MAHLE Industry

Low Pressure Filter
Pi 1500

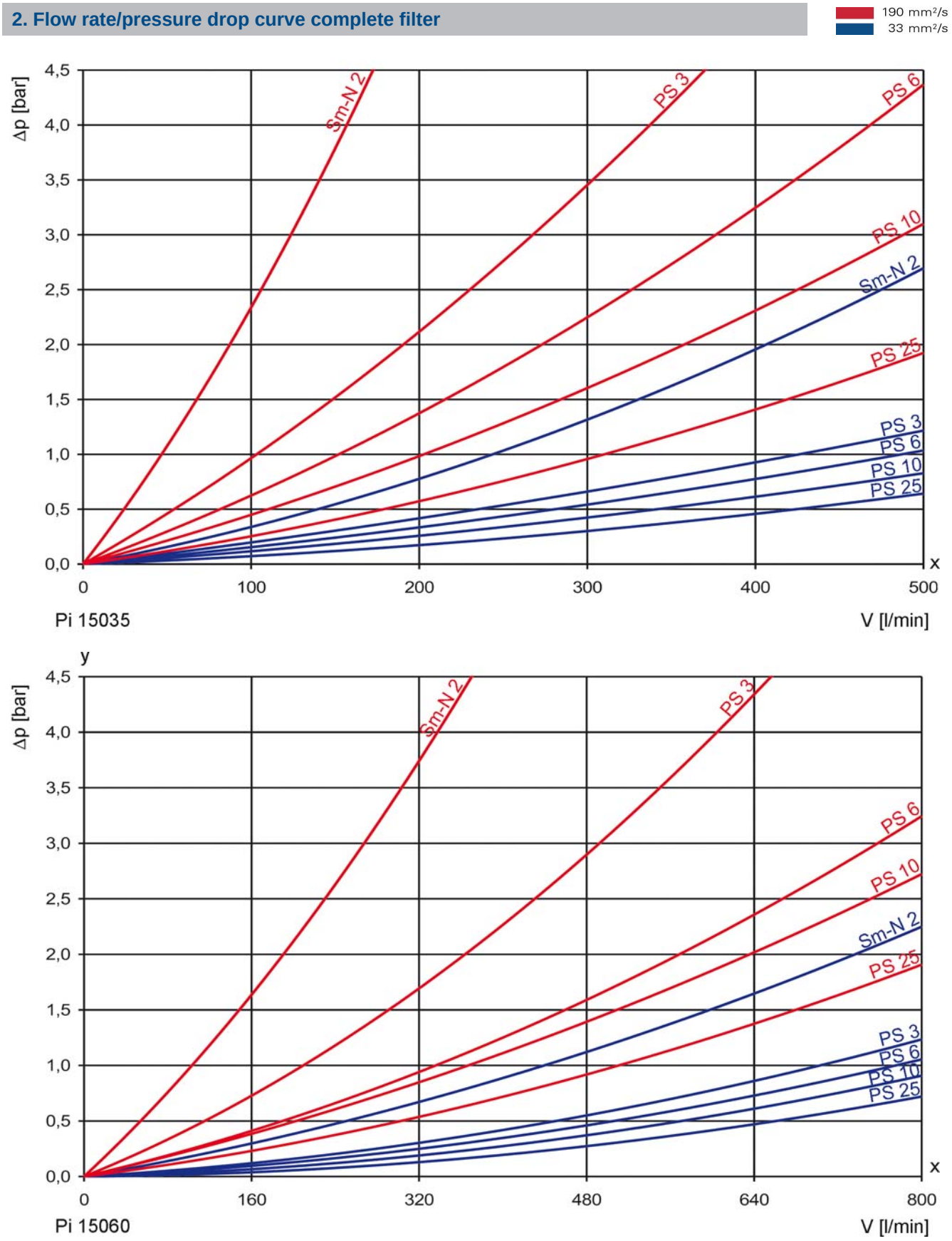
Nominal pressure 10/25 bar (140/360 psi), nominal size up to 600
Filter elements according to DIN 24550

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 PS filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution

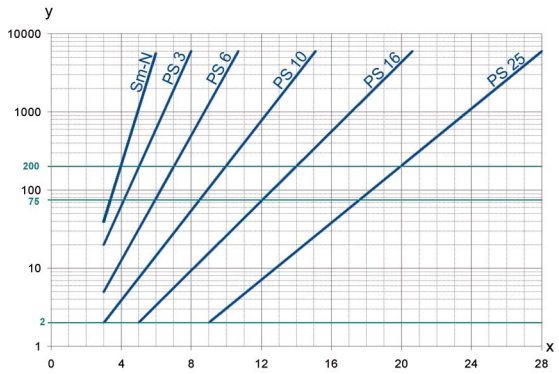
2. Flow rate/pressure drop curve complete filter



y = differential pressure Δp [bar]

x = flow rate V [l/min]

3. Separation 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)

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

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

Values guaranteed up to 10 bar differential pressure.

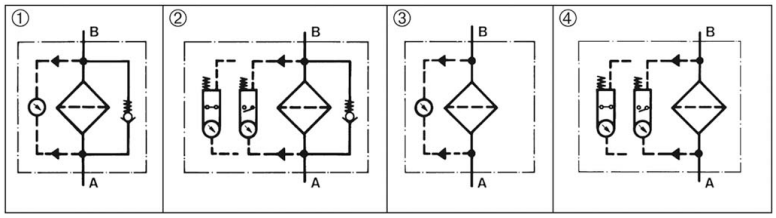
The filter element Sm-N 2 is an element with a very large dirt holding capacity, especially for bypass filtration.

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 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 housing	2. Filter element
V = 350 l/min, bypass, electrical maintenance indicator, Nominal pressure: 10 bar Type: Pi 15035/10-058 Order number: 76101778	PS 10 Type: Pi 23063 RN PS 10 Order number: 77924202

7.1 Housing design

Nominal size NG [l/min]	Order number	Type	Nominal pressure [bar]	① with bypass valve and visual indicator	② with bypass valve and electrical indicator	③ with visual indicator	④ 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. Δ p [bar]	Filter surface [cm²]
350	76112650	Pi 2S063 RN Sm-N 2	Sm-N 2	1	10	8850
	77924194	Pi 21063 RN PS 3	PS 3	1		13515
	77964091	Pi 22063 RN PS 6	PS 6	1		13515
	77924202	Pi 23063 RN PS 10	PS 10	1		13515
	77963671	Pi 24063 RN PS 16	PS 16	1		13515
	77960263	Pi 25063 RN PS 25	PS 25	1		13515
600	76112650	Pi 2S063 RN Sm-N 2	Sm-N 2	2	10	2 x 8850
	77924194	Pi 21063 RN PS 3	PS 3	2		2 x 13515
	77964091	Pi 22063 RN PS 6	PS 6	2		2 x 13515
	77924202	Pi 23063 RN PS 10	PS 10	2		2 x 13515
	77963671	Pi 24063 RN PS 16	PS 16	2		2 x 13515
	77960263	Pi 25063 RN PS 25	PS 25	2		2 x 13515

*a wider range of element types is available on request

8. Technical specifications

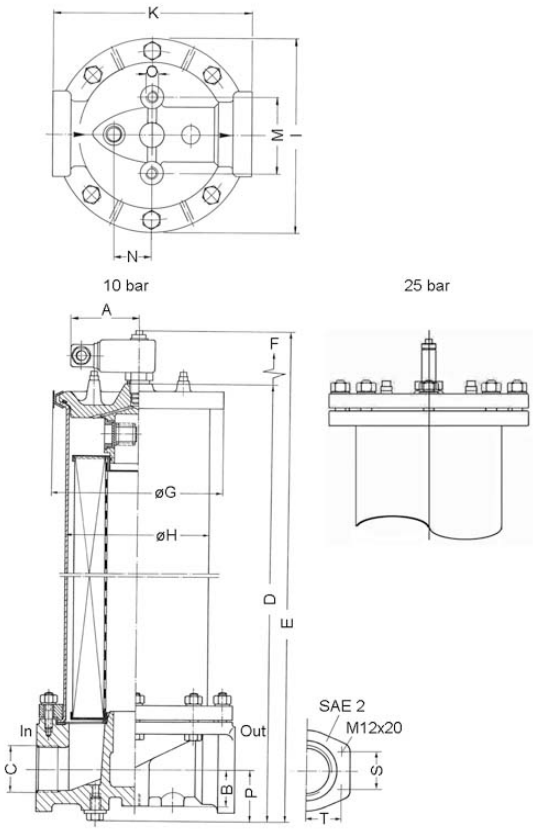
Nominal pressure:	10/25 bar (140/360 psi)
Temperature range:	- 10 °C to + 120 °C
	(other temperature ranges on request)
Bypass setting:	Δp 3.5 bar ± 10 %
Filter head material:	GAL
Filter housing material:	St
Sealing material:	NBR
Maintenance indicator setting:	Δp 2.2 bar ± 10 %
Electrical data of maintenance 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 sleave:	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 shoud 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 10 bar	G 25 bar	H	I	K	M	N	O	P	S	T	Weight [kg]
Pi 15035	78	42	G1½	643	680	425	190	225	165	225	230	90	44	M12x20	59	-	-	17.1
Pi 15060	78	42	SAE 2	1005	1045	850	190	225	165	225	230	90	44	M12x20	59	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.

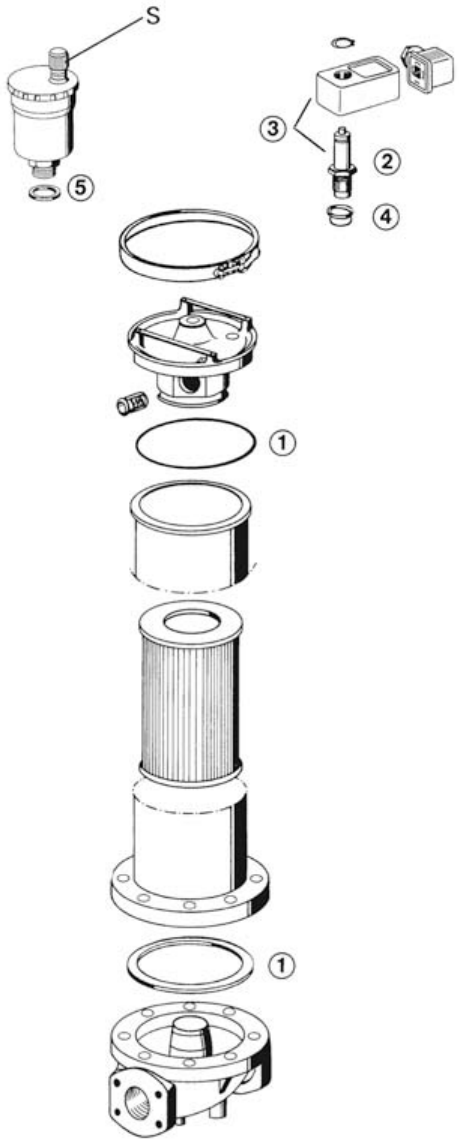
10.3 When should the filter element be replaced?

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 (PS, Sm-N) cannot be cleaned.

10.4 Element replacement

1 . Stop system and relieve filter from pressure.
2 . Loosen quick-action clamp (10 bar version) or screws of flanged cover, remove cover, and open drain valve. Housing completely vented.
3 . Remove filter element from filter housing. Remove spacer sleeve at Pi 15060. After proper cleaning please use again.
4 . Check seals for damage. Replace, if necessary.
5 . 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.
6 . 10 bar version: 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.
7 . 25 bar version: Close drain valve and put the cover plate on so that the stud bolts go into the holes of the cover plate. Make sure not to squeeze the O-ring on the bottom side of the cover plate. Hand-tighten the 8 mounting nuts with spring rings. Then draw up the nuts tight crosswise with a turn-screw SW 19 without canting the cover plate. Tightening torque for mountings nuts is 50 Nm. After bringing the hydraulic unit to service de-aerate the filter via vent-screw.

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	70323353
	Adapter for filter elements (Pi 15060)	76102073

MAHLE Industry

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MAHLE

Industry

Low Pressure Filter
Pi 150

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

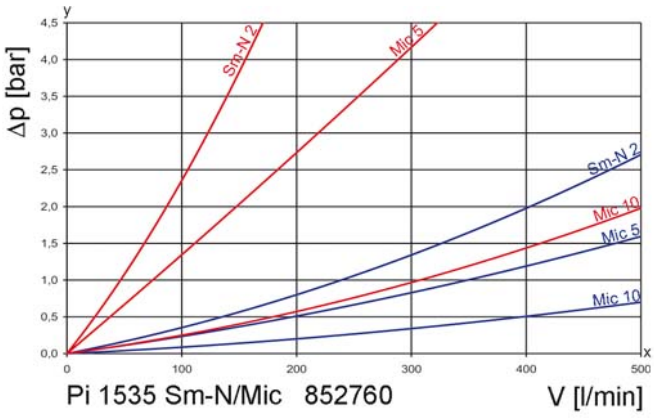
1. Features

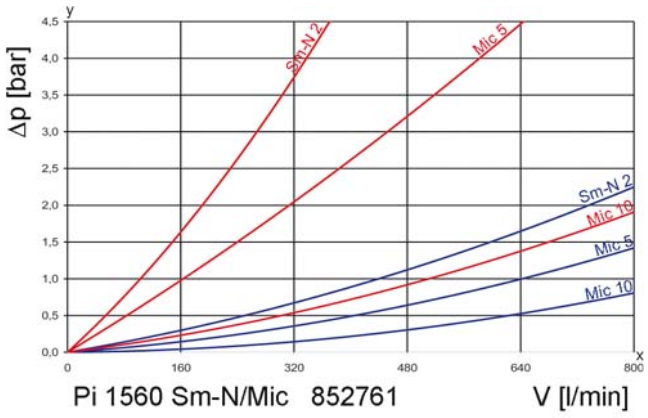
High performance filters for modern hydraulic systems

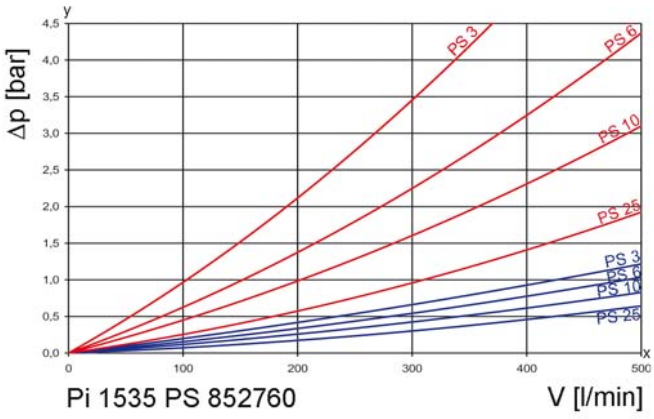
- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre PS filter elements
- Beta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

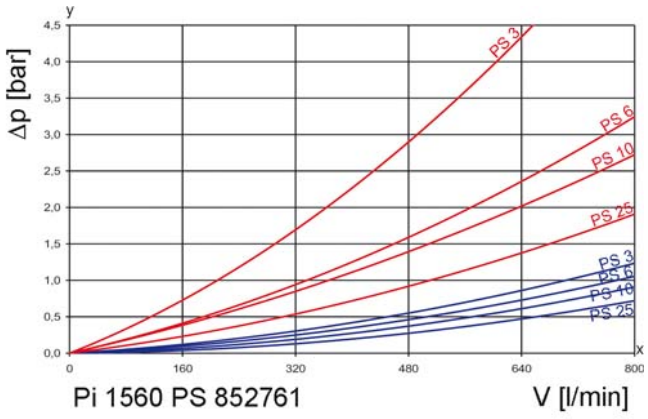
2. Flow rate/pressure drop curve complete filter

190 mm²/s
33 mm²/s



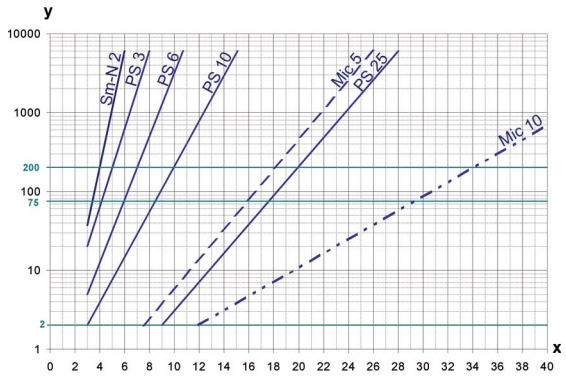






y = differential pressure Δp [bar]
x = flow rate V [l/min]

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)

PS elements with max. Δ p 10 bar
Sm-N 2 elements with max. Δ p 5 bar

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

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

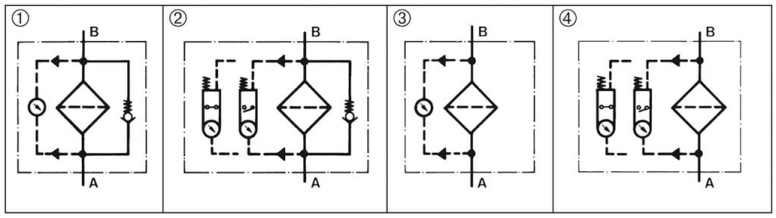
The filter element Sm-N 2 is an element with a very large dirt holding capacity, especially for bypass filtration.

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	PS 10 Type: 852 760 PS 10 Order number: 77774425

7.1 Housing design

Nominal size NG [l/min]	Order number	Type	Nominal pressure [bar]	① with bypass valve and visual indicator	② with bypass valve and electrical indicator	③ with visual indicator	④ 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 material	max. Δ p [bar]	Filter surface [cm²]
400	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		16000
	77774433	852 760 PS 3	PS 3	10	14500
	78299042	852 760 PS 6	PS 6		14500
	77774425	852 760 PS 10	PS 10		14500
	77806565	852 760 PS 25	PS 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
	77774391	852 761 PS 3	PS 3	10	29000
	78225898	852 761 PS 6	PS 6		29000
	77774383	852 761 PS 10	PS 10		29000
	77806573	852 761 PS 25	PS 25		29000

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

8. Technical specifications

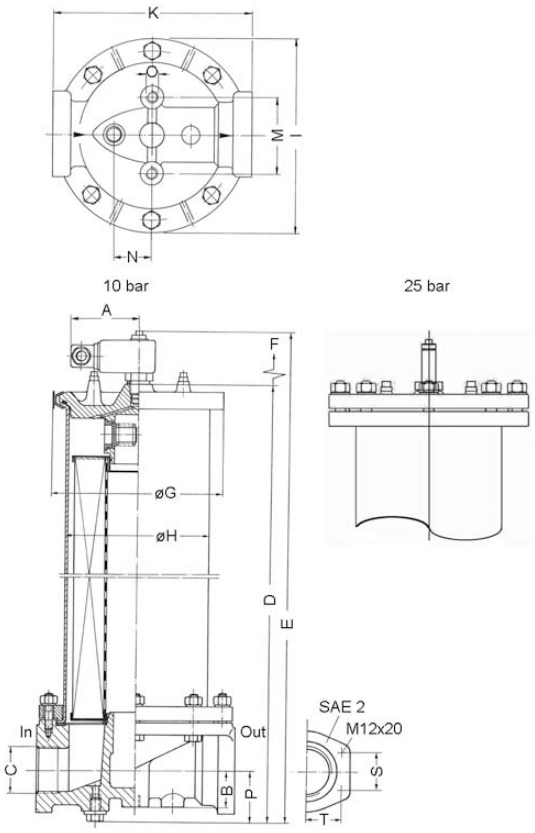
Nominal pressure:	10/25 bar (140/360 psi)
Temperature range:	-10 °C to +120 °C
	(other temperature ranges on request)
Bypass setting:	Δp 3.5 bar ± 10 %
Material filter head/cover:	GAL
Material filter housing:	St
Sealing material:	NBR
Maintenance indicator setting:	Δp 2.2 bar ± 10 %
Electrical data of 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 sleave:	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 10 bar	G 25 bar	H	I	K	M	N	O	P	S	T	Weight [kg]
Pi 1535	78	42	G1½	643	680	425	190	225	165	225	230	90	44	M12x20	59	-	-	17.1
Pi 1560	78	42	SAE 2	1005	1045	850	190	225	165	225	230	90	44	M12x20	59	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.

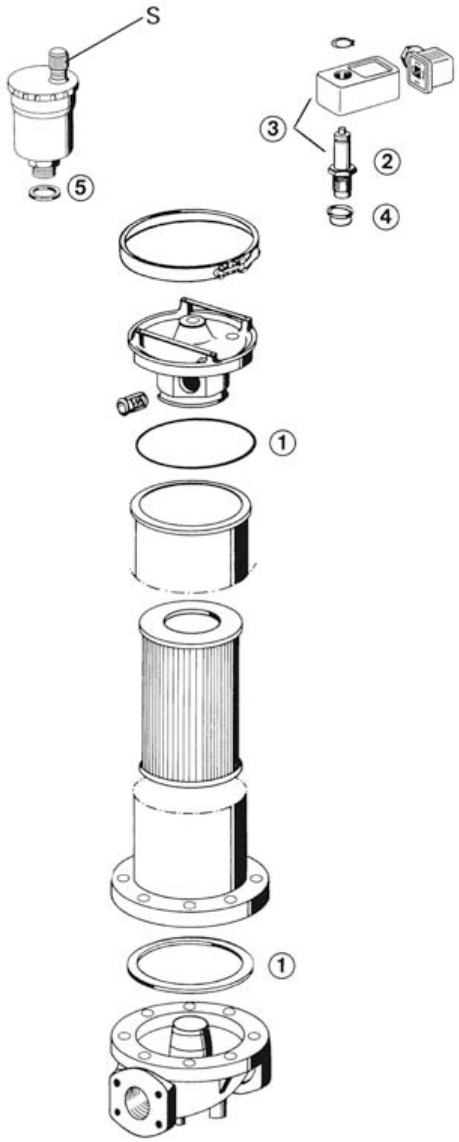
10.3 When should the filter element be replaced?

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 (PS, Sm-N, Mic) cannot be cleaned.

10.4 Element replacement

1 . Stop system and relieve filter from pressure.
2 . Loosen quick-action clamp (10 bar version) or screws of flanged cover, remove cover, and open drain valve. Housing completely vented.
3 . Remove filter element from the filter housing.
4 . Check seal for damages, replace if necessary.
5 . 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.
6 . 10 bar version: Close drain valve, relocate cover, and close the quick-action clamp. Filters are automatically vented via the air bleeder valve, the protection cap S has to be turned 2 times for being open.
7 . 25 bar version: Close drain valve, and put the cover plate on so that the stud bolts go into the holes of the cover plate. Make sure not to squeeze the O-ring on the bottom side of the cover plate. Hand-tighten the 8 mounting nuts with spring rings. Then draw up the nuts tight crosswise with a turn-screw SW19 without canting the cover plate. Tightening torque for mountings nuts is 50 Nm. After bringing the hydraulic unit to service de-aerate the filter via vent-screw.

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	70323353

MAHLE Industry

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78356305.03/2012

MAHLE Industry

Line filter
Pi 1907

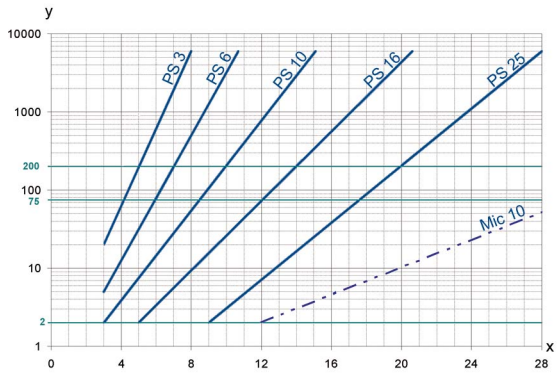
Nominal pressure 16 bar (230 psi), nominal size 400 up to 6000

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 PS/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)

PS elements with max. Δ p 10 bar

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

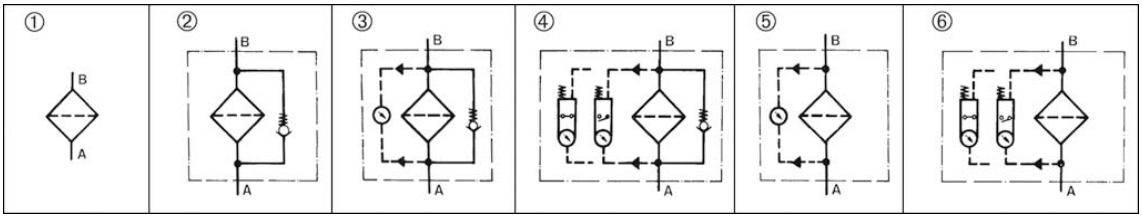
values guaranteed at 5 bar differential pressure

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/ 852 888 PS 10

Pi 1907	**3**	**16**	**150**	**V**	**E**	**Mg**	**Abh**	**852888 PS 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 according to DIN EN 1092-1
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:								Δ p 3.5 bar ± 10 %
Maintenance indicator setting:								Δ p 2.2 bar ± 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 sleave:								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.

