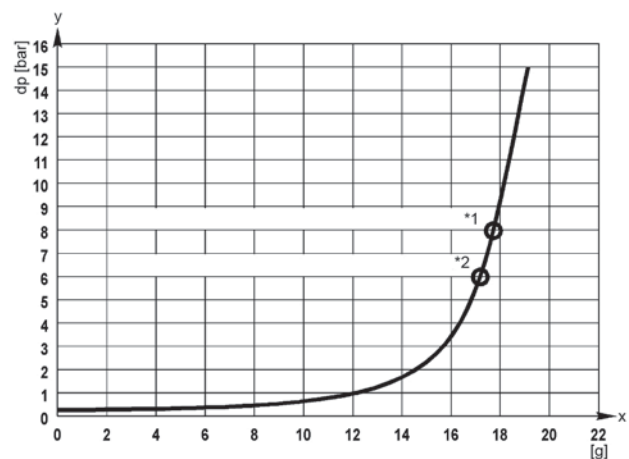
8. Function

The magnetic field as previously described, contactless operates reed contacts in the electrical upper part. The desired contact type is selected by inverting upper part. Another option keeping the electrical signal electronically suppressed up to 30 °C operating temperature is also available. This eliminates false electrical signal during the cold start phase.

For efficient servicing it is desirable to have a pre-warning device (so that the filter element can be replaced, e.g. with the next tool change). For this purpose electrical upper parts with two indicating points, i.e. at 75 % and at 100 % of the indicator setting are available.



Pressure/vacuum gauges give an analog reading of the existing state of contamination of the filter elements. They require continuous control to ensure that the service time and reserve capacity are not unduly exceeded. If the contamination signal is disregarded, the filter element may collapse or, if a bypass valve is installed, part of the contamination fluid may reach the hydraulic components via the bypass valve and cause failure of the hydraulics. Pressure/vacuum switches are provided with snap action switches, which ascertain that signal are issued only when the limit values have been fully reached.



Dirt holding capacity - Δp curve

x = dirt holding capacity [g]

y = differential pressure Δp [bar]

*1 = signal step maintenance indicator 100 %

*2 = signal step maintenance indicator 75 %

9. Technical specifications

9.1 Contact type normally open/normally closed

Contact type 1

Types PiS 3085, 3086, 3092, 3097, 3192

Max. voltage: 250 V AC/ 200 V DC

Max. current: 1 A

Contact load: 70 W

Type of protection: IP 65 in inserted and secured status

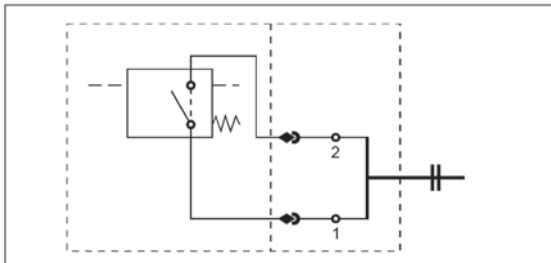
Contact type : normally open/normally closed

Cable sleeve: M20x1.5

Wiring box: DIN EN 175 301-803

The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact.

By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Electrical parts are insulated (plastic material housing).



9.2 Contact type normally closed or open with signal suppression

Contact type normally closed

Type PiS 3003 (expansion kit)

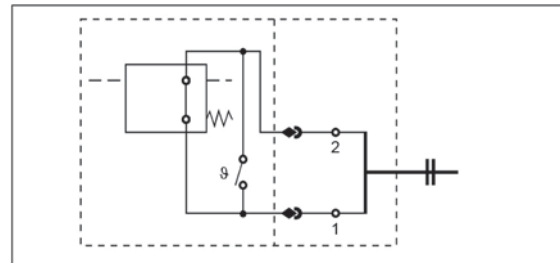
Contact type normally open

Type PiS 3002 (expansion kit)

Signal suppression by thermorelay

Signal is released at +30 °C

for further technical details see 9.1



9.3 Contact type normally closed 2 setting points

Contact type 2

Types PiS 3105, 3106, 3119

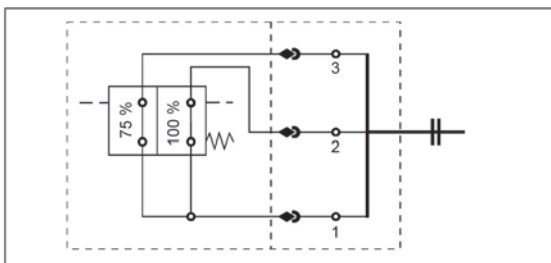
1. setting point at 75 % of the indicating pressure
2. setting point at 100 % of the indicating pressure

Max. voltage: 150 V AC/DC

Max. current: 1 A

Contact load: 20 VA/20W

for further technical details see 9.1



9.4 Contact type Change-over contact

Contact type 3

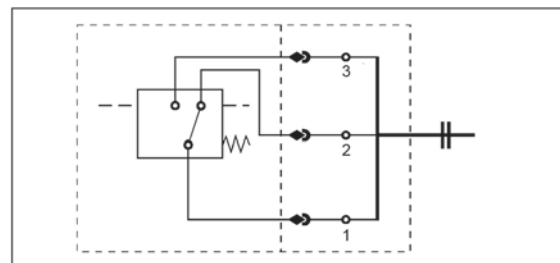
Types PiS 3115, 3116, 3125

Max. voltage: 150 V AC/DC

Max. current: 1 A

Contact load: 20 VA/20W

for further technical details see 9.1



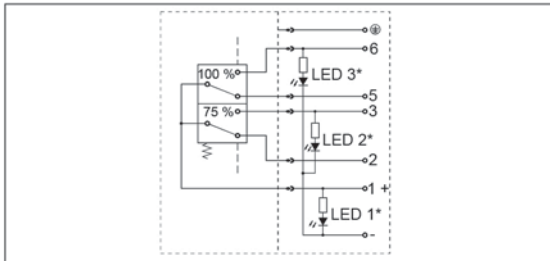
9.5 Contact type change-over contact, 2 setting points LED

Contact type 4

Types PiS 3012, 3102, 3103, 3104

1. setting point at 75 % of the indicating pressure
2. setting point at 100 % of the indicating pressure

Max. voltage: 10 - 30 V DC
 Max. current: 1 A
 Contact load: 20 VA/20 W
 Type of protection: IP 65 in inserted and secured status
 Plug connection: DIN EN 175201-804

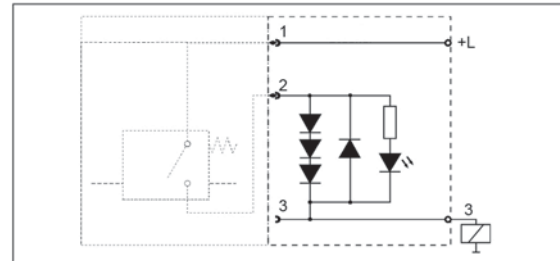


9.6 Wiring box with insert lamp

Will be supplied instead of standard connection.

Not to be combined with indicators with 2 setting points.

Max. voltage: 12-230 V AC/DC



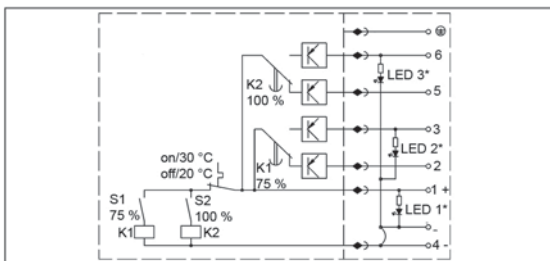
9.7 Contact type change-over contact, 2 setting points, LED, signal suppression, time delay

Contact type 5

Types PiS 3131, 3132, 3133

1. setting point at 75 % of the indicating pressure
2. setting point at 100 % of the indicating pressure

Max. voltage: 10 - 30 V DC
 Max. current: 1 A
 Contact load: 20 W
 Type of protection: IP 65 in inserted and secured status
 Plug connection: DIN EN 175201-804
 Signal suppression: by thermorelay
 Signal released: at + 30 °C
 Signal change down: at + 20 °C
 Impulse suppression K1 and K2 time delay 10 s



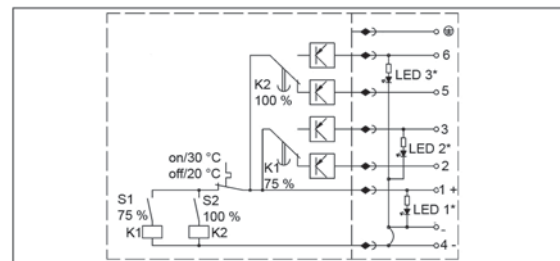
9.8 Contact type change-over contact, 2 setting points, LED, signal suppression

Contact type 6

Types PiS 3141, 3142, 3143

1. setting point at 75 % of the indicating pressure
2. setting point at 100 % of the indicating pressure

Max. voltage: 10 - 30 V DC
 Max. current: 1 A
 Contact load: 20 W
 Type of protection: IP 65 in inserted and secured status
 Plug connection: DIN EN 175201-804
 Signal suppression: by thermorelay
 Signal released: at + 30 °C
 Signal change down: at + 20 °C



LED 1* = Operating LED green

LED 2* = Setting point 75 % LED yellow

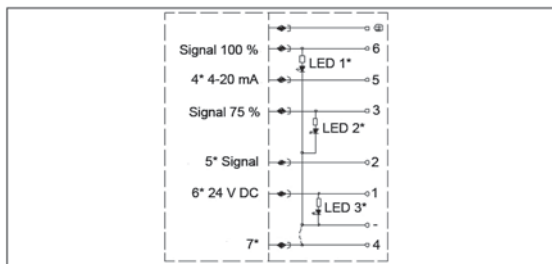
LED 3* = Setting point 100 % LED red

9.9 Contact type analog 4-20 mA, 2 setting points, LED, signal suppression

Contact type 7

Types PiS 3110, 3120

Max. voltage: 24 V DC
 Max. current:
 Contact load:
 Type of protection: IP 65 in inserted and secured status
 Plug connection: nach DIN EN 175201-804
 Output signal: 4-20 mA
 Outputs (PNP, max. 200 mA): cold start signal
 75 % setting point
 100 % setting point
 Signal damping: 20 s



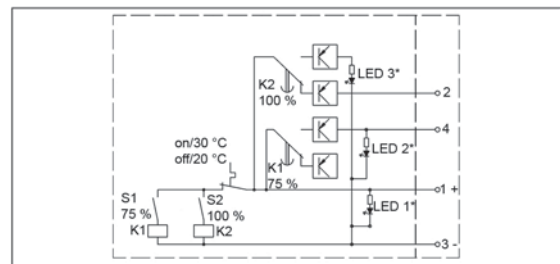
9.10 Contact type normally open/normally closed, 2 setting points, LED, signal suppression

Contact type 8

Types PiS 3151, 3152, 3153

1. setting point at 75 % of the indicating pressure (normally open)
2. setting point at 100 % of the indicating pressure (normally closed)

Max. voltage:
 Max. current:
 Contact load:
 Type of protection: IP 65 in inserted and secured status
 Plug connection: M12x1, 4 pole
 Signal suppression: by thermorelay
 Signal release: at + 30 °C
 Signal change down: at + 20 °C



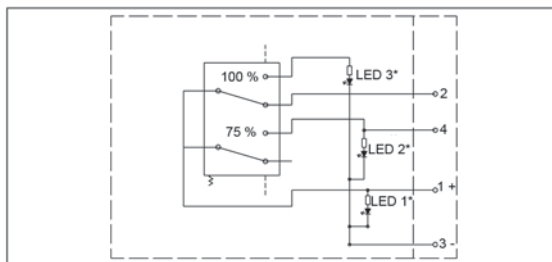
9.11 Contact type normally open/normally closed, 2 setting points

Contact type 9

PiS 3154, 3155, 3156

1. setting point at 75 % of the indicating pressure (normally open)
2. setting point at 100 % of the indicating pressure (normally closed)

Max. voltage: 10-30 V DC
 Max. current: 1 A
 Contact load: 20 W
 Type of protection: IP 65 in inserted and secured status
 Plug connection: M12x1, 4 pole

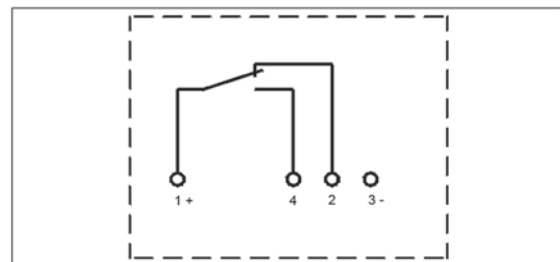


9.12 Contact type change-over contact

Contact type 10

PiS 3115-M12x1, 3116-M12x1, 3125-M12x1

Max. voltage: 150 V
 Max. current: 1 A
 Contact load: 20 W
 Type of protection: IP 65 in inserted and secured status
 Plug connection: M12x1, 4 pole



LED 1* = Operating LED green
 LED 2* = Setting point 75 % LED yellow
 LED 3* = Setting point 100 % LED red

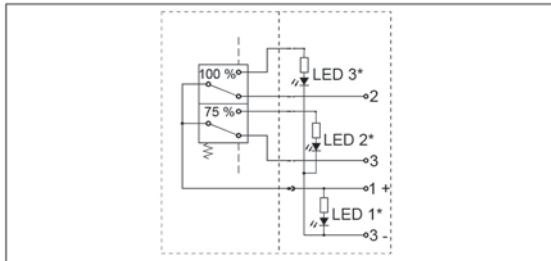
9.13 Contact type normally closed, 2 setting points

Contact type 11

Types PiS 3157, 3158, 3159

1. setting point at 75 % of the indicating pressure (normally open)
2. setting point at 100 % of the indicating pressure (normally closed)

Max. voltage:	10-30 V DC
Max. current:	1 A
Contact load:	20 W
Type of protection:	IP 65 in inserted and secured status
Plug connection:	M12x1, 4 pole



- LED 1* = Operating LED green
- LED 2* = Setting point 75 % LED yellow
- LED 3* = Setting point 100 % LED red

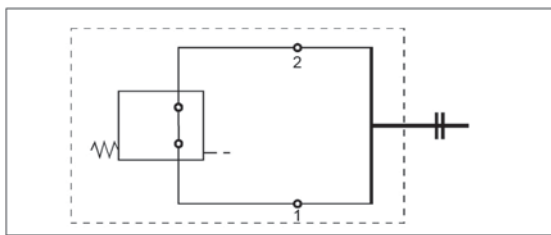
9.15 Vacuum switch HEO/LEO

Contact type normally closed

Contact load HEO*:	42 V/6 W
Contact load LEO*:	24 V/6 W

* at resistive load

for further technical details see 9.8

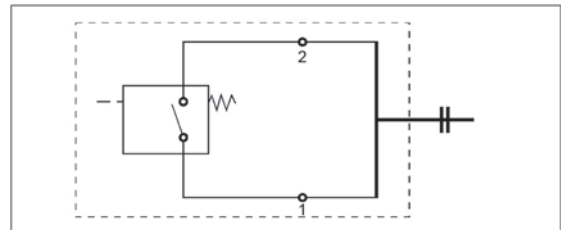


9.14 Vacuum switch HES/LES

Contact type normally open

Electrical connection:	AMP 6,3 DIN 43248
	bushings DIN 46247
	switch type 2 pole
Contact load HES*:	42 V/6 W
Contact load LES*:	24 V/6 W
Type of protection:	IP 54 - with protecting cap

* at resistive load

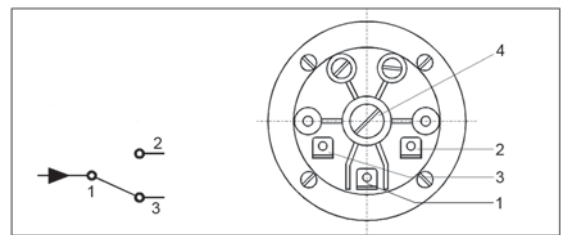


9.16 Vacuum switch PiS 3070

Contact type 1 pole change-over contact

Electrical connection:	AMP 6,3 DIN 43248
	bushings DIN 46247
Max. voltage:	230 V AC/DC
Max. current:	6 A
Type of protection:	IP 00 without cover
	IP 54 with cover

Position of installation: individual (position of installation is to be advised if setting point is adjusted)



- 1 = Supply line
- 2 = Operating contact

- 3 = Normally closed contact
- 4 = Adjusting screw

9.17 Pressure switch DSS

Contact type normally open

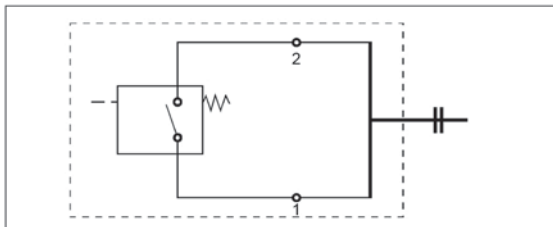
Electrical connection: AMP 6,3 DIN 46248
bushings DIN 46247
switch type 2 pole

Max. voltage: 42 V

Max. current: 2 A

Contact load: 100 VA

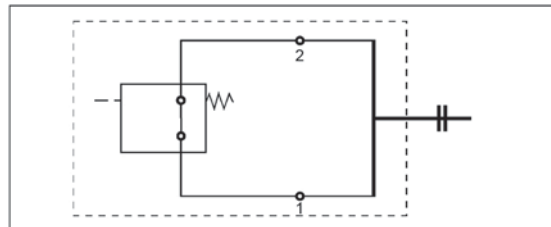
Duty classification: 200/min



9.18 Pressure switch DSO

Contact type normally closed

for further technical details see 9.17



Maintenance indicators PiS 3084, 3087, 3093, 3098, 3193 can be mounted in 45°.

We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application: Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

When using our filters in areas which are to be classified according to EU directive 94/9 EG (ATEX), we recommend prior discussion with us. The standard version can be used for liquids based on mineral oil /corresponding to the fluids in Group 2 of Directive 97/23 EG Article 9). Please consult with us if using other media.

Subject to technical alterations without prior notice.

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78357428.09/2008

FILTER ELEMENTS

Filter elements for liquid filters Degree of filtration 2 µm up to 500 µm

Nominal size 5 up to 1800
Differential pressure resistant up to 210 bar (3045 psi)

1. Features

High performance elements for nearly all fluids

- Sm-x und Sm-N: High performance and disposable depth filter elements for hydraulic oils and lubricants, fuels, aqueous media and synthetic media
- Mic: inexpensive disposable filter elements
- Drg: cleanable surface filter element, made of wire mesh
- KS-Mic: high efficient disposable depth filter elements for cooling emulsions
- WS-Mic and WS-Sm-x: Filter elements with additional water absorption ability
- Designed for MAHLE filter housings, as alternative elements in the dimensions of other manufacturers and according to a customized specification
- Complete product range according DIN 24550
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution

2. Preface

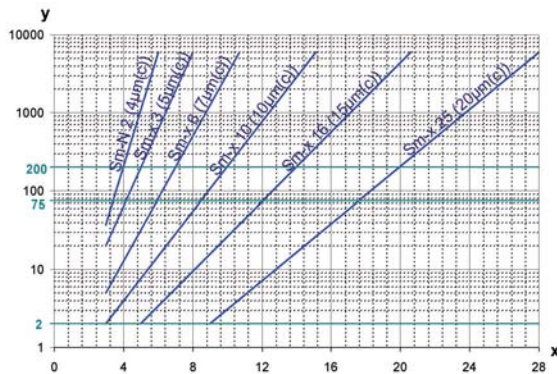
Filter elements are the virtual part of a filter through which the filtration process is realised. For the different liquids and applications MAHLE developed different filter materials. Therefore a variety of elements are available which would fit into the same housing, but would suit different applications.

3.1 Filter material Sm-x and Sm-N

Depth filters consisting of several layers of glass fibre to filter hydraulic oils and lubricants, flame resistant liquids, fuels and synthetic liquids.

- Sm-x is available in ratings of 5 µm (c), 7 µm (c), 10 µm (c), 15 µm (c) and 20 µm (c) according to ISO 16889 (3 µm, 6 µm, 10 µm, 16 µm and 25 µm according to ISO 4572) with a very high dirt holding capacity and simultaneous very low flow resistance.
- Sm-N 2 is available in ratings of 4 µm (c) according to ISO 16889 (2 µm according to ISO 4572) with an extremely high dirt holding capacity for very demanding requirements in regards to the filtration quality, for off-line filtration and for single-pass applications.

Separation grade characteristics



y = beta-value

x = particle size [µm]

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

In a hydraulic or lubrication system a filter has the task to reduce the contamination to the accepted cleanliness level and to keep it for as long as possible. For the identification of solid particles in industrial hydraulics it is common practice to count particles according to ISO 4406. Subsequently the achievable cleanliness classes of the Sm-x and Sm-N. These values mirror our longtime experience in designing hydraulic filters and could be considered as guide values.

Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x/Sm-N elements with max. Δp 10 bar

Sm-N	2	$\beta_{4(C)}$	≥ 200
Sm-x	3	$\beta_{5(C)}$	≥ 200
Sm-x	6	$\beta_{7(C)}$	≥ 200
Sm-x	10	$\beta_{10(C)}$	≥ 200
Sm-x	16	$\beta_{15(C)}$	≥ 200
Sm-x	25	$\beta_{20(C)}$	≥ 200

values guaranteed up to 10 bar differential pressure.

The filter element Sm-N2 is an element with very high dirt holding capacity and is preferred to be used in off-line filtration.

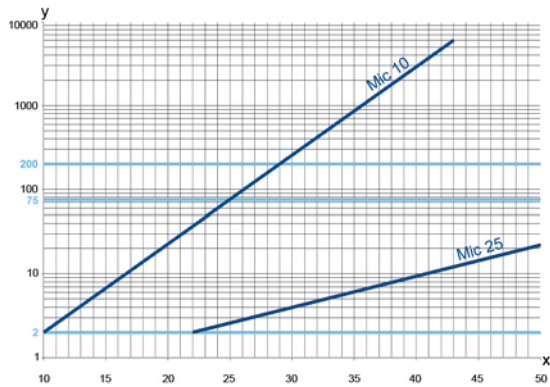
Cleanliness classes

Filter material	Cleanliness classes according to ISO 4406 (1999), > 4 µm(c)/ > 6 µm (c)/ >14 µm (c)
Sm-N 2	13/11/08
Sm-x 3	14/12/09
Sm-x 6	16/13/10
Sm-x 10	17/15/11
Sm-x 16	20/17/12
Sm-x 25	23/19/13

3.2 Filter material Mic

Depth filters made of cellulose or glass fibre layers with a high dirt holding capacity and a low flow resistance. Degree of filtration 10 µm and 25 µm according to MAHLE norm. Use in hydraulic oil and lubricants filtration as suction filter as well as low cost filtration in plants with minor demands in regards to the filtrat quality.

Separation grade characteristics



y = beta-value
x = particle size [µm]

Filter performance data

tested according to ISO 16889 (multipass test)

Mic	10	β_{10}	≥ 2
Mic	25	β_{25}	≥ 2

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

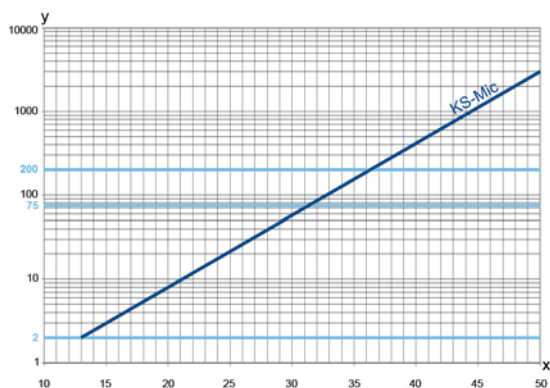
3.3 Filter material Drg

Surface filters made of stainless steel wire mesh with a very low flow resistance designed in the following weaves: plait, twill and linen. Degree of filtration 10 µm, 25 µm, 40 µm, 60 µm, 100 µm, 200 µm, 300 µm and 500 µm. For a wire mesh filter element the degree of filtration is determined by the largest diameter of a globular particle which would be able to pass the fabric. Wire mesh filter elements are used in hydraulic oil and lubricants filtration as suction or coarse filters, for high viscose fluids as well as safety filters for coolant filtration. Wire mesh elements possess a defined removal size as surface filter and a low dirt holding capacity as depth filter.

3.4 Filter material KS-Mic

Depth filter consisting of several, coordinated, binder-free polyester materials with a very high dirt holding capacity and low flow resistance. Degree of filtration: 25 µm according to MAHLE norm. Use as disposable filter in coolant filtration.