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8. Order numbers

8.1 Filter elements

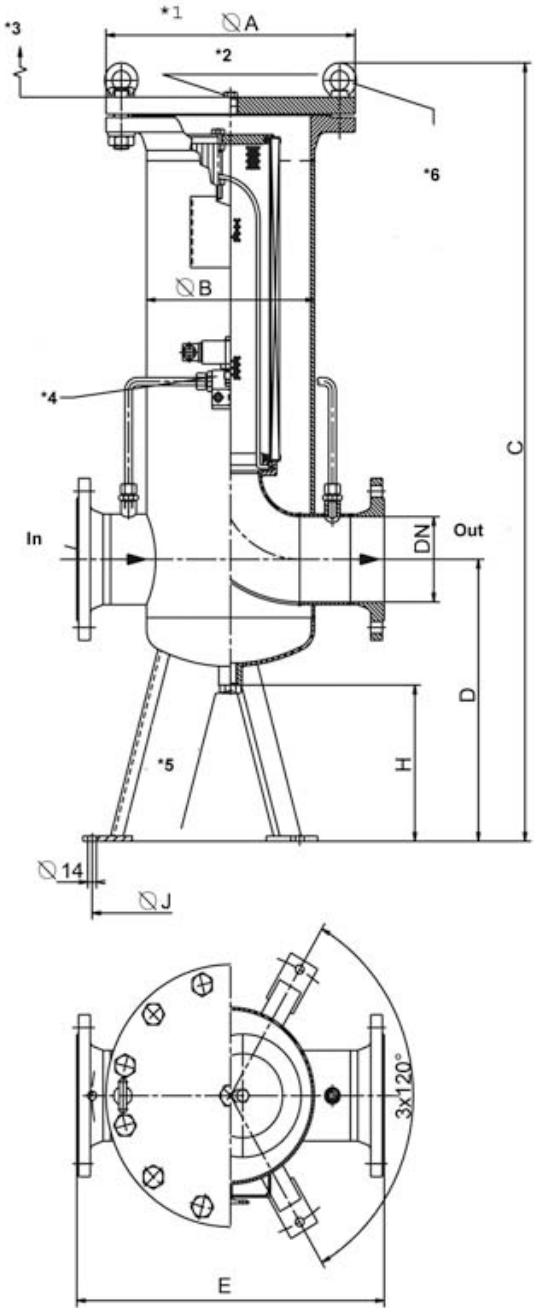
Nominal size NG [l/min]	Order number	Type	Filter material	max. Δ p [bar]	Filter surface [cm²]
400 DN 50	77924178	Pi 21040 RN PS 3 NBR	PS 3	10	8310
	77964083	Pi 22040 RN PS 6 NBR	PS 6		8310
	77924186	Pi 23040 RN PS 10 NBR	PS 10		8310
	77963663	Pi 24040 RN PS 16 NBR	PS 16		8310
	77960255	Pi 25040 RN PS 25 NBR	PS 25		8310
	77925050	Pi 13040 RN Mic 10 NBR	Mic 10	10	9450
	77963713	Pi 35040 RN DRG 25 NBR	DRG 25	10	6370
	77999444	Pi 36040 RN DRG 40 NBR	DRG 40		6370
	77963762	Pi 37040 RN DRG 60 NBR	DRG 60		6370
	78267833	Pi 38040 RN DRG 100 NBR	DRG 100		6370
630 DN 65	77924194	Pi 21063 RN PS 3 NBR	PS 3	10	13580
	77964091	Pi 22063 RN PS 6 NBR	PS 6		13580
	77924202	Pi 23063 RN PS 10 NBR	PS 10		13580
	77963671	Pi 24063 RN PS 16 NBR	PS 16		13580
	77960263	Pi 25063 RN PS 25 NBR	PS 25		13580
	77925068	Pi 13063 RN Mic 10 NBR	Mic 10	10	15550
	77963721	Pi 35063 RN DRG 25 NBR	DRG 25	10	8777
	77999451	Pi 36063 RN DRG 40 NBR	DRG 40		10320
	77963770	Pi 37063 RN DRG 60 NBR	DRG 60		8777
	78264459	Pi 38063 RN DRG 100 NBR	DRG 100		10320
800 DN 80	77924194	Pi 21063 RN PS 3 NBR	PS 3	10	13580
	77964091	Pi 22063 RN PS 6 NBR	PS 6		13580
	77924202	Pi 23063 RN PS 10 NBR	PS 10		13580
	77963671	Pi 24063 RN PS 16 NBR	PS 16		13580
	77960263	Pi 25063 RN PS 25 NBR	PS 25		13580
	77925068	Pi 13063 RN Mic 10 NBR	Mic 10	10	15550
	77963721	Pi 35063 RN DRG 25 NBR	DRG 25	10	8777
	77999451	Pi 36063 RN DRG 40 NBR	DRG 40		10320
	77963770	Pi 37063 RN DRG 60 NBR	DRG 60		8777
	78264459	Pi 38063 RN DRG 100 NBR	DRG 100		10320
1250 DN 100	78263295	852 888 PS 3 NBR	PS 3	10	21850
	78354029	852 888 PS 6 NBR	PS 6		21850
	78226813	852 888 PS 10 NBR	PS 10		21850
	78226821	852 888 PS 25 NBR	PS 25		21850
	78207664	852 888 Mic 10 NBR	Mic 10	10	21850
	78228017	852 888 Drg 25 NBR	DRG 25	10	16500
	78228025	852 888 Drg 40 NBR	DRG 40		16500
	78303026	852 888 Drg 60 NBR	DRG 60		16500
	78228470	852 888 Drg 100 NBR	DRG 100		16500

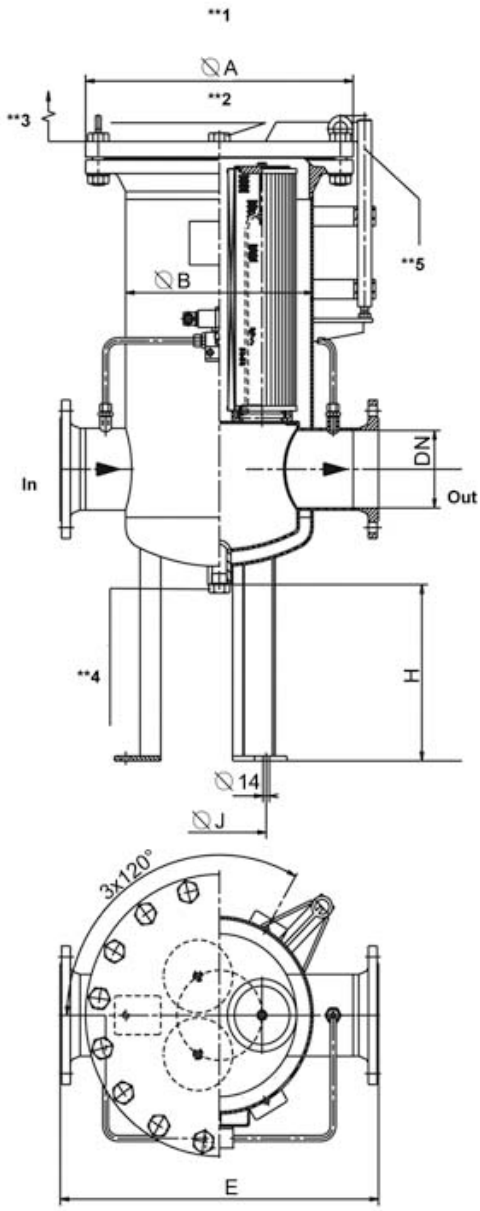
8.1 Filter elements					
Nominal size NG [l/min]	**Order number**	**Type**	**Filter material**	**max. Δ p [bar]**	**Filter surface [cm²]**
1800 DN 125	78227431	852 884 PS 3 NBR	PS 3	**10**	28500
	79337916	852 884 PS 6 NBR	PS 6		28500
	78226797	852 884 PS 10 NBR	PS 10		28500
	78226805	852 884 PS 25 NBR	PS 25		28500
	70366315	852 884 Mic 10 NBR	Mic 10	**10**	28500
	79337460	852 884 Drg 25 NBR	DRG 25	**10**	23450
	78261653	852 884 Drg 40 NBR	DRG 40		23450
	79700402	852 884 Drg 60 NBR	DRG 60		23450
	79327750	852 884 Drg 100 NBR	DRG 100		23450
3500 DN 150	78263295	3x 852 888 PS 3 NBR	PS 3	**10**	65550
	78354029	3x 852 888 PS 6 NBR	PS 6		65550
	78226813	3x 852 888 PS 10 NBR	PS 10		65550
	78226821	3x 852 888 PS 25 NBR	PS 25		65550
	78207664	3x 852 888 Mic 10 NBR	Mic 10	**10**	65550
	78228017	3x 852 888 DRG 25 NBR	DRG 25	**10**	49500
	78228025	3x 852 888 DRG 40 NBR	DRG 40		49500
	78303026	3x 852 888 DRG 60 NBR	DRG 60		49500
	78228470	3x 852 888 DRG 100 NBR	DRG 100		49500
6000 DN 200	78227431	3x 852 884 PS 3 NBR	PS 3	**10**	85506
	79337916	3x 852 884 PS 6 NBR	PS 6		85506
	78226797	3x 852 884 PS 10 NBR	PS 10		85506
	78226805	3x 852 884 PS 25 NBR	PS 25		85506
	70366315	3x 852 884 Mic 10 NBR	Mic 10	**10**	85500
	79337460	3x 852 884 DRG 25 NBR	DRG 25	**10**	70350
	78261653	3x 852 884 DRG 40 NBR	DRG 40		70350
	79700402	3x 852 884 DRG 60 NBR	DRG 60		70350
	79327750	3x 852 884 DRG 100 NBR	DRG 100		70350

9. Dimensions

All dimensions in mm.

Nominal size NG [l/min]	**Connection 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





*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 dirt side "G"
*6 Lifting eye; available for versions starting with size DN 100

**1 illustration shows execution starting with flange size DN 150
**2 vent screw
**3 "K" height required for element removal
**4 drain plug dirt side "G"
**5 cover lifting device

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.

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MAHLE

Industry

Low Pressure Filter/Suction Filter
Pi 1941

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

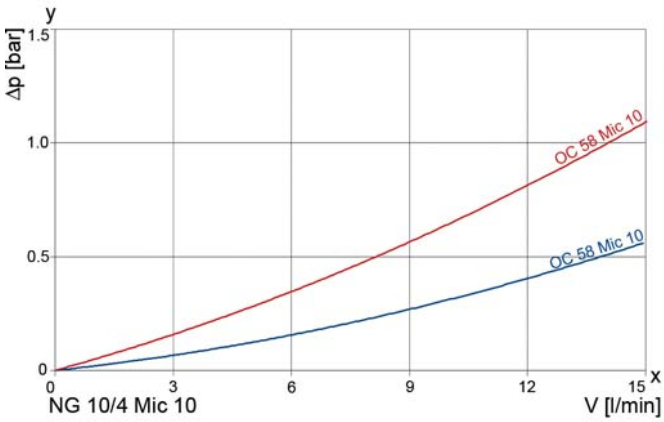
1. Features

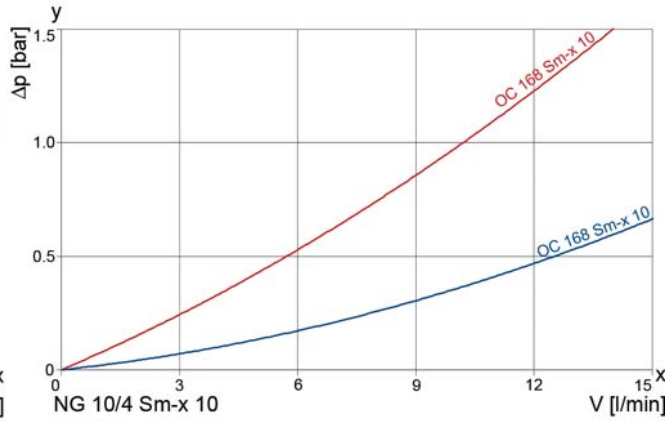
High performance filters for modern hydraulic systems

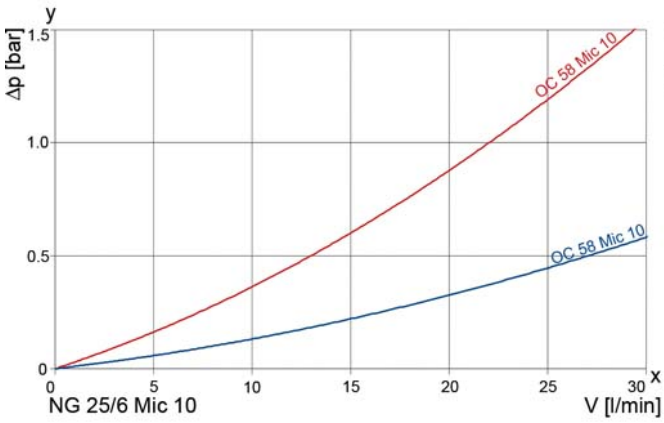
- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual maintenance indicator
- Threaded connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre Sm-x and Mic filter elements
- Beta reated elements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

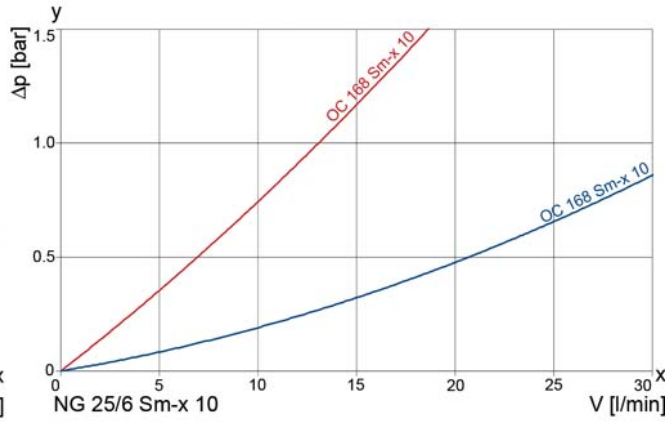
2. Flow rate/pressure drop curve complete filter

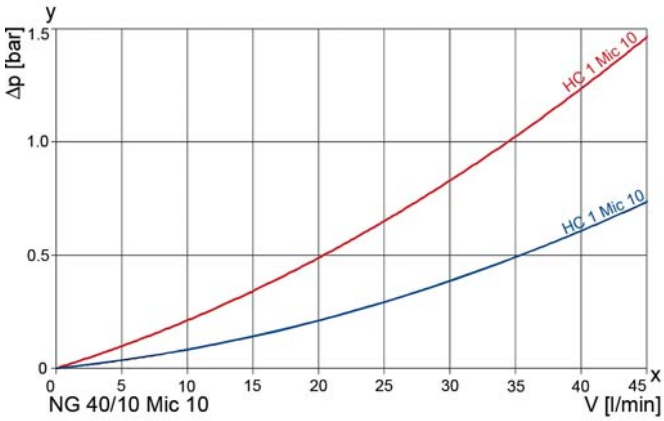
190 mm²/s
33 mm²/s

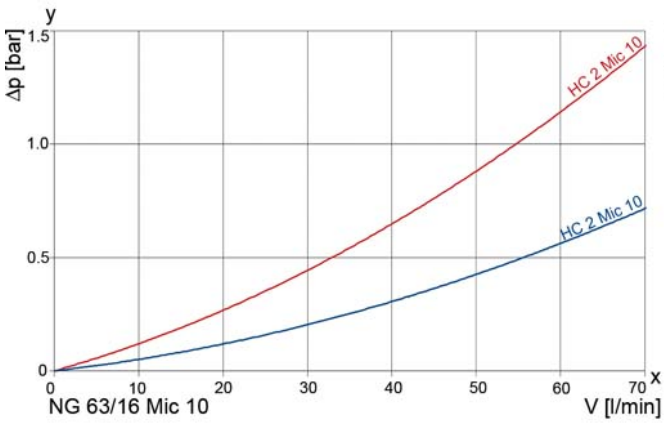


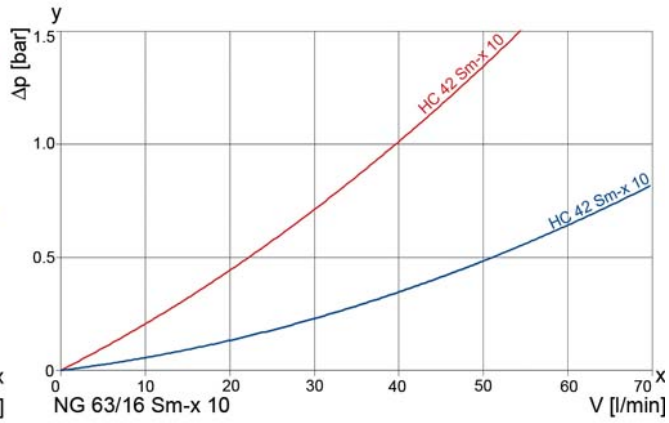






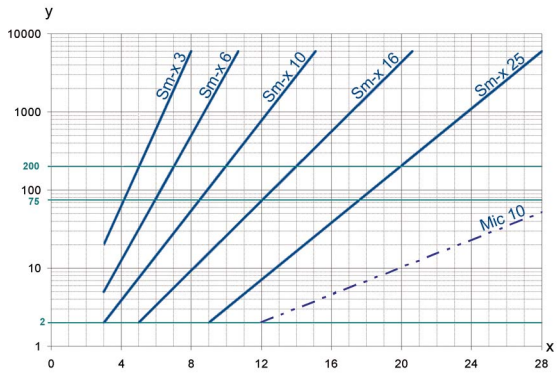






y = differential pressure Δp [bar]
x = flow rate V [l/min]

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. Δ p 5 bar

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

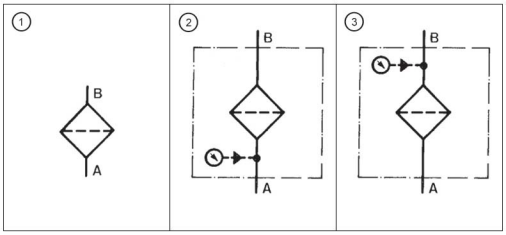
values guaranteed up to
5 bar differential pressure

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 2 Order number 77807811 + 72013241

7.1 Housing design/order number for pressure-side installation

Nominal flow rate NG [l/min]	Order number	Type	① no options	② 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	77785983	OC 58	Mic 10	5	1775
	77500184	OC 168	Sm-x 10		1309
40/10	77640899	HC 1	Mic 10	5	3000
63/16	72013241	HC 2	Mic 10	5	5440
	77501372	HC 42	Sm-x 10		3360

7.3 Housing design/order numbers for suction-side installation

Nominal flow rate NG [l/min]	Order number	Type	① no options	③ 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		■

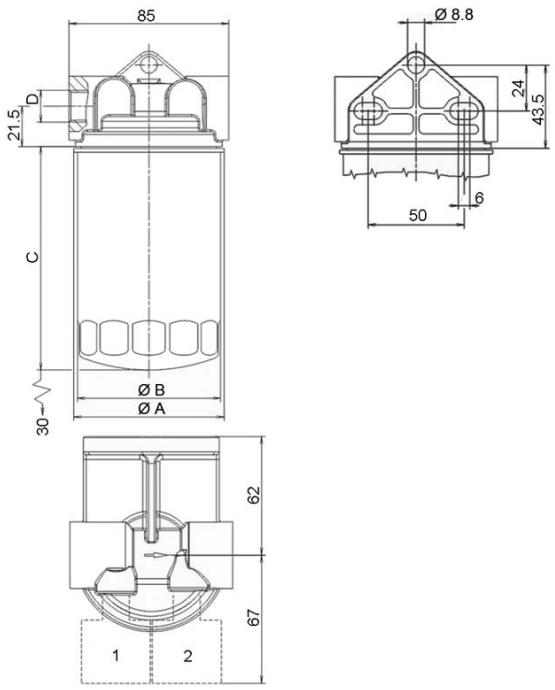
8. Technical specifications

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 cartrdiges at 25 bar presure 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 uns 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	Ø A	Ø B	C	D	Weight [kg] Execution Mic*	Weight [kg] Execution Sm-x*
Pi 1941/10/G 1/4	80	76	120	G 1/4	0.67	0.82
Pi 1941/10/G 3/8	80	76	120	G 3/8	0.67	0.82
Pi 1941/10/G 1/2	95	93	141	G 1/2	0.82	1.02
Pi 1941/10/G 3/4	95	93	210	G 3/4	1.02	1.02

*Design with gauge + 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.

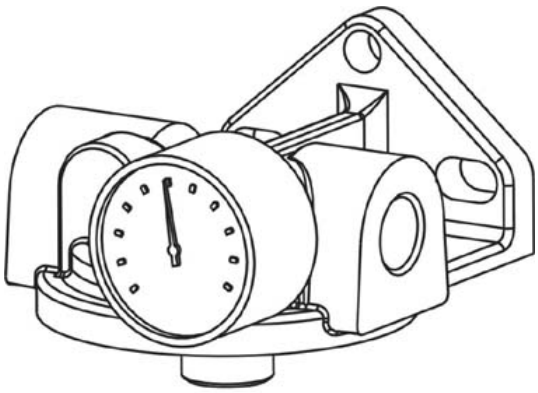
Preferably the filter should be installed with the spin-on cartridge pointing downwards.

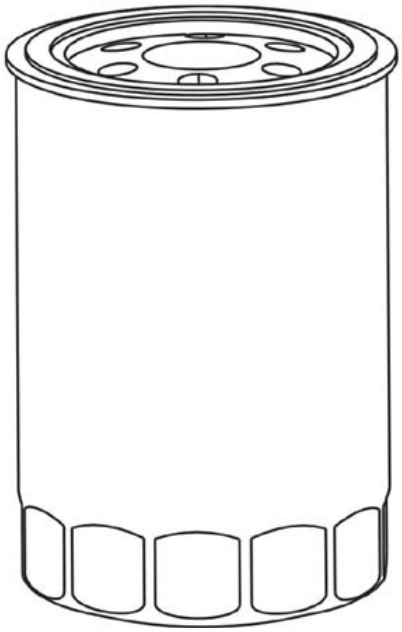
10.2 When should the spin-on cartridge be replaced?

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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78357337.02/2012

MAHLE

Industry

Low Pressure Filter
Pi 1975

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

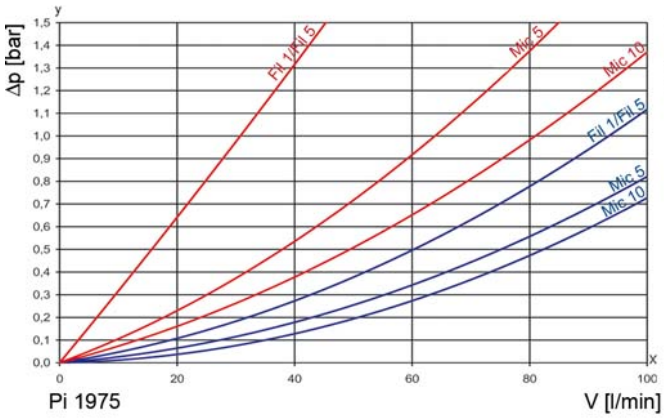
1. Features

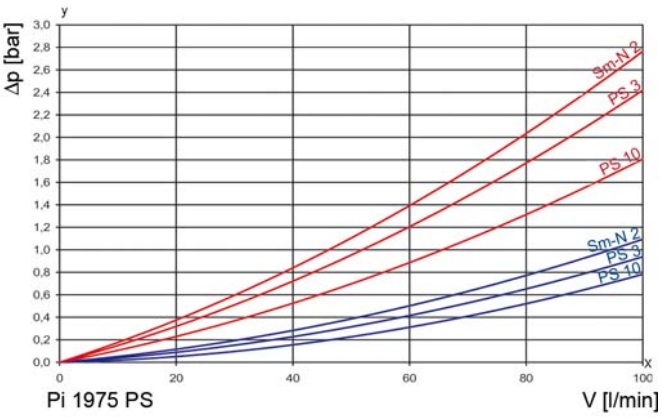
High performance filters for modern hydraulic systems

- 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 PS 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

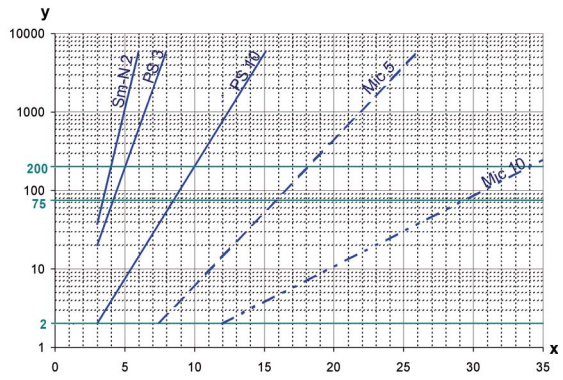
190 mm²/s
33 mm²/s





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)

PS/Sm-N 2 elements with
max. Δp 5 bar

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

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

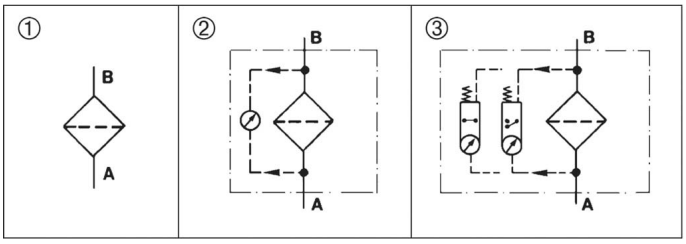
The filter element Sm-N 2 is an element with a very large dirt holding capacity, especially for bypass filtration.

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 3723	Hydraulic fluid power filter element, method for end load test
DIN ISO 3724	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	PS 10 Type: 852 275 PS 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. Δ p [bar]	Filter surface [cm²]
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 PS 3	PS 3		15500
	77725583	852 275 PS 10	PS 10		15500

* a wider range of element types is available on request

8. Technical specifications

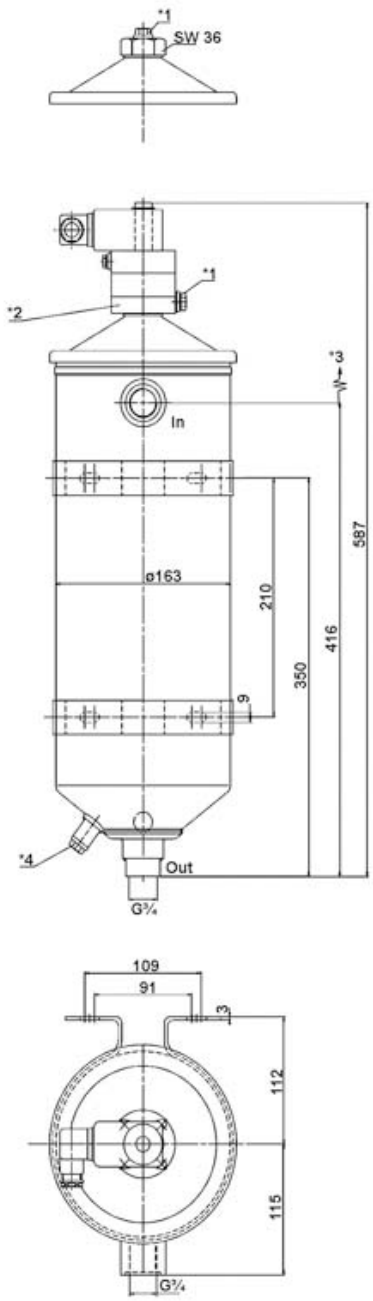
Design:	in-line filter
Nominal pressure:	6 bar (90 psi)
Test pressure:	8 bar (110 psi)
Temperature range:	- 10 °C to + 120 °C
	(other temperature ranges on request)
Filter head material:	St
Sealing material:	NBR/Cu
Maintenance indicator setting:	Δ p 1.2 bar ± 0.2 bar
Electrical data of maintenance indicator:	
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 sleave:	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 G¼
*2 SW 36 for maintenance
*3 height required for element removal 400
*4 drain plug G¼ 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

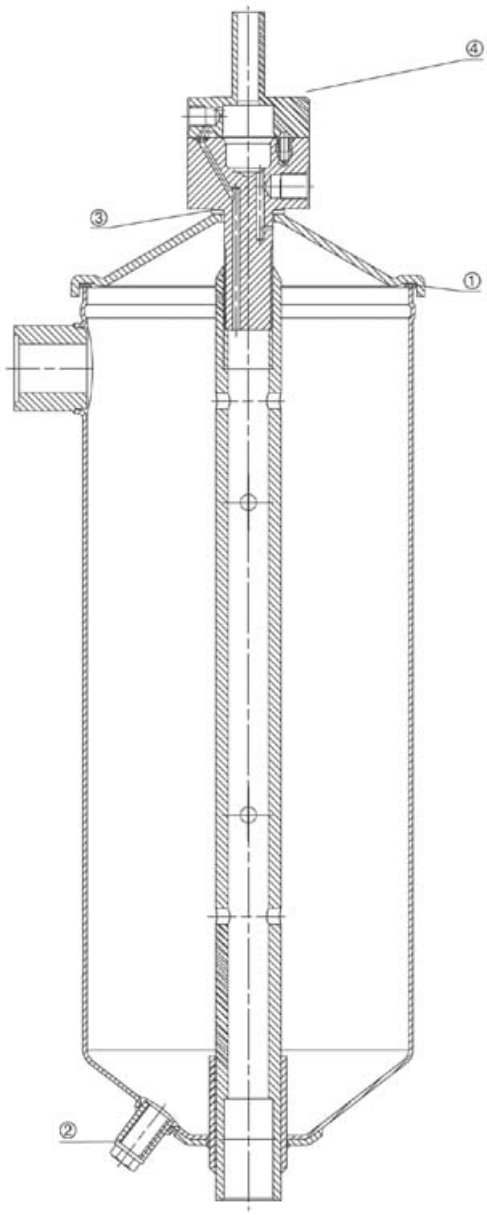
The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open to normally closed position or vice versa.

9.3 When should the filter be replaced?

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 make sure that you have original MAHLE spare elements in stock: Disposable elements (Mic, FIL, Sm-N or PS) cannot be cleaned.

9.4 Element replacement

1. Stop system and relieve filter from pressure.
2. Remove cover screw, then lift off cover. On executions with indicator please unscrew maintenance indicator.
3. Remove filter element.
4. Check seals for damage. Replace if necessary.
5. 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.
6. 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).



10. 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

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MAHLE

Industry

Low Pressure Filter
Pi 2000/Pi 2200

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

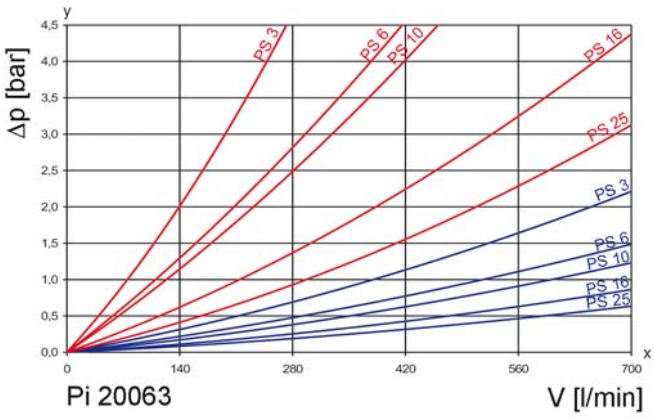
1. Features

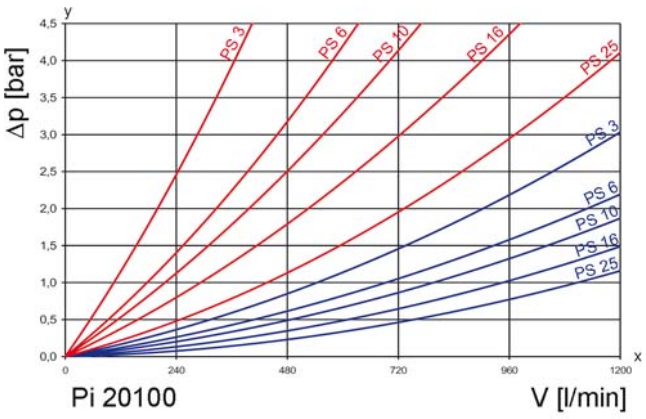
HIgh performance filters for modern hydraulic systems

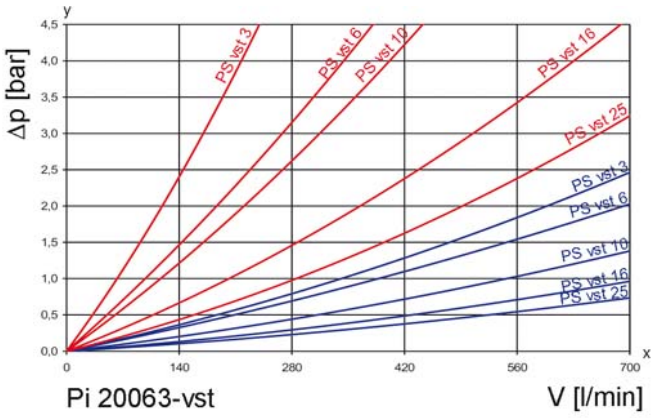
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical, electronic maintenance indicator
- Flanged connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre PS filter elements
- Beta rated elements according to ISO 16889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

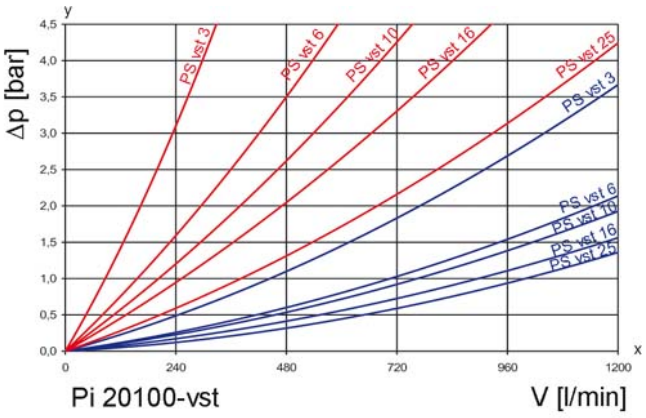
2. Flow rate/pressure drop curve complete filter

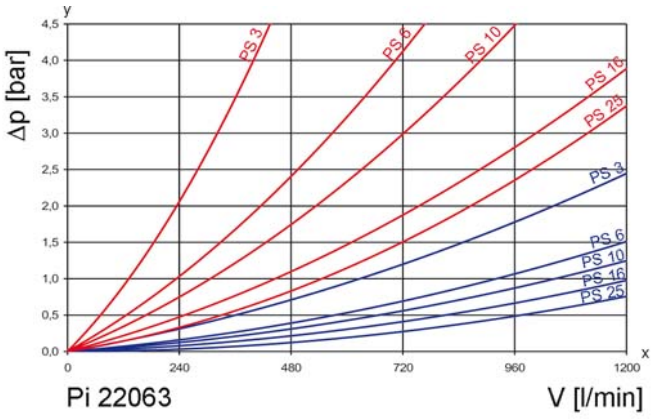
190 mm²/s
33 mm²/s

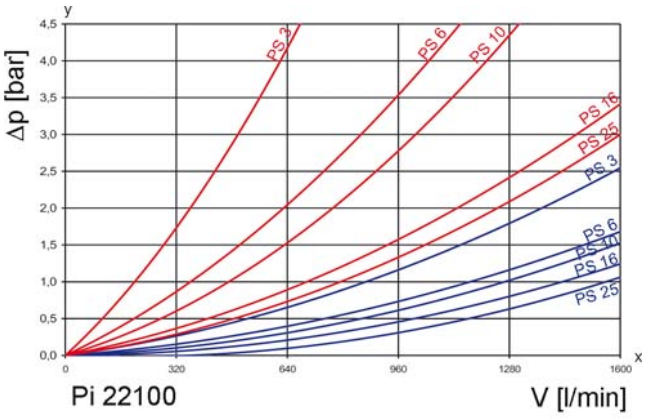


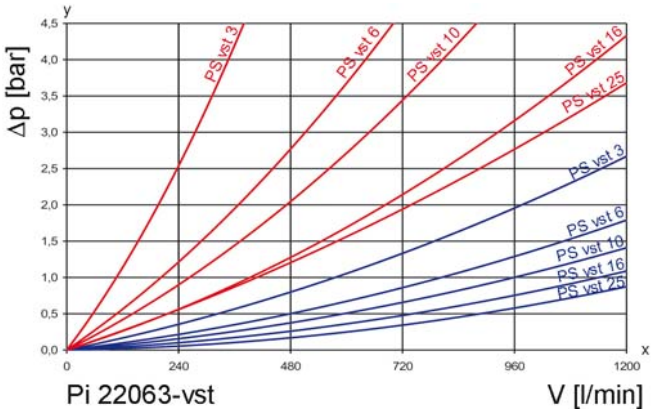


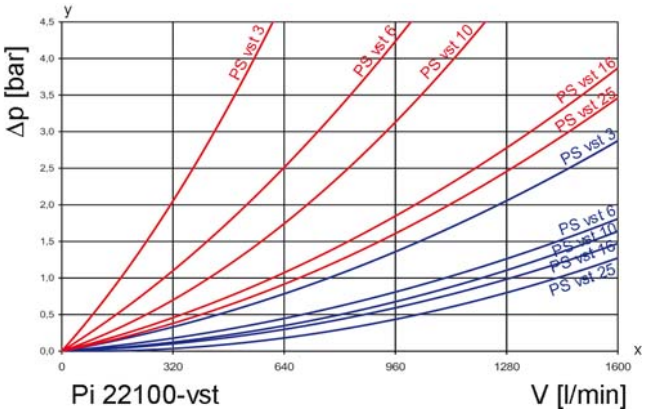








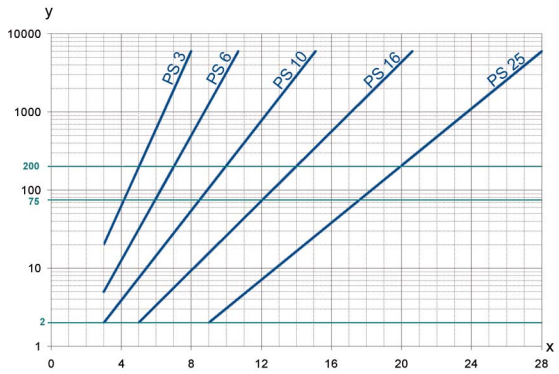




y = differential pressure Δ p [bar]

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)

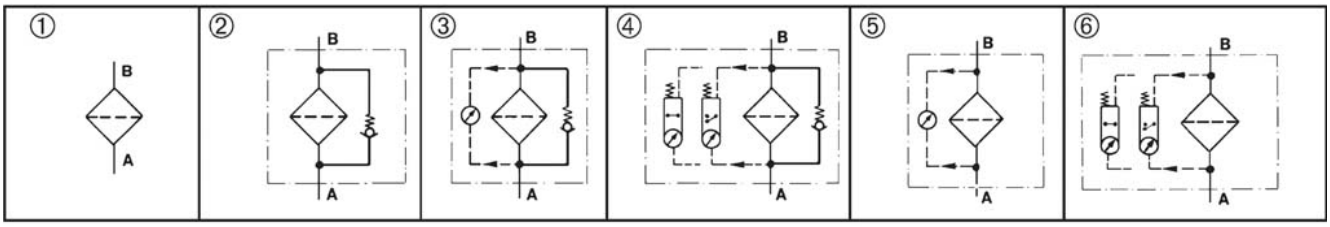
PS elements with max. Δ p 20 bar				PS vst elements with max. Δ p 210 bar			
PS	3	$\beta_{5(C)}$	≥200	PS vst	3	$\beta_{5(C)}$	≥200
PS	6	$\beta_{7(C)}$	≥200	PS vst	6	$\beta_{7(C)}$	≥200
PS	10	$\beta_{10(C)}$	≥200	PS vst	10	$\beta_{10(C)}$	≥200
PS	16	$\beta_{15(C)}$	≥200	PS vst	16	$\beta_{15(C)}$	≥200
PS	25	$\beta_{20(C)}$	≥200	PS vst	25	$\beta_{20(C)}$	≥200
values guaranteed at 10 bar differential pressure				values guaranteed at 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 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	PS vst 25 Type: Pi 75063 DN PS vst 25 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. Δ p [bar]**	**Filter surface [cm²]**
630	77961519	Pi 21063 DN PS 3	PS 3	**20**	9300
	77943699	Pi 22063 DN PS 6	PS 6		9300
	77925639	Pi 23063 DN PS 10	PS 10		9300
	77961527	Pi 24063 DN PS 16	PS 16		9300
	77961535	Pi 25063 DN PS 25	PS 25		9300
	77961543	Pi 71063 DN PS vst 3	PS vst 3	**210**	7490
	77960099	Pi 72063 DN PS vst 6	PS vst 6		7490
	77925712	Pi 73063 DN PS vst 10	PS vst 10		7490
	77961550	Pi 74063 DN PS vst 16	PS vst 16		7490
	77961568	Pi 75063 DN PS vst 25	PS vst 25		7490
1000	77961618	Pi 21100 DN PS 3	PS 3	**20**	14690
	77943723	Pi 22100 DN PS 6	PS 6		14690
	77925647	Pi 23100 DN PS 10	PS 10		14690
	77961626	Pi 24100 DN PS 16	PS 16		14690
	77961634	Pi 25100 DN PS 25	PS 25		14690
	77961642	Pi 71100 DN PS vst 3	PS vst 3	**210**	11700
	77960081	Pi 72100 DN PS vst 6	PS vst 6		11700
	77925720	Pi 73100 DN PS vst 10	PS vst 10		11700
	77961659	Pi 74100 DN PS vst 16	PS vst 16		11700
	77961667	Pi 75100 DN PS vst 25	PS vst 25		11700
1260	77961519	Pi 21063 DN PS 3	PS 3	**20**	2x9300
	77943699	Pi 22063 DN PS 6	PS 6		2x9300
	77925639	Pi 23063 DN PS 10	PS 10		2x9300
	77961527	Pi 24063 DN PS 16	PS 16		2x9300
	77961535	Pi 25063 DN PS 25	PS 25		2x9300
	77961543	Pi 71063 DN PS vst 3	PS vst 3	**210**	2x7490
	77960099	Pi 71063 DN PS vst 6	PS vst 6		2x7490
	77925712	Pi 72063 DN PS vst 10	PS vst 10		2x7490
	77961550	Pi 73063 DN PS vst 16	PS vst 16		2x7490
	77961568	Pi 74063 DN PS vst 25	PS vst 25		2x7490
2000	77961618	Pi 21100 DN PS 3	PS 3	**20**	2x14690
	77943723	Pi 22100 DN PS 6	PS 6		2x14690
	77925647	Pi 23100 DN PS 10	PS 10		2x14690
	77961626	Pi 24100 DN PS 16	PS 16		2x14690
	77961634	Pi 25100 DN PS 25	PS 25		2x14690
	77961642	Pi 71100 DN PS vst 3	PS vst 3	**210**	2x11700
	77960081	Pi 72100 DN PS vst 6	PS vst 6		2x11700
	77925720	Pi 73100 DN PS vst 10	PS vst 10		2x11700
	77961659	Pi 74100 DN PS vst 16	PS vst 16		2x11700
	77961667	Pi 75100 DN PS vst 25	PS vst 25		2x11700

* a wider range of element types is available on request

8. Technical specifications

Design:	in-line 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:	Δ p 3.5 bar ± 10 %
Filter head material:	GAL
Filter housing material:	AL
Sealing material:	NBR/AL
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 sleave:	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.

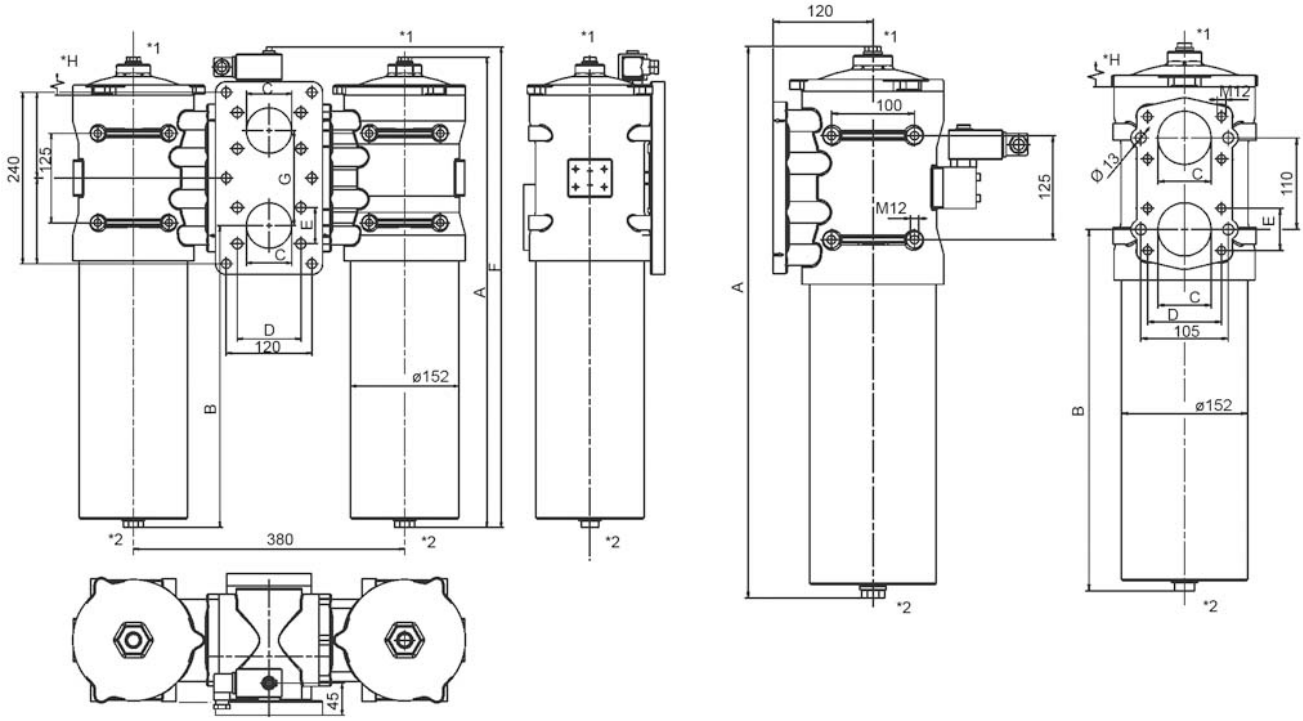
We draw attention to the fact that all values indicated are average values and do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer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

Subject to technical alteration without prior notice.

9. Dimensions



*1 = Vent screw G3/8
*2 = Drain plug G¾ 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	659	434	DN64	89	50.8	-	110	400	12.5
Pi 20100	889	664	DN64	89	50.8	-	110	630	15.0
Pi 22063	659	434	DN76	106	61.9	674	133	400	30.0
Pi 22100	889	664	DN76	106	61.9	904	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?

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 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 (PS) cannot be cleaned.