Separation grade characteristics



y = beta-value
x = particle size [µm]

Filter performance data

tested according to ISO 16889 (multipass test)

KS-Mic	25	β_{25}	≥ 5
--------	----	--------------	----------

determined by multipass tests (ISO 16889)
calibration according to ISO 11171 (NIST)

3.5 Filter materials WS-Mic, WS-Sm-x and WS-Sm-N

MAHLE WS-elements for water removal are available as water absorber elements WS-Mic 25 with a low filter efficiency for particles or in combination with the highly efficient Sm-N 2 and Sm-x 10 configuration. A super absorber will change its chemical structure while absorbing water and indicates the amount of absorbed free water by an increase of flow resistance. The free water will be absorbed until the saturation limit is reached. WS-elements are applicable for all common lubrication and hydraulic fluids. The filter property complies with the corresponding Mic-, Sm-x- and Sm-N 2 element. The flow resistance of a water-free liquid would be insignificantly higher.

4. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 3723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3724	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power-filters-evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters-multipass method for evaluation filtration performance of a filter element

5. Technical specifications

Pleated filter elements

Flow direction from outside to inside

End caps and support tube galvanised and chromated

Burst pressure resistance up to 210 bar

Filter material and filter area see table

Temperature range of application: -10 °C to +120 °C

Possible applications see description „Filter material“ chapter 3.1

Standard sealings for DIN elements: NBR, other sealing materials available on request

Elements with stainless steel parts available on request

6.1 Type number key and order numbers filter elements for in-line filters

6.1.1 Type number key filter elements for in-line filters

Type

Pi in-line filter

Filter material and degree of filtration

01	Sm-N 2
10	Mic 25
11	Mic 10
21	Sm-x 3
22	Sm-x vst 3
31	Sm-x 10
32	Sm-x vst 10
41	Sm-x 25
42	Sm-x vst 25
51	Sm-x 6
52	Sm-x vst 6
81	Drq 10
82	Drq 25
83	Drq 40
84	Drq 60
85	Drq 100
86	Drq 200
87	Drq 300
88	Drq 500
89	Drq special version
91	Drq vst 10
92	Drq vst 25
93	Drq vst 40
94	Drq vst 60
95	Drq vst 100
96	Drq vst 200
97	Drq vst 300
98	Drq vst 500
99	metal edge

Nominal size

05	NG 50
08	NG 80
11	NG 110
15	NG 150
30	NG 300
45	NG 450

Pi 10 05 Selection example

6.1.2 Filter elements* for in-line filters

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]	
50	77576630	Pi 1105 Mic 10	Mic 10	20	640	
	77718620	Pi 1005 Mic 25	Mic 25		640	
	77680135	Pi 2105 Sm-x 3	Sm-x 3		590	
	77943509	Pi 5105 Sm-x 6	Sm-x 6		590	
	77680325	Pi 3105 Sm-x 10	Sm-x 10		590	
	77680440	Pi 4105 Sm-x 25	Sm-x 25		590	
	77680192	Pi 2205 Sm-x vst 3	Sm-x vst 3	210	470	
	77943533	Pi 5205 Sm-x vst 6	Sm-x vst 6		470	
	77680382	Pi 3205 Sm-x vst 10	Sm-x vst 10		470	
	77680507	Pi 4205 Sm-x vst 25	Sm-x vst 25		470	
	77680895	Pi 8105 Drg 10	Drg 10	20	590	
	77680911	Pi 8205 Drg 25	Drg 25		590	
	77680960	Pi 8305 Drg 40	Drg 40		590	
	77576648	Pi 8405 Drg 60	Drg 60		365	
	77681067	Pi 8505 Drg 100	Drg 100		590	
	77718687	Pi 8605 Drg 200	Drg 200		365	
	77718703	Pi 8705 Drg 300	Drg 300		365	
	77718695	Pi 8805 Drg 500	Drg 500		590	
	77689102	Pi 9105 Drg vst 10	Drg vst 10		210	470
	77689128	Pi 9205 Drg vst 25	Drg vst 25			470
	77689169	Pi 9305 Drg vst 40	Drg vst 40	470		
	77689219	Pi 9405 Drg vst 60	Drg vst 60	470		
	77689276	Pi 9505 Drg vst 100	Drg vst 100	470		
	77740921	Pi 9605 Drg vst 200	Drg vst 200	470		
	77740939	Pi 9705 Drg vst 300	Drg vst 300	470		
	77740947	Pi 9805 Drg vst 500	Drg vst 500	470		
	on request	on request	KS-Mic25	20	-	
	on request	on request	Sm-N 2		-	
	80	77680085	Pi 1108 Mic 10	Mic 10	20	1250
		77657174	Pi 1008 Mic 25	Mic 25		1250
77680143		Pi 2108 Sm-x 3	Smx 3	1150		
77943517		Pi 5108 Sm-x 6	Smx 6	1150		
77680341		Pi 3108 Sm-x 10	Smx 10	1150		
77680457		Pi 4108 Sm-x 25	Smx 25	1150		
77680200		Pi 2208 Sm-x vst 3	Smx vst 3	210	900	
77943541		Pi 5208 Sm-x vst 6	Smx vst 6		900	
77681190		Pi 3208 Sm-x vst 10	Smx vst 10		900	
77680515		Pi 4208 Sm-x vst 25	Smx vst 25		900	
77718737		Pi 8108 Drg 10	Drg 10	20	1150	
77680929		Pi 8208 Drg 25	Drg 25		1150	
77680978		Pi 8308 Drg 40	Drg 40		1150	
77681018		Pi 8408 Drg 60	Drg 60		725	

* A wider range of element types is available on request.

6.1.2 Filter elements* for in-line filters

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]	
80	77681075	Pi 8508 Drg 100	Drg 100	20	1150	
	77718711	Pi 8608 Drg 200	Drg 200		725	
	77668528	Pi 8708 Drg 300	Drg 300		725	
	77718729	Pi 8808 Drg 500	Drg 500		1150	
	77689110	Pi 9108 Drg vst 10	Drg vst 10	210	950	
	77740954	Pi 9208 Drg vst 25	Drg vst 25		950	
	77740970	Pi 9308 Drg vst 40	Drg vst 40		950	
	77689227	Pi 9408 Drg vst 60	Drg vst 60		950	
	77740962	Pi 9508 Drg vst 100	Drg vst 100		950	
	77740988	Pi 9608 Drg vst 200	Drg vst 200		950	
	77740996	Pi 9708 Drg vst 300	Drg vst 300		950	
	77741002	Pi 9808 Drg vst 500	Drg vst 500		950	
	on request	on request	KS-Mic 25		20	-
	on request	on request	SM-N 2			-
110	77680093	Pi 1111 Mic 10	Mic 10	20	1840	
	77657182	Pi 1011 Mic 25	Mic 25		1840	
	77680150	Pi 2111 Sm-x 3	Sm-x 3		1700	
	77943525	Pi 5111 Sm-x 6	Sm-x 6		1700	
	77680333	Pi 3111 Sm-x 10	Sm-x 10		1700	
	77680465	Pi 4111 Sm-x 25	Sm-x 25		1700	
	77680218	Pi 2211 Sm-x vst 3	Sm-x vst 3	210	1275	
	77943558	Pi 5211 Sm-x vst 6	Sm-x vst 6		1275	
	77680390	Pi 3211 Sm-x vst 10	Sm-x vst 10		1275	
	77680523	Pi 4211 Sm-x vst 25	Sm-x vst 25		1275	
	77680903	Pi 8111 Drg 10	Drg 10	20	1700	
	77680937	Pi 8211 Drg 25	Drg 25		1700	
	77680986	Pi 8311 Drg 40	Drg 40		1700	
	77681026	Pi 8411 Drg 60	Drg 60		1080	
	77718778	Pi 8511 Drg 100	Drg 100		1700	
	77718760	Pi 8611 Drg 200	Drg 200		1080	
	77718752	Pi 8711 Drg 300	Drg 300		1080	
	77718745	Pi 8811 Drg 500	Drg 500		1700	
	77741010	Pi 9111 Drg vst 10	Drg vst 10		210	1410
	77689136	Pi 9211 Drg vst 25	Drg vst 25			1410
	77689177	Pi 9311 Drg vst 40	Drg vst 40	1410		
	77689235	Pi 9411 Drg vst 60	Drg vst 60	1410		
	77689284	Pi 9511 Drg vst 100	Drg vst 100	1410		
	77668544	Pi 9611 Drg vst 200	Drg vst 200	1410		
	77668551	Pi 9711 Drg vst 300	Drg vst 300	1410		
	77741028	Pi 9811 Drg vst 500	Drg vst 500	1410		
	76182067	Pi 1011 KS-Mic 25	KS-Mic 25	20		1240
	on request	on request	Sm-N 2			-

* A wider range of element types is available on request.

6.1.2 Filter elements* for in-line filters

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δ p [bar]	Filter surface [cm ²]	
150	77680101	Pi 1115 Mic 10	Mic 10	20	2565	
	77657190	Pi 1015 Mic 25	Mic 25		2565	
	77680168	Pi 2115 Sm-x 3	Sm-x 3		2425	
	77955099	Pi 5115 Sm-x 6	Sm-x 6		2425	
	77680358	Pi 3115 Sm-x 10	Sm-x 10		2425	
	77680473	Pi 4115 Sm-x 25	Sm-x 25		2425	
	77680226	Pi 2215 Sm-x vst 3	Sm-x vst 3		210	2010
	77955123	Pi 5215 Sm-x vst 6	Sm-x vst 6	2010		
	77680408	Pi 3215 Sm-x vst 10	Sm-x vst 10	2010		
	77680531	Pi 4215 Sm-x vst 25	Sm-x vst 25	2010		
	77711120	Pi 8115 Drg 10	Drg 10	20	2250	
	77680945	Pi 8215 Drg 25	Drg 25		2250	
	77680994	Pi 8315 Drg 40	Drg 40		2250	
	77681034	Pi 8415 Drg 60	Drg 60		1575	
	77681083	Pi 8515 Drg 100	Drg 100		2250	
	77711138	Pi 8615 Drg 200	Drg 200		1575	
	77711146	Pi 8715 Drg 300	Drg 300		1575	
	77711153	Pi 8815 Drg 500	Drg 500	2250		
	77741036	Pi 9115 Drg vst 10	Drg vst 10	210	1800	
	77689144	Pi 9215 Drg vst 25	Drg vst 25		1800	
	77689185	Pi 9315 Drg vst 40	Drg vst 40		1800	
	77689243	Pi 9415 Drg vst 60	Drg vst 60		1800	
	77689292	Pi 9515 Drg vst 100	Drg vst 100		1800	
	77741044	Pi 9615 Drg vst 200	Drg vst 200		1800	
	77741051	Pi 9715 Drg vst 300	Drg vst 300		1800	
	77741069	Pi 9815 Drg vst 500	Drg vst 500		1800	
	on request	on request	KS-Mic 25	20	-	
	76373112	Pi 0115 SM-N 2	Sm-N 2		2150	
	300	77680119	Pi 1130 Mic 10	Mic 10	20	4885
		77657208	Pi 1030 Mic 25	Mic 25		4885
77680176		Pi 2130 Sm-x 3	Sm-x 3	4620		
77955107		Pi 5130 Sm-x 6	Sm-x 6	4620		
77680366		Pi 3130 Sm-x 10	Sm-x 10	4620		
77680481		Pi 4130 Sm-x 25	Sm-x 25	4620		
77680234		Pi 2230 Sm-x vst 3	Sm-x vst 3	210		3800
77955131		Pi 5230 Sm-x vst 6	Sm-x vst 6		3800	
77680416		Pi 3230 Sm-x vst 10	Sm-x vst 10		3800	
77680549		Pi 4230 Sm-x vst 25	Sm-x vst 25		3800	
77718810		Pi 8130 Drg 10	Drg 10	20	4280	
77680952		Pi 8230 Drg 25	Drg 25		4280	
77718802		Pi 8330 Drg 40	Drg 40		4280	
77681042		Pi 8430 Drg 60	Drg 60		2975	

* A wider range of element types is available on request.

6.1.2 Filter elements* for in-line filters

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
300	77689078	Pi 8530 Drg 100	Drg 100	20	4280
	77668510	Pi 8630 Drg 200	Drg 200		2975
	77718786	Pi 8730 Drg 300	Drg 300		2975
	77718794	Pi 8830 Drg 500	Drg 500		4280
	77741077	Pi 9130 Drg vst 10	Drg vst 10	210	3400
	77689151	Pi 9230 Drg vst 25	Drg vst 25		3400
	77689193	Pi 9330 Drg vst 40	Drg vst 40		3400
	77689250	Pi 9430 Drg vst 60	Drg vst 60		3400
	77689300	Pi 9530 Drg vst 100	Drg vst 100		3400
	77741085	Pi 9630 Drg vst 200	Drg vst 200		3400
	77741093	Pi 9730 Drg vst 300	Drg vst 300		3400
	77741101	Pi 9830 Drg vst 500	Drg vst 500		3400
	78268625	Pi 1030 KS-Mic 25	KS-Mic 25	20	4190
	77879877	Pi 0130 Sm-N 2	Sm-N 2		4215
	450	77680127	Pi 1145 Mic 10	Mic 10	20
77711161		Pi 1045 Mic 25	Mic 25	7265	
77680184		Pi 2145 Sm-x 3	Sm-x 3	6865	
77955115		Pi 5145 Sm-x 6	Sm-x 6	6865	
77680374		Pi 3145 Sm-x 10	Smx 10	6865	
77680499		Pi 4145 Sm-x 25	Smx 25	6865	
77680242		Pi 2245 Sm-x vst 3	Smx vst 3	210	5600
77955149		Pi 5245 Smx vst 6	Smx vst 6		5600
77680424		Pi 3245 Smx vst 10	Smx vst 10		5600
77680556		Pi 4245 Smx vst 25	Smx vst 25		5600
77711179		Pi 8145 Drg 10	Drg 10	20	6370
77711187		Pi 8245 Drg 25	Drg 25		6370
77681000		Pi 8345 Drg 40	Drg 40		6370
77681059		Pi 8445 Drg 60	Drg 60		4410
77689094		Pi 8545 Drg 100	Drg 100		6370
77725534		Pi 8645 Drg 200	Drg 200		4410
77725559		Pi 8745 Drg 300	Drg 300		4410
77725542		Pi 8845 Drg 500	Drg 500		6370
77741119		Pi 9145 Drg vst 10	Drg vst 10	210	5020
77741127		Pi 9245 Drg vst 25	Drg vst 25		5020
77689201		Pi 9345 Drg vst 40	Drg vst 40		5020
77689268		Pi 9445 Drg vst 60	Drg vst 60		5020
77689318		Pi 9545 Drg vst 100	Drg vst 100		5020
77741135		Pi 9645 Drg vst 200	Drg vst 200		5020
77741143		Pi 9745 Drg vst 300	Drg vst 300		5020
77741150		Pi 9845 Drg vst 500	Drg vst 500		5020
79359746		Pi 1045 KS-Mic 25	KS-Mic 25	20	6230
79337130		Pi 0145 Sm-N 2	Sm-N 2		6260

* A wider range of element types is available on request.

6.2 Type number key and order numbers filter elements for DIN filters

6.2.1 Type number key filter elements acc. DIN 24550 part 3 and part 4

Typ

Pi in-line filter

Filter material

- 1 Mic
- 2 Sm-x
- 3 Drg
- 7 Sm-x vst
- 8 Drg vst

Degree of filtration

- 1 3 µm
- 2 6 µm
- 3 10 µm
- 4 16 µm
- 5 25 µm
- 6 40 µm
- 7 60 µm
- 8 100 µm
- 9 250 µm
- S optionall

Nominal size

- 004 NG 40
- 006 NG 60
- 010 NG 100
- 016 NG 160
- 025 NG 250
- 040 NG 400
- 063 NG 630
- 100 NG 1000

Version

- D pressure filter
- R return line filter

Dichtungswerkstoff

- N NBR
- E EPDM
- F FPM
- P PTFE or PTFE coated
- C CR

Pi 2 5 006 D N Selection example

Optional degree of filtration: the degree of filtration (µm) will be added to the corresponding type designation, e.g. Pi 3S 004 DN 500

6.2.2 Filter elements for in-line filters acc. DIN 24550 part 3

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]	
40	77929698	Pi 13004 DN Mic 10	Mic 10	20	475	
	78260911	Pi 15004 DN Mic 25	Mic 25		475	
	78260929	Pi 21004 DN Sm-x 3	Sm-x 3		475	
	77960859	Pi 22004 DN Sm-x 6	Sm-x 6		475	
	77925571	Pi 23004 DN Sm-x 10	Sm-x 10		475	
	78260937	Pi 24004 DN Sm-x 16	Sm-x 16		475	
	78260945	Pi 25004 DN Sm-x 25	DN Sm-x 25		475	
	78216079	Pi 71004 DN Sm-x vst 3	Sm-x vst 3		210	445
	77960156	Pi 72004 DN Sm-x vst 6	Sm-x vst 6	445		
	77925654	Pi 73004 DN Sm-x vst 10	DN Sm-x vst 10	445		
	78216087	Pi 74004 DN Sm-x vst 16	DN Sm-x vst 16	445		
	78216095	Pi 75004 DN Sm-x vst 25	Sm-x vst 25	445		
	70317774	Pi 33004 DN Drg 10	Drg 10	20		475
	79769308	Pi 35004 DN Drg 25	Drg 25			475
	79704461	Pi 36004 DN Drg 40	Drg 40			475
	76116909	Pi 37004 DN Drg 60	Drg 60		475	
	79703802	Pi 38004 DN Drg 100	Drg 100		475	
	70314654	Pi 39004 DN Drg 250	Drg 250		475	
	76371090	Pi 83004 DN Drg vst 10	Drg vst 10		210	445
	79737461	Pi 85004 DN Drg vst 25	Drg vst 25			445
	78266587	Pi 86004 DN Drg vst 40	Drg vst 40	445		
	79713942	Pi 87004 DN Drg vst 60	Drg vst 60	445		
		on request	Pi 88004 DN Drg vst 100	Drg vst 100		-
	63	77929706	Pi 13006 DN Mic 10	Mic 10	20	835
78260952		Pi 15006 DN Mic 25	Mic 25	835		
78260960		Pi 21006 DN Sm-x 3	Sm-x 3	835		
77960867		Pi 22006 DN Sm-x 6	Sm-x 6	835		
77925589		Pi 23006 DN Sm-x 10	Sm-x 10	835		
78260978		Pi 24006 DN Sm-x 16	Sm-x 16	835		
78260986		Pi 25006 DN Sm-x 25	Sm-x 25	835		
78216137		Pi 71006 DN Sm-x vst 3	Sm-x vst 3	210		780
77960149		Pi 72006 DN Sm-x vst 6	Sm-x vst 6		780	
77925662		Pi 73006 DN Sm-x vst 10	Sm-x vst 10		780	
78216145		Pi 74006 DN Sm-x vst 16	Sm-x vst 16		780	
78216152		Pi 75006 DN Sm-x vst 25	Sm-x vst 25		780	
76362586		Pi 33006 DN Drg 10	Drg 10		20	835
70307615		Pi 35006 DN Drg 25	Drg 25			835
on request		Pi 36006 DN Drg 40	Drg 40			-
on request		Pi 37006 DN Drg 60	Drg 60	-		
76132369		Pi 38006 DN Drg 100	Drg 100	835		
on request		Pi 83006 DN Drg vst 10	Drg vst 10	210		-
on request		Pi 85006 DN Drg vst 25	Drg vst 25			-
on request		Pi 86006 DN Drg vst 40	Drg vst 40			780
70318732		Pi 87006 DN Drg vst 60	Drg vst 60		525	
on request		Pi 88006 DN Drg vst 100	Drg vst 100		780	
76940050		Pi 89006 DN Drg vst 200	Drg vst 250		525	

6.2.2 Filter elements for in-line filters acc. DIN 24550 part 3

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]	
100	77929714	Pi 13010 DN Mic 10	Mic 10	20	1375	
	78260994	Pi 15010 DN Mic 25	Mic 25		1375	
	78227472	Pi 21010 DN Sm-x 3	Sm-x 3		1375	
	77960875	Pi 22010 DN Sm-x 6	Sm-x 6		1375	
	77925597	Pi 23010 DN Sm-x 10	Sm-x 10		1375	
	78261000	Pi 24010 DN Sm-x 16	Sm-x 16		1375	
	78261018	Pi 25010 DN Sm-x 25	Sm-x 25		1375	
	78227480	Pi 71010 DN SM-x vst 3	SM-x vst 3		210	1275
	77960131	Pi 72010 DN Sm-x vst 6	Sm-x vst 6	1275		
	77925670	Pi 73010 DN Sm-x vst 10	Sm-x vst 10	1275		
	78261281	Pi 74010 DN Sm-x vst 16	Sm-x vst 16	1275		
	78216160	Pi 75010 DN Sm-x vst 25	Sm-x vst 25	1275		
	70305610	Pi 33010 DN Drg 10	Drg 10	20		1375
	79735762	Pi 35010 DN Drg 25	Drg 25			1375
	76329098	Pi 36010 DN Drg 40	Drg 40			1375
	76344501	Pi 37010 DN Drg 60	Drg 60		1375	
	79394677	Pi 38010 DN Drg 100	Drg 100		1375	
	76330898	Pi 39010 DN Drg 250	Drg 250		1375	
	on request	Pi 83010 DN Drg vst 10	Drg vst 10		210	1275
	79755877	Pi 85010 DN Drg vst 25	Drg vst 25			1275
	79359886	Pi 86010 DN Drg vst 40	Drg vst 40	1275		
	79714239	Pi 87010 DN Drg vst 60	Drg vst 60	1275		
	on request	Pi 88010 DN Drg vst 100	Drg vst 100	1275		
160	77929722	Pi 13016 DN Mic 10	Mic 10	20	2530	
	78261026	Pi 15016 DN Mic 25	Mic 25		2530	
	78261034	Pi 21016 DN Sm-x 3	Sm-x 3		2530	
	77960826	Pi 22016 DN Sm-x 6	Sm-x 6		2530	
	77925605	Pi 23016 DN Sm-x 10	Sm-x 10		2530	
	78261042	Pi 24016 DN Sm-x 16	Sm-x 16		2530	
	78261059	Pi 25016 DN Sm-x 25	Sm-x 25		2530	
	77940638	Pi 71016 DN Sm-x vst 3	Sm-x vst 3		210	1885
	77960123	Pi 72016 DN Sm-x vst 6	Sm-x vst 6	1885		
	77925688	Pi 73016 DN Sm-x vst 10	Sm-x vst 10	1885		
	78269797	Pi 74016 DN Sm-x vst 16	Sm-x vst 16	1885		
	78216178	Pi 75016 DN Sm-x vst 25	Sm-x vst 25	1885		
	on request	Pi 33016 DN Drg 10	Drg 10	20		2225
	79701954	Pi 35016 DN Drg 25	Drg 25			2225
	79363474	Pi 36016 DN Drg 40	Drg 40			2225
	76111991	Pi 37016 DN Drg 60	Drg 60		2225	
	76371900	Pi 38016 DN Drg 100	Drg 100		2225	
	on request	Pi 83016 DN Drg vst 10	Drg vst 10		210	-
	76940621	Pi 85016 DN Drg vst 25	Drg vst 25			1660
	on request	Pi 86016 DN Drg vst 40	Drg vst 40			-
	on request	Pi 87016 DN Drg vst 60	Drg vst 60	-		
	76371967	Pi 88016 DN Drg vst 100	Drg vst 100	1660		