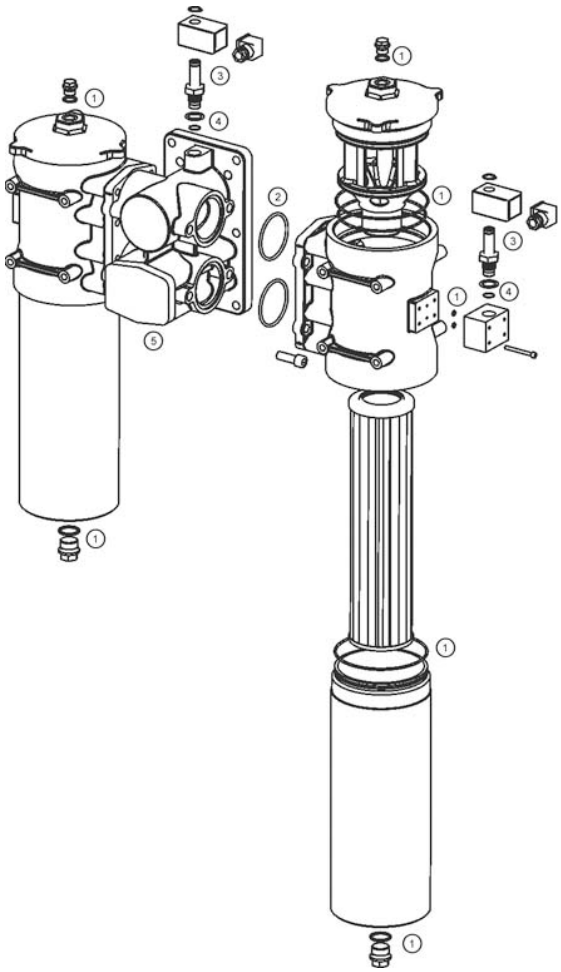
10.4 Element replacement

1 . Stop system and relieve filter from pressure.
2 . Open venting screw in filter cover (ascertain switching lever position with duplex filter and carefully check which filter housing is under pressure).
3 . Remove drain plug in housing bottom and drain oil.
4 . Unscrew filter cover (CCW).
5 . Lift out filter element.
6 . Check seal on filter cover. We recommend replacment in any case.
7 . 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.
8 . Carefully insert element holding fixture of the filter cover into the open end of the element and tighten cover against stop.
9 . Close drain plug on housing bottom.
10 . Carefully vent filter prior operation. Then thighten 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	77760309
	FPM	77760317
	EPDM	77760325
⑤	Parallel unit (for parallel filter modification)	77974876



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MAHLE Industry

Low Pressure Filter
Pi 2000

Nominal pressure 32/63 bar (460/900 psi), nominal size up to 400
according DIN 24550

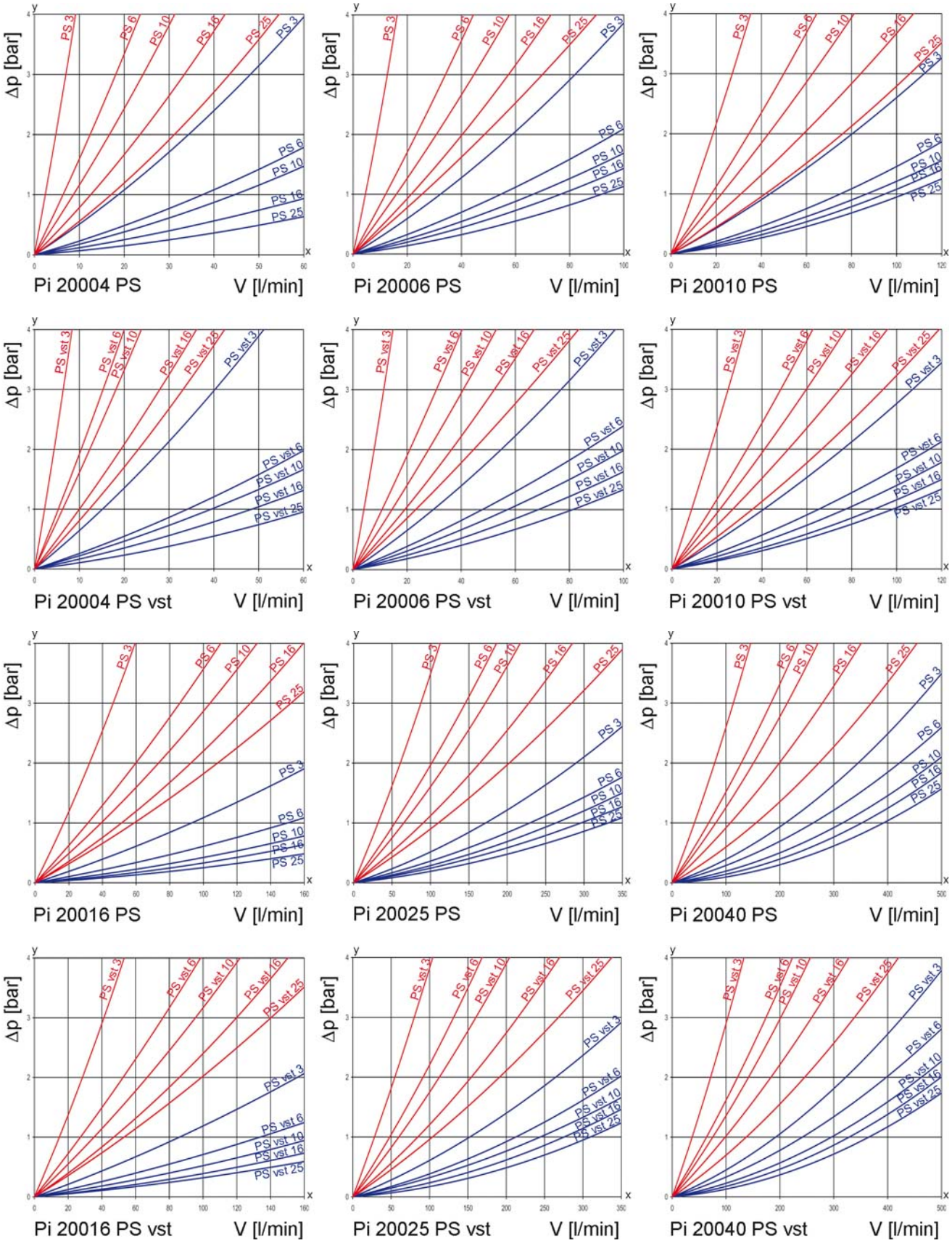
1. Features

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 higly efficient glass fibre PS filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Other connections on request
- Worldwide distribution

2. Flow rate/pressure drop curve complete filter

190 mm²/s
33 mm²/s

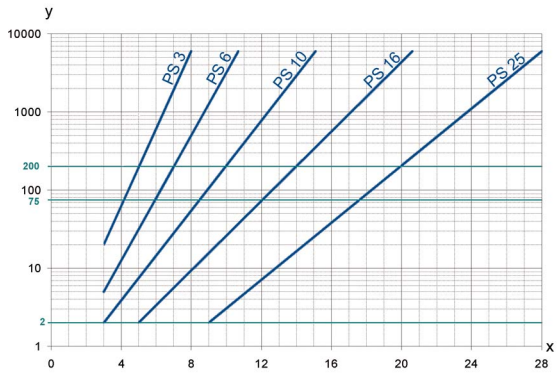


y = differential pressure Δp [bar]

x = flow rate V [l/min]

Calculation of individual filter under www.industrialfiltration-catalogue.mahle.com

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)

PS elements with max. Δ p 20 bar

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

values guaranteed up to 10 bar differential pressure

PS vst elements with max. Δ p 210 bar

PS vst	3	$\beta_{5(C)}$	≥200
PS vst	6	$\beta_{7(C)}$	≥200
PS vst	10	$\beta_{10(C)}$	≥200
PS vst	16	$\beta_{15(C)}$	≥200
PS vst	25	$\beta_{20(C)}$	≥200

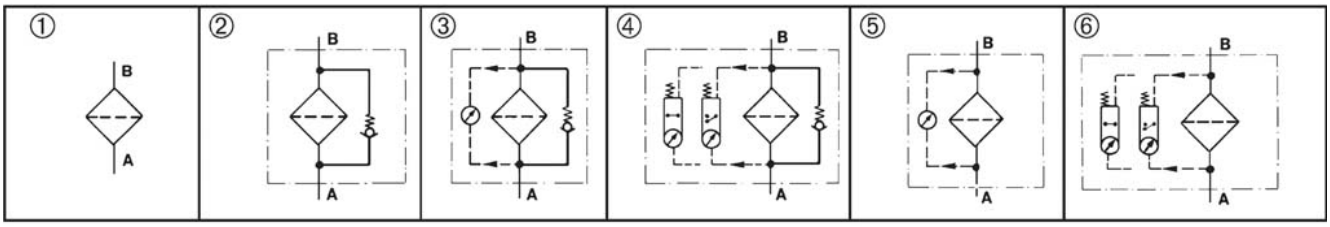
values guaranteed up to 20 bar differential pressure

5. Quality assurance

MAHLE filters and filter elements are produced according to the following international 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 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 = 100 l/min with visual/electrical maintenance indicator Type: Pi 20010-069 Order number: 78265035	PS vst 3 NBR Type: Pi 71010 DN PS vst 3 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. Δ p [bar]**	**Filter surface [cm²]**
40	78260929	Pi 21004 DN PS 3	PS 3	**20**	475
	77960859	Pi 22004 DN PS 6	PS 6		475
	77925571	Pi 23004 DN PS 10	PS 10		475
	78260937	Pi 24004 DN PS 16	PS 16		475
	78260945	Pi 25004 DN PS 25	PS 25		475
	78216079	Pi 71004 DN PS vst 3	PS vst 3	**210**	445
	77960156	Pi 72004 DN PS vst 6	PS vst 6		445
	77925654	Pi 73004 DN PS vst 10	PS vst 10		445
	78216087	Pi 74004 DN PS vst 16	PS vst 16		445
	78216095	Pi 75004 DN PS vst 25	PS vst 25		445
63	78260960	Pi 21006 DN PS 3	PS 3	**20**	835
	77960867	Pi 22006 DN PS 6	PS 6		835
	77925589	Pi 23006 DN PS 10	PS 10		835
	78260978	Pi 24006 DN PS 16	PS 16		835
	78260986	Pi 25006 DN PS 25	PS 25		835
	78216137	Pi 71006 DN PS vst 3	PS vst 3	**210**	780
	77960149	Pi 72006 DN PS vst 6	PS vst 6		780
	77925662	Pi 73006 DN PS vst 10	PS vst 10		780
	78216145	Pi 74006 DN PS vst 16	PS vst 16		780
	78216152	Pi 75006 DN PS vst 25	PS vst 25		780
100	78227472	Pi 21010 DN PS 3	PS 3	**20**	1375
	77960875	Pi 22010 DN PS 6	PS 6		1375
	77925597	Pi 23010 DN PS 10	PS 10		1375
	78261000	Pi 24010 DN PS 16	PS 16		1375
	78261018	Pi 25010 DN PS 25	PS 25		1375
	78227480	Pi 71010 DN PS vst 3	PS vst 3	**210**	1275
	77960131	Pi 72010 DN PS vst 6	PS vst 6		1275
	77925670	Pi 73010 DN PS vst 10	PS vst 10		1275
	78261281	Pi 74010 DN PS vst 16	PS vst 16		1275
	78216160	Pi 75010 DN PS vst 25	PS 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. Δ p [bar]**	**Filter surface [cm²]**
160	78261034	Pi 21016 DN PS 3	PS 3	**20**	2530
	77960826	Pi 22016 DN PS 6	PS 6		2530
	77925605	Pi 23016 DN PS 10	PS 10		2530
	78261042	Pi 24016 DN PS 16	PS 16		2530
	78261059	Pi 25016 DN PS 25	PS 25		2530
	77940638	Pi 71016 DN PS vst 3	PS vst 3	**210**	1885
	77960123	Pi 72016 DN PS vst 6	PS vst 6		1885
	77925688	Pi 73016 DN PS vst 10	PS vst 10		1885
	78269797	Pi 74016 DN PS vst 16	PS vst 16		1885
	78216178	Pi 75016 DN PS vst 25	PS vst 25		1885
250	78227514	Pi 21025 DN PS 3	PS 3	**20**	4020
	77960834	Pi 22025 DN PS 6	PS 6		4020
	77925613	Pi 23025 DN PS 10	PS 10		4020
	78261075	Pi 24025 DN PS 16	PS 16		4020
	78261083	Pi 25025 DN PS 25	PS 25		4020
	77940646	Pi 71025 DN PS vst 3	PS vst 3	**210**	3090
	77960115	Pi 72025 DN PS vst 6	PS vst 6		3090
	77925696	Pi 73025 DN PS vst 10	PS vst 10		3090
	78269813	Pi 74025 DN PS vst 16	PS vst 16		3090
	78216186	Pi 75025 DN PS vst 25	PS vst 25		3090
400	78227522	Pi 21 040 DN PS 3	PS 3	**20**	6770
	77960842	Pi 22 040 DN PS 6	PS 6		6770
	77925621	Pi 23 040 DN PS 10	PS 10		6770
	78261109	Pi 24 040 DN PS 16	PS 16		6770
	78261117	Pi 25 040 DN PS 25	PS 25		6770
	77940653	Pi 71 040 DN PS vst 3	PS vst 3	**210**	5240
	77960107	Pi 72 040 DN PS vst 6	PS vst 6		5240
	77930829	Pi 73 040 DN PS vst 10	PS vst 10		5240
	78269821	Pi 74 040 DN PS vst 16	PS vst 16		5240
	78260903	Pi 75 040 DN PS vst 25	PS vst 25		5240

* a wider range of element types is available on request

8. Technical specifications

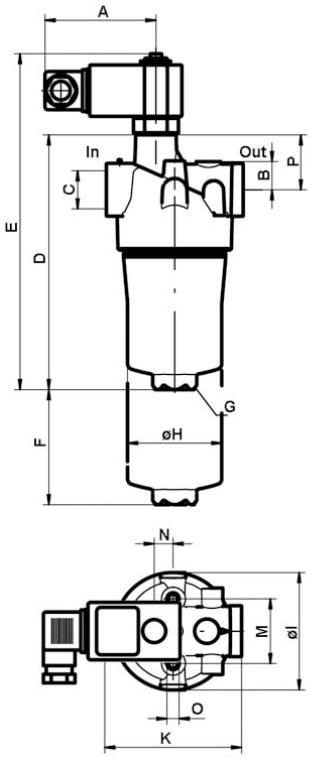
Design:	line mounting filter
Nominal pressure:	
Pi 20004-20010	10^7 load changes 63 bar (900 psi)
Pi 20016-20040	10^7 load changes 25 bar (360 psi) 2x 10^6 load changes 32 bar (460 psi)
Test pressure:	
Pi 20004-20010	95 bar (1370 psi)
Pi 20016-20040	48 bar (690 psi)
Temperature range:	- 30 °C to + 120 °C survival temperature - 40 °C (other temperature ranges on request)
Bypass setting:	Δ p 3.5 bar ± 10 %
Filter head material:	GDAL
Filter housing material:	AL/St.
Sealing material:	NBR/AL
Maintenance indicator setting:	Δ p 2.2 bar ± 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 sleave:	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.



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 20004	78	19	G½	186	240	80	27	66	80	95	45	13	M8x10	37.5	0.9
Pi 20006	78	19	G¾	243	300	80	27	66	80	95	45	13	M8x10	37.5	1.0
Pi 20010	78	19	G¾	333	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	509	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

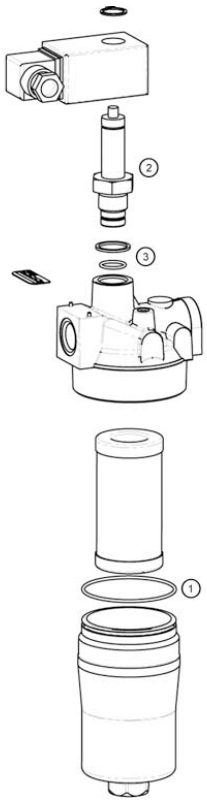
The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open position to normally closed position or vice versa. The state on delivery is a normally closed contact.

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 cannot be cleaned.

10.4 Element replacement

1. Stop system and relieve filter from pressure.
2. Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
3. Remove element by pulling down carefully.
4. Check O-ring on the filter housing for damage. Replace, if necessary.
5. 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.
6. Lightly lubricate the threads of the filter housing a little bit and screw into the filter head. Maximum tightening torque for NG 40 to 100 = 60 Nm, for NG 160 to 400 = 100 Nm.



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

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79784455.09/2012

MAHLE Industry

Low Pressure Filter
Pi 200

Nominal pressure 32/63 bar (460/910 psi), nominal size up to 600

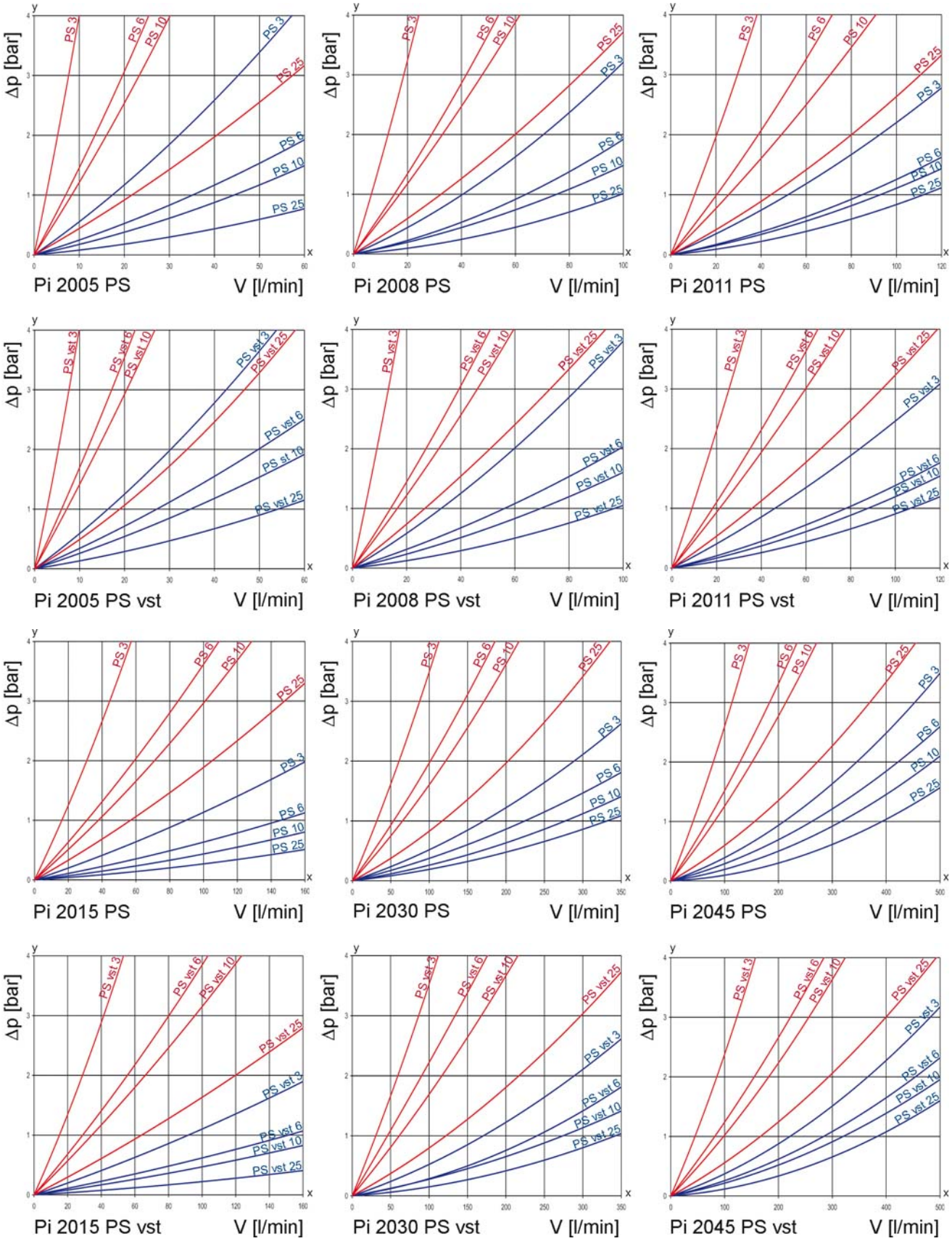
1. Features

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 PS filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Other connections on request
- Worldwide distribution

2. Flow rate/pressure drop curve (filter housing incl. element)

190 mm²/s
33 mm²/s

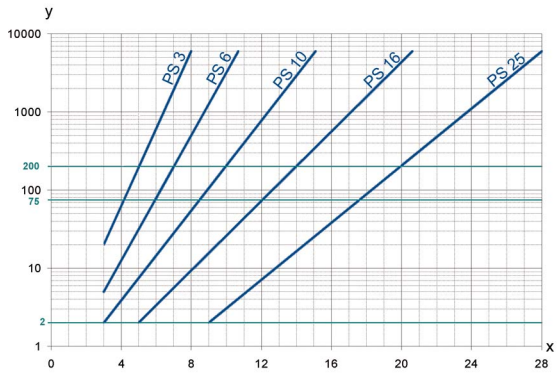


y = differential pressure Δp [bar]

x = flow rate V [l/min]

Calculation of individual filter under **www.industrialfiltration-catalogue.mahle.com**

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)

PS elements with
max. Δ p 20 bar

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

values guaranteed up to 10 bar differential pressure

PS vst elements with
max. Δ p 210 bar

PS vst	3	$\beta_{5(C)}$	≥200
PS vst	6	$\beta_{7(C)}$	≥200
PS vst	10	$\beta_{10(C)}$	≥200
PS vst	25	$\beta_{20(C)}$	≥200

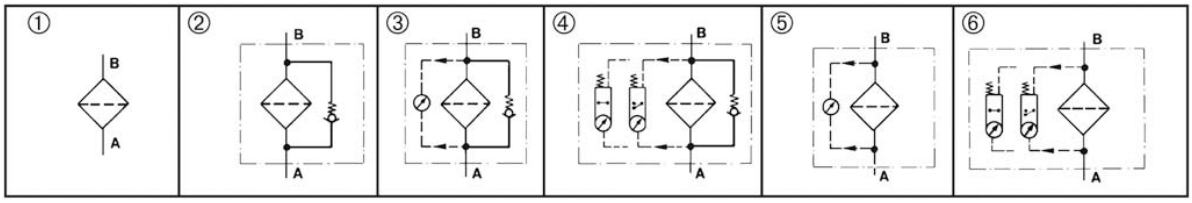
values guaranteed up to 20 bar differential pressure

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. Filter housing	2. Filter element
V = 80 l/min and visual/electrical maintenance indicator Type: Pi 2008-069 Order number: 77665284	PS vst 3 Type: Pi 2208 PS vst 3 Order number: 77680200

7.1 Housing 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
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						■

7.1 Housing 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
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						■
600	70576045	Pi 2060-060	■					
	70534876	Pi 2060-056		■				
	79714171	Pi 2060-057			■			
	70576046	Pi 2060-058				■		
	78205254	Pi 2060-068					■	
	70576047	Pi 2060-069						■

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 availble on request)

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm²]
50	77680135	Pi 2105 PS 3	PS 3	20	590
	77943509	Pi 5105 PS 6	PS 6		590
	77680325	Pi 3105 PS 10	PS 10		590
	77680440	Pi 4105 PS 25	PS 25		590
	77680192	Pi 2205 PS vst 3	PS vst 3	210	425
	77943533	Pi 5205 PS vst 6	PS vst 6		425
	77680382	Pi 3205 PS vst 10	PS vst 10		425
	77680507	Pi 4205 PS vst 25	PS vst 25		425
80	77680143	Pi 2108 PS 3	PS 3	20	1150
	77943517	Pi 5108 PS 6	PS 6		1150
	77680341	Pi 3108 PS 10	PS 10		1150
	77680457	Pi 4108 PS 25	PS 25		1150
	77680200	Pi 2208 PS vst 3	PS vst 3	210	850
	77943541	Pi 5208 PS vst 6	PS vst 6		850
	77681190	Pi 3208 PS vst 10	PS vst 10		850
	77680515	Pi 4208 PS vst 25	PS vst 25		850
110	77680150	Pi 2111 PS 3	PS 3	20	1700
	77943525	Pi 5111 PS 6	PS 6		1700
	77680333	Pi 3111 PS 10	PS 10		1700
	77680465	Pi 4111 PS 25	PS 25		1700
	77680218	Pi 2211 PS vst 3	PS vst 3	210	1275
	77943558	Pi 5211 PS vst 6	PS vst 6		1275
	77680390	Pi 3211 PS vst 10	PS vst 10		1275
	77680523	Pi 4211 PS vst 25	PS vst 25		1275
150	77680168	Pi 2115 PS 3	PS 3	20	2425
	77955099	Pi 5115 PS 6	PS 6		2425
	77680358	Pi 3115 PS 10	PS 10		2425
	77680473	Pi 4115 PS 25	PS 25		2425

7.2 Filter elements (a wider range of element types is availble on request)					
Nominal size NG [l/min]	**Order number**	**Type**	**Filter material**	**max. Δp [bar]**	**Filter surface [cm²]**
150	77680226	Pi 2215 PS vst 3	PS vst 3	**210**	2010
	77955123	Pi 5215 PS vst 6	PS vst 6		2010
	77680408	Pi 3215 PS vst 10	PS vst 10		2010
	77680531	Pi 4215 PS vst 25	PS vst 25		2010
300	77680176	Pi 2130 PS 3	PS 3	**20**	4620
	77955107	Pi 5130 PS 6	PS 6		4620
	77680366	Pi 3130 PS 10	PS 10		4620
	77680481	Pi 4130 PS 25	PS 25		4620
	77680234	Pi 2230 PS vst 3	PS vst 3	**210**	3800
	77955131	Pi 5230 PS vst 6	PS vst 6		3800
	77680416	Pi 3230 PS vst 10	PS vst 10		3800
	77680549	Pi 4230 PS vst 25	PS vst 25		3800
450	77680184	Pi 2145 PS 3	PS 3	**20**	6865
	77955115	Pi 5145 PS 6	PS 6		6865
	77680374	Pi 3145 PS 10	PS 10		6865
	77680499	Pi 4145 PS 25	PS 25		6865
	77680242	Pi 2245 PS vst 3	PS vst 3	**210**	5600
	77955149	Pi 5245 PS vst 6	PS vst 6		5600
	77680424	Pi 3245 PS vst 10	PS vst 10		5600
	77680556	Pi 4245 PS vst 25	PS vst 25		5600
600	70346506	Pi 2160 PS 3	PS 3	**20**	9398
	76114318	Pi 5160 PS 6	PS 6		9398
	79393380	Pi 3160 PS 10	PS 10		9398
	79748047	Pi 4160 PS 25	PS 25		9398

8. Technical specifications

Design: in-line filter

Nominal pressure:

Pi 2005 - 2011: 10^7 load changes 63 bar (900 psi)

Pi 2015 - 2060: 10^7 load changes 25 bar (360 psi)
2x 10^6 load changes 32 bar (460 psi)

Test pressure:

Pi 2005 - 2011: 95 bar (1370 psi)

Pi 2015 - 2060: 48 bar (690 psi)

Temperature range: -30 °C to +120 °C
survival temperature -40 °C (other temperature ranges on request)

Bypass setting: Δ p 3.5 bar ± 10 %

Filter head material: GDAL

Filter housing material: AL/St

Sealing material: NBR/AL

Maintenance indicator setting

PiS 3098/97: Δ p 2.2 bar ± 10 %

Electrical data of maintenance indicator PiS 3097:

Max. voltage: 250 V AC/200 V DC

Max. current: 1 A

Max. current: 70 W

Type of protection: IP 65 in inserted and secured status

Contact: normally open/closed

Cable sleave: M20x1.5

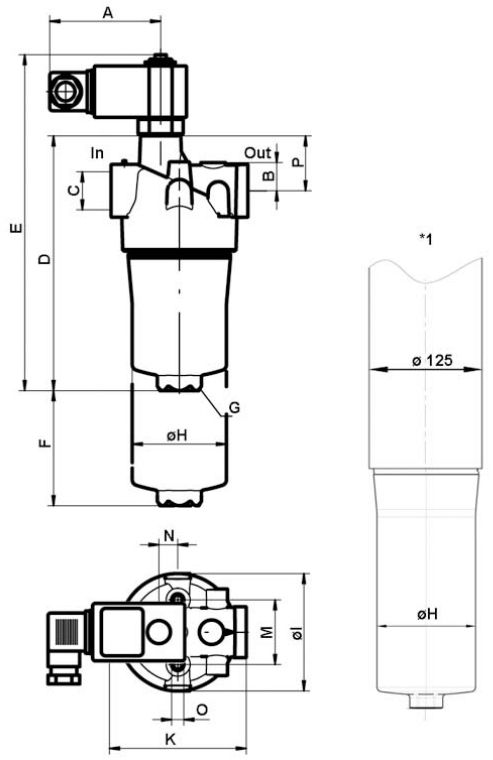
The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance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

9. Dimensions



In Inlet
Out Outlet
*1 Housing design for NG 600

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	G½	186	240	80	27	66	80	95	45	13.0	M8x10	37.5	0.9
Pi 2008	78	19	G¾	243	300	80	27	66	80	95	45	13.0	M8x10	37.5	1.0
Pi 2011	78	19	G¾	333	393	80	27	66	80	95	45	13.0	M8x10	37.5	1.1
Pi 2015	78	30	G1¼	268	326	110	32	109	128	150	60	24.5	M12x15	43.5	2.3
Pi 2030	78	30	G1¼	363	421	110	32	109	128	150	60	24.5	M12x15	43.5	2.5
Pi 2045	78	30	G1¼	509	566	110	32	109	128	150	60	24.5	M12x15	43.5	7.4
Pi 2060	78	30	G1¼	615	672	110	32	109	128	150	60	24.5	M12x15	43.5	5.5

* 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.
The state on delivery is a normally closed contact
.

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 cannot be cleaned.

10.4 Element replacement

1 . Stop system and relieve filter from pressure.
2 . Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
3 . Remove element by pulling down carefully.
4 . Check O-ring on the filter housing for damage. Replace, if necessary.
5 . 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.
6 . Lightly lubricate the threads of the filter housing a little bit and screw into the filter head. Maximum tightening torque for NG 50 to 110 = 60 Nm, for NG 150 to 600 = 100 Nm.

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78356446.01/2013

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 - Pi 2060	
	NBR	77550221
	FPM	77845811
	EPDM	77845829
③	Maintenance indicator	
	Visual PiS 3098/2,2	77669971
	Electrical PiS 3097/2,2	77669948
	Electrical upper section only	77536550
④	Seal kit for maintenance indicator	
	NBR	77760309
	FPM	77760317
	EPDM	77760325

MAHLE

Industry

Low Pressure Filter/Suction Filter
Pi 220

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

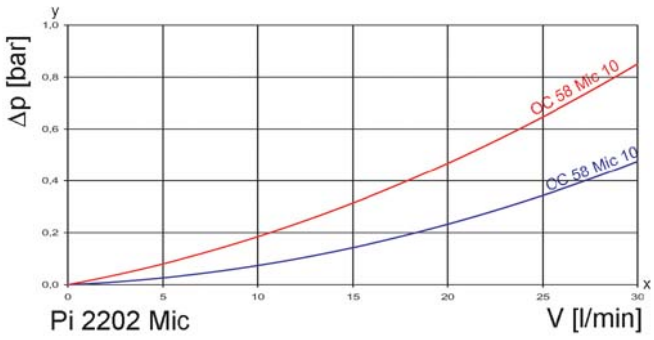
1. Features

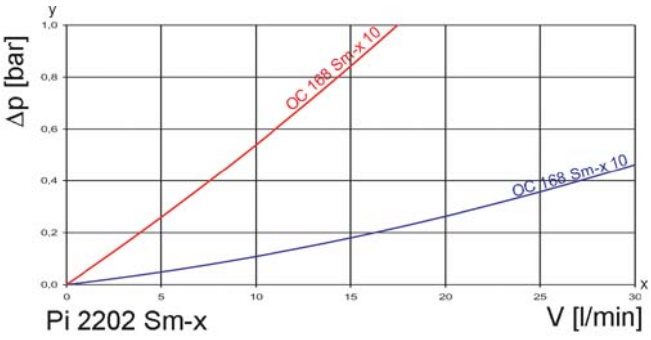
High performance filters for modern hydraulic systems

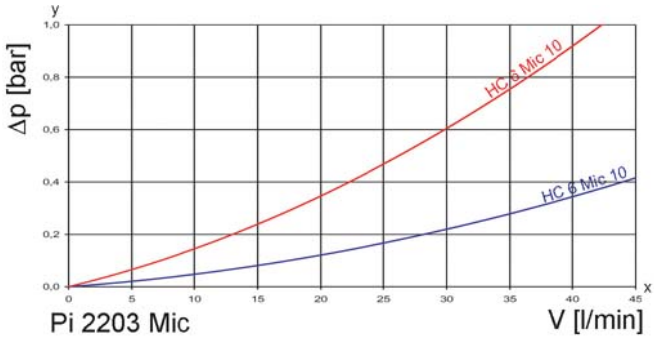
- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electronic/electronical maintenance indicator
- Threaded connections
- Quality filters, easy to service
- Equipped with highly efficient Mic or Sm-x filter elements
- Beta rated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

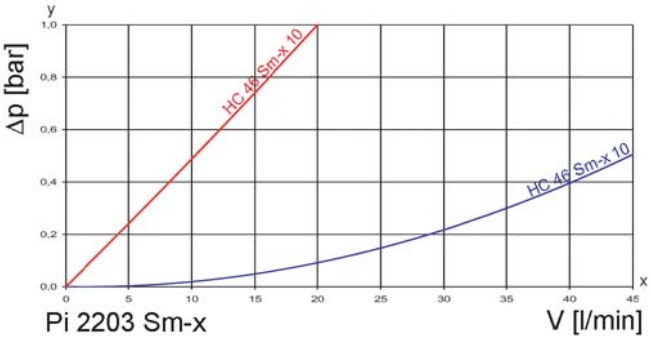
2. Flow rate/pressure drop curve complete filter

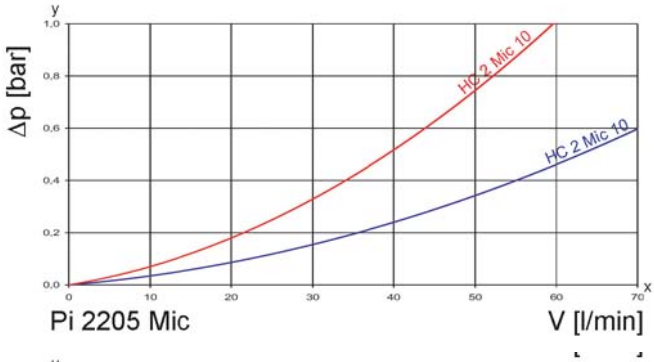
190 mm²/s
33 mm²/s

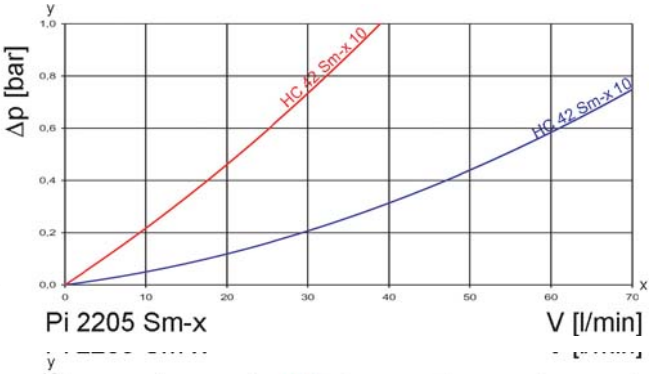


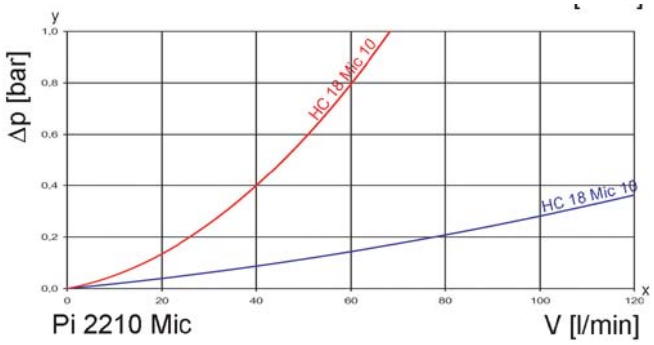


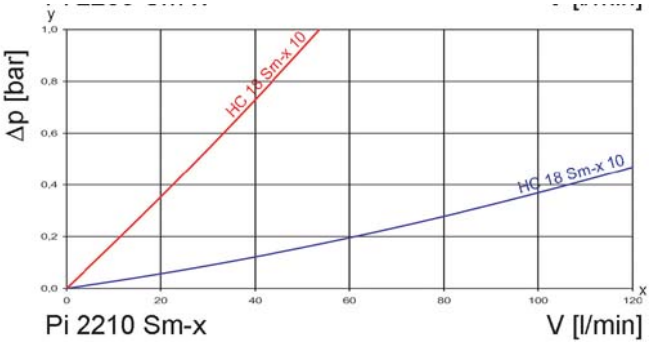


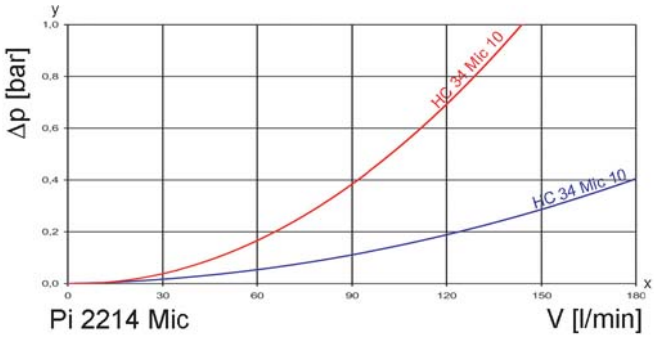


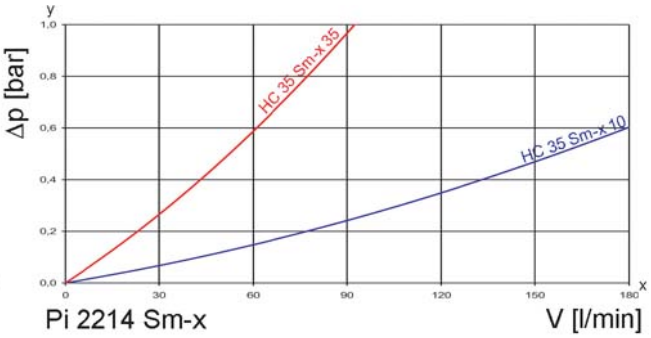






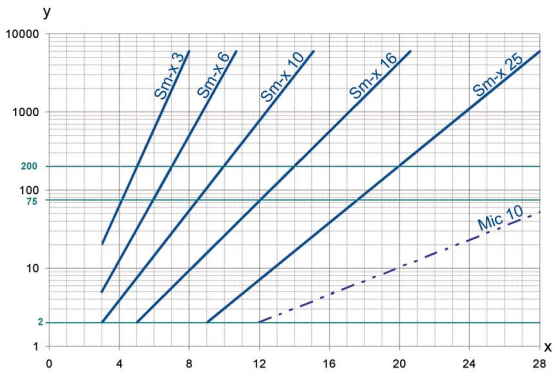






y = differential pressure Δp [bar]
x = flow rate V [l/min]

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. Δ p 5 bar

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

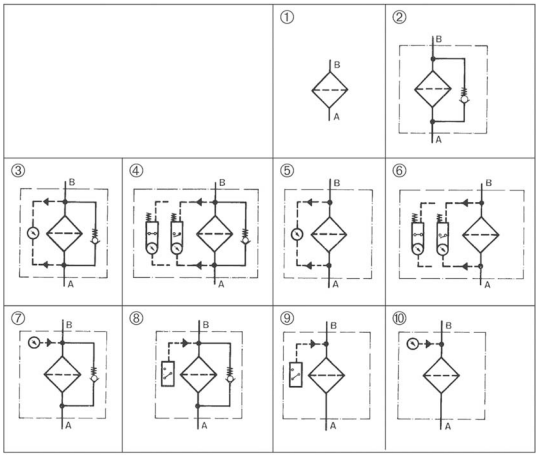
values guaranteed up to
5 bar differential pressure

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 Type: Pi 2202-058 Order number: 77665649	Mic 10 Type: OC 58 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. Δ p [bar]	Filter surface [cm²]
25/10	77785983	OC 58	Mic 10	5	1775
	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	⑧ with bypass 0.25 bar and vacuum switch	⑨ 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

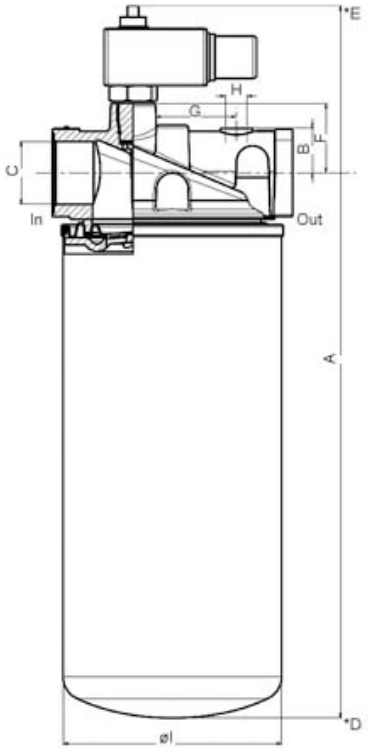
Design:	line mounting filter
Nominal pressure:	10 bar (140 psi)*
Test pressure:	13 bar (180 psi)
Temperature range:	-10 °C to +120 °C
	(other temperature ranges on request)
Bypass setting:	
Pressure side:	Δ p 3.5 bar ± 10%
Suction side:	Δ p 0.25 bar ± 10%
Filter head material:	GDAL
Filter housing material:	St
Sealing material:	NBR/AL
Maintenance indicator setting:	Δ p 2.2 bar ± 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 sleave:	M20x1.5

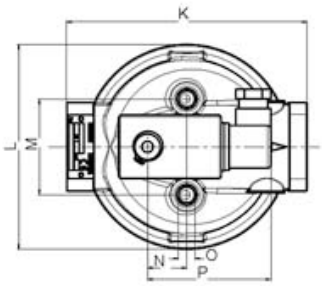
The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance 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 appliacation. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized departement will be pleased to offer you advice.

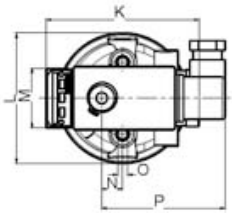
We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids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

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





Pi 2210 - Pi 2214



Pi 2202 - Pi 2205

In = Inlet
Out= Outlet
*D = Height required for spin-on cartridge removal
*E = Height required for maintenance indicator removal
Subject to technical alteration without prior notice.

9. Dimensions

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

Type	A	B	C	D	E	F	G*	H*	I	K	L	M	N	O	P	Weight [kg]
Pi 2202	241	19	G½	30	45	37.5	23.5	G1/8	76	95	80	45	13.0	M8x10	78	0.90
Pi 2203	261	19	G½	30	45	37.5	23.5	G1/8	93	95	80	45	13.0	M8x10	78	1.00
Pi 2205	328	19	G¾	30	45	37.5	23.5	G1/8	93	95	80	45	13.0	M8x10	78	1.25
Pi 2210	302	30	G1¼	40	45	43.5	40.0	G1/8	136	150	128	60	24.5	M12x15	78	2.30
Pi 2214	442	30	G1¼	40	45	43.5	40.0	G1/8	136	150	128	60	24.5	M12x15	78	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 cardrige. Filter should be installed with the spin-on cartridge pointing downwards.
The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

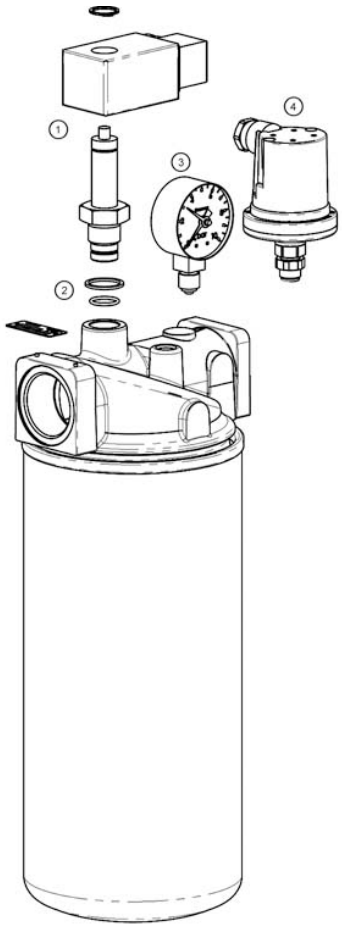
The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2.
The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

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 cartrige 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	76345763
④	Vacuum switch PiS 3070	77669724

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78356610.03/2012

MAHLE

Industry

Low Pressure Filter
Pi 2300

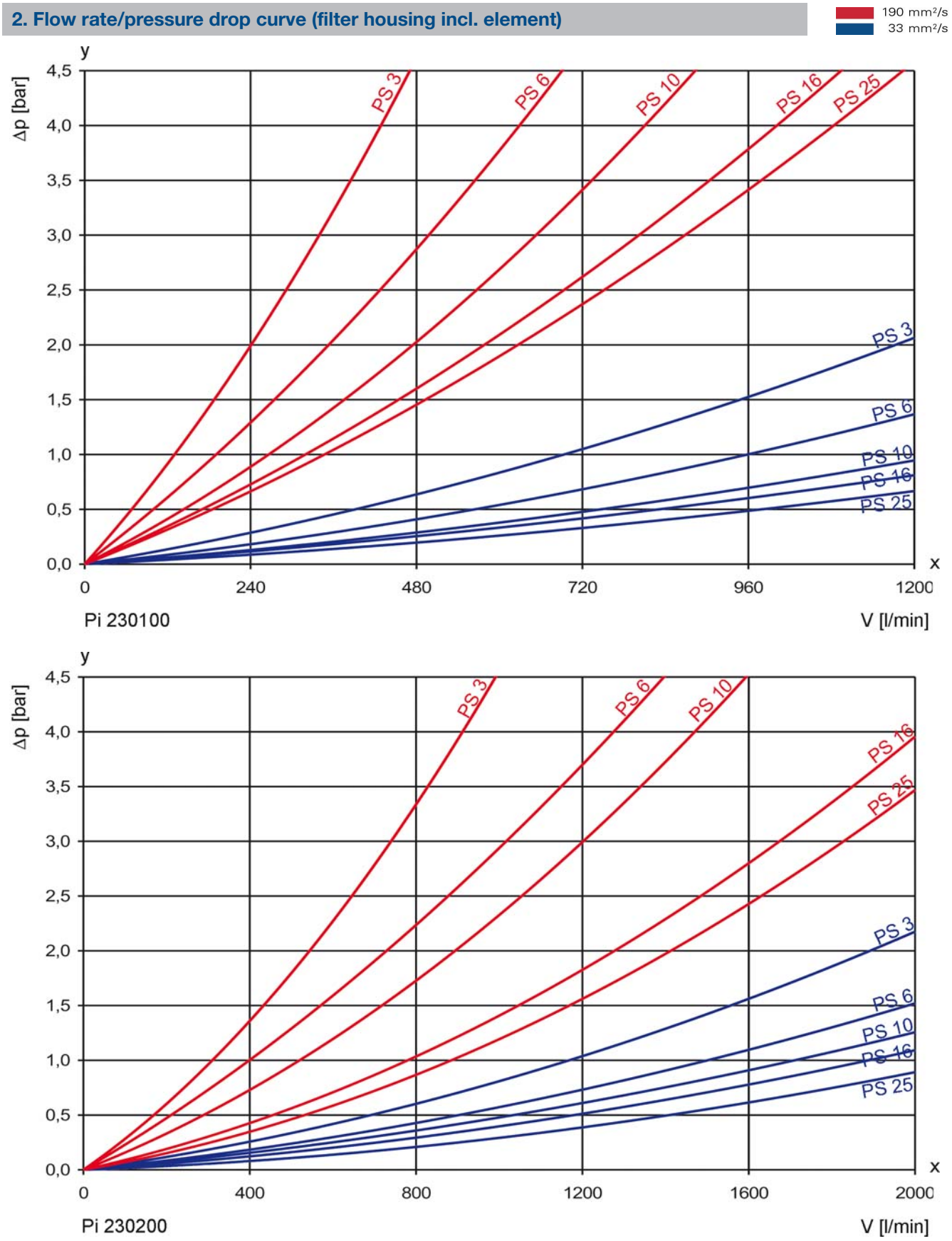
Nominal pressure 25/40 bar (360/570 psi), nominal size up to 1200
Filter elements according DIN 24550

1. Features

High performance filters for modern hydraulic systems

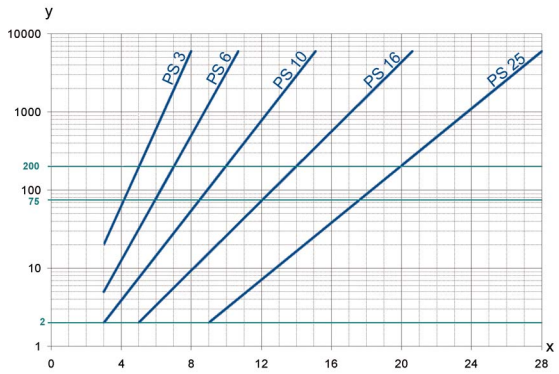
- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical,electronic maintenance indicator
- Quality filters, easy to service
- Equipped with highly efficient PS filter elements
- Beta rated elements according to ISO 16889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

2. Flow rate/pressure drop curve (filter housing incl. element)



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)

PS elements with
max. Δ p 10 bar

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

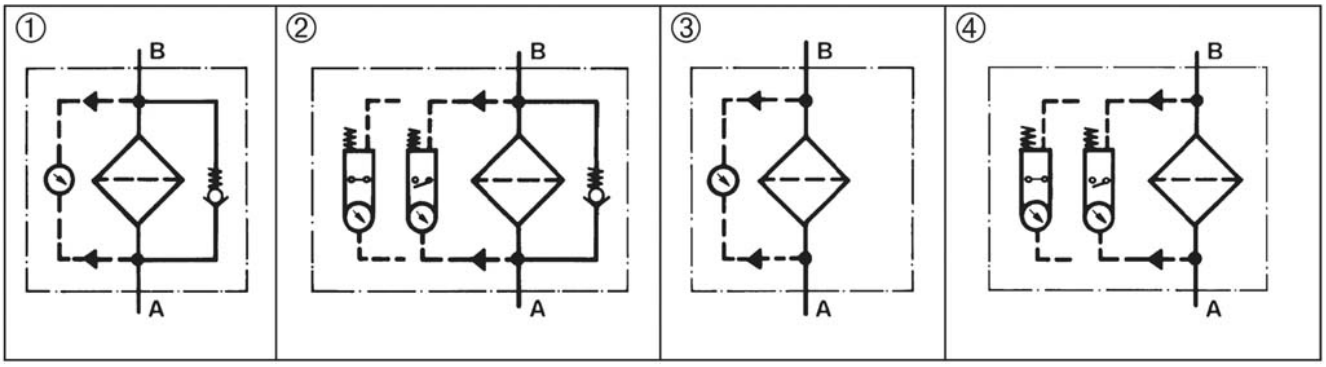
values guaranteed up to
10 bar differential pressure

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 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
Nominal size 750, with bypass, electrical maintenance indicator, inlet at the bottom Type: Pi 230100/11-058 Order number: 76321129	PS 10 Type: 23100 RN PS 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 with bypass valve and visual indicator	② with bypass valve and electrical indicator	③ with visual indicator	④ 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 [cm²]
750	77924210	Pi 21100 RN PS 3	PS 3	10	18760
	77964109	Pi 22100 RN PS 6	PS 6		18760
	77924228	Pi 23100 RN PS 10	PS 10		18760
	77963689	Pi 24100 RN PS 16	PS 16		18760
	77960271	Pi 25100 RN PS 25	PS 25		18760
1200	77924210	Pi 21100 RN PS 3	PS 3	10	2 x 18760
	77964109	Pi 22100 RN PS 6	PS 6		2 x 18760
	77924228	Pi 23100 RN PS 10	PS 10		2 x 18760
	77963689	Pi 24100 RN PS 16	PS 16		2 x 18760
	77960271	Pi 25100 RN PS 25	PS 25		2 x 18760

* a wider range of element types is available on request

8. Technical specifications

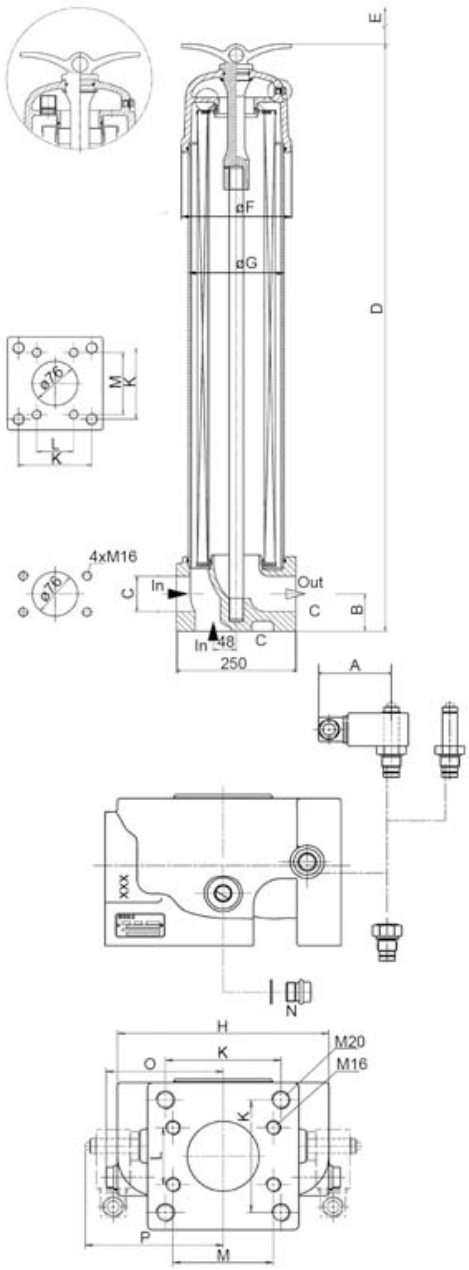
Nominal pressure (10 LW):	25 bar (360 psi)
Test pressure (statical):	40 bar (570 psi)
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Bypass setting:	Δp 3.5 bar ± 10 %
Filter head material:	GAL
Filter housing material:	AL
Sealing material:	NBR
Maintenance indicator setting	Δp 2.2 bar ± 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 sleave:	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.