6.2.2 Filter elements for in-line filters acc. DIN 24550 part 3

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]	
250	77929730	Pi 13025 DN Mic 10	Mic 10	20	4020	
	78261067	Pi 15025 DN Mic 25	Mic 25		4020	
	78227514	Pi 21025 DN Sm-x 3	Sm-x 3		4020	
	77960834	Pi 22025 DN Sm-x 6	Sm-x 6		4020	
	77925613	Pi 23025 DN Sm-x 10	Sm-x 10		4020	
	78261075	Pi 24025 DN Sm-x 16	Sm-x 16		4020	
	78261083	Pi 25025 DN Sm-x 25	Sm-x 25		4020	
	77940646	Pi 71025 DN Sm- x vst 3	Sm- x vst 3		210	3090
	77960115	Pi 72025 DN Sm- x vst 6	Sm- x vst 6	3090		
	77925696	Pi 73025 DN Sm- x vst 10	Sm- x vst 10	3090		
	78269813	Pi 74025 DN Sm- x vst 16	Sm- x vst 16	3090		
	78216186	Pi 75025 DN Sm- x vst 25	Sm- x vst 25	3090		
	on request	Pi 33025 DN Drg 10	Drg 10	-		
	76347199	Pi 35025 DN Drg 25	Drg 25	20		3530
	79736430	Pi 36025 DN Drg 40	Drg 40			3530
	79766882	Pi 37025 DN Drg 60	Drg 60		3530	
	76370514	Pi 38025 DN Drg 100	Drg 100		3530	
	on request	Pi 83025 DN Drg vst 10	Drg vst 10		-	
	on request	Pi 85025 DN Drg vst 25	Drg vst 25		-	
	on request	Pi 86025 DN Drg vst 40	Drg vst 40		-	
	70303520	Pi 87025 DN Drg vst 60	Drg vst 60		3090	
	76106504	Pi 88025 DN Drg vst 100	Drg vst 100	3090		
	400	77929748	Pi 13040 DN Mic 10	Mic 10	20	6770
		78261091	Pi 15040 DN Mic 25	Mic 25		6770
78227522		Pi 21040 DN Sm-x 3	Sm-x 3	6770		
77960842		Pi 22040 DN Sm-x 6	Sm-x 6	6770		
77925621		Pi 23040 DN Sm-x 10	Sm-x 10	6770		
78261109		Pi 24040 DN Sm-x 16	Sm-x 16	6770		
78261117		Pi 25040 DN Sm-x 25	Sm-x 25	6770		
77940653		Pi 71040 DN Sm-x vst 3	Sm-x vst 3	210		5240
77960107		Pi 72040 DN Sm-x vst 6	Sm-x vst 6		5240	
77930829		Pi 73040 DN Sm-x vst 10	Sm-x vst 10		5240	
78269821		Pi 74040 DN Sm-x vst 16	Sm-x vst 16		5240	
78260903		Pi 75040 DN Sm-x vst 25	Sm-x vst 25		5240	
on request		Pi 33040 DN Drg 10	Drg 10		-	
76180749		Pi 35040 DN Drg 25	Drg 25		20	5900
76344949		Pi 36040 DN Drg 40	Drg 40			5900
76114367		Pi 37040 DN Drg 60	Drg 60	3950		
76131809		Pi 38040 DN Drg 60	Drg 100	5900		
on request		Pi 83040 DN Drg vst 10	Drg vst 10	210		4900
on request		Pi 85040 DN Drg vst 25	Drg vst 25			4900
76370803		Pi 86040 DN Drg vst 40	Drg vst 40			4900
78381196		Pi 87040 DN Drg vst 60	Drg vst 60			3300
76180673		Pi 88040 DN Drg vst 100	Drg vst 100		4900	

6.2.2 Filter elements for in-line filters acc. DIN 24550 part 3

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]	
630	77929755	Pi 13063 DN Mic 10	Mic 10	20	9300	
	77961501	Pi 15063 DN Mic 25	Mic 25		9300	
	77961519	Pi 21063 DN Sm-x 3	Sm-x 3		9300	
	77943699	Pi 22063 DN Sm-x 6	Sm-x 6		9300	
	77925639	Pi 23063 DN Sm-x 10	Sm-x 10		9300	
	77961527	Pi 24063 DN Sm-x 16	Sm-x 16		9300	
	77961535	Pi 25063 DN Sm-x 25	Sm-x 25		9300	
	77961543	Pi 71063 DN Sm-x vst 3	Sm-x vst 3		7230	
	77960099	Pi 72063 DN Sm-x vst 6	Sm-x vst 6		7230	
	77925712	Pi 73063 DN Sm-x vst 10	Sm-x vst 10	210	7230	
	77961550	Pi 74063 DN Sm-x vst 16	Sm-x vst 16		7230	
	77961568	Pi 75063 DN Sm-x vst 25	Sm-x vst 25		7230	
	79308107	Pi 33063 DN Drg 10	Drg 10		8685	
	77943707	Pi 35063 DN Drg 25	Drg 25		8685	
	77999154	Pi 36063 DN Drg 40	Drg 40	20	8685	
	77943715	Pi 37063 DN Drg 60	Drg 60		8685	
	77963408	Pi 38063 DN Drg 100	Drg 100		8685	
	79309915	Pi 39063 DN Drg 250	Drg 250		8685	
	1000	77929763	Pi 13100 DN Mic 10		Mic 10	20
77961600		Pi 15100 DN Mic 25	Mic 25	14950		
77961618		Pi 21100 DN Sm-x 3	Sm-x 3	14950		
77943723		Pi 22100 DN Sm-x 6	Sm-x 6	14950		
77925647		Pi 23100 DN Sm-x 10	Sm-x 10	14950		
77961626		Pi 24100 DN Sm-x 16	Sm-x 16	14950		
77961634		Pi 25100 DN Sm-x 25	Sm-x 25	14950		
77961642		Pi 71100 DN Sm-x vst 3	Sm-x vst 3	210	11700	
77960081		Pi 72100 DN Sm-x vst 6	Sm-x vst 6		11700	
77925720		Pi 73100 DN Sm-x vst 10	Sm-x vst 10		11700	
77961659		Pi 74100 DN Sm-x vst 16	Sm-x vst 16		11700	
77961667		Pi 75100 DN Sm-x vst 25	Sm-x vst 25		11700	
on request		Pi 33100 DN Drg 10	Drg 10	20	14000	
77943731		Pi 35100 DN Drg 25	Drg 25		14000	
78229569		Pi 36100 DN Drg 40	Drg 40		14000	
77943749		Pi 37100 DN Drg 60	Drg 60		14000	
77977465		Pi 38100 DN Drg 100	Drg 100		14000	
78264095		Pi 39100 DN Drg 250	Drg 250		14000	

6.2.3 Filter elements for tank top return line filters acc. DIN 24550 part 4

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
40	77925001	Pi 13004 RN Mic 10	Mic 10	10	900
	77962210	Pi 15004 RN Mic 25	Mic 25		900
	77923998	Pi 21004 RN Sm-x 3	Sm-x 3		820
	77964034	Pi 22004 RN Sm-x 6	Sm-x 6		820
	77924004	Pi 23004 RN Sm-x 10	Sm-x 10		820
	77962244	Pi 24004 RN Sm-x 16	Sm-x 16		820
	77960206	Pi 25004 RN Sm-x 25	Sm-x 25		820
	on request	Pi 33004 RN Drg 10	Drg 10		-
	77962277	Pi 35004 RN Drg 25	Drg 25		520
	77999394	Pi 36004 RN Drg 40	Drg 40		520
	77962301	Pi 37004 RN Drg 60	Drg 60		520
	on request	Pi 38004 RN Drg 100	Drg 100		-
63	77925019	Pi 13006 RN Mic 10	Mic 10	10	1585
	77962228	Pi 15006 RN Mic 25	Mic 25		1585
	77924012	Pi 21006 RN Sm-x 3	Sm-x 3		1445
	77964042	Pi 22006 RN Sm-x 6	Sm-x 6		1445
	77924020	Pi 23006 RN Sm-x 10	Sm-x 10		1445
	77962251	Pi 24006 RN Sm-x 16	Sm-x 16		1445
	77960214	Pi 25006 RN Sm-x 25	Sm-x 25		1445
	76345326	Pi 33006 RN Drg 10	Drg 10		-
	77962285	Pi 35006 RN Drg 25	Drg 25		915
	77999402	Pi 36006 RN Drg 40	Drg 40		915
	77962319	Pi 37006 RN Drg 60	Drg 60		915
	78266520	Pi 38006 RN Drg 100	Drg 100		915
100	77925027	Pi 13010 RN Mic 10	Mic 10	10	2610
	77962236	Pi 15010 RN Mic 25	Mic 25		2610
	77924038	Pi 21010 RN Sm-x 3	Sm-x 3		2380
	77940844	Pi 22010 RN Sm-x 6	Sm-x 6		2380
	77924046	Pi 23010 RN Sm-x 10	Sm-x 10		2380
	77962269	Pi 24010 RN Sm-x 16	Sm-x 16		2380
	77960222	Pi 25010 RN Sm-x 25	Sm-x 25		2380
	on request	Pi 33010 RN Drg 10	Drg 10		-
	77962293	Pi 35010 RN Drg 25	Drg 25		1510
	77999410	Pi 36010 RN Drg 40	Drg 40		1510
	77962327	Pi 37010 RN Drg 60	Drg 60		1510
	78298226	Pi 38010 RN Drg 100	Drg 100		1510
160	77925035	Pi 13016 RN Mic 10	Mic 10	10	3750
	77963598	Pi 15016 RN Mic 25	Mic 25		3750
	77924137	Pi 21016 RN Sm-x 3	Sm-x 3		3750
	77964067	Pi 22016 RN Sm-x 6	Sm-x 6		3750
	77924145	Pi 23016 RN Sm-x 10	Sm-x 10		3750
	77963648	Pi 24016 RN Sm-x 16	Sm-x 16		3750
	77960230	Pi 25016 RN Sm-x 25	Sm-x 25		3750
	on request	Pi 33016 RN Drg 10	Drg 10		-
	77963697	Pi 35016 RN Drg 25	Drg 25		2020
	77999428	Pi 36016 RN Drg 40	Drg 40		2020
	77963747	Pi 37016 RN Drg 60	Drg 60		2020
	on request	Pi 38016 RN Drg 100	Drg 100		-

6.2.3 Filter elements for tank top return line filters acc. DIN 24550 part 4

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
250	77925043	Pi 13025 RN Mic10	Mic 10	10	6050
	77963606	Pi 15025 RN Mic 25	Mic 25		6050
	77924152	Pi 21025 RN Sm-x 3	Sm-x 3		6050
	77964075	Pi 22025 RN Sm-x 6	Sm-x 6		6050
	77924160	Pi 23025 RN Sm-x 10	Sm-x 10		6050
	77963655	Pi 24025 RN Sm-x 16	Sm-x 16		6050
	77960248	Pi 25025 RN Sm-x 25	Sm-x 25		6050
	on request	Pi 33025 RN Drg 10	Drg 10		-
	77963705	Pi 35025 RN Drg 25	Drg 25		3250
	77999436	Pi 36025 RN Drg 40	Drg 40		3250
	77963754	Pi 37025 RN Drg 60	Drg 60		3250
	79335746	Pi 38025 RN Drg 100	Drg 100		3250
400	77925050	Pi 13040 RN Mic 10	Mic 10	10	9450
	77963614	Pi 15040 RN Mic 25	Mic 25		9450
	77924178	Pi 21040 RN Sm-x 3	Sm-x 3		8250
	77964083	Pi 22040 RN Sm-x 6	Sm-x 6		8250
	77924186	Pi 23040 RN Sm-x 10	Sm-x 10		8250
	77963663	Pi 24040 RN Sm-x 16	Sm-x16		8250
	77960255	Pi 25040 RN Sm-x 25	Sm-x 25		8250
	on request	Pi 33040 RN Drg 10	Drg 10		-
	77963713	Pi 35040 RN Drg 25	Drg 25		6370
	77999444	Pi 36040 RN Drg 40	Drg 40		6370
	77963762	Pi 37040 RN Drg 60	Drg 60		6370
	78267833	Pi 38040 RN Drg 100	Drg 100		6370
	79335894	Pi 39040 RN Drg 250	Drg 250		6370
	630	77925068	Pi 13063 RN Mic 10		Mic 10
77963622		Pi 15063 RN Mic 25	Mic 25	15550	
77924194		Pi 21063 RN Sm-x 3	Sm-x 3	13515	
77964091		Pi 22063 RN Sm-x 6	Sm-x 6	13515	
77924202		Pi 23063 RN Sm-x 10	Sm-x 10	13515	
77963671		Pi 24063 RN Sm-x 16	Sm-x 16	13515	
77960263		Pi 25063 RN Sm-x 25	Sm-x 25	13515	
on request		Pi 33063 RN Drg 10	Drg 10	-	
77963721		Pi 35063 RN Drg 25	Drg 25	10320	
77999451		Pi 36063 RN Drg 40	Drg 40	10320	
77963770		Pi 37063 RN Drg 60	Drg 60	10320	
78264459		Pi 38063 RN Drg 100	Drg 100	10320	
79309253		Pi 39063 RN Drg 250	Drg 250	10320	

6.2.3 Filter elements for tank top return line filters acc. DIN 24550 part 4

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
1000	77925076	Pi 13100 RN Mic 10	Mic 10	10	18335
	77963630	Pi 15100 RN Mic 25	Mic 25		18335
	77924210	Pi 21100 RN Sm-x 3	Sm-x 3		18335
	77964109	Pi 22100 RN Sm-x 6	Sm-x 6		18335
	77924228	Pi 23100 RN Sm-x 10	Sm-x 10		18335
	77963689	Pi 24100 RN Sm-x 16	Sm-x 16		18335
	77960271	Pi 25100 RN Sm-x 25	Sm-x 25		18335
	on request	Pi 33100 RN Drg 10	Drg 10		-
	77963739	Pi 35100 RN Drg 25	Drg 25		14210
	77999469	Pi 363100 RN Drg 40	Drg 40		14210
	77963788	Pi 37100 RN Drg 60	Drg 60		9590
	78299174	Pi 38100 RN Drg 250	Drg 100		14210

6.3 Filter elements 852 xxx series

6.3.1 Filter elements 852 xxx series

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]	Field of use
5	77684566	852 149	Mic 10	20	190	Pi 4301
	77684582		Mic 25		190	
	on request		Sm-N 2		-	
	77684632		Sm-x 3		165	
	on request		Sm-x 6		-	
	77684640		Sm-x 10		165	
	77684665		Sm-x 25		165	
5	77684681	852 149	Sm-x vst 3	160	150	Pi 4301
	on request		Sm-x vst 6		-	
	77684699		Sm-x vst 10		150	
	77684715		Sm-x vst 25		150	
5	77684343	852 149	Drg 10	20	165	Pi 4301
	77684368		Drg 25		165	
	77684384		Drg 40		165	
	77684400		Drg 60		165	
	77684525		Drg 100		165	
	77856990		Drg 200		165	
	on request		Drg 250		-	
	77857014		Drg 500		165	
5	77684434	852 149	Drg vst 10	160	150	Pi 4301
	77684459		Drg vst 25		150	
	77684475		Drg vst 40		150	
	77684483		Drg vst 60		150	
	77684509		Drg vst 100		150	

6.3.1 Filter elements 852 xxx series

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]	Field of use
20	77685340	852 243	Mic 10	20	360	Pi 41002
	77685373		Mic 25		360	
	on request		Sm-N 2		-	
	77685407		Sm-x 3		305	
	78216038		Sm-x 6		305	
	77740327		Sm-x 10		305	
	78216053		Sm-x 16		305	
	77685415		Sm-x 25		305	
20	77685423	852 243	Sm-x vst 3	160	275	Pi 41002
	78216046		Sm-x vst 6		275	
	77685431		Sm-x vst 10		275	
	78216061		Sm-x vst 16		275	
	77685449		Sm-x vst 25		275	
20	77740301	852 243	Drg 10	20	305	Pi 41002
	77685316		Drg 25		305	
	on request		Drg 40		-	
	77685324		Drg 60		305	
	77740319		Drg 100		305	
	77872625		Drg 200		305	
	on request		Drg 300		-	
	on request		Drg 500		-	
20	77740822	852 243	Drg vst 10	160	275	Pi 41002
	77740830		Drg vst 25		275	
	on request		Drg vst 40		-	
	77685332		Drg vst 60		275	
	77740848		Drg vst 100		275	
35	78309387	852 939	Mic 10	5	870	Pi 53003
	78206781		Mic 25		870	
35	77699705	852 588	Mic 10	10	920	Pi 53003
	78206328		Mic 25		920	
	79312117		Sm-x 3		650	
	79355595		Sm-x 6		650	
	79312125		Sm-x 10		650	
	on request		Sm-x 16		-	
	79312133		Sm-x 25		650	
	79353509		Drg 25		590	
	77696065		Drg 100		590	
50	78309205	852 940	Mic 10	5	1100	Pi 53005
	79312299		Mic 25		1100	
50	79312158	852 945	Sm-x 3	10	810	Pi 53005
	on request		Sm-x 6		-	
	79312166		Sm-x 10		810	
	on request		Sm-x 16		-	
	79312174		Sm-x 25		810	
	79362690		Drg 25		750	

6.3.1 Filter elements 852 xxx series

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]	Field of use
50	77675903	852 275	Mic 10	5	27000	Pi 1975
	77675911		Mic 25		27000	
	79735952		KS-Mic 25		18150	
	79309303		Sm-N 2		13150	
	77956220		Sm-x 3		15500	
	on request		Sm-x 6		-	
	77725583		Sm-x 10		15500	
	on request		Sm-x 16		-	
	on request		Sm-x 25		-	
	on request		Drg 10		-	
	77678048		Drg 25		14000	
	77910011		Drg 40		14000	
	on request		Drg 60		-	
	77678097		Drg 100		14000	
	on request		Drg 200		-	
	79747114		Drg 250		14000	
on request	Drg 500	-				
80	77729338	852 753	Mic 10	*	5700	Pi 1607
	77729429		Mic 25		5700	
	77729551		Sm-x 10		3750	
	77729577		Sm-x 25		3750	
	77998388		Drg 10		2300	
	on request		Drg 25		-	
	77729460		Drg 40		2300	
	77862345		Drg 60		2300	
	77729486		Drg 100		2300	
	on request		Drg 250		-	
	on request		Drg 500		-	
	100		77729387		852 754	
77729445		Mic 25	15850			
77730179		Sm-x 10	10400			
77730195		Sm-x 25	10400			
on request		Drg 10	-			
on request		Drg 25	-			
77729510		Drg 40	6250			
77862352		Drg 60	6250			
77729528		Drg 100	6250			
on request		Drg 250	-			
on request		Drg 500	-			

6.3.1 Filter elements 852 xxx series

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]	Field of use
160	77874514	852 821	Mic 10	*	16750	Pi 1620
	77874522		Mic 25		16750	
	77999089		Sm-x 10		11000	
	77874530		Sm-x 25		11000	
	on request		Drg 10		-	
	on request		Drg 25		-	
	on request		Drg 40		-	
	77874548		Drg 60		6650	
	77874555		Drg 100		6650	
	78376238		Drg 250		6650	
	on request		Drg 500		-	
400	77774441	852 760	Mic 10	5	23800	Pi 1535
	77806581		Mic 25		23800	
	79364407		KS-Mic 25		19000	
	77955859		Sm-N 2		16000	
400	77774433	852 760	Sm-x 3	10	14500	Pi 1535
	78299042		Sm-x 6		14500	
	77774425		Sm-x 10		14500	
	77806565		Sm-x 25		14500	
	on request		Drg 10		-	
	77936594		Drg 25		11680	
	on request		Drg 40		-	
	78367682		Drg 60		11680	
	77914773		Drg 100		11680	
	on request		Drg 250		-	
	79336785		Drg 500		11680	
630	77774409	852 761	Mic 10	5	47600	Pi 1560
	77806599		Mic 25		47600	
	79364134		KS-Mic 25		38000	
	78375867		Sm-N 2		38000	
630	on request	852 761	Sm-N 2	10	-	Pi 1560
	77774391		Sm-x 3		29000	
	78225898		Sm-x 6		29000	
	77774383		Sm-x 10		29000	
	77806573		Sm-x 25		29000	
	on request		Drg 10		-	
	78269938		Drg 25		23360	
	79376542		Drg 40		23360	
	78264574		Drg 60		23360	
	77896913		Drg 100		23360	
	78379653		Drg 250		23360	
	77974629		Drg 500		23360	

* Suction filters; flow direction from inside to outside

6.3.1 Filter elements 852 xxx series

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]	Field of use
800	76113369	852 014	Mic 10	20	26440	Pi 23040
	76113385		Mic 25		26440	
	76113401		KS-Mic 25		22690	
	76136220		Sm-N 2		18533	
	76321830		Sm-x 3		24830	
	76321822		Sm-x 6		24830	
	76321814		Sm-x 10		24830	
	76321806		Sm-x 25		24830	
	on request		Drg 10		-	
	70367987		Drg 25		21860	
	on request		Drg 40		-	
	on request		Drg 60		-	
	on request		Drg 100		-	
	70367986		Drg 250		14350	
	on request		Drg 500		-	
1250	78207664	852 888	Mic 10	10	21850	Pi 1907 Pi 281
	78226839		Mic 25		21850	
	76111371		KS-Mic 25		20100	
	76114979		Sm-N 2		14000	
	78263295		Sm-x 3		21850	
	78354029		Sm-x 6		21850	
	78226813		Sm-x 10		21850	
	78226821		Sm-x 25		21850	
	on request		Drg 10		-	
	78228017		Drg 25		16500	
	78228025		Drg 40		16500	
	78303026		Drg 60		16500	
	78228470		Drg 100		16500	
	78382772		Drg 250		16500	
	79337148		Drg 500		16500	
1400	76113427	852 015	Mic 10	20	60900	Pi 23080
	76113443		Mic 25		60900	
	76345995		KS-Mic 25		52250	
	76136212		Sm-N 2		42275	
	76321897		Sm-x 3		57200	
	76321889		Sm-x 6		57200	
	76321871		Sm-x 10		57200	
	76321863		Sm-x 25		57200	
	on request		Drg 10		-	
	70341663		Drg 25		51450	
	76940290		Drg 40		51450	
	70360020		Drg 60		34242	
	76919666		Drg 100		51450	
	on request		Drg 200		-	
	on request		Drg 250		-	
	on request		Drg 500		-	

6.3.1 Filter elements 852 xxx series

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]	Field of use
1800	70366315	852 884	Mic 10	10	-	Pi 1907 Pi 281
	78267171		Mic 25		28500	
	on request		KS-Mic 25		-	
	79715434		Sm-N 2		23450	
	78227431		Sm-x 3		28500	
	79337916		Sm-x 6		28500	
	78226797		Sm-x 10		28500	
	78375925		Sm-x 16		28500	
	78226805		Sm-x 25		28500	
	on request		Drg 10		-	
	79337460		Drg 25		23450	
	78261653		Drg 40		23450	
	79700402		Drg 60		23450	
	79327750		Drg 100		23450	
	78367393		Drg 250		23450	
	78376204		Drg 500		23450	

7. When should the filter element be replaced?

- Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced after the end of the shift.
- Filters without maintenance indicator:
The filter element should be replaced after the trial run or flushing of the system. Afterwards follow instructions of the manufacturer.
- Please always ensure that you have original MAHLE spare elements in stock. Disposable elements (Mic, KS-Mic and Sm-x) cannot be cleaned.

8. Possibilities of cleaning wire gauge elements

1. Ultrasonic cleaning

Immerse contaminated filter element into the ultrasonic bath for approx. 90 – 120 minutes, then flush with clean solvent. Then carefully blow out filter element from the clean side in outward direction using compressed air. As solvent, cleaning gasoline etc. may be used.

2. Manual cleaning

Only for degree of filtration $\geq 40 \mu\text{m}$.

- Remove coarse external dirt with a brush or similar tool in a separate cleaning container filled with solvent such as cleaning gasoline.
- Put filter element into a clean liquid solvent (approx. 20 minutes).
- Flush filter element with liquid solvent from inside to outside.
- Blow out filter element from the clean side in outward direction using compressed air.

With either method ascertain that no dirt can deposit on the inside (clean side) of the filter element. Further it needs to be considered that the element will not be damaged because of proper handling. An entire cleaning (100 %) cannot be achieved (especially at a grade of filtration $\leq 25 \mu\text{m}$). The service life of the element will decrease continuously per cleaning!

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70373334.09/2008

Coalescer Filter PiW 1975

1. Description

The Coalescer filter has been specially designed to separate water from hydraulic fluids.

According to VDMA standard sheet 24568, the amount of water in HE pressure fluids has to be kept below 1000 ppm (0.1 %). HLP fluids should not contain any free water at all. Free water always causes turbidity which can be seen by the human eye. Physically, turbidity is a two-phase mixture (emulsion) in which small droplets of water are present in the pressure fluid. For this reason, it is advisable to carry out a mechanical separation of these water droplets; this technique is based on the coalescer - principle. The droplets are collected in various layers and brought together into larger units. The water drops thus formed are several millimetres in diameter.

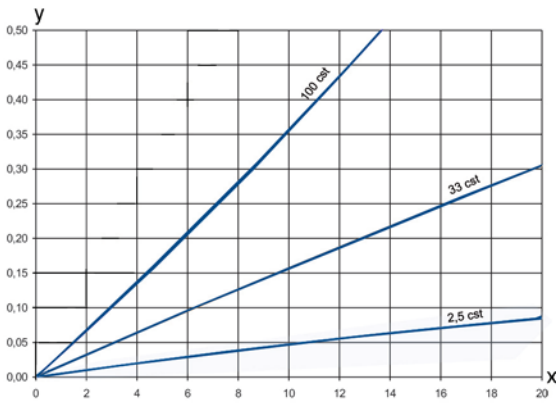
After leaving the coalescer layer, the drops come in contact with a special hydrophobic fabric, where the separation from the pressure fluid takes place. The water is removed from the circuit by means of sedimentation. It is important that a certain differential pressure is not exceeded during the process. The viscosity also needs to be taken into account to ensure proper operation. The maximum viscosity for effective water separation is approx. 68 mm²/s. The coalescer works best if the pressure fluids contain a minimal amount of emulsifying additives. The bottom line: in systems that are frequently at risk for water ingress, expensive special oils can be replaced by simple, cost-effective pressure fluids.