In = Inlet
Out = Outlet

9. Dimensions

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

Type	A	B	C	D	E	F	G	H	K	L	M	N	O	P	Weight [kg]
Pi 230100	78	80	SAE 3, 3000 psi	710	770	230	200	224	122.3	61.9	106.6	G½	124	146	29
Pi 230200	78	80	SAE 3, 3000 psi	1260	770	230	200	224	122.3	61.9	106.6	G½	124	146	30

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 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

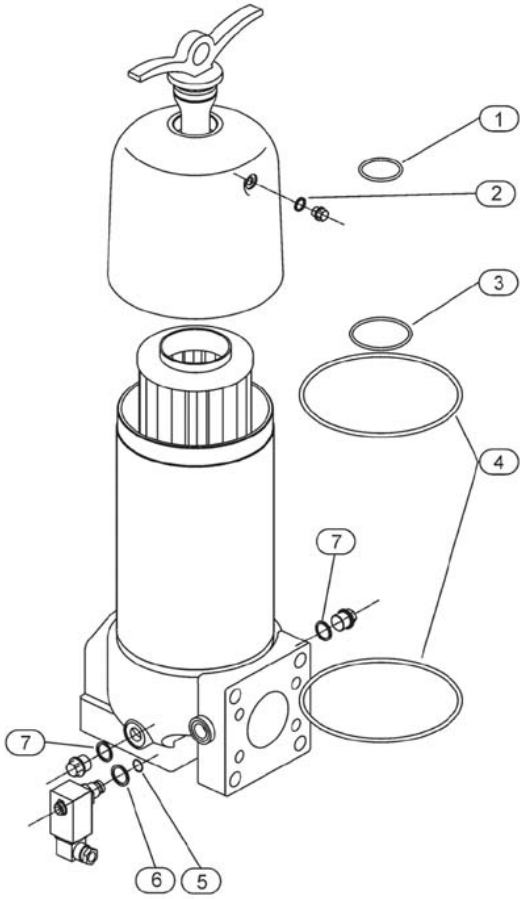
The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2. The electrical section can be inverted to change from normally open to normally closed position or vice versa.

10.3 When should the filter element be replaced?

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 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 (PS) cannot be cleaned.

10.4 Element replacement

1. Stop system and relieve filter from pressure.
2. Loosen toggle, remove cover, and open drain valve. Housing completely vented.
3. Remove filter element from the filter bowl. With filter type Pi 230200 remove the spacer sleeve from the elements clean and reuse.
4. Check seals for damages. Replace, if necessary.
5. 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.
6. Close drain valve. Put the thumb screw together with the cover on the centre rod and tighten strong. Filter must be bleeded!



11. Spare parts list

Order numbers for spare parts		
Position	**Type**	**Order number**
①②③④⑦	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
⑤⑥	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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MAHLE

Industry

Low Pressure Filter
Pi 230

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

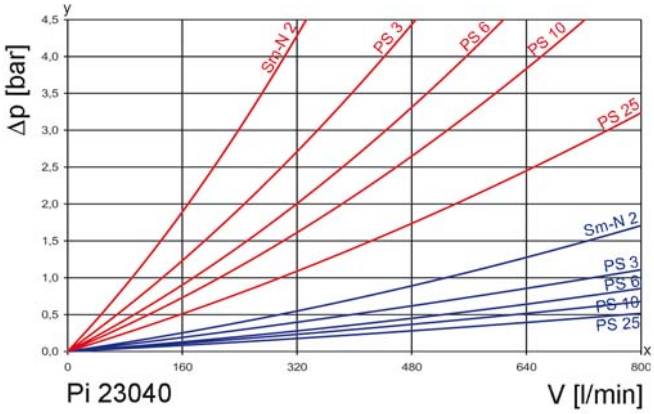
1. Features

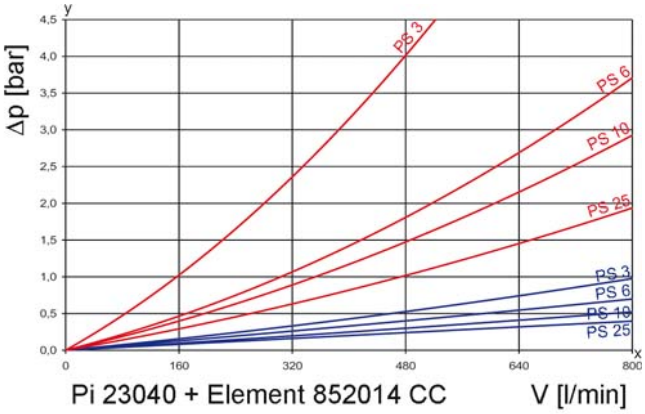
High performance filters for modern hydraulic systems

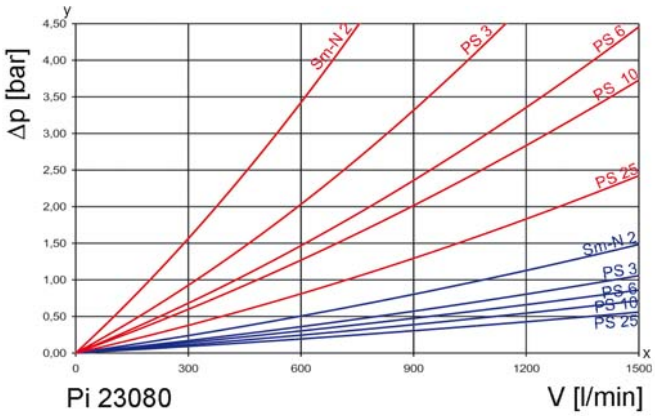
- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Quality filters, easy to service
- Equipped with highly efficient glass fibre PS filter elements
- Beta rated elements according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

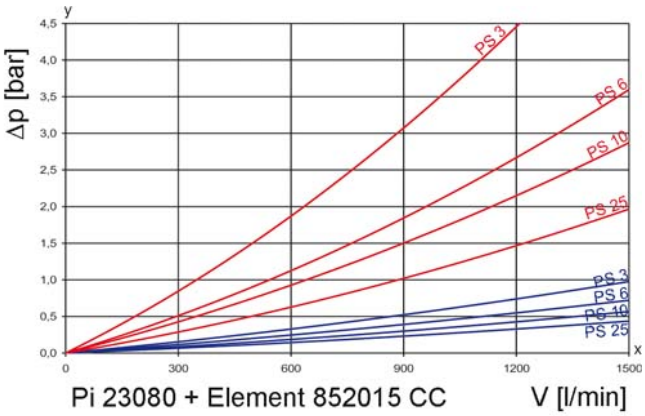
2. Flow rates/pressure drop curve (filter housing incl. element)

190 mm²/s
33 mm²/s





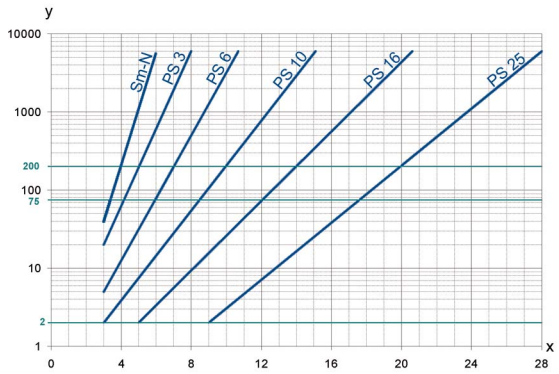




y = differential pressure Δp [bar]

x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particel 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)

PS elements with
max. Δ p 20 bar

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

values guaranteed up to 10 bar differential pressure

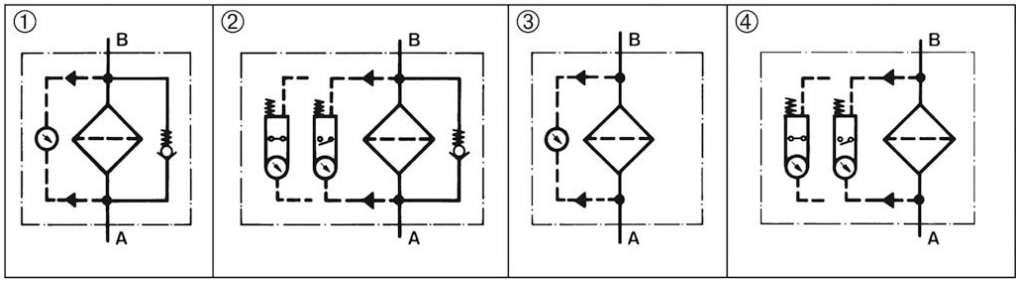
The filter element Sm-N 2 is an element with a very large dirt holding capacity, especially for bypass filtration

5. Quality assurance

MAHLE filters and filter elements are 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 indicatior, inlet at the side for standard filter elements Type: Pi 23040/22-058 Order number: 76320972	PS 10 Type: Pi 852014 PS 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 with bypass valve and visual indicator	② with bypass valve and electrical indicator	③ with visual indicator	④ 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. Δ p [bar]	Filter surface [cm²]
800	76136220	852014 Sm-N 2	Sm-N 2	20	18533
	76321830	852014 PS 3	PS 3		24830
	76321822	852014 PS 6	PS 6		24830
	76321814	852014 PS 10	PS 10		24830
	76321806	852014 PS 25	PS 25		24830
1400	76136212	852015 Sm-N 2	Sm-N 2	20	42275
	76321897	852015 PS 3	PS 3		57200
	76321889	852015 PS 6	PS 6		57200
	76321871	852015 PS 10	PS 10		57200
	76321863	852015 PS 25	PS 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 with bypass valve and visual indicator	② with bypass valve and electrical indicator	③ with visual indicator	④ 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 configurationis 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. Δ p [bar]	Filter surface [cm²]
800	76135859	852014 CC PS 3	PS 3	5	23000
	76135867	852014 CC PS 6	PS 6		23000
	76135875	852014 CC PS 10	PS 10		23000
	76135883	852014 CC PS 25	PS 25		23000
1400	76322028	852015 CC PS 3	PS 3	5	60159
	76322010	852015 CC PS 6	PS 6		60159
	76322002	852015 CC PS 10	PS 10		60159
	76321996	852015 CC PS 25	PS 25		60159

* a wider range of element types is available on request

8. Technical specifications

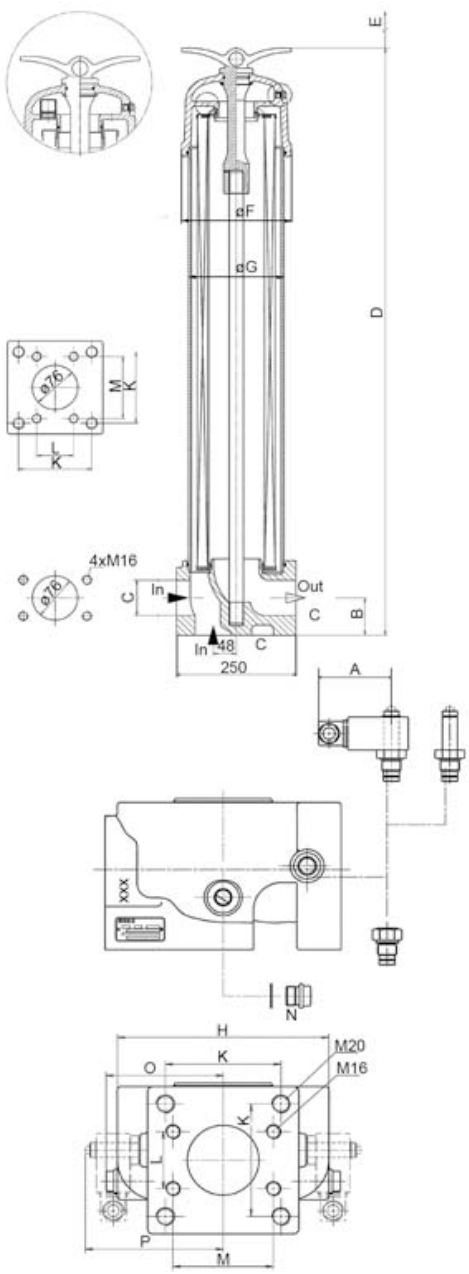
Nominal pressure (10^7 LW):	25 bar (360 psi)
Nominal pressure (static):	40 bar (570 psi)
Temperature range:	-10 °C to +120 °C
	(other temperature ranges on request)
Bypass setting:	Δ 3.5 bar ± 10 %
Filter head and cap material:	GAL
Filter housing material:	AL
Sealing material:	NBR
Maintenance indicator 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.

We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/4 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to fluids in Group2 of DirectiveDirective 97/23 EC Article 9). If you consider to use other fluds please contact us for additional support.

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	K	L	M	N	O	P	Weight [kg]
Pi 23040	78	80	SAE 3, 3000 psi	710	770	230	200	224	122,3	61,9	106,6	G½	124	146	29
Pi 23080	78	80	SAE 3, 3000 psi	1260	770	230	200	224	122,3	61,9	106,6	G½	124	146	30

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 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?

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 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 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 the instructions of the manufacturer.

3 . Please always ensure that you have original MAHLE spare elements in stock: Disposable elements (PS, Sm-N) cannot be cleaned.

10.4. Element replacement

1 . Stop system and relieve filter from pressure.

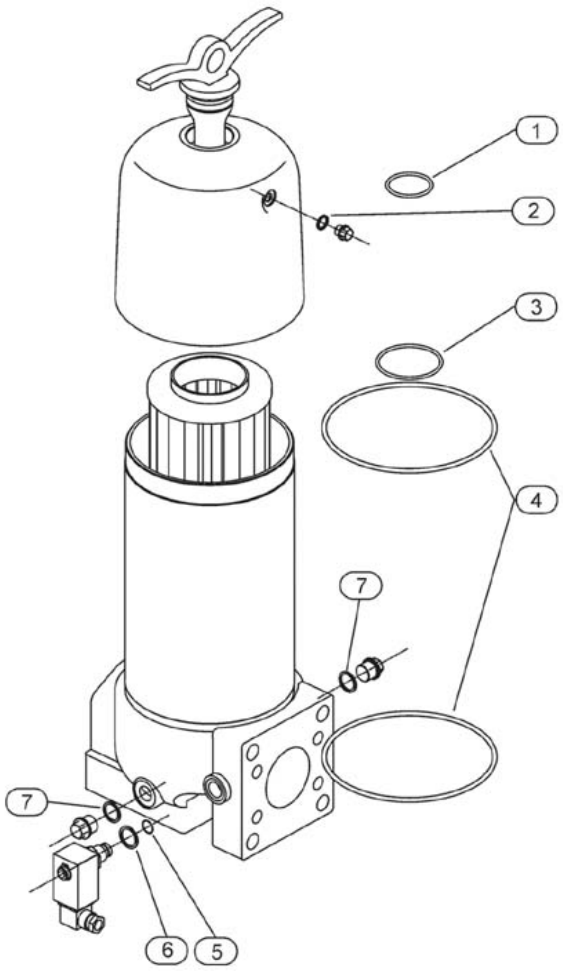
2 . Loosen quick-action clamp, remove cover and open drain valve. Housing completely vented.

3 . Remove filter element from filter housing.

4 . Check seals for damages. Replace, if necessary.

5 . 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.

6 . Close drain valve. Put the thumb screw together with the cover on the centre rod and tighten strong. Filter must be bleeded.



11. Spare parts list

Order numbers for spare parts		
Position	**Type**	**Order number**
①②③ ④⑦	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
⑤⑥	Seal kit for maintenance indicator	
	NBR	77760309
	FPM	77760317
	EPDM	77760325

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MAHLE
Industry

Low Pressure Filter/Suction Filter
Pi 270

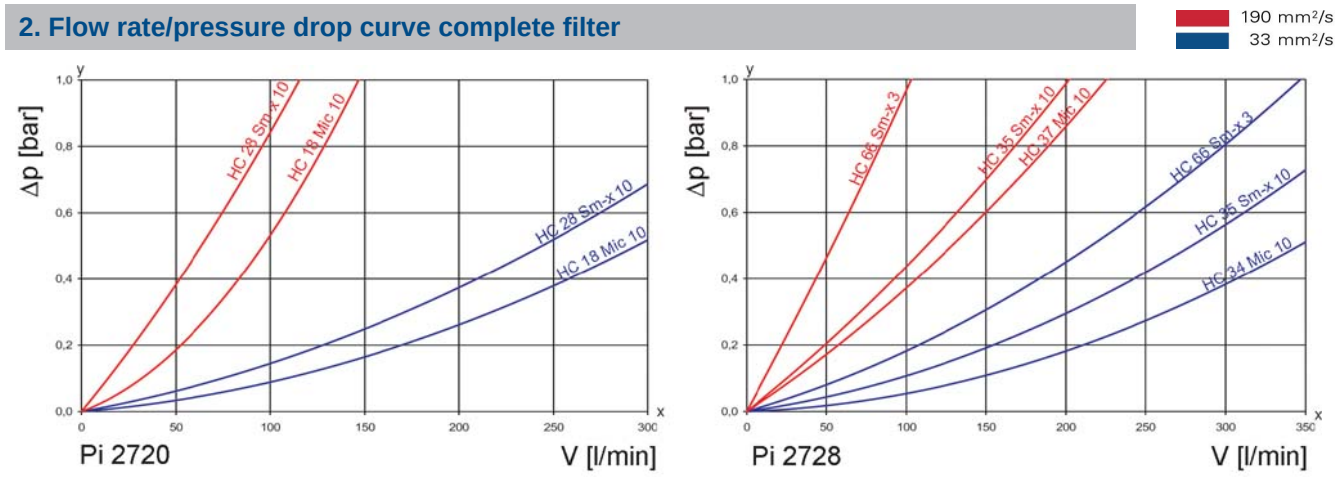
Nominal pressure 10 bar (140 psi), up to nominal size 315

1. Features

High performance filters for modern hydraulic systems

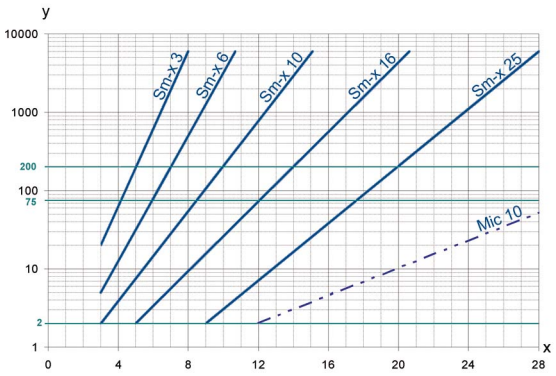
- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded connections
- Quality filters, easy to service
- Equipped with highly efficient Mic or Sm-x filter elements
- Beta rated 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



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 5 bar

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

values guaranteed up to 5 bar differential pressure

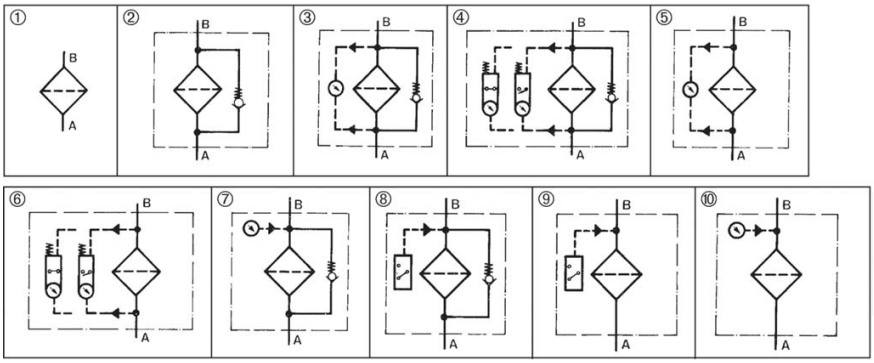
Subject to technical alteration without prior notice.

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 no options	② with bypass 3.5 bar	③ with bypass 3.5 bar and visual indicator	④ with bypass 3.5 bar and electrical indicator	⑤ with visual indicator	⑥ 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. Δ p [bar]	Filter surface [cm²]
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 Δ p 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. Δ p [bar]	Filter surface [cm²]
80	77643331	HC 18	Mic 10	**5**	7000
125	77504194	HC 34	Mic 10		14025

8. Technical specifications

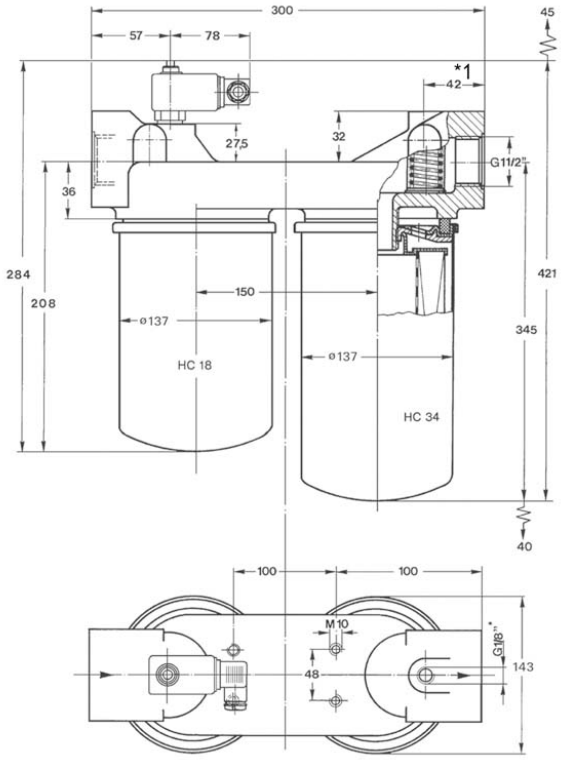
Design:	in-line filter
Nominal pressure:	10 bar (140 psi)
Test pressure:	13 bar (180 psi)
Temperature range:	-10 °C to +120 °C
	(other temperature ranges on request)
Bypass setting:	
Pressure side:	Δ p 3.5 bar ± 10 %
Suction side:	Δ p 0.25 bar ± 10 %
Filter head material:	GAL
Spin-on cartridge material:	St
Sealing material:	NBR/AL
Maintenance indicator setting:	Δ p 2.2 bar ± 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

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 only existing at suction side design

9. Installation, operating and maintenance instructions

9.1 Filter installation

When installing the filter make sure that sufficient space is available to remove spin-on cardrige. Filter should be installed with the spin-on cartridge 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 position to normally closed position or vice versa.