Characteristics:

- Mechanical separation of water droplets - coalescer principle
- Water removing by means of sedimentation
- Expensive special oils can be replaced by simple, cost-effective pressure fluids
- Worldwide distribution

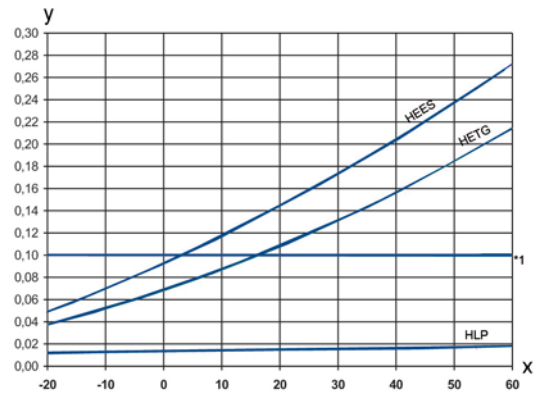


2. Flow rate



y = differential pressure in bar
x = flow rate in l/min

3. Water solubility



X = temperature [°C]
y = water solubility

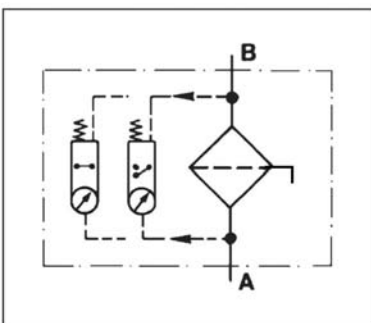
1* VDMA-threshold

4. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 2923	Hydraulic fluid power filter elements; method for end load test
DIN ISO 2924	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power filters; evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters; multipass method for evaluation filtration performance of a filter element

5. Symbols



6. Order number

Housing Design	Spare parts
complete with visual/electrical indicator, demister and coalescer element Type: PiW 1975/E-Coalescer Order number: 76334031	Type: 853 275 Coalescer Order number: 76345300

7. Technical specifications

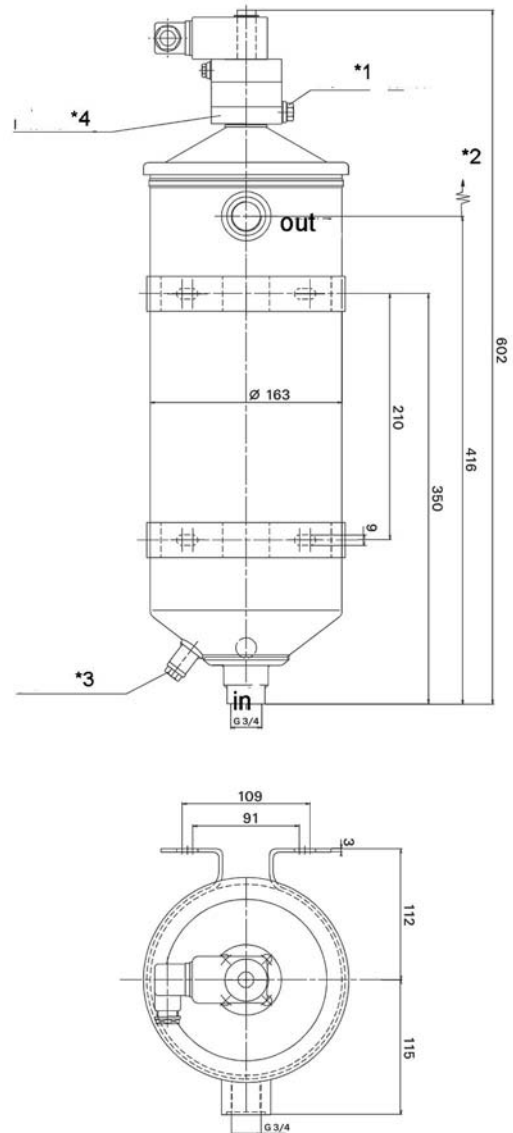
Design:	line mounting filter
Nominal pressure:	6 bar (90 psi)
Test pressure:	8 bar (110 psi)
Temperature range:	-10 °C to +80 °C (other temperature ranges on request)
Filter housing material:	St
Sealing material:	NBR/Cu
Maintenance indicator setting:	Δp 1.2 bar \pm 0.2 bar
Electrical data of maintenance indicator:	
Maximum voltage:	250 V AC/200 V DC
Maximum current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M 20 x 1.5

The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

Subject to technical alteration without prior notice.



- *1 vent screw
- *2 extension degree 400
- *3 drain screw G 1/2 drawn 90° shifted
- *4 SW 36 for filter maintenance

Weight 8 kg

8. Installation, operating and maintenance instructions

8.1 Filter installation

When installing filter make sure that sufficient space is available to remove filter element.

Install filter vertical so that the separated water can flow down and can be discharged.

8.2 Connecting the electrical maintenance indicator

The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803, with poles marked 1 and 2. The electrical section can be inverted to change from normally open to normally closed position and vice versa.

8.3 Operating instruction

The max. viscosity for an effective water separation should not exceed 68 mm²/s. The coalescer should run with a differential pressure of approx. 0.3 bar, that means that the volumetric flow is determined by the viscosity of the oil. To prevent premature contamination of the coalescer, a protective filter with a retention rate of $\beta_{7(C)} \geq 200$ should be installed before the coalescer, because the coalescer element is so fine and therefore very sensitive to dirt. In order to recognise the separated water, a transparent water-detection device with a tap should be mounted to the cone of the filter housing.

8.4 When does the coalescer element need to be replaced?

A differential pressure indicator with a switching level of Δp 1.2 bar is mounted at the top of the filter housing. As already mentioned above, the filter should run at Δp of approx. 0.3 bar. During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the coalescer must be replaced after the end of the shift.

Remark: Please note permissible operating pressure of the housing.

8.5 Replacing the coalescer element

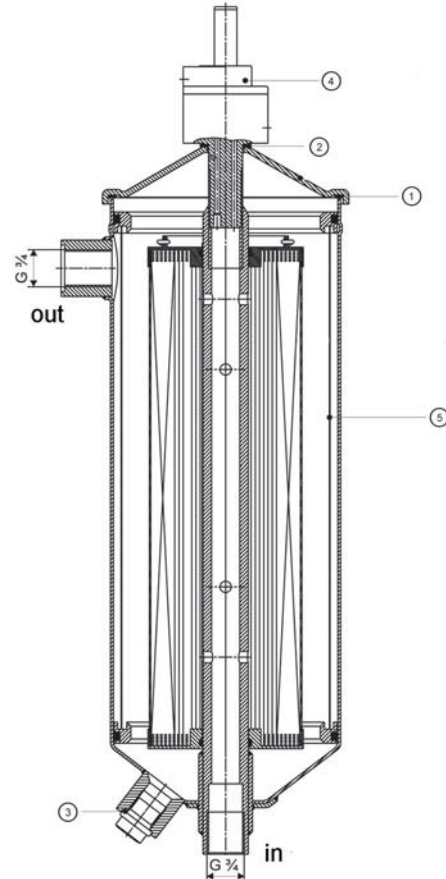
Before an element can be replaced, the entire system needs to be shut down and the filter released from the pressure. Use the water tap to empty the housing. The differential pressure indicator (1) also serves as a cover screw which needs to be removed to take off the cover (2). Remove the coalescer element (3) from the housing. The separator only needs to be replaced, if it is damaged.

Push a new coalescer element over the centre pipe in the housing. Check seals in the lid-cover for possible damages, replace if necessary.

Place the top cover back on top of the housing and tighten it together with the differential pressure indicator.

Close the water tap.

The venting of the filter will be accomplished by the vent screw on the Δp indicator. Please unscrew the vent screw 1-2 turn until fluid emerge. Tight vent screw.



9. Spare parts list

Order number for spare parts		
Position	Type	Order number
① - ②	Seal kit for housing	
	NBR	76375364
④	Maintenance indicator	
	Visual PiS 3111/1,2	76375372
	Electrical PiS 3114/1,2	76375380
	Electrical upper section only	77536550
	Seal kit for maintenance indicator	
	NBR	78389280
⑤	Demister	76333876

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Water Separator PiW 2075

1. Features

The Coalescer filter has been specially designed to separate water from hydraulic fluids.

According to VDMA standard sheet 24568, the amount of water in HE pressure fluids has to be kept below 1000 ppm (0.1 %). HLP fluids should not contain any free water at all. Free water always causes turbidity which can be seen by the human eye. Physically, turbidity is a two-phase mixture (emulsion) in which small droplets of water are present in the pressure fluid. For this reason, it is advisable to carry out a mechanical separation of these water droplets; this technique is based on the coalescer - principle. The droplets are collected in various layers and brought together into larger units. The water drops thus formed are several millimetres in diameter.

After leaving the coalescer layer, the drops come in contact with a special hydrophobic fabric, where the separation from the pressure fluid takes place. The water is removed from the circuit by means of sedimentation. It is important that a certain differential pressure is not exceeded during the process. The viscosity also needs to be taken into account to ensure proper operation. The maximum viscosity for effective water separation is approx. 68 mm²/s. The coalescer works best if the pressure fluids contain a minimal amount of emulsifying additives. The bottom line: in systems that are frequently at risk for water ingress, expensive special oils can be replaced by simple, cost-effective pressure fluids.

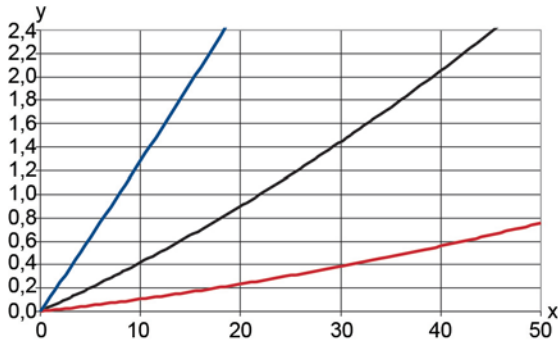
Characteristics:

- Mechanical separation of water droplets - coalescer principle
- Water removing by means of sedimentation
- Expensive special oils can be replaced by simple, cost-effective pressure fluids
- Worldwide distribution



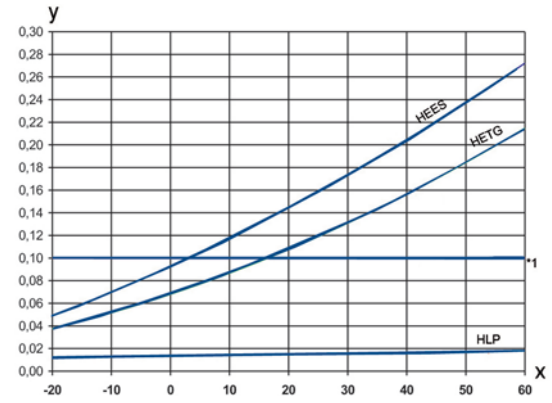
2. Flow rate

— 500 mm²/s
— 190 mm²/s
— 33 mm²/s



y = differential pressure in bar
 x = flow rate in l/min

3. Water solubility



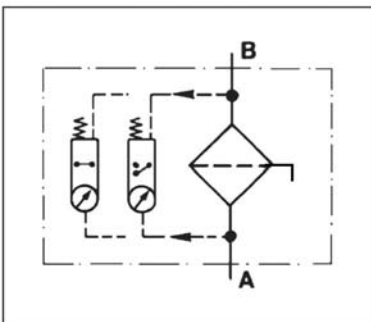
x = temperature in °C
 y = water solubility
 *1 VDMA-threshold

4. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 2923	Hydraulic fluid power filter elements; method for end load test
DIN ISO 2924	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power filters; evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters; multipass method for evaluation filtration performance of a filter element

5. Symbol



6. Order numbers

Example for ordering filters:

1. Filter housing	2. Filter element
complete with visual/electrical maintenance indicator, droplet separator and coalescer element Type: PiW 2075 Order number: 70306850	Type: KE 2629 E1 COA Order number: 76361281

7. Technical specifications

Design:	in-line filter
Nominal pressure:	6 bar (87 psi)
Test pressure:	8 bar (116 psi)
Temperature range:	-10 °C to +80 °C (other temperature ranges on request)
Filter housing material:	Alu
Sealing material:	NBR/Cu
Water collection chamber:	approx. 2 l
Maintenance indicator setting:	Δp 1.2 bar \pm 0.2 bar
Electrical data of maintenance indicator:	
Max. voltage:	250 V AC/200 V DC
Max. current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M20x1.5

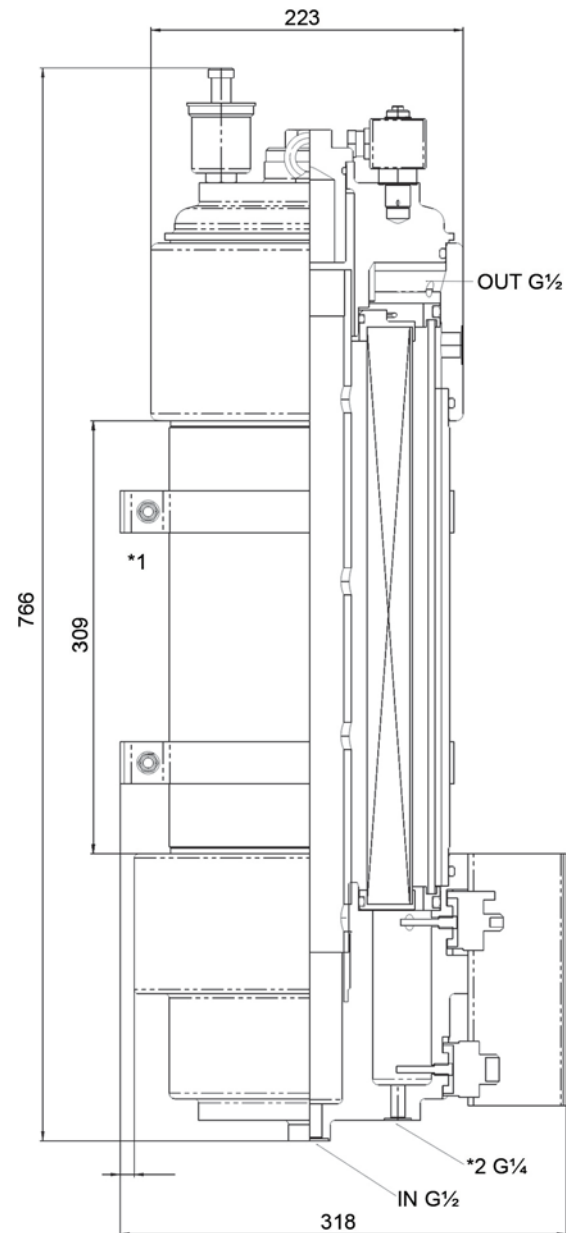
The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet.

We draw attention to the fact that all values indicated are average values and do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

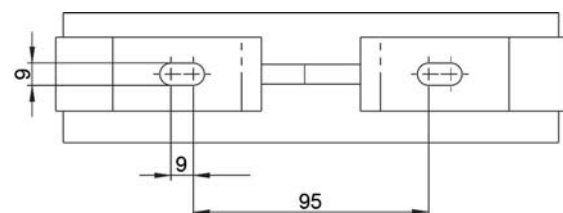
Subject to technical alteration without prior notice.

8. Dimensions



*1 holder adjustable

*2 water drain screw G $\frac{1}{4}$



holder dimensions

9. Installation, operating and maintenance instructions

9.1 Filter installation

When installing the filter make sure that sufficient space is available to remove filter element and filter housing.

Install filter vertical so that the separated water can flow down and can be discharged.

9.2 Connecting the electrical maintenance indicator

The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

9.3 Operating instruction

The max. viscosity for an effective water separation should not exceed 68 mm²/s. The coalescer should run with a differential pressure of approx. 0.3 bar, that means that the volumetric flow is determined by the viscosity of the oil. The separated water will be collected in the PiW 2075 (max. 2 l). The Water can be discharged automatically by using the water level sensor KW 9/1. In order to recognize the separated water, a transparent water-detection device with a tap or so called warning indicator should be mounted.

Remark: Please note permissible operating pressure of the housing.

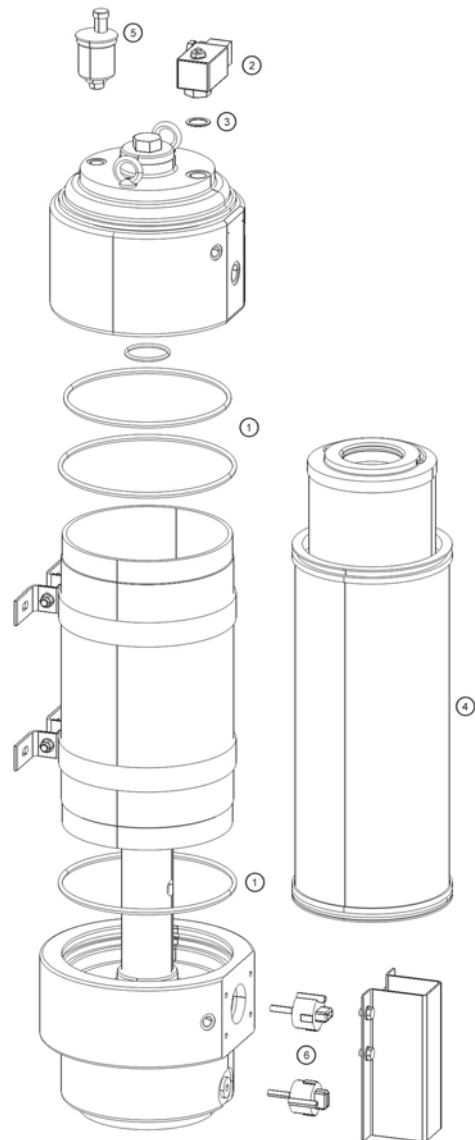
9.4 When should the coalescer element be replaced?

A differential pressure indicator with a switching level of Δp 1.2 bar is mounted at the top of the filter housing. During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the coalescer must be replaced after the end of the shift. As already mentioned above, the filter should run at Δp of approx. 0.3 bar. The flow rate/pressure drop curves show the flow rates according to the viscosity. If the indicator may give a warning signal, the coalescer element have to be changed.

9.5 Element replacement

Stop system and relieve filter from pressure. Use the water tap to empty the housing. Unscrew the cover and change the coalescer element. Check seals in the lid-cover for possible damages, replace if necessary. Place the top cover back on top of the housing and tighten it. Close the water tap.

The venting will start automatically at the 10 bar version by the air release valve (the black protecting cap have to be opened 2 turn).



10. Spare parts list

Order numbers of spare parts		
Position	Type	Order number
①	Seal kit for filter housing	
	NBR	70365435
②	Maintenance indicator	
	Visual PiS 3111/1,2	77669971
	Electrical PiS 3114/1,2	79764028
	Electrical upper section only	79764036
③	Seal kit for maintenance indicator	
	NBR	77760309
④	Droplet separator	70318050
⑤	Air-release valve	79352519
⑥	Water level sensor KW 9/1	76607030

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Turbidity Sensor PiT 400

1. Description

The MAHLE Turbidity Sensor PiT 400 was developed to reliably identify turbidity in hydraulic fluids.

Ingress of water into the hydraulic system causes turbidity in the hydraulic fluid:

Water in hydraulic fluids can harm the function of the entire system and reduce the life span of the pressure fluid and the system's components.

Turbidity in the fluid is quickly recognised by the sensor, so that precautionary measures can be taken before a failure of the system occurs. Therefore the sensor offers great security for the entire system. The sensor should be installed in all fluid systems that are at risk of being contaminated by water, e.g. by defect coolers, broken seals or condensed water.

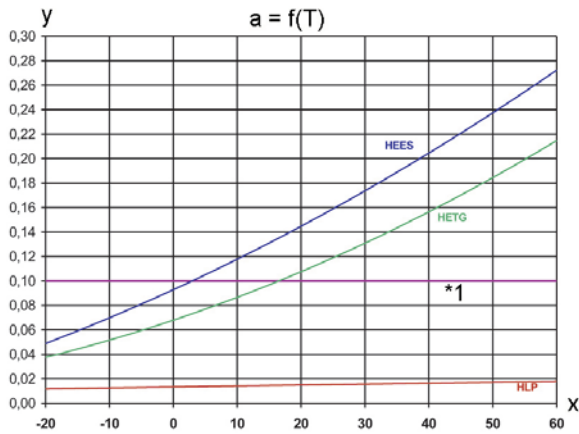
The sensor should preferably be installed in the return line, the tank or the bypassing oil cooling. It can be easily calibrated to the normal condition of the fluid by the push of a button.

The sensor measures the reduction of emitted IR-light caused by turbidity.

The range of applications covers all HLP-, HEES- and HETG - fluids.



2. Water solubility



Water solubility of different hydraulic fluids determined by the temperature.

*1 VDMA-threshold

x = temperature T [°C]

y = water content [%]

4. Specifications

Materials:	CuZn, PA
Type of protection:	IP 65
Connection:	G 1¼
Nominal pressure:	10 bar
Operating temperature:	-25 °C to 85 °C
Signal suppression:	< 0 °C
Connection plug:	M12x1plug, 4pole
Power supply:	24 V DC 20 %
Switching outlet:	PNP, 200 mA
Signal delay:	60 s

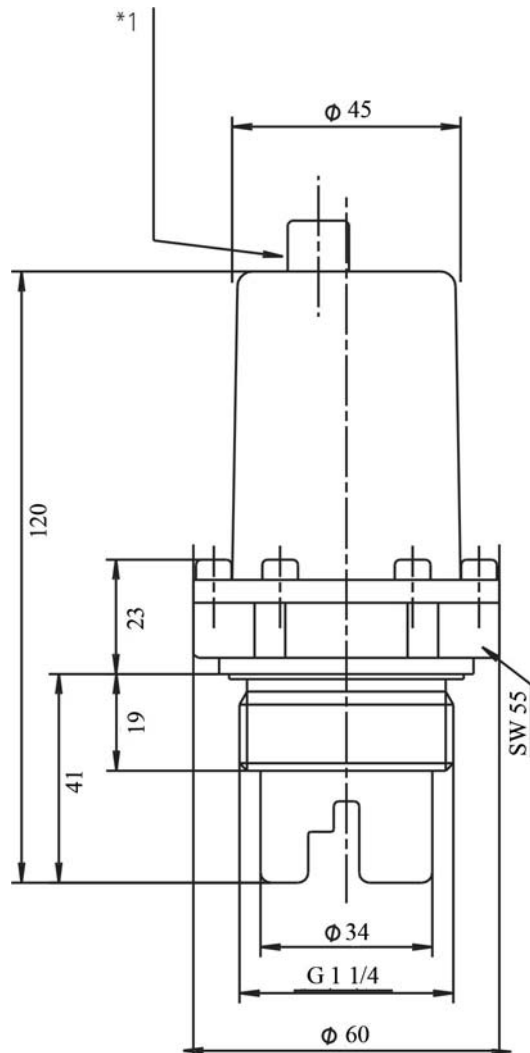
5. Order number

Type number	Order number
PiT 400	76322598

Subject to technical alteration without prior notice.

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3. Dimensions



*1 M12x1 plug, 4 pole



Mobile Filter Units

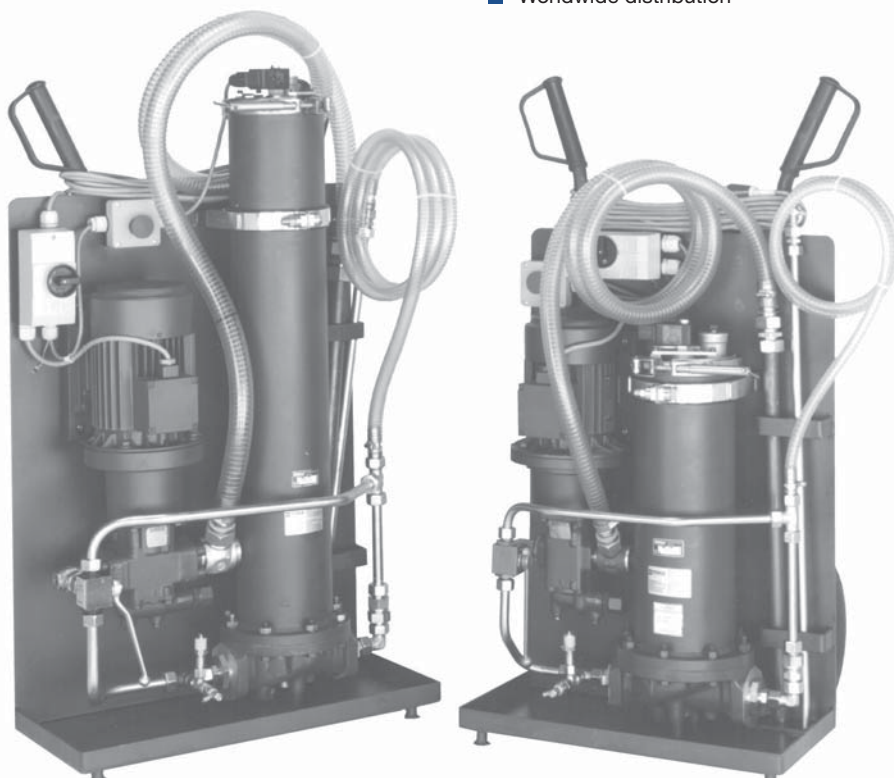
Pi 8100

Flow rates 27/32 and 55/66 l/min

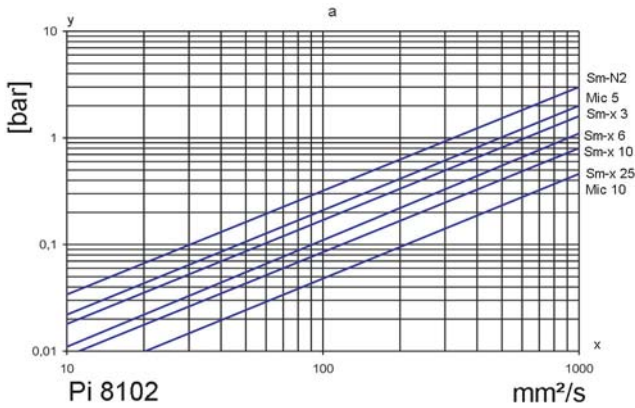
1. Features

High performance filters for modern hydraulic systems

- Mobile bypass filtration for hydraulic and lubricating systems
- System and container filling
- Pumping out of old oil
- Transfer pumping of container contents
- Reduces dirt loading of system filters on start-up and following repairs
- Achievement of specified cleanliness classes using MAHLE Sm-x filter elements
- Excellent contamination absorption performance using MAHLE Sm-N 2 filter elements
- MAHLE low pressure filter Pi 150 housing with quick-release cover for fast element replacement
- Oil collection tank/automatic bleeding
- Automatic pump cut-off
- Low operating noise
- Robust feed pump with helical gearing and integrated bypass valve
- Suitable for mineral oils, HFC and biodegradable oils
- Good suction performance, also suitable for high viscosity products
- Worldwide distribution



2. Flow rate/pressure drop curve complete filter



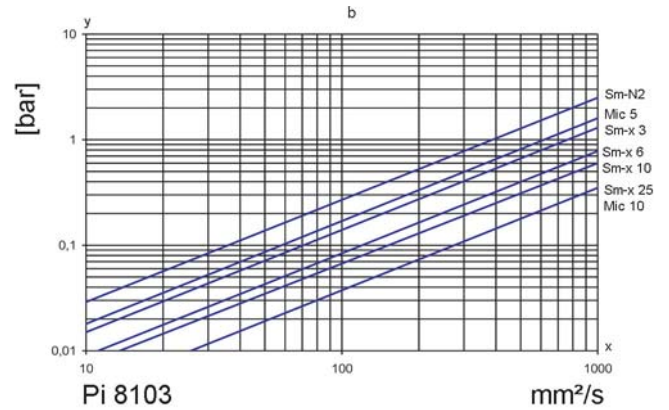
a = differential pressure-viscosity curve Pi 8102

flow rate = 27 l/min

y = differential pressure [bar]

x = viscosity [mm²/s]

Illustration shows initial Δp of complete filter (housing incl. element) of the mobile filter units.



b = differential pressure-viscosity curve Pi 8103

flow rate = 55 l/min

y = differential pressure [bar]

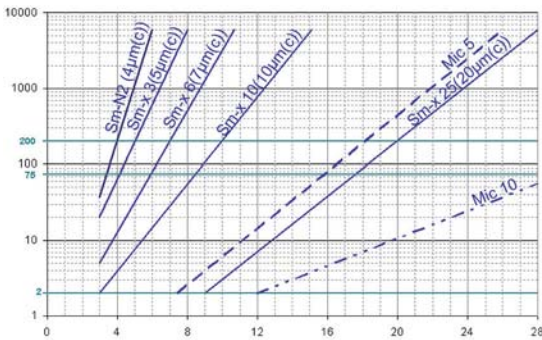
x = viscosity [mm²/s]

Recommended initial Δp :

max. 0.5 bar at bypass filtration

max. 0.8 bar for filling or transfer by pump

3. Separation grade characteristics



y = beta-value

x = particle size [μm]

determined by multipass tests (ISO 16889)

calibration according to ISO 11171 (NIST)

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 2923	Hydraulic fluid power filter elements; method for end load test
DIN ISO 2924	Hydraulic fluid power filter elements; verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power-filters-evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters-multipass method for evaluation filtration performance of a filter element

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-N/Sm-x elements with max. Δp 10 bar

Sm-N 2 $\beta_{4(C)} \geq 200$

Sm-x 3 $\beta_{5(C)} \geq 200$

Sm-x 6 $\beta_{7(C)} \geq 200$

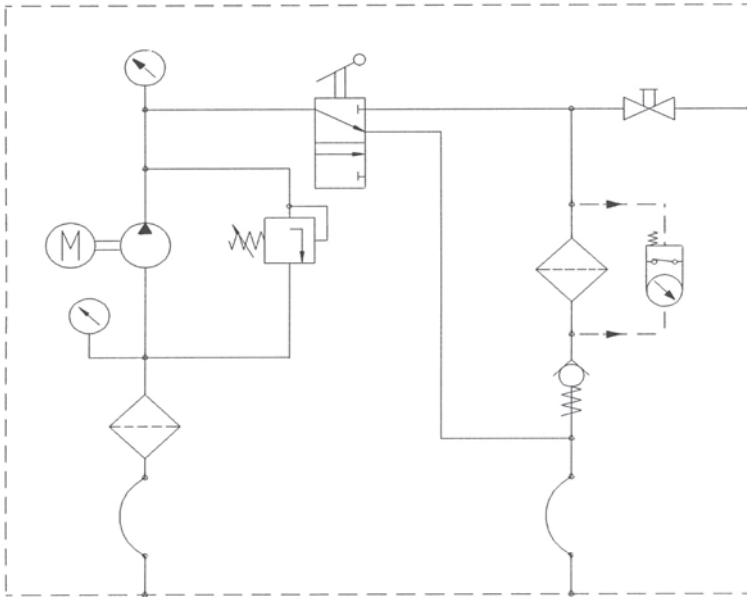
Sm-x 10 $\beta_{10(C)} \geq 200$

Sm-x 25 $\beta_{20(C)} \geq 200$

values guaranteed up to 10 bar differential pressure.

The filter element Sm-N 2 has a very high dirt load capacity and is very suitable for bypass filtration.

6. Wiring diagramm



7. Order numbers

Example for ordering filters:

1. Filter Unit	2. Replacement element to 1
55 l/min with filter element Sm-N 2 Type: Pi 8103-069/852 761 Sm-N 2	Sm-N 2 Type: Pi 852 761 Sm-N 2 Order number: 78375867

7.1 Housing design*

Flow rate [l/min]	Type	Design
27/32	Pi 8102-069	with visual/electrical maintenance indicator and pump cut off
57/66	Pi 8103-069	

* other designs are available on request

7.2 Filterelemente*

Flow rate [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter Surface [cm ²]
27/32	77774458	852 760 Mic 5	Mic 5	5	23800
	77774441	852 760 Mic 10	Mic 10		23800
	77955859	852 760 Sm-N 2	Sm-N 2	10	16000
	77774433	852 760 Sm-x 3	Sm-x 3		14500
	78299042	852 760 Sm-x 6	Sm-x 6		14500
	77774425	852 760 Sm-x 10	Sm-x 10		14500
	77806565	852 760 Sm-x 25	Sm-x 25		14500
55/66	77774417	852 761 Mic 5	Mic 5	5	47600
	77774409	852 761 Mic 10	Mic 10		47600
	78375867	852 761 Sm-N 2	Sm-N 2	10	32000
	77774391	852 761 Sm-x 3	Sm-x 3		29000
	78225898	852 761 Sm-x 6	Sm-x 6		29000
	77774383	852 761 Sm-x 10	Sm-x 10		29000
	77806573	852 761 Sm-x 25	Sm-x 25		29000

* a wider range of element types is available on request

8. Technical specifications

Filtration unit type	Pi 8102-069	Pi 8103-069
Delivery flow	27 l/min at 50 Hz	55 l/min at 50 Hz
	32 l/min at 60 Hz	66 l/min at 60 Hz
Motor output	0.75 KW/1400 1/min at 220 - 245/380 - 420 V/50 Hz	1.5 KW/1410 1/min at 220 - 245/380 - 420 V/50 Hz
	0.90 KW/1680 1/min at 220 - 280/380 - 480 V/60 Hz	1.8 KW/1692 1/min at 220 - 280/380 - 480 V/60 Hz
Power supply (standard)	3 AC 400 V/50 Hz	
	others on request	
Connection cable	7 m with EEC connector	7 m with EEC connector
Pressure limiting valve	5 bar	5 bar
Pumpe, type	WP gear pump with outward-facing helical gear shafts	WP gear pump with outward-facing helical gear shafts
Pump protection filter	Cleanable 150 µm wire mesh suction filter	Cleanable 150 µm wire mesh suction filter
Minimum suction pressure	0.6 bar	0.6 bar
Maximum suction pressure	1.4 bar	1.4 bar
Pump viscosity range	7.5 - 2500 mm ² /s	7.5 - 2500 mm ² /s
Pump temperature range	-20 °C to +120 °C	-20 °C to +120 °C
MAHLE low pressure filter	Pi 1535/10-069	Pi 1560/10-069
Nominal pressure	10 bar	10 bar
Filter element	see options table	see options table
Filter area loading	0.0011-0.0019 l/min/cm ²	0.0011-0.0019 l/min/cm ²
Filter monitor	visual/electrical differential pressure indicator and automatic pump cut-off	visual/electrical differential pressure indicator and automatic pump cut-off
Δp reading threshold pressure	2.2 bar	2.2 bar
Unit monitor	Vacuum pressure gauge at the pump and pressure gauge suction points	Vacuum pressure gauge at the pump and pressure gauge suction points
Filtration unit/ filter element operating range	see differential/viscosity curves	see differential pressure/viscosity curves
Pipes	Screw fittings and pipes are zinc plated and chromated	Screw fittings and pipes are zinc plated and chromated
2.5 m flexible ransparent suction hose with suction pipe	DN 25	DN 38
2.5 m flexible delivery hose, with pipe lance	DN 19	DN 25
Noise level	< 72 db (A)	< 72 db (A)
Seals	FPM (Viton)*	FPM (Viton)*
Weight	approx. 80 kg	approx. 108 kg

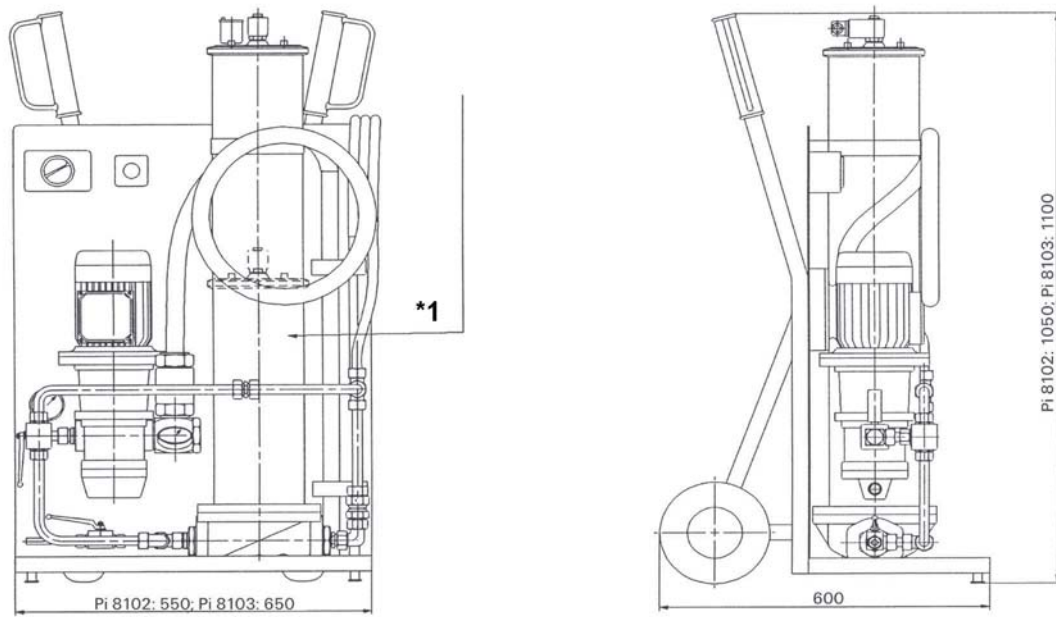
* other seals can be supplied on request

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Subject to technical alteration without prior notice.

8. Technical specifications



*1

low pressure filter

Pi 8102 (dashed): Pi 1535

Pi 8103: Pi 1560

MAHLE

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79781899.09/2008

Portable Contamination Measuring System PiC 9100

max. nominal pressure 315 bar (4480 psi)

1. Features

- Rugged portable unit for quick and simple particle analysis on site
- Simple menu-driven operation
- Laser sensor with 12 channels for exact and reproducible results
- Suitable for suction side- and pressure side operation
- Integrated suction pump patented double pump system, viscosity and pressure independent flow control
- Prior to each measurement automatic flushing of the gauge head
- Adjustable measuring mode (single and cyclic measurements)
- Long term measurements up to 330 hours
- Memory bank for 1400 measurement values (up to 99 series)
- Manual flush valve for quick internal hose flushing
- Calibration according to ISO 11171: 1999 (NIST)
- Analysis according to ISO 4406: 1999
- Analysis according to ISO 4406: 1987; class 1 up to 24
- Analysis according to NAS 1638; class 0 up to 24
- Measuring range ISO 4402: 2 μm - 100 μm
- Measuring range ISO 11171 4 μm - 50 μm
- Indication of the absolute numbers of particles in all channels
- Serial interface for further data processing via PC
- Integrated printer
- Threshold function contact for preset min. and max. classes
- Built-in tank for measuring liquid
- Timer
- Definable measuring series



2. Technical specifications

Pressure connection:	Measuring connection M16, max. 315 bar (Minimess)
Suction connection:	Screw connection 6 L, max. 10 bar (140 psi)
Return line:	Screw connection 6 L
Pressure fluctuation:	permissible
Medium:	hydraulic fluids, fuels, water, provided the fluid is optically homogenous
Viscosity range:	max. 500 mm ² , on suction side max. 100 mm ² /s
Temperature range:	Ambience: 0 to 50 °C; Fluid: 0 to 80 °C
Sensor flow rate:	40 ml/min
Flushing volume flow:	40 ml/min
Measuring volume:	10 to 100 ml, adjustable (10 ml steps)
Volume prior to counting:	10 to 50 ml, adjustable in (10 ml steps)
Counting time:	15 s
Cycling time:	1 to 99 min
Sensor:	Laser diode sensor
Number of channels = 12:	2/>5/>15/>25/>50/>100 µm acc. ISO 4406: 1987 (extended) >4/>6/>14/>21/>38/>70 µm(c) acc. ISO 4406: 1999
Indication acc. NAS 1638:	2-5/5-15/15-25/25-50/50-100 µm
Measuring range NAS-classes:	0 to 12
Indication acc. SAE AS 4059:	>4/>6/>14/>21/>38/>70 µm(c)
Measuring range acc. SAE clas- ses:	000 to 12
Tank volume:	0.75 l
Indication acc. ISO 4406: 1999	>4/>6/>14 µm(c)
Measuring range ISO classes:	1 to 24
Calibration:	acc. ISO 11171: 1999 and ISO 4402 (ACFTD)
Power supply:	115/ 230 VAC; 50/ 60 Hz; version with accumulator 12 VDC
Dimensions:	400 x 240 x 380 mm
Weight:	approx. 12 kg

Subject to technical alteration without prior notice.

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70353688.07/2008

3. Technical manual

The portable particle counter PiC 9100 consists of a sensor with pump/volume regulation unit, particle counter with display, an integrated printer and tank.

All systems are fitted in an aluminium case.

The connections of suction, pressure and return line are fixed at the outer side of the case.

For the electrical connection cables and hoses separate compartments are available.

4. Software/Display

The indication is effected by a LCD with 8 lines. Capability up to 99 series of measurements with max. 2700 measurement values.

Analysis according ISO 4406: 1999 NAS 1638 SAE AS 4059

Printing output of number of particles and ISO/NAS classes.

The indication of number of particles and the corresponding NAS/ISO classes are adjustable.

Serial interface is available for data output.

For control purposes availability of threshold function contact for pre-adjustment of min. and max. ISO/NAS classes (potential free switch-over contact).

German/english software.

5. Options

Data transfer to notebook (graphic illustration) with "LOG and SHOW" software.

Accumulator version for mobile use.

Bottle sampling- and adapter-kit.

Fluid sampling - and adapter kit for PiC 9100

1.Features

The fluid sampling kit enables the correct sampling of fluids from a hydraulic system for subsequent analysis in a laboratory.

The kit contains glass-sampling bottles cleaned according to DIN-ISO 5884 and the necessary accessories for taking a correct fluid sample.

Furthermore the kit contains all important adapters to connect the contamination measurement device PiC 9100 to a hydraulic system.

- Sampling of hydraulic fluids by means of measurement connections M16x2 (Minimess)
- Sampling on all MAHLE inline filters by means of screw-in adapters into the maintenance indicator cavity.
- Sampling of fluid before and after the filter element
- Sampling from hydraulic tanks by means of a vacuum hand pump
- Adapters to connect the contamination measurement device PiC 9100 to MAHLE inline filters and measurement connections M16x2 (Minimess)



Type	Order number
Fluid sampling and adapter kit, complete	79392994
Spare sampling bottles, cleaned, break-proof packed (5 pcs)	77875065

MAHLE

Industrial Filtration

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70343498.04/2008

OIL MIST SEPARATION

Oil Mist Separator Unit

LGA 600 F/FU

Nominal volume flow 600 m³/h

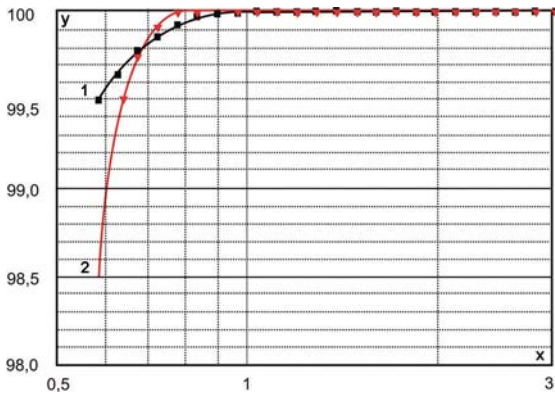
1. Features

High performance oil mist separator unit for separation of coolant from tooling machine exhaust air

- Compact design
- High oil mist load capacity
- Excellent retention rates
- Quality filters, easy to service
- Equipped with high-efficient coalescer elements
- Optimized service life
- Modular design for direct installation of main components into tooling machines
- Worldwide distribution



2. Fractional collection efficiency



x = Particle size in μm

y = Fractional retention rate in %

Aerosol: Wiolan SH 10

Raw gas concentration: 50 mg/m^3

Volume flow: $600 \text{ m}^3/\text{h}$

1 = Filter cartridge as delivered

2 = Filter cartridge after 100 operating hours

4. Application

Suitable for non-water-miscible cooling lubricants (cutting oil, grinding oil, drilling oil) and oil aerosol exhausted by machine tools.

Coolant emulsions on request.

Operating limits

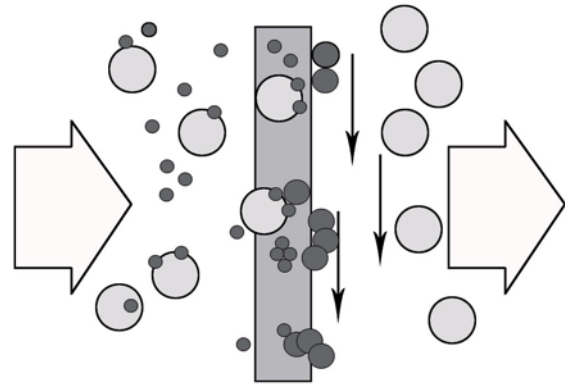
If oil is used as cooling lubricant for machining processes, air usually has to be sucked away from the working area to prevent the atomized oil from dispersing. The concentrations that often occur in the cooling lubricant jet or in the machine room could result in ignition in case of tool breakage, for example. If the machining process involves flammable cooling lubricants or flammable materials, safe operation must be ensured by providing suitable fire and explosion protection devices in conformance with statutory regulations.

Installation in potentially explosive atmosphere (Zones 0, 1 and 2) is not permitted!

6. Order numbers

Type	Order number
LGA 600 F	70353616
LGA 600 FU	70329105
LGA 600 F (special voltage)	70359300
LGA 600 FU (special voltage)	On request

3. Operating principle



Oil aerosols are sucked away from the machining space of machine tools. The oil-laden air flows outward through the coalescer element from the inside. The oil attaches itself to the fibre media as it passes through the filter. Minute oil droplets "coalesce" to form larger drops. These larger droplets migrate downwards on the coalescer element due to gravity. The oil accumulates at the bottom of the housing and is returned to the cooling lubricant storage reservoir via the oil drain hose and the membrane valve. The vacuum in the filter housing causes external air to be sealed off by the membrane valve. The valve opens automatically when the oil in the drain hose reaches a height of at least 500 mm. The cleaned airflow is sucked away by means of a high-pressure fan and blown out at the top through a silencer.

5. Product information

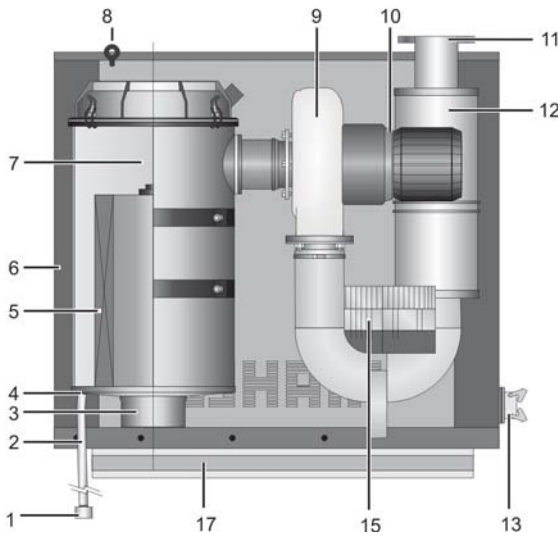
LGA 600 F

The LGA 600 F is driven by a frequency controlled motor. The motor runs at the maximum permissible speed. At initial operation the volume flow achieves approx. $1300 \text{ m}^3/\text{h}$ at low differential pressure. This flow rate is reduced to around $600 \text{ m}^3/\text{h}$ within one or two days, depending on the raw gas concentration.

LGA 600 FU

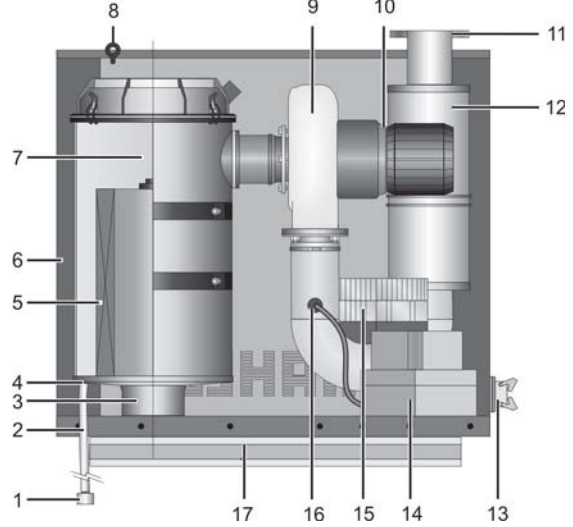
The LGA 600 FU is driven by a frequency controlled motor. A volumetric flowrate sensor supplies the actual value required to obtain a constant volume flow of $600 \text{ m}^3/\text{h}$. If this value falls below the setpoint, an electrical signal is output at approximately $450 \text{ m}^3/\text{h}$. These signals can be evaluated to enable suitable maintenance action to be taken.

7. Modules/main components



LGA 600 F

- 1 Membrane valve
- 2 Oil hose
- 3 Air inlet nozzle
- 4 Oil drain nozzle
- 5 Coalescer element
- 6 Housing
- 7 Filter housing
- 8 Eyebolt for transport
- 9 Fan



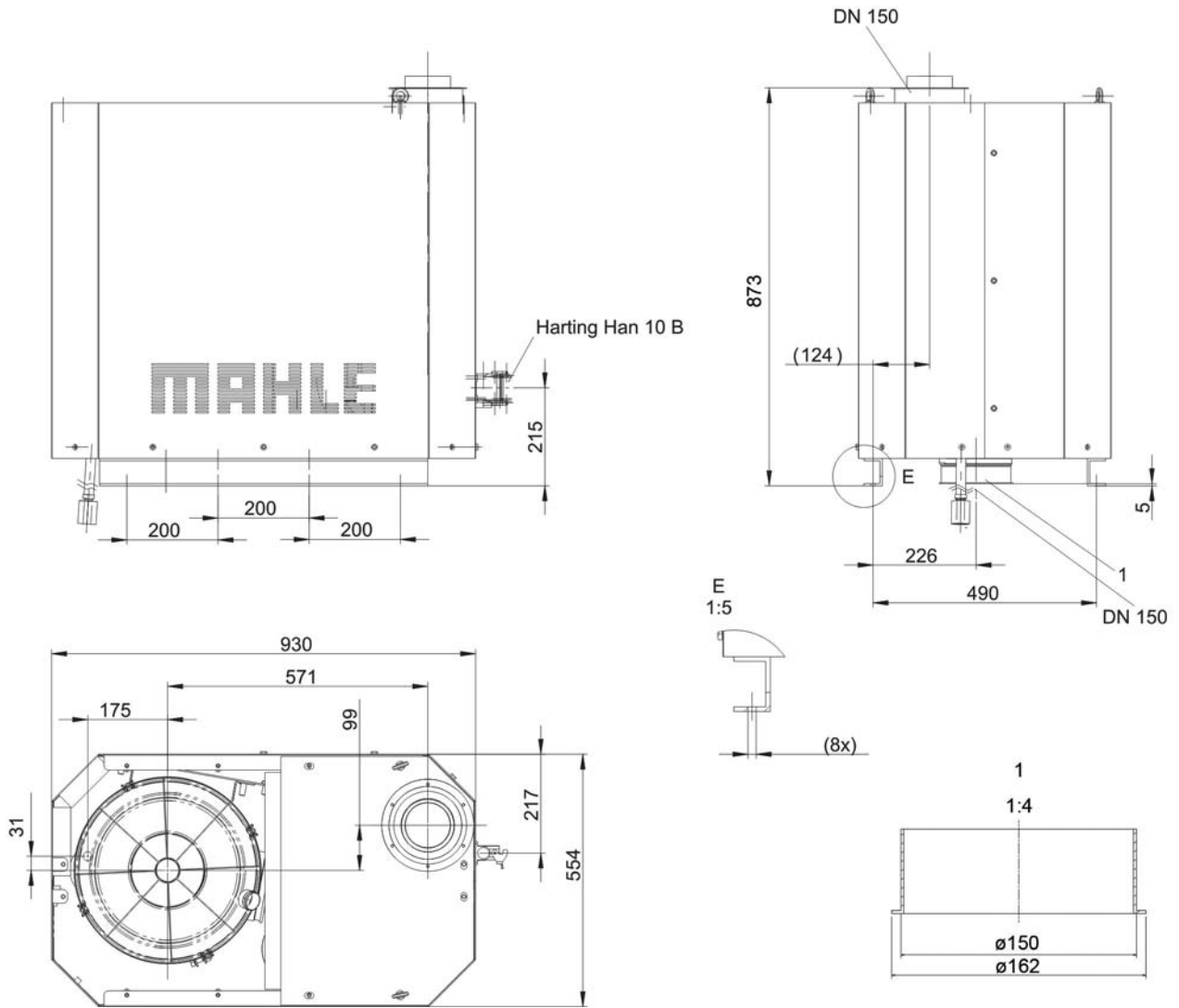
LGA 600 FU

- 10 Electric motor
- 11 Air outlet nozzle
- 12 Silencer
- 13 Connection port
- 14 Control unit
- 15 Frequency converter
- 16 Volumetric flowrate sensor
- 17 Mounting base plate

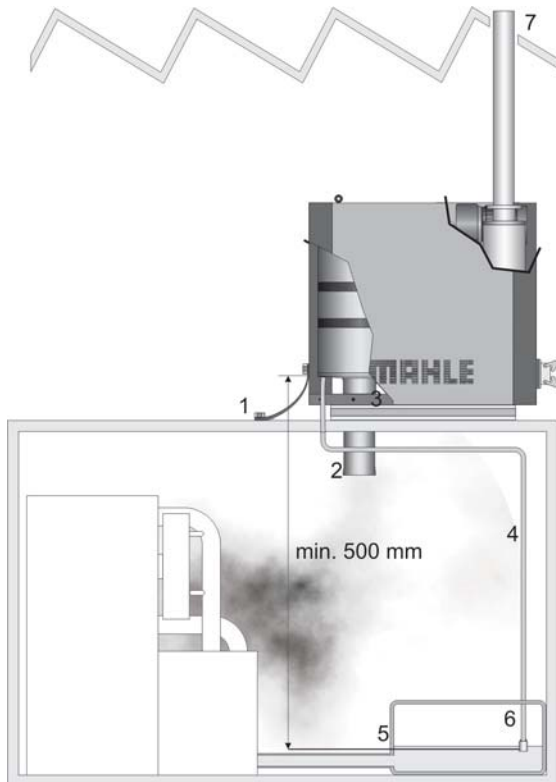
8. Technical data

	LGA 600 F/FU, 400 V/50-60 Hz (standard)	LGA 600 F/FU, 200 V/50-60 Hz (special)
Volume flow	600 m³/h	600 m³/h
Temperature range	+ 10 °C to + 60 °C	+ 10 °C to + 60 °C
Nozzles	150 mmm (2x Jacob)	150 mmm (2x Jacob)
Oil hose	PVC transparent 15x2 mm (3 m)	PVC transparent 15x2 mm (3 m)
Filter	1 coalescer element	1 coalescer element
Filter surface	4.6 m²	4.6 m²
Dimensions (LxWxH)	930x555x780 mm	930x555x780 mm
Weight	140 kg	140 kg
Supply voltage	3 AC 400 V/N/PE, 50-60 Hz	3 AC 200 V/N/PE, 50-60 Hz
Current consumption	6.9/4.0 A	7.8/4.6 A
Protection class	IP 54	IP 54
Backup fuse	16 A	16 A
Connection port	Harting 10 B	Harting 10 B
Motor output	2.2 kW	2.2 kW
Motor speed	6140 U/min	6140 U/min
Sound level	72 dB (A)	72 dB (A)

9. Dimensions



10. Installation



- 1 Equipotential bonding
- 2 Suction pipe
- 3 Air inlet nozzle
- 4 Oil hose
- 5 Oil storage reservoir
- 6 Membrane valve
- 7 Exhaust air

Note the minimum clearance of 480 mm is required for element removal!

11. Spare parts and accessories

Order numbers for spare parts and accessories

Designation	Order number
Coalescer element	79354390
Membrane valve	78769697
Harting plug connector	70344112
Harting easy hood (19 30 010 1540)	70360184
Harting bush insert (09 33 010 2716)	70345233
Jacob hose nozzles	70346551
Jacob clamp ring	79389081
Jacob NBR flanged sealing ring	76141121
Jacob 90° pipe bend	70365712

MAHLE

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70302266.07/2008

FILTERS FOR INDUSTRIAL PROCESS TECHNOLOGY

Filters for industrial process technology

PiP K10

Cartridge filter housing

1. Features

High-performance filters for modern process systems

MAHLE can call on a long history of experience in the production of high-quality filters and cartridges for hydraulic filtration. This know-how is also leveraged for other applications, such as the filtration of washing fluids for cleaning components.

Increasingly strict requirements are specified regarding the cleanliness of industrial parts - and thus the washing fluids.

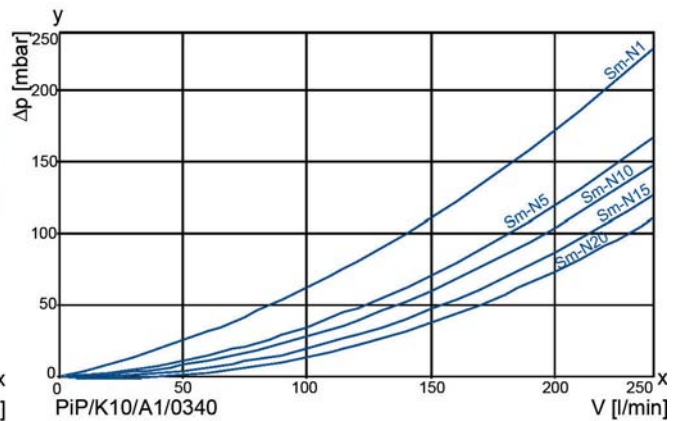
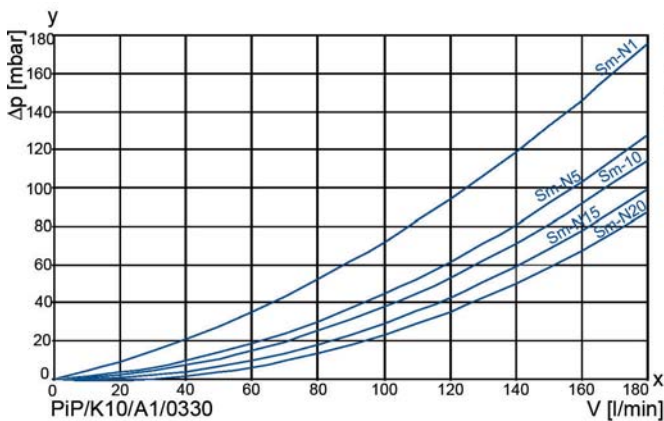
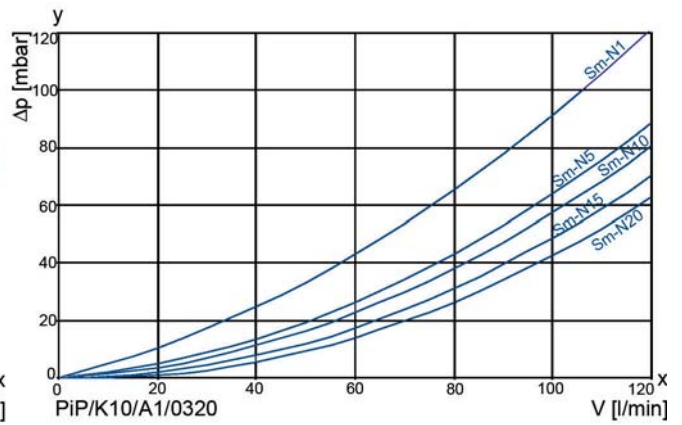
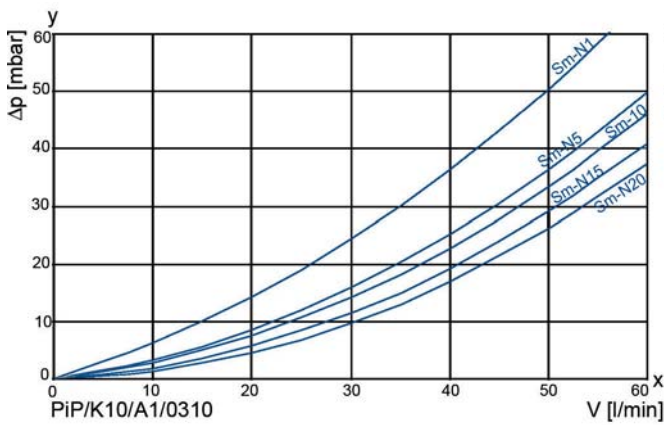
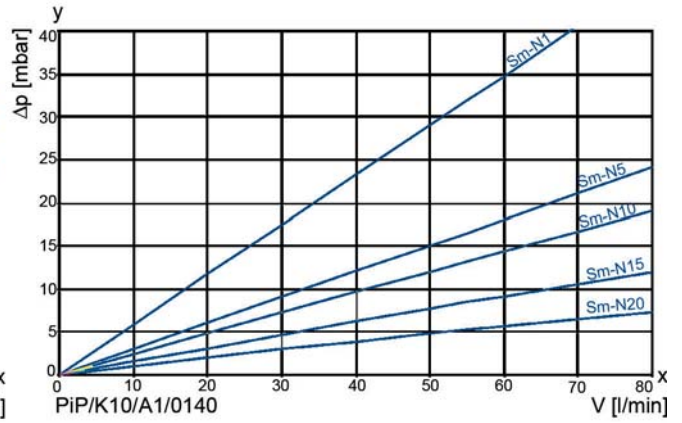
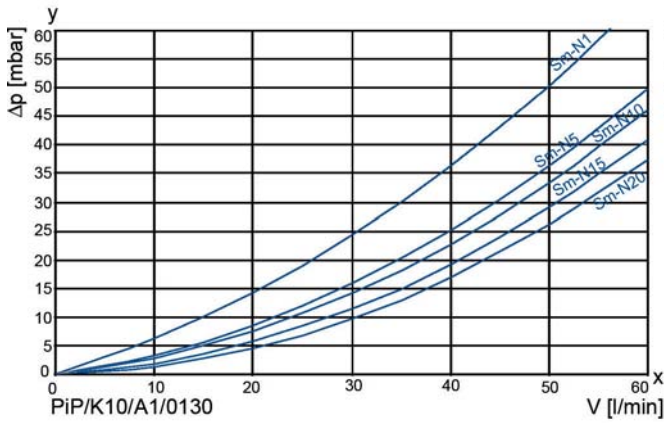
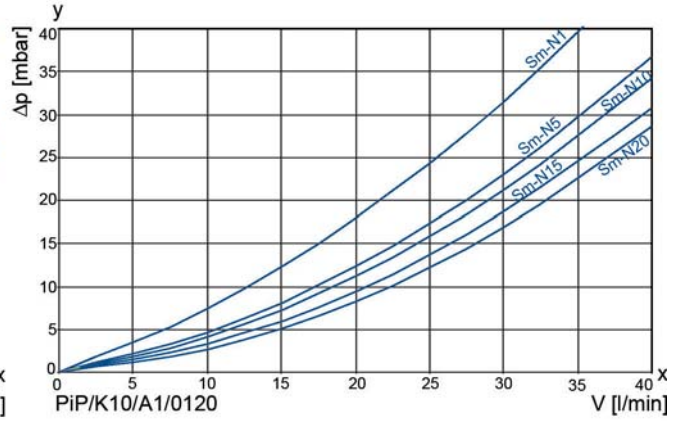
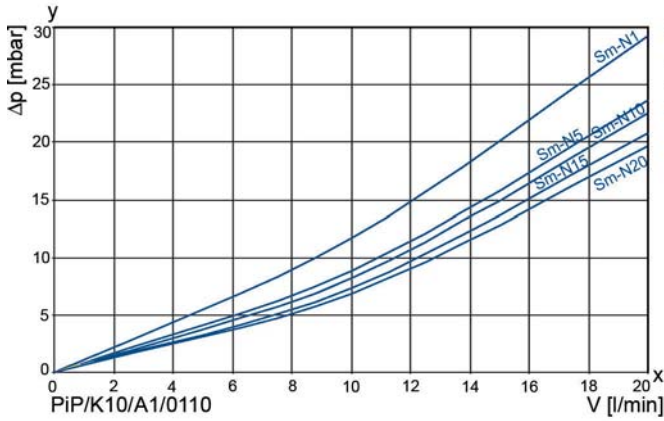
The filters and filter materials are suitable for all popular washing media used to clean components.

These filter housings are manufactured completely from stainless steel and installed in a wide variety of process filtration systems.

- Low space requirement thanks to compact construction
- Minimal pressure loss due to flow optimized design of components
- Visual/electrical/digital maintenance indicator
- DIN flanges
- Easy adaptation to higher dirt load by fitting a taller top housing part and longer cartridge - with no need to convert the system
- Equipped with high-efficient Sm-N filter cartridges
- High differential pressure stability and dirt holding capacity of the cartridges for optimum operating lifetime
- Guaranteed separation rates acc. to ISO 16889 multi-pass test
- Filter cartridges freely accessible when top part of housing is lifted off
- Worldwide distribution

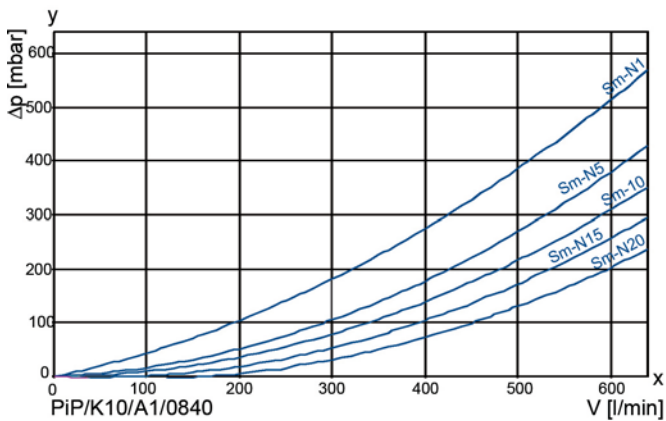
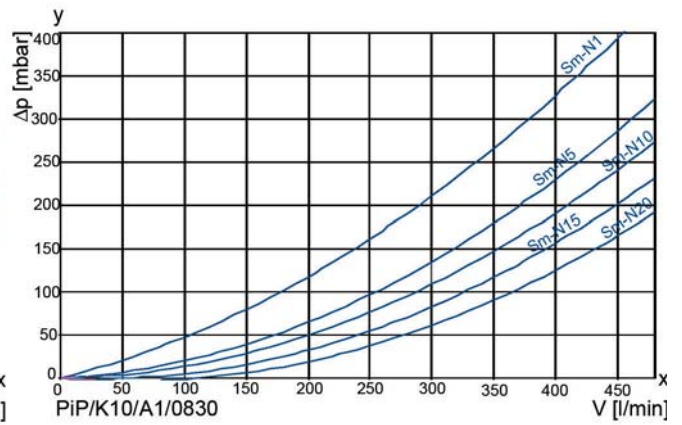
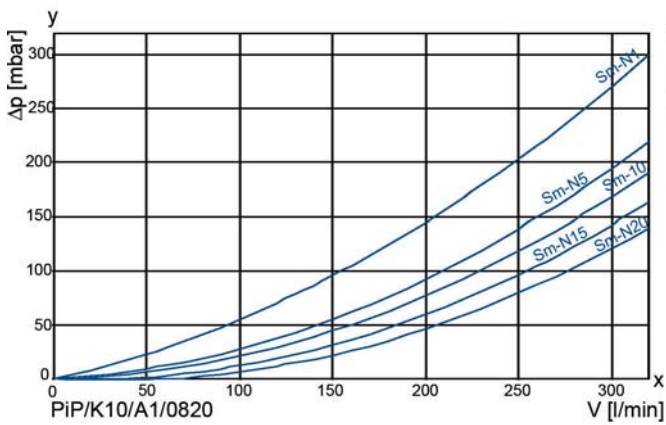
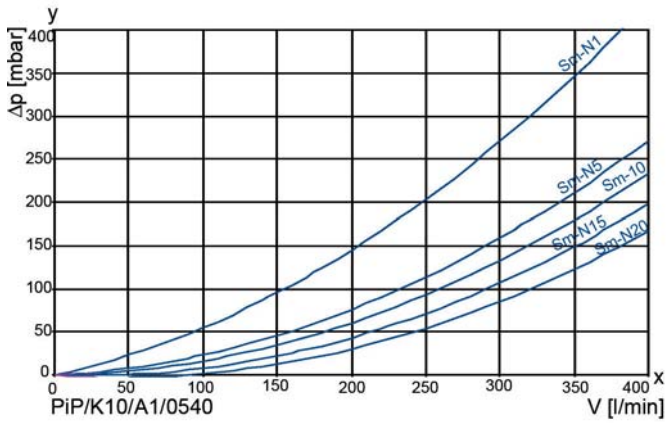
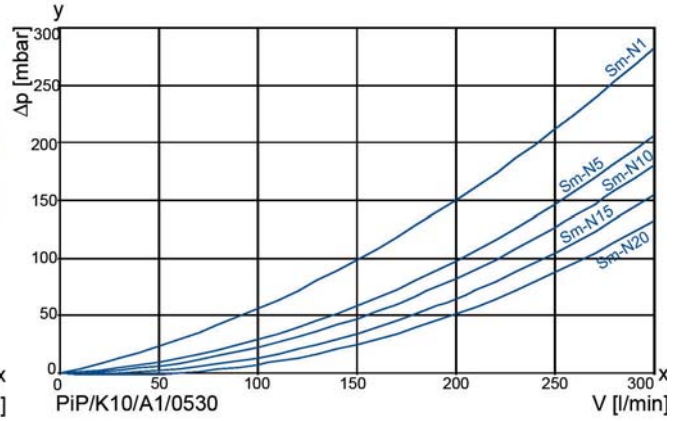
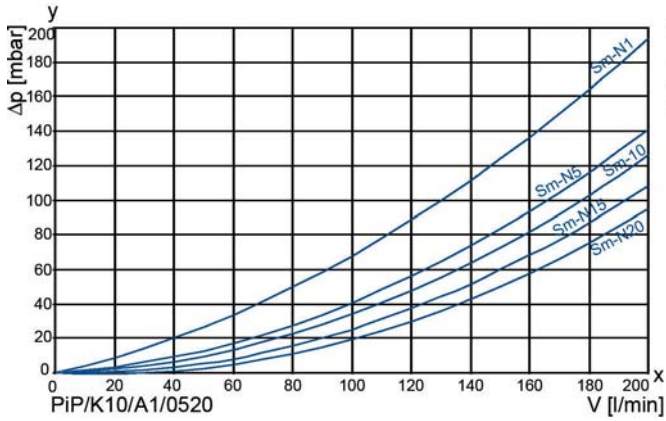


2. Flow rate/pressure drop curve complete filters with single or three-cartridge configuration



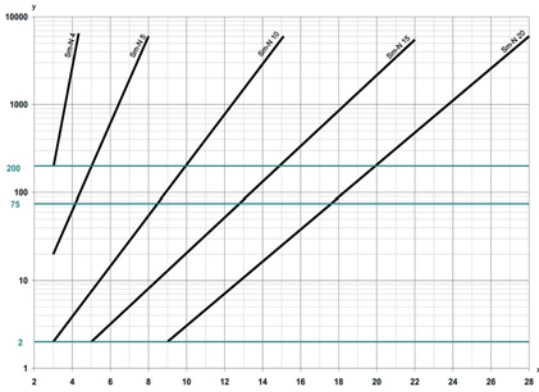
x = flow rate [l/min]
y = Δp [mbar]

2. Flow rate/pressure drop curve complete filter with five or eight-cartridge configuration



x = flow rate [l/min]
y = Δp [mbar]

3. Separation grade characteristics



x = particle size [μm]
y = beta value

determined by multipass tests
calibration according to ISO 11171 (NIST)

4. Filter performance data

tested according to ISO 16889 (Multipass-Test)

Sm-N elements with max. Δp 3 bar

Sm-N	1	$\beta_{4(C)}$	\geq	3000
Sm-N	5	$\beta_{5(C)}$	\geq	200
Sm-N	10	$\beta_{10(C)}$	\geq	200
Sm-N	15	$\beta_{15(C)}$	\geq	200
Sm-N	20	$\beta_{20(C)}$	\geq	200

values guaranteed up to 2.2 bar differential pressure

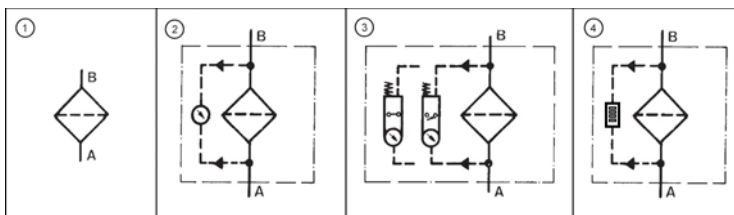
Degree of filtration acc. NIST-definition (ISO 11171); equivalent to ACFTD-definition (ISO 4402:1991) $\leq 1 \mu\text{m}$

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power - filter elements - verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power - filter elements - verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power - filter elements - verification of material compatibility with fluids
DIN ISO 3723	Hydraulic fluid power - filter elements - method for end load test
DIN ISO 3724	Hydraulic fluid power - filter elements - verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power-filters-evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters-multipass method for evaluation filtration performance of a filter element

6. Symbols



7. Type number key and order numbers

7.1 Type number key PiP filter housings

Type

PiP Filter for industrial process technology

Design

K10 Filter housing, max. 10 bar operating pressure

Housing lock

F Bracket, flat-gasket DIN 32676

O Bracket, o-ring seal

Cartridge spigot

A Double o-ring (SOE 222)

B Bayonet, double o-ring (SOE 226)

Cartridge type

0 Open at one end (SOE) without centre point

1 Open at one end(SOE) with centre point

No. of cartridges

01 1 cartridge

03 3 cartridges

05 5 cartridges

08 8 cartridges

Cartridge length

10 10 "

20 20 "

30 30 "

40 40 "

Connection

G Flange DIN EN 1092-1

M Thread

Housing fixing

F Tri-pod

S Bracket

H Support angle

Maintenance indicator

010 without

068 visual

069 electrical

161 digital

PiP/ **K10** / **F** / **A-** / **1** / **03** / **20** / **G** / **F-** **069** Example for ordering

7.2 Order numbers PiP filter housings

Nominal size NG [l/min]	No. of cartridges	Order number	Type	①	②	③	④
				with cavity for indicator	with visual indicator	with electr. indicator	with digital indicator
25	1	70340535	PiP/K10F/A-1/0110/G/H-010				
		70330162	PiP/K10F/A-1/0110/G/H-068				
		70330201	PiP/K10F/A-1/0110/G/H-069				
		70330202	PiP/K10F/A-1/0110/G/H-161				
		70340602	PiP/K10F/A-1/0110/M/H-010				
		70340604	PiP/K10F/A-1/0110/M/H-068				
		70340605	PiP/K10F/A-1/0110/M/H-069				
		70340606	PiP/K10F/A-1/0110/M/H-161				
50	1	70340536	PiP/K10F/A-1/0120/G/H-010				
		70330163	PiP/K10F/A-1/0120/G/H-068				
		70330203	PiP/K10F/A-1/0120/G/H-069				
		70330204	PiP/K10F/A-1/0120/G/H-161				

When filter with non indicator configuration is selected, the collapse pressure of the element must not be exceeded.

7.2 Order numbers PiP filter housings

Nominal size NG [l/min]	No. of cartridges	Order number	Type	①	②	③	④
				with cavity for indicator	with visual indicator	with electr. indicator	with digital indicator
75	1	70340537	PiP/K10F/A-1/0130/G/F-010				
		70330165	PiP/K10F/A-1/0130/G/F-068				
		70330206	PiP/K10F/A-1/0130/G/F-069				
		70330207	PiP/K10F/A-1/0130/G/F-161				
100	1	70340538	PiP/K10F/A-1/0140/G/F-010				
		70330167	PiP/K10F/A-1/0140/G/F-068				
		70330208	PiP/K10F/A-1/0140/G/F-069				
		70330209	PiP/K10F/A-1/0140/G/F-161				
75	3	70340540	PiP/K10F/A-1/0310/G/F-010				
		70330168	PiP/K10F/A-1/0310/G/F-068				
		70330210	PiP/K10F/A-1/0310/G/F-069				
		70330211	PiP/K10F/A-1/0310/G/F-161				
150	3	70340541	PiP/K10F/A-1/0320/G/F-010				
		70330169	PiP/K10F/A-1/0320/G/F-068				
		70330212	PiP/K10F/A-1/0320/G/F-069				
		70330213	PiP/K10F/A-1/0320/G/F-161				
225	3	70340542	PiP/K10F/A-1/0330/G/F-010				
		70330173	PiP/K10F/A-1/0330/G/F-068				
		70330215	PiP/K10F/A-1/0330/G/F-069				
		70330216	PiP/K10F/A-1/0330/G/F-161				
300	3	70340543	PiP/K10F/A-1/0340/G/F-010				
		70330174	PiP/K10F/A-1/0340/G/F-068				
		70330217	PiP/K10F/A-1/0340/G/F-069				
		70330218	PiP/K10F/A-1/0340/G/F-161				
250	5	70340545	PiP/K10F/A-1/0520/G/F-010				
		70330175	PiP/K10F/A-1/0520/G/F-068				
		70330219	PiP/K10F/A-1/0520/G/F-069				
		70330220	PiP/K10F/A-1/0520/G/F-161				
375	5	70340546	PiP/K10F/A-1/0530/G/F-010				
		70330176	PiP/K10F/A-1/0530/G/F-068				
		70330221	PiP/K10F/A-1/0530/G/F-069				
		70330222	PiP/K10F/A-1/0530/G/F-161				
500	5	70340547	PiP/K10F/A-1/0540/G/F-010				
		70330177	PiP/K10F/A-1/0540/G/F-068				
		70330223	PiP/K10F/A-1/0540/G/F-069				
		70330224	PiP/K10F/A-1/0540/G/F-161				

When filter with non indicator configuration is selected, the collapse pressure of the element must not be exceeded.

7.2 Order numbers PiP filter housings

Nominal size NG [l/min]	No. of cartridges	Order number	Type	①	②	③	④
				with cavity for indicator	with visual indicator	with electr. indicator	with digital indicator
400	8	70340548	PiP/K10F/A-1/0820/G/F-010				
		70330178	PiP/K10F/A-1/0820/G/F-068				
		70330225	PiP/K10F/A-1/0820/G/F-069				
		70330226	PiP/K10F/A-1/0820/G/F-161				
600	8	70340549	PiP/K10F/A-1/0830/G/F-010				
		70330179	PiP/K10F/A-1/0830/G/F-068				
		70330227	PiP/K10F/A-1/0830/G/F-069				
		70330228	PiP/K10F/A-1/0830/G/F-161				
800	8	70340550	PiP/K10F/A-1/0840/G/F-010				
		70330180	PiP/K10F/A-1/0840/G/F-068				
		70330229	PiP/K10F/A-1/0840/G/F-069				
		70330230	PiP/K10F/A-1/0840/G/F-161				

When filter with non indicator configuration is selected, the collapse pressure of the element must not be exceeded.

7.3 Order numbers PiP filter elements*

Nominal size NG [l/min]	recommended volume flow [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
25	10	70323913	PiP/A-1/10-Sm-N 1	Sm-N 1	3	2580
	15	70323950	PiP/A-1/10-Sm-N 5	Sm-N 5		
	20	70323970	PiP/A-1/10-Sm-N 10	Sm-N 10		
	23	70323983	PiP/A-1/10-Sm-N 15	Sm-N 15		
	25	70324006	PiP/A-1/10-Sm-N 20	Sm-N 20		
50	20	70324081	PiP/A-1/20-Sm-N 1	Sm-N 1	3	5270
	30	70324087	PiP/A-1/20-Sm-N 5	Sm-N 5		
	40	70324094	PiP/A-1/20-Sm-N 10	Sm-N 10		
	46	70324099	PiP/A-1/20-Sm-N 15	Sm-N 15		
	50	70324103	PiP/A-1/20-Sm-N 20	Sm-N 20		
75	30	70324106	PiP/A-1/30-Sm-N 1	Sm-N 1	3	8270
	45	70324466	PiP/A-1/30-Sm-N 5	Sm-N 5		
	60	70324479	PiP/A-1/30-Sm-N 10	Sm-N 10		
	69	70324486	PiP/A-1/30-Sm-N 15	Sm-N 15		
	75	70324490	PiP/A-1/30-Sm-N 20	Sm-N 20		
100	40	70324563	PiP/A-1/40-Sm-N 1	Sm-N 1	3	11000
	60	70324575	PiP/A-1/40-Sm-N 5	Sm-N 5		
	80	70324589	PiP/A-1/40-Sm-N 10	Sm-N 10		
	92	70326186	PiP/A-1/40-Sm-N 15	Sm-N 15		
	100	70326194	PiP/A-1/40-Sm-N 20	Sm-N 20		

*A wider range of element types is available on request.

8. Technical specification

Housing

Housing material: 1.4403/1.4571 media contact
1.4301 no media contact

Seal material: FPM/PTFE

Nominal/test pressure: 10/13 bar (145/188 psi)

Temperature range: -10 to +90 °C
(other temperature ranges on request)

Maintenance indicator setting: $\Delta p 2.2 \pm 0,3$ bar

Electrical data of electrical maintenance indicator

Max. voltage: AC 250 V/DC 200 V

Max. current: 1 A

Contact load: 70 W

Type of protection: IP 65 in inserted and secured status

Contact: normally open/normally closed

Cable sleeve: M20x1.5

Electrical data of digital maintenance indicator

Max. voltage: AC/DC 12 bis 32 V

Contact load approx.: 2 VA/W

Type of protection: IP 65 acc. DIN EN 60529

Contacts: 2 floating relay contacts, programmable
as normally open (NO)
or normally closed (NC)

Connection: 2x plug connection M12

Technical data is subject to change without notice!

The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance indicator details and designs are available in the maintenance indicator data sheet. Further indicator details about digital maintenance indicator are available in the maintenance indicator data sheet or manual instruction PiS 3160.

We draw attention to the fact that all values indicated are average values and do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer you advice.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids please contact us for additional support.

The filter housings (pressure equipment) in standard design according to pressure equipment-directive 97/23/EG are applicable for

- fluids whose vapour pressure comes up to max. 0.5 bar above the standard atmospheric pressure (1013 mbar) at the permissible temperature (art. 3/1.1/b).

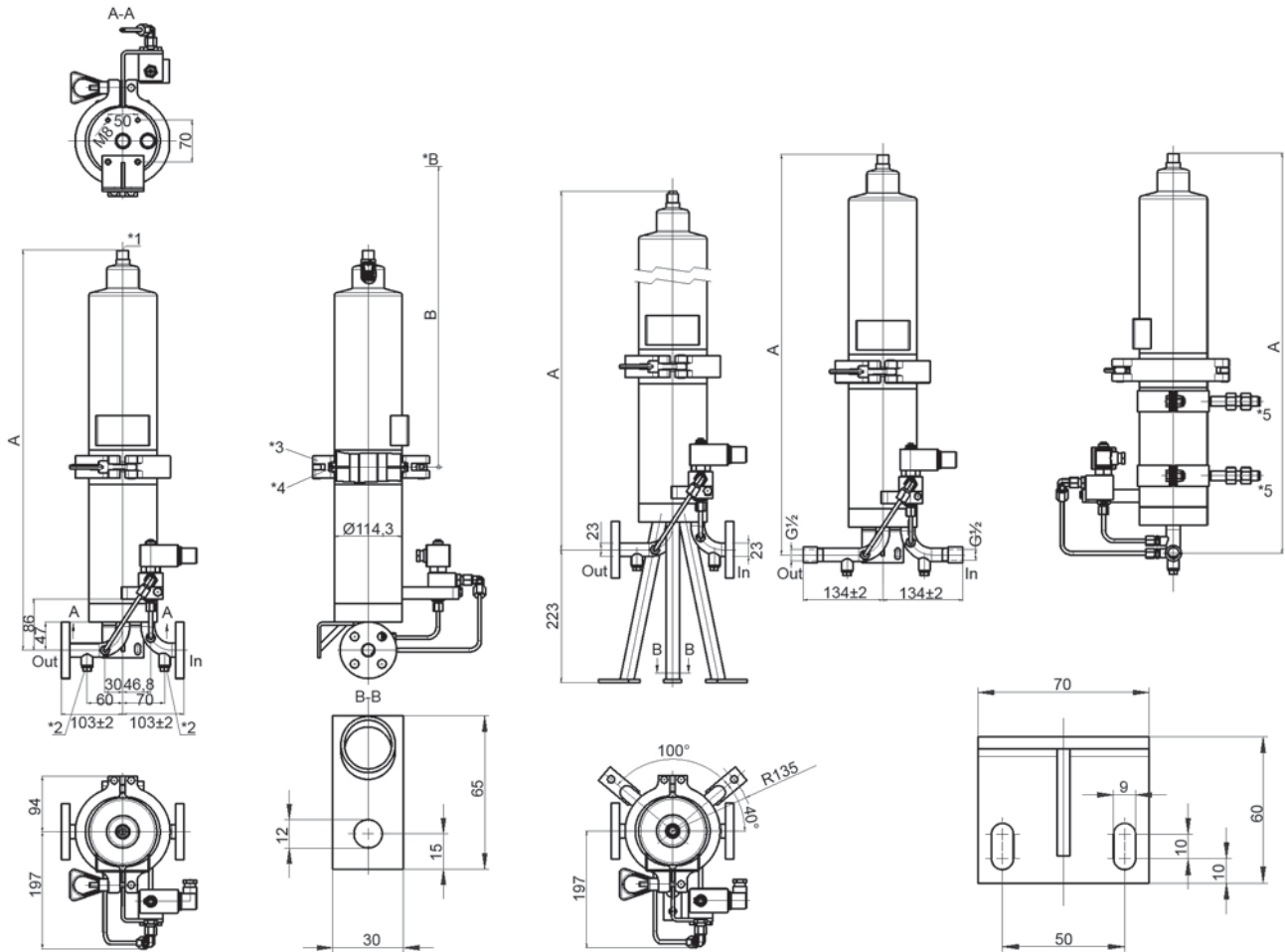
- fluids of liquid group 2 (art.9) with max. 90 °C.

Filter design and production is made according to pressure equipment-directive 97/23/EG art. 3, paragraph 3.

For this kind of filter housings, no CE-conformity declaration according to 97/23/EG can be issued.

The standard design can be used for all current cleaning fluids in the process technology. This contains the most hydrous, neutral, basic, acid and hydrocarbon cleaners. With amine-containing cleaners, the exact operating conditions (concentration as well as temperature) have to be clarified in advance. Other applications and media only available on request and if necessary after laboratory investigation.

9. Dimensions



All dimensions in mm.

Type	A	B
PiP/K10F/.../0110/...	485	225
PiP/K10F/.../0120/...	721	690
PiP/K10F/.../0130/...	1216	1235
PiP/K10F/.../0140/...	1468	1735

In = inlet

Out = outlet

*B = height required for element removal

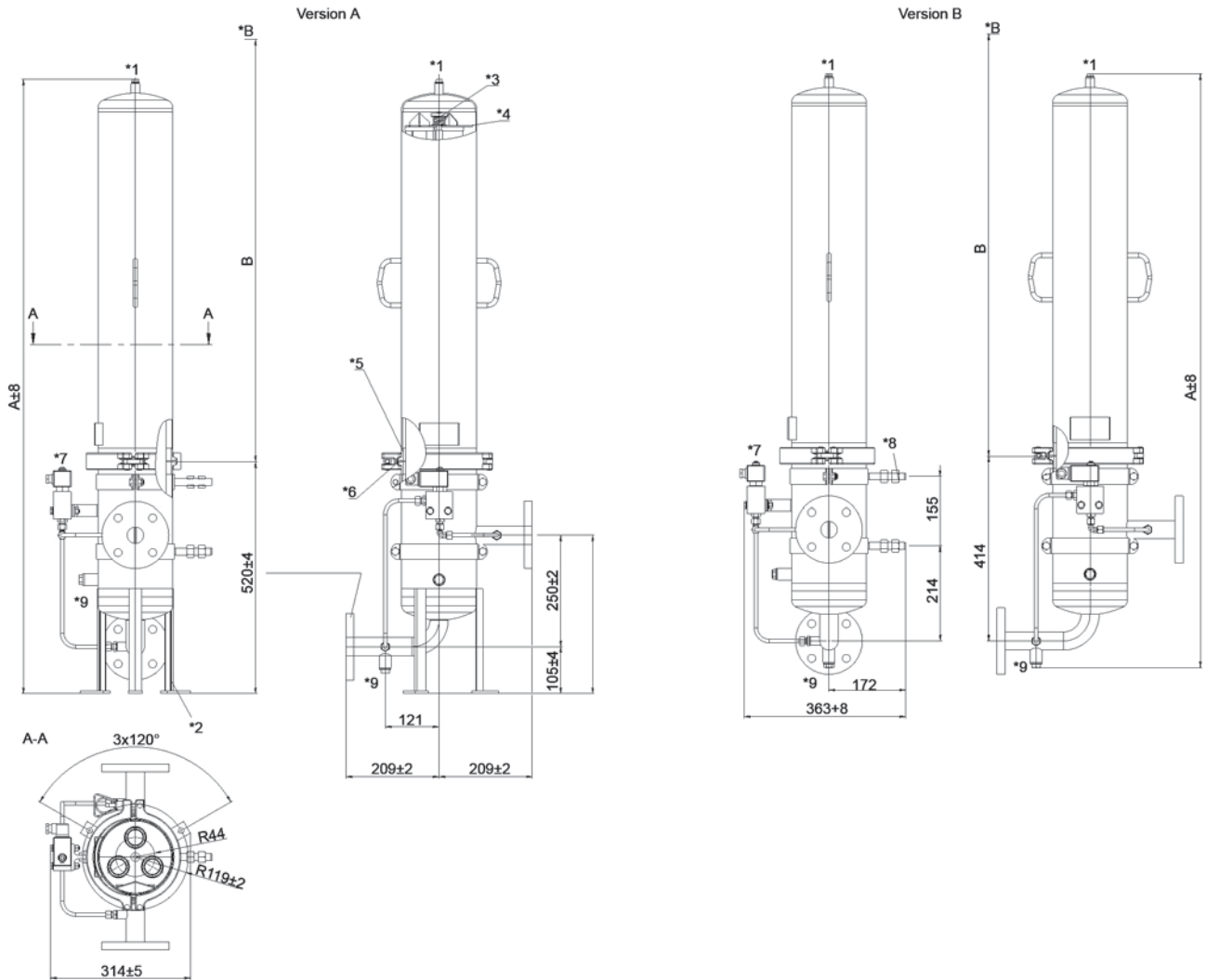
*1 = vent screw G $\frac{1}{4}$

*2 = drain screw G $\frac{1}{4}$

*3 = housing flange

*4 = sealing and bracket

*5 = fixing optional



All dimensions in mm.

Type	Version A		Version B	
	A	B	A	B
PiP/K10F/.../0310/...	624	306	576	306
PiP/K10F/.../0320/...	857	542	809	542
PiP/K10F/.../0330/...	1129	814	1081	814
PiP/K10F/.../0340/...	1381	1066	1333	1066

In = inlet

Out = outlet

*B = height required for element removal

*1 = vent screw G $\frac{1}{4}$

*2 = fixing

*3 = clamping screw

*4 = element holder

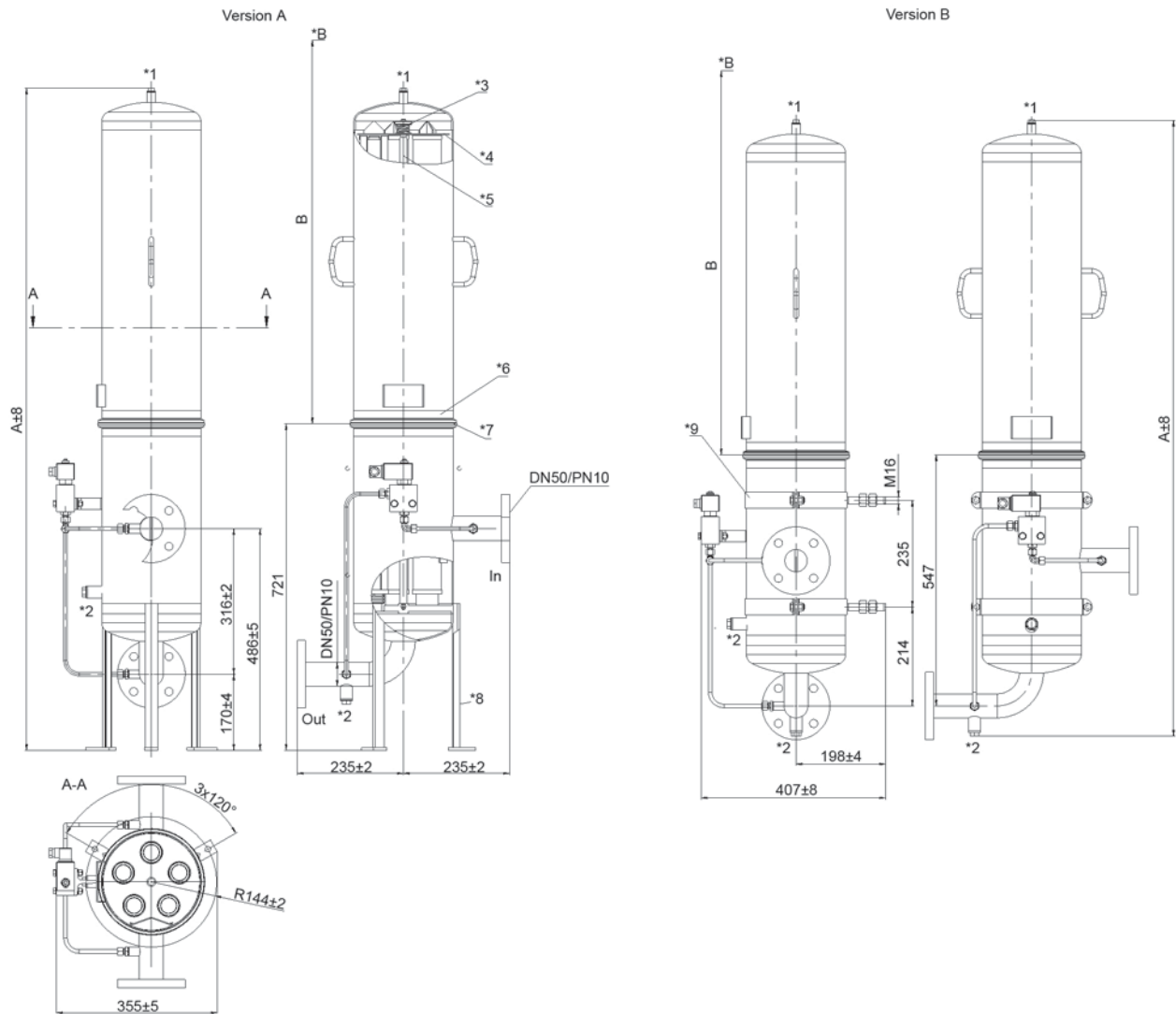
*5 = housing flange

*6 = sealing and bracket

*7 = maintenance indicator

*8 = fixing variable ± 15

*9 = drain screw G $\frac{1}{2}$



All dimensions in mm.

Type	Version A		Version B	
	A	B	A	B
PiP/K10F/.../0520/...	914	542	772	542
PiP/K10F/.../0530/...	1213	814	1044	814
PiP/K10F/.../0540/...	1465	1066	1296	1066

In = inlet

Out = outlet

*B = height required for element removal

*1 = vent screw G $\frac{1}{4}$

*2 = drain screw G $\frac{1}{2}$

*3 = clamping screw

*4 = element holder

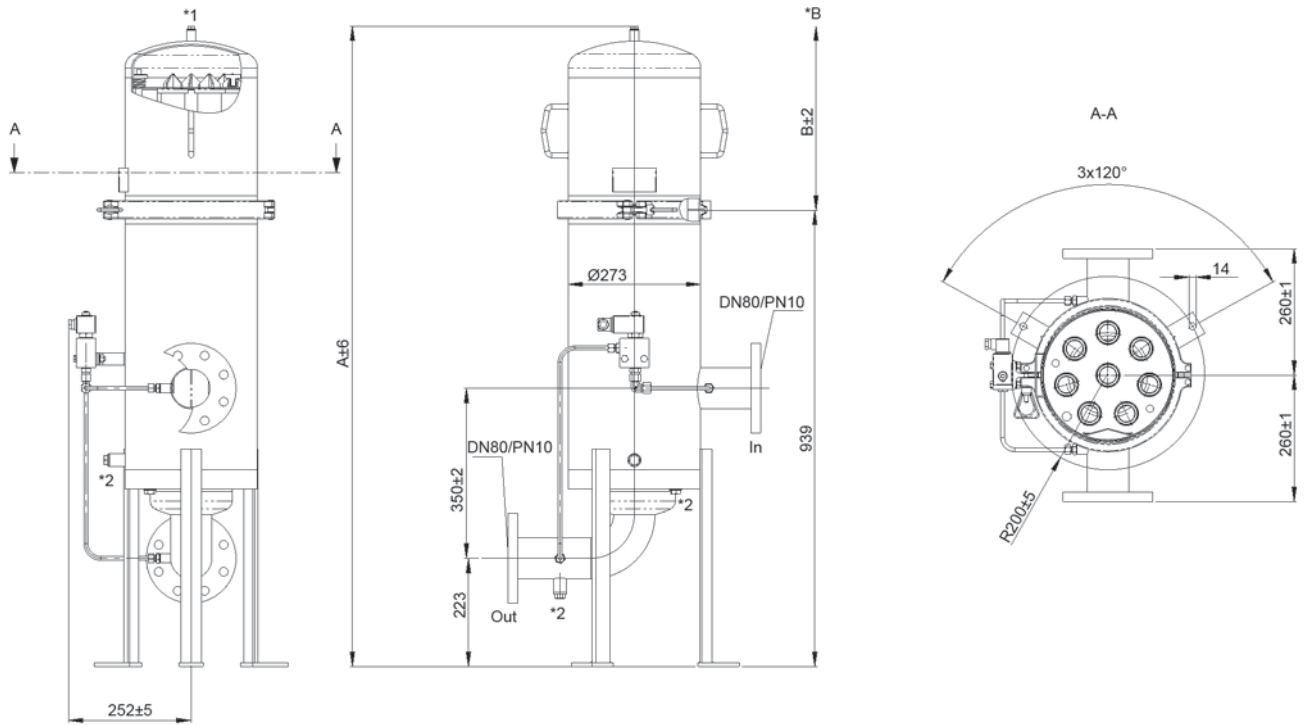
*5 = distance piece

*6 = housing flange

*7 = sealing and bracket

*8 = fixing

*9 = fixing variable ± 15



All dimensions in mm.

Type	A	B
PiP/K10F/.../0820/...	1070	550
PiP/K10F/.../0830/...	1310	815
PiP/K10F/.../0840/...	1565	1155

In = inlet

Out = outlet

*B = height required for element removal

*1 = vent screw G1/4

*2 = fixing

10. Installation, operating and maintenance instructions

10.1 Filter installation

When installing the filter make sure that sufficient space is available to remove filter element and filter housing. The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

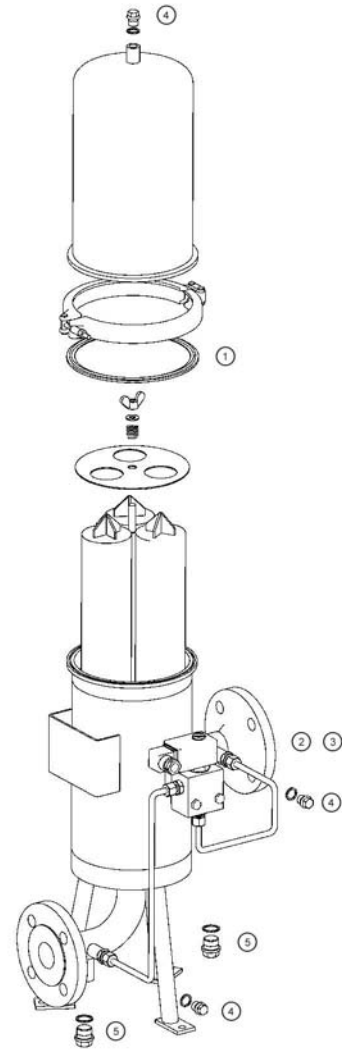
1. The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open position to normally closed position or vice versa (see data sheet PiS 3192/2.2).
2. Filter with a digital differential gauge and analog signal outlet, can be integrated into an existing system control. The programming of the PiS 3160 has to be made according to parameter sheet enclosed, in order to ensure an element replacement at 2.2 bar (see data sheet/manual instruction PiS 3160).

10.3 When should the filter element be replaced?

1. Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the filter element must be replaced.
2. Filter with a digital differential gauge, analogue signal outlet and switch contact:
The signal for element replacement can be displayed via the switch contact or the analog signal output and a system control unit.
3. Filters without maintenance indicator:
The filter element should be replaced when a differential pressure of 2.2 bar is reached. Afterwards follow instructions of the manufacturer.
4. Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (Sm-x) cannot be cleaned.

10.4 Element replacement

1. Stop system and relieve filter from pressure.
2. Discharge the filter housing completely.
3. Open clamps or black flange screws.
4. Remove cover carefully.
5. With filter housings with more cartridge configuration, loose and remove the elements' holding plate/fixing.
6. Pull the filter element out of its spigot by turning and light listing.
7. Make sure that the order number on the spare element corresponds to the order number of the filter name-plate.
8. For insertion of the new elements, lightly bathe the o-rings with the medium to be filtered.
9. Attach and fix the elements' holding plate/fixing.
10. Check O-ring on the filter housing for damage. Replace, if necessary.
11. Attach the cover carefully and close with the clamp or with black flange tighten the screws.
12. Close the drain plug and vent the filter completely.
13. After venting, check the housing on leak tightness.



11. Spare parts list

Order numbers of spare parts		
Position	Type	Order number
①	Seal kit FPM for filter	
	1 cartridge configuration	70330181
	3 cartridges configuration	70330183
	5 cartridges configuration	70330184
②	8 cartridges configuration	70330185
	Maintenance indicator	
	Visual PiS 3193/2.2	78307191
	Electrical PiS 3192/2,2	70340440
③	Digital PiS 3160	70341010
	Electrical upper section only	
④ and ⑤	Seal kit for maintenance indicator	
	FPM	70341011
	Screw plug	
④ and ⑤	G ¼	70341026
	G ½	70341024

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Process filtration

PiP

Pleated cartridges

1. Features

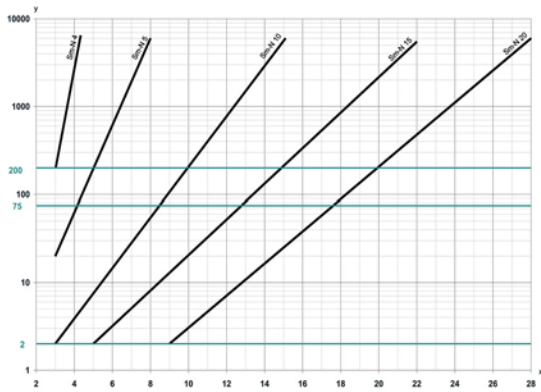
MAHLE pleated cartridges of the PiP-series are high-efficient Sm-N pleated cartridges for process filtration. These cartridges are used for lots of demanding applications in the industrial production process. They are especially suitable for the filtration of cleaning fluids in the process technology. Furthermore, the PiP-series can be used for water treatment as well as for filtration of low-viscosity oils and emulsions. With this particular filter series for the industrial process filtration, MAHLE offers a depth filter with a great efficient filter surface as well as a collection efficiency.

Characteristics

- High-efficient Sm-N cartridges
- Standard lengths: 10", 20", 30" and 40"
- High differential pressure stability and dirt holding capacity for optimum operating lifetime
- Guaranteed separation rates acc. to ISO 16889 multi-pass test
- Worldwide distribution



2. Separation grade characteristics



x = particle size [μm]

y = beta value

determined by multi-pass tests (ISO 16889)

calibration according to ISO 11171 (NIST)

3. Filter performance data

testet according to ISO 16889 (Multipass-Test)

Sm-N with max. Δp 3 bar

		$\beta_{x(C)} 200$	$\beta_{x(C)} 1000$	$\beta_{x(C)} 3000$
Sm-N 1	1	$\leq 4 \mu\text{m}$	$\leq 4 \mu\text{m}$	$\sim 4 \mu\text{m}$
Sm-N 5	5	$5 \mu\text{m}$	$\sim 6,5 \mu\text{m}$	$\sim 7,5 \mu\text{m}$
Sm-N 10	10	$10 \mu\text{m}$	$\sim 12,5 \mu\text{m}$	$\sim 14 \mu\text{m}$
Sm-N 15	15	$15 \mu\text{m}$	$\sim 18,5 \mu\text{m}$	$\sim 20,5 \mu\text{m}$
Sm-N 20	20	$20 \mu\text{m}$	$\sim 23,5 \mu\text{m}$	$\sim 26,5 \mu\text{m}$

values guaranteed up to 2.2 bar differential pressure

Degree of filtration acc. NIST-definition (ISO 11171) equivalent to ACFTD definition (ISO 4402:1991) $\leq 1 \mu\text{m}$.

4. Quality assurance

MAHLE filters and filter elements are produced according to the following international standards:

Norm	Designation
DIN ISO 2941	Hydraulic fluid power - filter elements - verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power - filter elements - verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power - filter elements - verification of material compatibility with fluids
DIN ISO 3723	Hydraulic fluid power - filter elements - method for end load test
DIN ISO 3724	Hydraulic fluid power - filter elements - verification of flow fatigue characteristics
ISO 3968	Hydraulic fluid power-filters-evaluation of pressure drop versus flow characteristics
ISO 10771.1	Fatigue pressure testing of metal containing envelopes in hydraulic fluid applications
ISO 16889	Hydraulic fluid power filters-multipass method for evaluation filtration performance of a filter element

5. Type number key and order numbers

5.1 Type number key PiP pleated cartridges

Type

PiP Filter for industrial process technology

Design

KF Pleated cartridge

Cartridge spigot

- A** Double o-ring, SOE 222
- B** Bayonet, double o-ring, SOE 226
- C** Cross-groove, double o-ring, SOE
- D** Flat seal, DOE

Cartridge type

- 0** Open at one end (SOE) without centre point
- 1** Open at one end (SOE) with centre point
- 2** Open at both ends (DOE)

Cartridge length

- 10** 10"
- 20** 20"
- 30** 30"
- 40** 40"

Filter material

Sm-N

Degree of filtration

- 1** 1 µm
- 5** 5 µm
- 10** 10 µm
- 15** 15 µm
- 20** 20 µm

PiP/ KF/ A- 1/ 10- Sm-N 5 **Example for ordering**

5.2 Order numbers PiP pleated cartridges

Nominal size NG [l/min]	Recomm. flow rate [l/min]	Order number	Type	Filter material	Δ p max. [bar]	Filter surface [cm ²]
25	10	70329906	PiP/KF/A-0/10-Sm-N 1	Sm-N 1	3	2580
	15	70329913	PiP/KF/A-0/10-Sm-N 5	Sm-N 5		
	20	70329917	PiP/KF/A-0/10-Sm-N 10	Sm-N 10		
	23	70329919	PiP/KF/A-0/10-Sm-N 15	Sm-N 15		
	25	70329923	PiP/KF/A-0/10-Sm-N 20	Sm-N 20		
50	20	70329929	PiP/KF/A-0/20-Sm-N 1	Sm-N 1	3	5270
	30	70329936	PiP/KF/A-0/20-Sm-N 5	Sm-N 5		
	40	70329944	PiP/KF/A-0/20-Sm-N 10	Sm-N 10		
	46	70329948	PiP/KF/A-0/20-Sm-N 15	Sm-N 15		
	50	70329964	PiP/KF/A-0/20-Sm-N 20	Sm-N 20		
75	30	70329967	PiP/KF/A-0/30-Sm-N 1	Sm-N 1	3	8270
	45	70329973	PiP/KF/A-0/30-Sm-N 5	Sm-N 5		
	60	70329975	PiP/KF/A-0/30-Sm-N 10	Sm-N 10		
	69	70329977	PiP/KF/A-0/30-Sm-N 15	Sm-N 15		
	75	70329979	PiP/KF/A-0/30-Sm-N 20	Sm-N 20		
100	40	70329983	PiP/KF/A-0/40-Sm-N 1	Sm-N 1	3	11000.
	60	70329986	PiP/KF/A-0/40-Sm-N 5	Sm-N 5		
	80	70329929	PiP/KF/A-0/40-Sm-N 10	Sm-N 10		
	92	70330001	PiP/KF/A-0/40-Sm-N 15	Sm-N 15		
	100	70330004	PiP/KF/A-0/40-Sm-N 20	Sm-N 20		

5.2 Order numbers PiP pleated cartridges

Nominal size NG [l/min]	Recomm. flow rate [l/min]	Order number	Type	Filter material	Δp max. [bar]	Filter surface [cm ²]
25	10	70323913	PiP/KF/A-1/10-Sm-N 1	Sm-N 1	3	2580
	15	70323950	PiP/KF/A-1/10-Sm-N 5	Sm-N 5		
	20	70323970	PiP/KF/A-1/10-Sm-N 10	Sm-N 10		
	23	70323983	PiP/KF/A-1/10-Sm-N 15	Sm-N 15		
	25	70324006	PiP/KF/A-1/10-Sm-N 20	Sm-N 20		
50	20	70324081	PiP/KF/A-1/20-Sm-N 1	Sm-N 1	3	5270
	30	70324087	PiP/KF/A-1/20-Sm-N 5	Sm-N 5		
	40	70324094	PiP/KF/A-1/20-Sm-N 10	Sm-N 10		
	46	70324099	PiP/KF/A-1/20-Sm-N 15	Sm-N 15		
	50	70324103	PiP/KF/A-1/20-Sm-N 20	Sm-N 20		
75	30	70324106	PiP/KF/A-1/30-Sm-N 1	Sm-N 1	3	8270
	45	70324466	PiP/KF/A-1/30-Sm-N 5	Sm-N 5		
	60	70324479	PiP/KF/A-1/30-Sm-N 10	Sm-N 10		
	69	70324486	PiP/KF/A-1/30-Sm-N 15	Sm-N 15		
	75	70324490	PiP/KF/A-1/30-Sm-N 20	Sm-N 20		
100	40	70324563	PiP/KF/A-1/40-Sm-N 1	Sm-N 1	3	11000
	60	70324575	PiP/KF/A-1/40-Sm-N 5	Sm-N 5		
	80	70324589	PiP/KF/A-1/40-Sm-N 10	Sm-N 10		
	92	70326186	PiP/KF/A-1/40-Sm-N 15	Sm-N 15		
	100	70326194	PiP/KF/A-1/40-Sm-N 20	Sm-N 20		
25	10	70314642	PiP/KF/B-0/10-Sm-N 1	Sm-N 1	3	3100
	15	70314644	PiP/KF/B-0/10-Sm-N 5	Sm-N 5		
	20	70329530	PiP/KF/B-0/10-Sm-N 10	Sm-N 10		
	23	70329590	PiP/KF/B-0/10-Sm-N 15	Sm-N 15		
	25	70329612	PiP/KF/B-0/10-Sm-N 20	Sm-N 20		
50	20	70314651	PiP/KF/B-0/20-Sm-N 1	Sm-N 1	3	6250
	30	70314652	PiP/KF/B-0/20-Sm-N 5	Sm-N 5		
	40	70329623	PiP/KF/B-0/20-Sm-N 10	Sm-N 10		
	46	70329634	PiP/KF/B-0/20-Sm-N 15	Sm-N 15		
	50	70329646	PiP/KF/B-0/20-Sm-N 20	Sm-N 20		
25	10	70329601	PiP/KF/D-2/10-Sm-N 1	Sm-N 1	3	3140
	15	70329606	PiP/KF/D-2/10-Sm-N 5	Sm-N 5		
	20	70329607	PiP/KF/D-2/10-Sm-N 10	Sm-N 10		
	23	70329608	PiP/KF/D-2/10-Sm-N 15	Sm-N 15		
	25	70329610	PiP/KF/D-2/10-Sm-N 20	Sm-N 20		
50	20	70307272	PiP/KF/D-2/20-Sm-N 1	Sm-N 1	3	6380
	30	70319962	PiP/KF/D-2/20-Sm-N 5	Sm-N 5		
	40	70319969	PiP/KF/D-2/20-Sm-N 10	Sm-N 10		
	46	70321386	PiP/KF/D-2/20-Sm-N 15	Sm-N 15		
	50	70329636	PiP/KF/D-2/20-Sm-N 20	Sm-N 20		

5.2 Order numbers PiP pleated cartridges

Nominal size NG [l/min]	Recomm. flow rate [l/min]	Order number	Type	Filter material	Δp max. [bar]	Filter surface [cm ²]
75	30	70329637	PiP/KF/D-2/30-Sm-N 1	Sm-N 1	3	9900
	45	70314541	PiP/KF/D-2/30-Sm-N 5	Sm-N 5		
	60	70319303	PiP/KF/D-2/30-Sm-N 10	Sm-N 10		
	69	70320742	PiP/KF/D-2/30-Sm-N 15	Sm-N 15		
	75	70329638	PiP/KF/D-2/30-Sm-N 20	Sm-N 20		
100	40	70329701	PiP/KF/D-2/40-Sm-N 1	Sm-N 1	3	13250
	60	70329702	PiP/KF/D-2/40-Sm-N 5	Sm-N 5		
	80	70329703	PiP/KF/D-2/40-Sm-N 10	Sm-N 10		
	92	70329704	PiP/KF/D-2/40-Sm-N 15	Sm-N 15		
	100	70329705	PiP/KF/D-2/40-Sm-N 20	Sm-N 20		

6. Technical specification

Material

End caps: PA/1.4571/1.4404

Seal material: FPM

Filter material: Micro glass fibre

Frames: 1.4301

Temperature range: 0 to + 80 °C (other ranges on request)

recommended. Δp : up to 2.2 bar

max. Δp : 3 bar

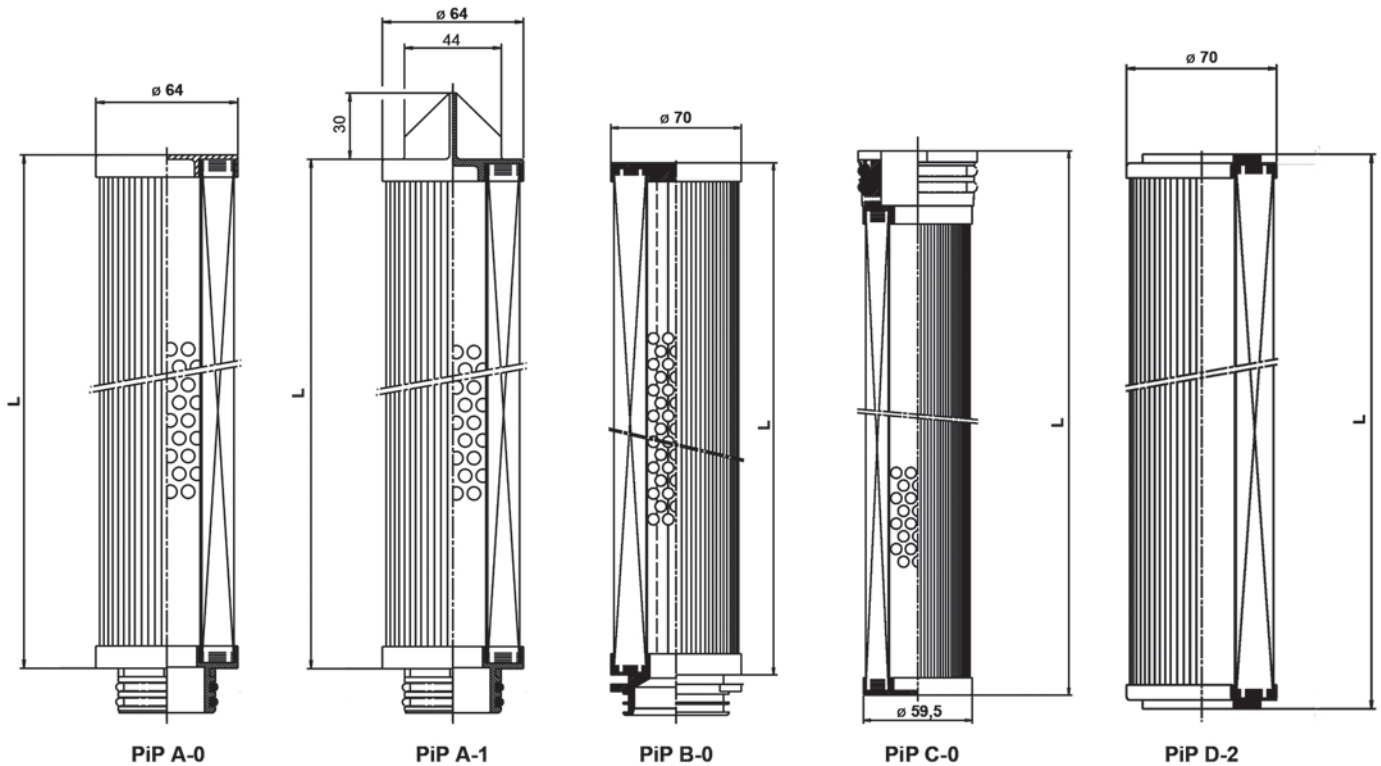
Technical data is subject to change without notice!

The standard type is suitable for all popular washing fluids used to clean components, including most aqueous, neutral, alkaline, acid and hydrocarbon cleaners. If an amine cleaner is used, the specific operating conditions (concentration and temperature) must be clarified beforehand. Furthermore, the pleated cartridges can be used for water treatment, low-viscosity oils and emulsions.

Other applications or media require prior consultation and possibly laboratory tests.

These cartridges are not cleanable!

7. Dimensions



Type	L [mm]
PiP/KF/A-0/10-Sm-N ...	256
PiP/KF/A-0/20-Sm-N ...	492
PiP/KF/A-0/30-Sm-N ...	764
PiP/KF/A-0/40-Sm-N ...	1016
PiP/KF/A-1/10-Sm-N ...	256
PiP/KF/A-1/20-Sm-N ...	492
PiP/KF/A-1/30-Sm-N ...	764
PiP/KF/A-1/40-Sm-N ...	1016
PiP/KF/B-0/10-Sm-N ...	254,5
PiP/KF/B-0/20-Sm-N ...	490,5
PiP/KF/C-0/30-Sm-N ...	793
PiP/KF/C-0/40-Sm-N ...	1045
PiP/KF/D-2/10-Sm-N ...	260
PiP/KF/D-2/20-Sm-N ...	501,5
PiP/KF/D-2/30-Sm-N ...	768
PiP/KF/D-2/40-Sm-N ...	1020

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 70340343.10/2008

ATEX recommendation fluid technology

Fluid filters in hazardous zones

Recommendation for the use of fluid filters and maintenance indicators in hazardous zones
acc. to Directive 94/9EG (ATEX)

Short description

Fluid filters

Filters (hydraulic-, lubrication-oil-, air breather-) in fluid systems are not subject to this directive.

Fluid filters do not require a CE- marking.

For fluid filters to be used in hazardous zones, the ignition sources have to be analysed by the operator, considering the complete installation. MAHLE Filtersysteme GmbH, Industriefiltration as manufacturer of the fluid filter may assist.

During filtration of fluids and gases electrostatic charge may occur on the filter element, the filter housing and the fluid - especially when glass fibre filter elements are used.

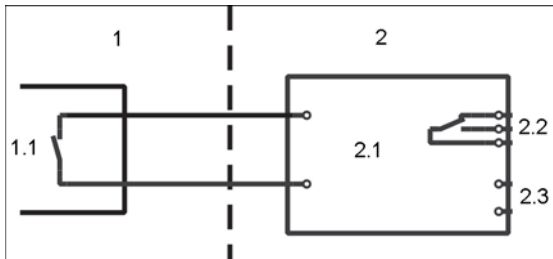
For use in hazardous zones, MAHLE Filtersysteme GmbH, Industriefiltration recommends to use only metal filter housings and to connect the housing electrically to ground.

These filters do not possess any external ignition source.

The earthing is realised by using the clamping bolts. The maximum content of magnesium is less than 7,5 %.

The size of the largest projected nonconducting areas are smaller than 100 sqcm (400 sqcm if a conducting framing is provided). According to DIN EN 13463 the MAHLE fluid filters are suitable for the use in appliance group II group G/D up to 120 Deg C.

The function of the electrical maintenance indicator is described in the right column.



Maintenance indicators

The electrical maintenance indicators, which are mentioned in the MAHLE list of released products, are simple electrical devices according to DIN EN 50020, without own supply voltage.

The electrical components consists of reed-contacts, bimetal switches, plug connections and terminal clamps.

The components are in accordance with DIN EN 50014 and DIN EN 50020.

For equipment group II, category 2G (zone 1) and category 3G (zone 2), these components can be used acc. DIN EN 60079-14 in intrinsically safe circuits [EEX ib] without making and certification.

The electrical utilities are attributed to category ib and temperature class T5.

Das If the electrical upper part is used conventional (intrinsically safe circuit) it will not present itself as a heat source.

Usage in EX- zones is possible when the indicators are connected intrinsically safe (EX-i).

For that purpose a switch-amplifier with an intrinsically safe input is required. The switch amplifier must be installed outside the EX-zone, leaving only the intrinsically safe wires in contact with the hazardous zone.

1. Ex-zones
 - 1.1 Maintenance indicator
2. Intrinsically safe input
 - 2.1 Switch-amplifier with PTB-approval
 - 2.2 Output cast
 - 2.3 Power-supply

The required switch-amplifiers are offered by manufacturers of Ex-control equipment.

A two-step indicator requires a switch amplifier with two intrinsically safe inputs.

Subject to technical alteration without prior notice.

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Notices

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