9.3 When should the filter element be replaced?

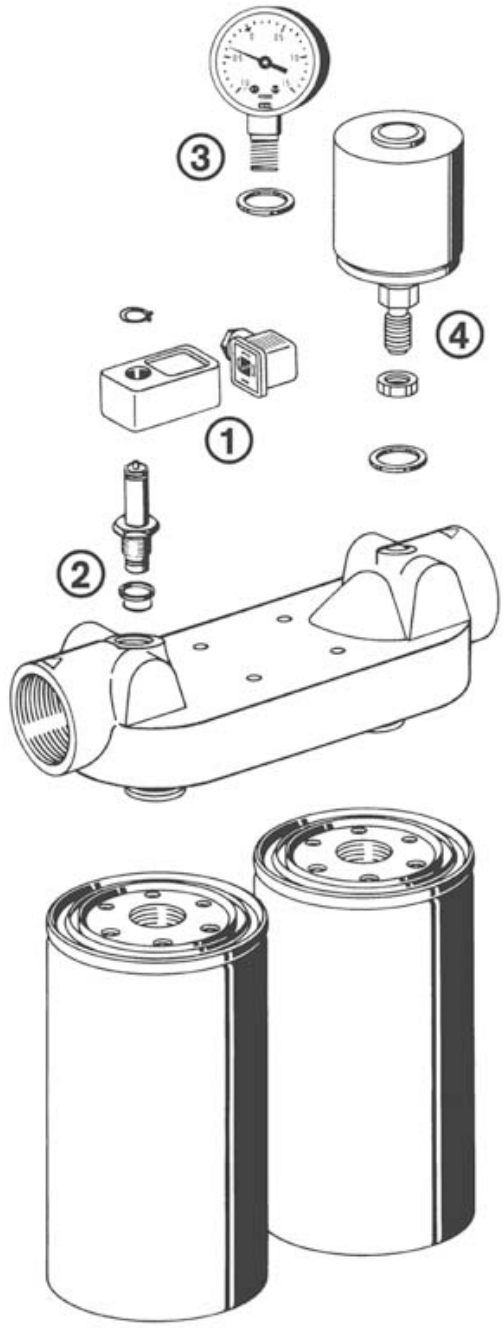
1 . Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical 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 spin-on cartridges in stock.

9.4 Spin-on cartrige replacement

1 . Stop system and relieve filter from pressure.
2 . Unscrew the spin-on cartridge by using a filter wrench by turning counter-clockwise.
3 . Make sure that the order number on the spin-on cartridge corresponds to the order number of the filter plate.
4 . Oil the seal of the spin-on cartridge.
5 . 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	76345763
④	Vacuum switch PiS 3070/200 mbar	77669724

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78356677.03/2012

MAHLE
Industry

Medium Pressure Filter
Pi 3000

Nominal pressure 210/315 bar (3040/4570 psi), nominal size up to 400
according to DIN 24550

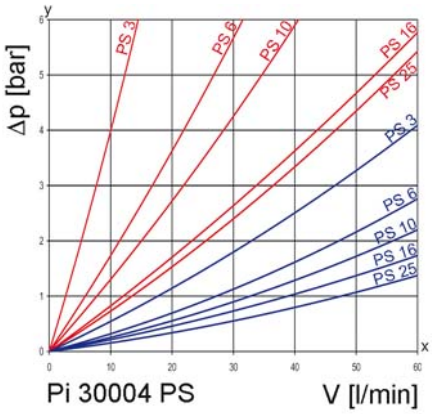
1. Features

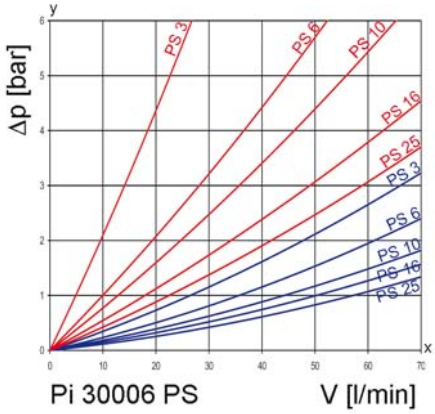
High performance filters for modern hydraulic systems

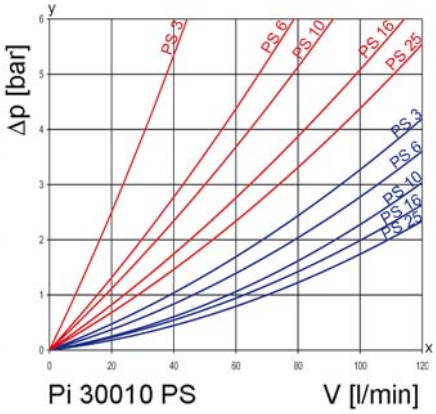
- Provided for pipe installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre PS filter elements
- Beta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

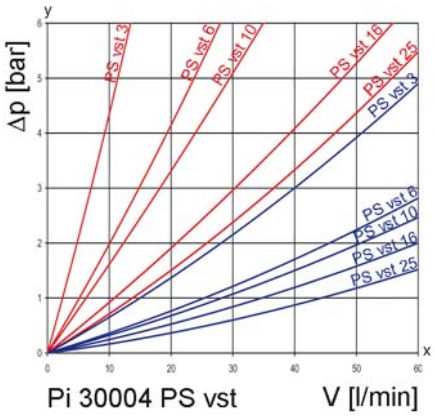
2. Flow rate/pressure drop curve (filter housing incl. element)

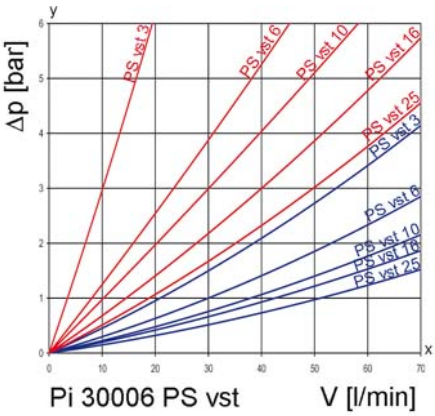
190 mm²/s
33 mm²/s

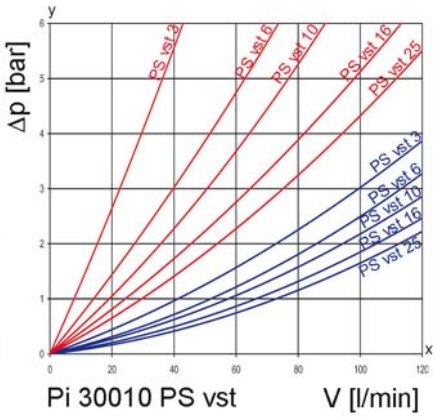


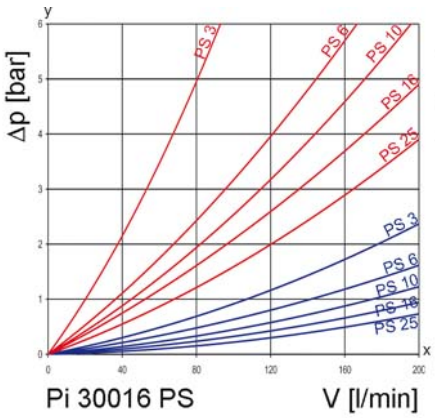


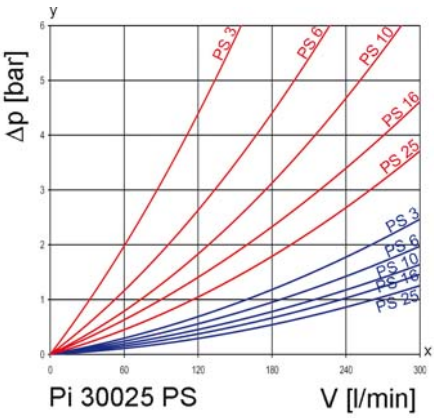


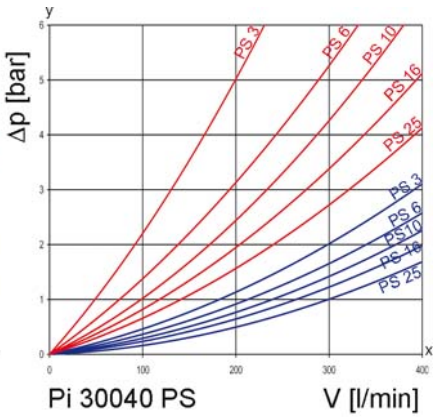


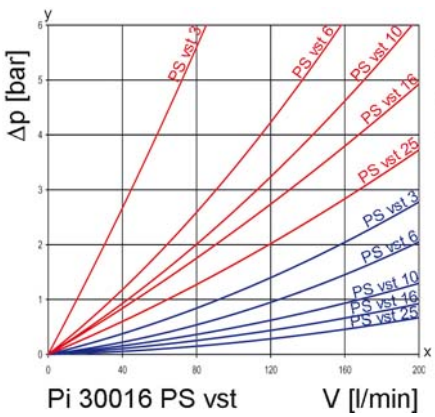


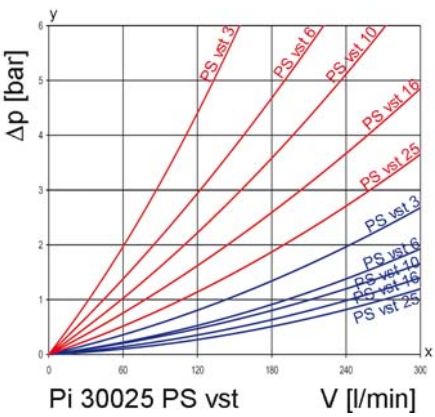


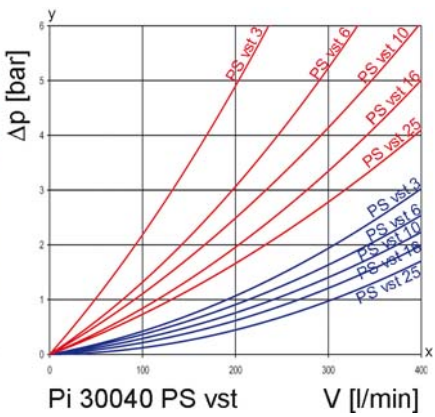








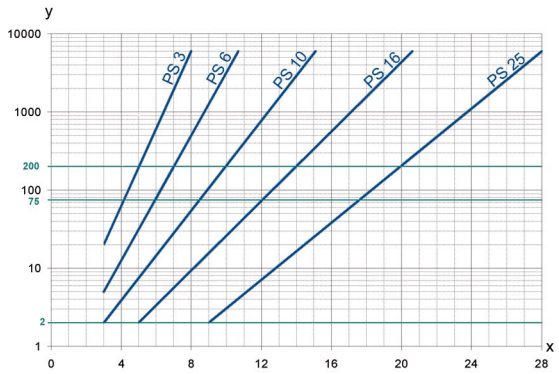




y = differential pressure Δ p [bar]

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)

PS elements with
max. Δ p 20 bar

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

values guaranteed up to
10 bar differential pressure

PS vst elements with
max. Δ p 210 bar

PS vst	3	$\beta_{5(C)}$	≥200
PS vst	6	$\beta_{7(C)}$	≥200
PS vst	10	$\beta_{10(C)}$	≥200
PS vst	16	$\beta_{15(C)}$	≥200
PS vst	25	$\beta_{20(C)}$	≥200

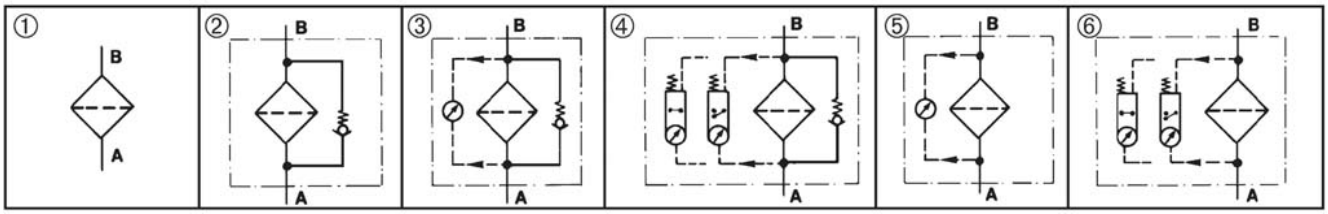
values guaranteed up to
20 bar differential pressure

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. Filter housing	2. Filter element
V = 100l/min and electrical maintenance indicator Type: Pi 30010-015 Order number: 78208084	PS vst 3 Type: Pi 71010 DN PS 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. Δ p [bar]**	**Filter surface [cm²]**
40	78260929	Pi 21004 DN PS 3 NBR	PS 3	**20**	475
	77960859	Pi 22004 DN PS 6 NBR	PS 6		475
	77925571	Pi 23004 DN PS 10 NBR	PS 10		475
	78260937	Pi 24004 DN PS 16 NBR	PS 16		475
	78260945	Pi 25004 DN PS 25 NBR	PS 25		475
	78216079	Pi 71004 DN PS vst 3 NBR	PS vst 3	**210**	445
	77960156	Pi 72004 DN PS vst 6 NBR	PS vst 6		445
	77925654	Pi 73004 DN PS vst 10 NBR	PS vst 10		445
	78216087	Pi 74004 DN PS vst 16 NBR	PS vst 16		445
	78216095	Pi 75004 DN PS vst 25 NBR	PS vst 25		445
63	78260960	Pi 21006 DN PS 3 NBR	PS 3	**20**	835
	77960867	Pi 22006 DN PS 6 NBR	PS 6		835
	77925589	Pi 23006 DN PS 10 NBR	PS 10		835
	78260978	Pi 24006 DN PS 16 NBR	PS 16		835
	78260986	Pi 25006 DN PS 25 NBR	PS 25		835
	78216137	Pi 71006 DN PS vst 3 NBR	PS vst 3	**210**	780
	77960149	Pi 72006 DN PS vst 6 NBR	PS vst 6		780
	77925662	Pi 73006 DN PS vst 10 NBR	PS vst 10		780
	78216145	Pi 74006 DN PS vst 16 NBR	PS vst 16		780
	78216152	Pi 75006 DN PS vst 25 NBR	PS vst 25		780
100	78227472	Pi 21010 DN PS 3 NBR	PS 3	**20**	1375
	77960875	Pi 22010 DN PS 6 NBR	PS 6		1375
	77925597	Pi 23010 DN PS 10 NBR	PS 10		1375
	78261000	Pi 24010 DN PS 16 NBR	PS 16		1375
	78261018	Pi 25010 DN PS 25 NBR	PS 25		1375
	78227480	Pi 71010 DN PS vst 3 NBR	PS vst 3	**210**	1275
	77960131	Pi 72010 DN PS vst 6 NBR	PS vst 6		1275
	77925670	Pi 73010 DN PS vst 10 NBR	PS vst 10		1275
	78261281	Pi 74010 DN PS vst 16 NBR	PS vst 16		1275
	78216160	Pi 75010 DN PS vst 25 NBR	PS 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. Δ p [bar]**	**Filter surface [cm²]**
160	78261034	Pi 21016 DN PS 3 NBR	PS 3	**20**	2530
	77960826	Pi 22016 DN PS 6 NBR	PS 6		2530
	77925605	Pi 23016 DN PS 10 NBR	PS 10		2530
	78261042	Pi 24016 DN PS 16 NBR	PS 16		2530
	78261059	Pi 25016 DN PS 25 NBR	PS 25		2530
	77940638	Pi 71016 DN PS vst 3 NBR	PS vst 3	**210**	1885
	77960123	Pi 72016 DN PS vst 6 NBR	PS vst 6		1885
	77925688	Pi 73016 DN PS vst 10 NBR	PS vst 10		1885
	78269797	Pi 74016 DN PS vst 16 NBR	PS vst 16		1885
	78216178	Pi 75016 DN PS vst 25 NBR	PS vst 25		1885
250	78227514	Pi 21025 DN PS 3 NBR	PS 3	**20**	4020
	77960834	Pi 22025 DN PS 6 NBR	PS 6		4020
	77925613	Pi 23025 DN PS 10 NBR	PS 10		4020
	78261075	Pi 24025 DN PS 16 NBR	PS 16		4020
	78261083	Pi 25025 DN PS 25 NBR	PS 25		4020
	77940646	Pi 71025 DN PS vst 3 NBR	PS vst 3	**210**	3090
	77960115	Pi 72025 DN PS vst 6 NBR	PS vst 6		3090
	77925696	Pi 73025 DN PS vst 10 NBR	PS vst 10		3090
	78269813	Pi 74025 DN PS vst 16 NBR	PS vst 16		3090
	78216186	Pi 75025 DN PS vst 25 NBR	PS vst 25		3090
400	78227522	Pi 21040 DN PS 3 NBR	PS 3	**20**	6770
	77960842	Pi 22040 DN PS 6 NBR	PS 6		6770
	77925621	Pi 23040 DN PS 10 NBR	PS 10		6770
	78261109	Pi 24040 DN PS 16 NBR	PS 16		6770
	78261117	Pi 25040 DN PS 25 NBR	PS 25		6770
	77940653	Pi 71040 DN PS vst 3 NBR	PS vst 3	**210**	5240
	77960107	Pi 72040 DN PS vst 6 NBR	PS vst 6		5240
	77930829	Pi 73040 DN PS vst 10 NBR	PS vst 10		5240
	78269821	Pi 74040 DN PS vst 16 NBR	PS vst 16		5240
	78260903	Pi 75040 DN PS vst 25 NBR	PS vst 25		5240

* a wider range of element types is available on request

8. Technical specifications

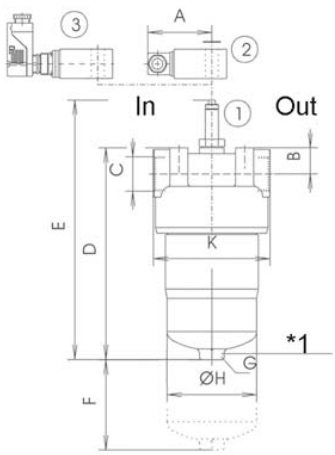
Design:	in-line filter
Nominal pressure: Pi 30016-30040	210 bar (3070 psi)
Pi 30004, 30006, 30010	315 bar (4570 psi)
Test pressure: Pi 30016-30040	275 bar (4280 psi)
Pi 30004, 30006, 30010	410 bar (5940 psi)
Temperature range:	-10 °C to +120 °C
	(other temperature ranges on request)
Bypass setting:	Δp 7 bar ± 10 %
Filter head material:	GGG
Filter housing material:	St
Sealing material:	NBR/PTFE
Maintenance indicator setting:	Δp 5 bar ± 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 sleave:	M20x1.5

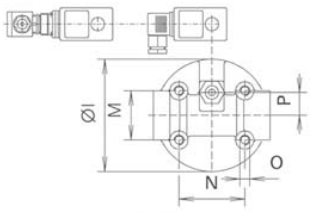
The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance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

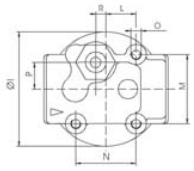
We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids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

Subject to technical alteration without prior notice.





NG 160 - 400



NG 40 - 100

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	181	238	80	27	66	90	92	23.5	54	47	M8x16	21	8	4.2
Pi 30006	78	31	G¾	241	298	80	27	66	90	92	23.5	54	47	M8x16	21	8	4.9
Pi 30010	78	31	G1	331	389	80	27	66	90	92	23.5	54	47	M8x16	21	8	5.8
Pi 30016	78	32	G1¼	267	324	110	30	109	137	142	-	60	80	M12x16	28	-	10.0
Pi 30025	78	32	G1¼	357	414	110	30	109	137	142	-	60	80	M12x16	28	-	12.0
Pi 30040	78	32	G1¼	507	564	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 housingl. 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?

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 (PS) cannot be cleaned.

10.4 Element replacement

1 . Stop system and relieve filter from pressure.
2 . Filter sizes 250 and 400: empty the filter housing by removing the drain plug.
3 . Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
4 . Remove element by pulling down carefully.
5 . Check o-ring and spigot 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. 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.
7 . Lightly lubricate threads of the filter housing a little bit and screw into the filter head. Maximum tightening torque for NG 40 to 100 = 60 Nm, for NG 160 to 400 = 100 Nm.
8 . Check seals of vent drain plug - if necessary, please replace. Torque drain plug 30 Nm**.**

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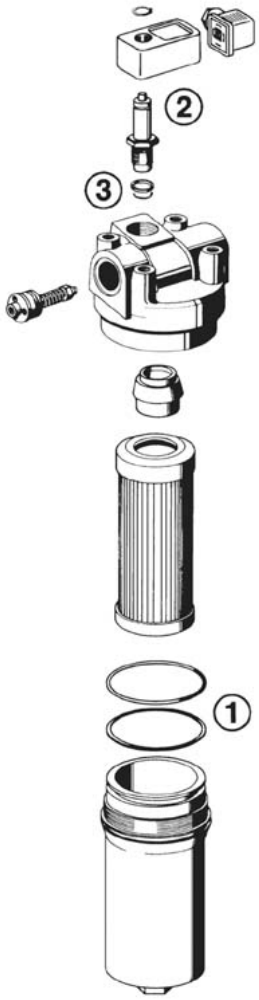
78396012.07/2012



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

MAHLE
Industry

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)

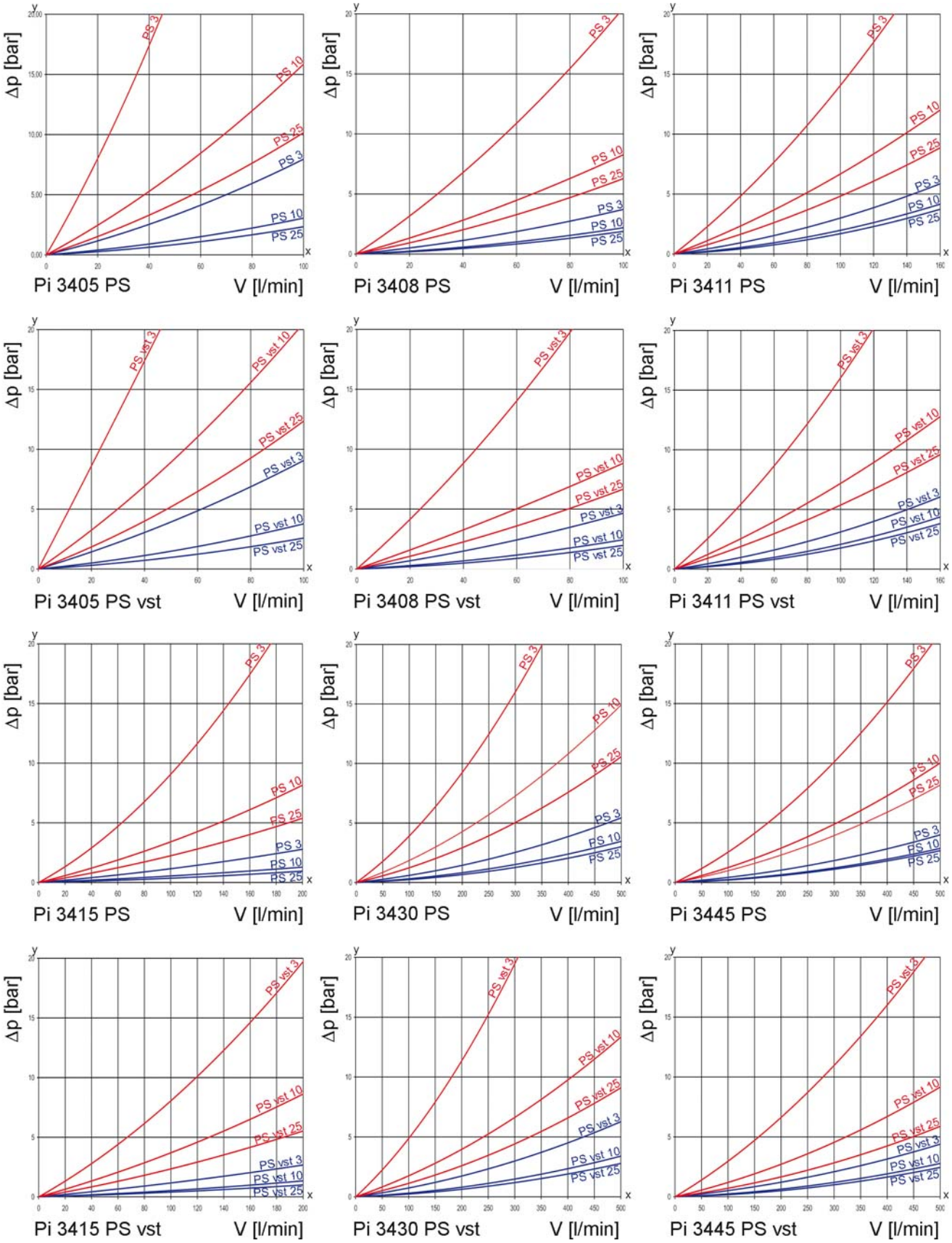
1. Features

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 PS filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution

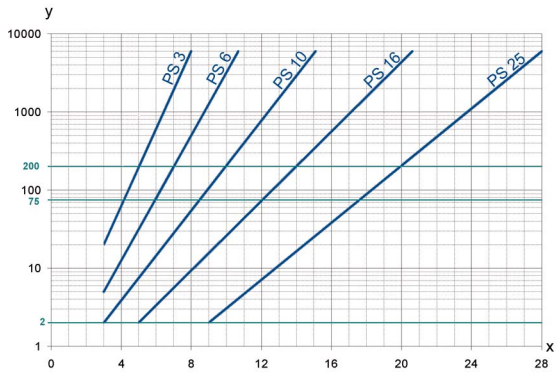
2. Flow rate/pressure drop curve (filter housing incl. element)

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)

PS elements with
max. Δ p 20 bar

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

values guaranteed up to
10 bar differential pressure

PS vst elements with
max. Δ p 210 bar

PS vst	3	$\beta_{5(C)}$	≥200
PS vst	6	$\beta_{7(C)}$	≥200
PS vst	10	$\beta_{10(C)}$	≥200
PS vst	25	$\beta_{20(C)}$	≥200

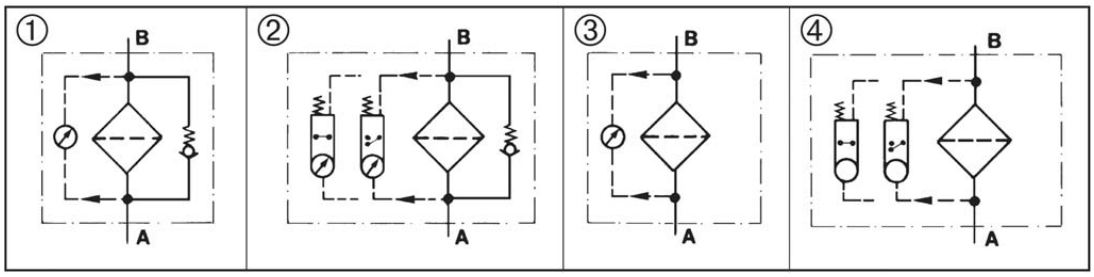
values guaranteed up to
20 bar differential pressure

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; verifiaction 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	PS vst 3 Type: Pi 2208 PS 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 availble on request)					
Nominal size NG [l/min]	**Order number**	**Type**	**Filter material**	**max. Δp [bar]**	**Filter surface [cm²]**
50	77680135	Pi 2105 PS 3	PS 3	**20**	590
	77943509	Pi 5105 PS 6	PS 6		590
	77680325	Pi 3105 PS 10	PS 10		590
	77680440	Pi 4105 PS 25	PS 25		590
	77680192	Pi 2205 PS vst 3	PS vst 3	**210**	425
	77943533	Pi 5205 PS vst 6	PS vst 6		425
	77680382	Pi 3205 PS vst 10	PS vst 10		425
	77680507	Pi 4205 PS vst 25	PS vst 25		425
80	77680143	Pi 2108 PS 3	PS 3	**20**	1150
	77943517	Pi 5108 PS 6	PS 6		1150
	77680341	Pi 3108 PS 10	PS 10		1150
	77680457	Pi 4108 PS 25	PS 25		1150
	77680200	Pi 2208 PS vst 3	PS vst 3	**210**	850
	77943541	Pi 5208 PS vst 6	PS vst 6		850
	77681190	Pi 3208 PS vst 10	PS vst 10		850
	77680515	Pi 4208 PS vst 25	PS vst 25		850
110	77680150	Pi 2111 PS 3	PS 3	**20**	1700
	77943525	Pi 5111 PS 6	PS 6		1700
	77680333	Pi 3111 PS 10	PS 10		1700
	77680465	Pi 4111 PS 25	PS 25		1700
	77680218	Pi 2211 PS vst 3	PS vst 3	**210**	1275
	77943558	Pi 5211 PS vst 6	PS vst 6		1275
	77680390	Pi 3211 PS vst 10	PS vst 10		1275
	77680523	Pi 4211 PS vst 25	PS vst 25		1275
150	77680168	Pi 2115 PS 3	PS 3	**20**	2425
	77955099	Pi 5115 PS 6	PS 6		2425
	77680358	Pi 3115 PS 10	PS 10		2425
	77680473	Pi 4115 PS 25	PS 25		2425
	77680226	Pi 2215 PS vst 3	PS vst 3	**210**	2010
	77955123	Pi 5215 PS vst 6	PS vst 6		2010
	77680408	Pi 3215 PS vst 10	PS vst 10		2010
	77680531	Pi 4215 PS vst 25	PS vst 25		2010
300	77680176	Pi 2130 PS 3	PS 3	**20**	4620
	77955107	Pi 5130 PS 6	PS 6		4620
	77680366	Pi 3130 PS 10	PS 10		4620
	77680481	Pi 4130 PS 25	PS 25		4620
	77680234	Pi 2230 PS vst 3	PS vst 3	**210**	3800
	77955131	Pi 5230 PS vst 6	PS vst 6		3800
	77680416	Pi 3230 PS vst 10	PS vst 10		3800
	77680549	Pi 4230 PS vst 25	PS vst 25		3800
450	77680184	Pi 2145 PS 3	PS 3	**20**	6865
	77955115	Pi 5145 PS 6	PS 6		6865
	77680374	Pi 3145 PS 10	PS 10		6865
	77680499	Pi 4145 PS 25	PS 25		6865
	77680242	Pi 2245 PS vst 3	PS vst 3	**210**	5600
	77955149	Pi 5245 PS vst 6	PS vst 6		5600
	77680424	Pi 3245 PS vst 10	PS vst 10		5600
	77680556	Pi 4245 PS vst 25	PS 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:	Δ p 7 bar ± 10 %
Filter head material:	GGG
Filter housing material:	St
Sealing material:	NBR/PTFE
Maintenance indicator setting:	Δ p 5 bar ± 10 %
Electrical data of maintenance indicator:	
Maximum voltage:	250 V AC/200 V DC
Maximum curent:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleave:	M20x1.5

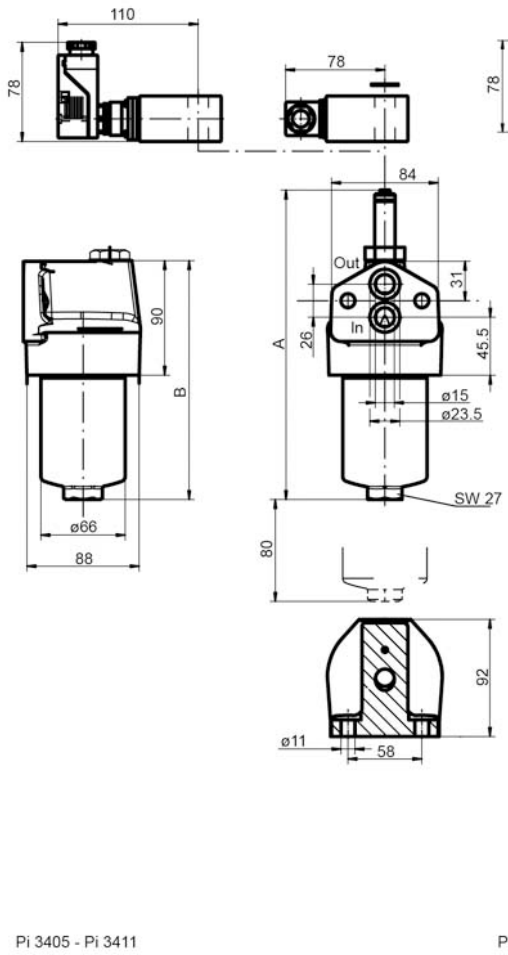
The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By the inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further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

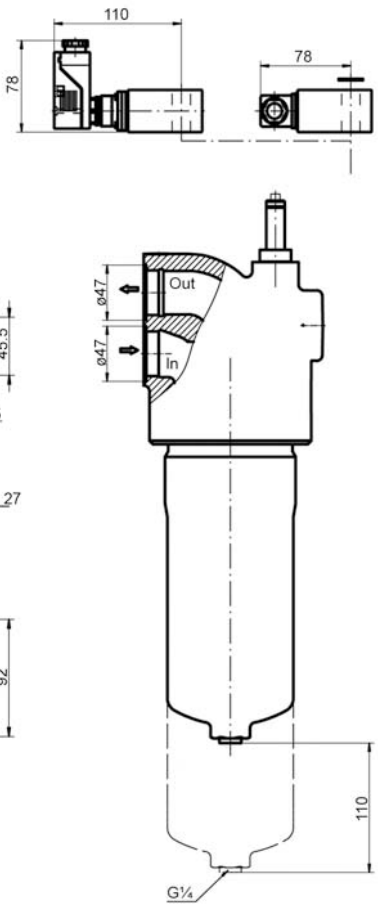
We recommend you to contact us concerning applications of our filters in areas governed by the EU Directive 94/9 EC (ATEX 95). The standard version can be used for liquids based on mineral oil (corresponding to the fluids in Group 2 of Directive 97/23 EC Article 9). If you consider to use other fluids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

Subject to technical alteration without prior notice.

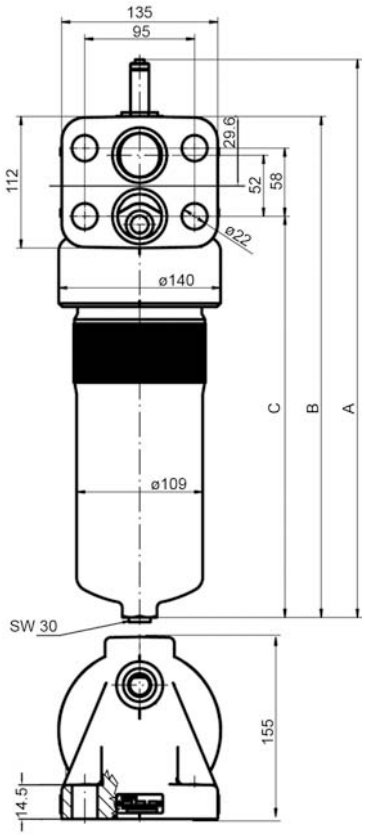
9. Dimensions



Pi 3405 - Pi 3411



Pi 3415 - Pi 3445



In = intlet
Out = outlet

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

All dimensions in mm.

Type	A	B	C	Weight [kg]
Pi 3405	241	188	-	3.7
Pi 3408	320	265	-	4.7
Pi 3411	395	342	-	5.5
Pi 3415	360	305	227	14.4
Pi 3430	474	419	341	17.3
Pi 3445	590	535	457	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.

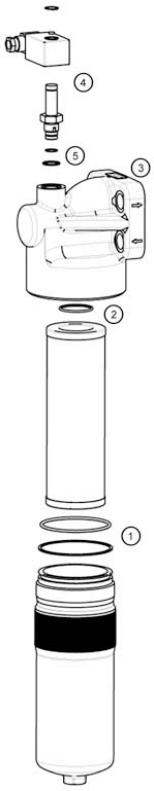
10.3 When should the filter element be replaced?

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 (PS) cannot be cleaned.

10.4 Element replacement

1 . Stop system and relieve filter from pressure.
2 . Filter sizes 300 and 450: empty the filter housing by removing the drain plug.
3 . Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
4 . Remove element by pulling down carefully.
5 . Check o-ring, spigot and o-ring in the element locator 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.
   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.
7 . Lightly lubricate the threads of the filter housing a little bit and screw into the filter head. Maximum tightening torque for NG 50 to 110 = 60 Nm, for NG 150 to 450 = 100 Nm.
8 . Check seals of vent drain plug - if necessary, please replace. Torque drain plug 30 Nm.

11. Spare parts list



Order numbers for spare parts		
Position	**Type**	**Order number**
① bis 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

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78356750.03/2012

MAHLE Industry

Medium Pressure Filter
Pi 360

Nominal pressure 210/315 bar (2990/4480 psi), nominal size up to 450

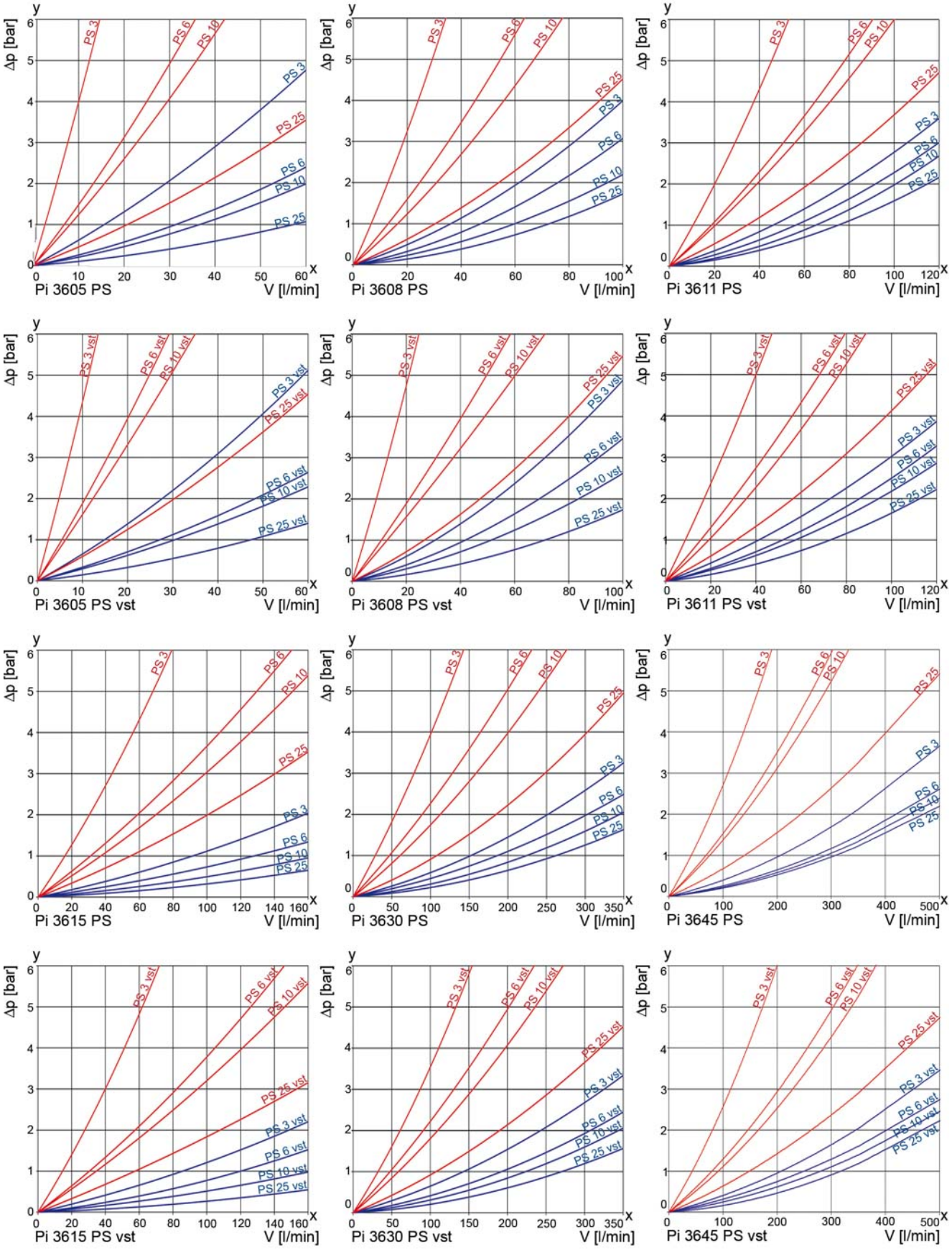
1. Features

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 control
- 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 PS 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 (filter housing incl. element)

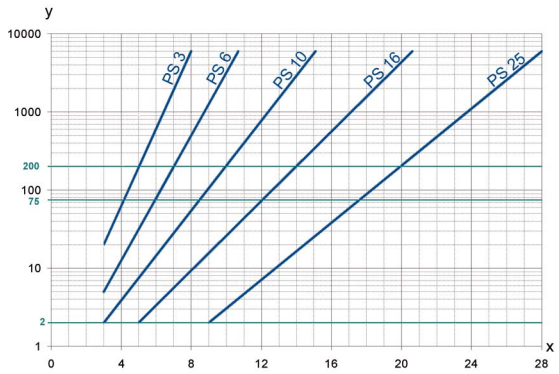
190 mm²/s
33 mm²/s



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 1171 (NIST)

4. Filter performance data

tested according to ISO 16889 (multipass test)

PS elements with
max. Δ p 20 bar

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

values guaranteed up to
10 bar differential pressure

PS vst elements with
max. Δ p 210 bar

PS vst	3	$\beta_{5(C)}$	≥200
PS vst	6	$\beta_{7(C)}$	≥200
PS vst	10	$\beta_{10(C)}$	≥200
PS vst	25	$\beta_{20(C)}$	≥200

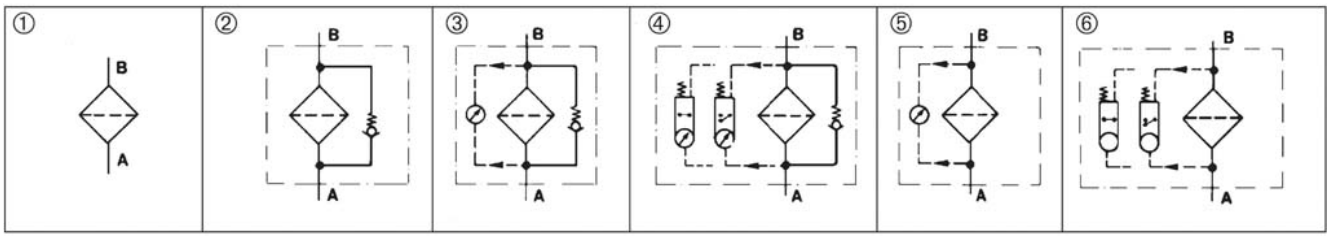
values guaranteed up to
20 bar differential pressure

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. Filter housing	2. Filter element
V=80 l/min and electrical maintenance indicator	PS vst 3
Type: Pi 3608-15	Type: Pi 2208 PS vst 3
Order number: 77666282	Order number: 77680200

7.1 Housing design

Nominal size NG [l/min]	Order number	Type	① no options	② with bypass and indicator cavity	③ with bypass and visual indicator	④ with bypass and electrical indicator	⑤ with visual indicator	⑥ with electrical indicator
50	77655996	Pi 3605-060	■					
	77666217	Pi 3605-011		■				
	77666225	Pi 3605-012			■			
	77656044	Pi 3605-013				■		
	77666233	Pi 3605-014					■	
	77666241	Pi 3605-015						■
80	77656002	Pi 3608-060	■					
	77666258	Pi 3608-011		■				
	77666266	Pi 3608-012			■			
	77656036	Pi 3608-013				■		
	77666274	Pi 3608-014					■	
	77666282	Pi 3608-015						■
110	77656010	Pi 3611-060	■					
	77666290	Pi 3611-011		■				
	77666308	Pi 3611-012			■			
	77656028	Pi 3611-013				■		
	77731821	Pi 3611-014					■	
	77666316	Pi 3611-015						■
150	77647845	Pi 3615-060	■					
	77731854	Pi 3615-011		■				
	77666324	Pi 3615-012			■			
	77655988	Pi 3615-013				■		
	77731862	Pi 3615-014					■	
	77731847	Pi 3615-015						■
300	77655970	Pi 3630-060	■					
	77731896	Pi 3630-011		■				
	77666332	Pi 3630-012			■			
	77647837	Pi 3630-013				■		
	77731904	Pi 3630-014					■	
	77731888	Pi 3630-015						■
450	70328126	Pi 3645-060	■					
	79343153	Pi 3645-011		■				
	79350810	Pi 3645-012			■			
	77883648	Pi 3645-013				■		
	79343161	Pi 3645-014					■	
	78299307	Pi 3645-015						■

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. Δ p [bar]**	**Filter surface [cm²]**
50	77680135	Pi 2105 PS 3	PS 3	**20**	590
	77943509	Pi 5105 PS 6	PS 6		590
	77680325	Pi 3105 PS 10	PS 10		590
	77680440	Pi 4105 PS 25	PS 25		590
	77680192	Pi 2205 PS vst 3	PS vst 3	**210**	425
	77943533	Pi 5205 PS vst 6	PS vst 6		425
	77680382	Pi 3205 PS vst 10	PS vst 10		425
	77680507	Pi 4205 PS vst 25	PS vst 25		425
80	77680143	Pi 2108 PS 3	PS 3	**20**	1150
	77943517	Pi 5108 PS 6	PS 6		1150
	77680341	Pi 3108 PS 10	PS 10		1150
	77680457	Pi 4108 PS 25	PS 25		1150
	77680200	Pi 2208 PS vst 3	PS vst 3	**210**	850
	77943541	Pi 5208 PS vst 6	PS vst 6		850
	77681190	Pi 3208 PS vst 10	PS vst 10		850
	77680515	Pi 4208 PS vst 25	PS vst 25		850
110	77680150	Pi 2111 PS 3	PS 3	**20**	1700
	77943525	Pi 5111 PS 6	PS 6		1700
	77680333	Pi 3111 PS 10	PS 10		1700
	77680465	Pi 4111 PS 25	PS 25		1700
	77680218	Pi 2211 PS vst 3	PS vst 3	**210**	1275
	77943558	Pi 5211 PS vst 6	PS vst 6		1275
	77680390	Pi 3211 PS vst 10	PS vst 10		1275
	77680523	Pi 4211 PS vst 25	PS vst 25		1275
150	77680168	Pi 2115 PS 3	PS 3	**20**	2425
	77955099	Pi 5115 PS 6	PS 6		2425
	77680358	Pi 3115 PS 10	PS 10		2425
	77680473	Pi 4115 PS 25	PS 25		2425
	77680226	Pi 2215 PS vst 3	PS vst 3	**210**	2010
	77955123	Pi 5215 PS vst 6	PS vst 6		2010
	77680408	Pi 3215 PS vst 10	PS vst 10		2010
	77680531	Pi 4215 PS vst 25	PS vst 25		2010
300	77680176	Pi 2130 PS 3	PS 3	**20**	4620
	77955107	Pi 5130 PS 6	PS 6		4620
	77680366	Pi 3130 PS 10	PS 10		4620
	77680481	Pi 4130 PS 25	PS 25		4620
	77680234	Pi 2230 PS vst 3	PS vst 3	**210**	3800
	77955131	Pi 5230 PS vst 6	PS vst 6		3800
	77680416	Pi 3230 PS vst 10	PS vst 10		3800
	77680549	Pi 4230 PS vst 25	PS vst 25		3800
450	77680184	Pi 2145 PS 3	PS 3	**20**	6865
	77955115	Pi 5145 PS 6	PS 6		6865
	77680374	Pi 3145 PS 10	PS 10		6865
	77680499	Pi 4145 PS 25	PS 25		6865
	77680242	Pi 2245 PS vst 3	PS vst 3	**210**	5600
	77955149	Pi 5245 PS vst 6	PS vst 6		5600
	77680424	Pi 3245 PS vst 10	PS vst 10		5600
	77680556	Pi 4245 PS vst 25	PS vst 25		5600

8. Technical specifications

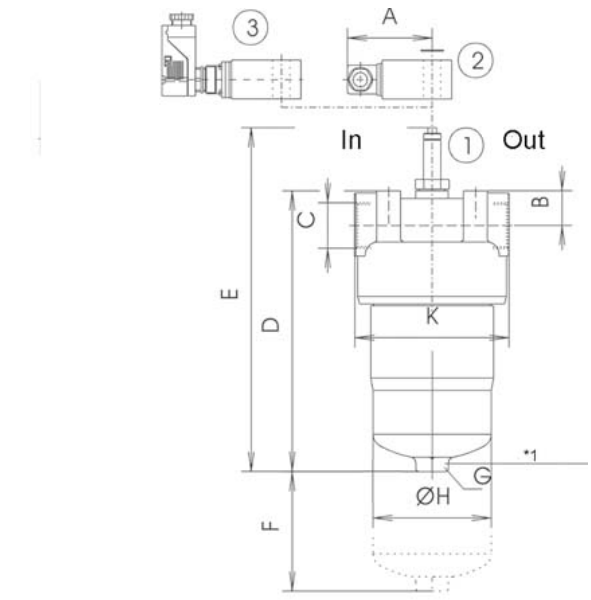
Design:	line mounting filter
Nominal pressure: Pi 3615-3645	210 bar (2990 psi)
Pi 3605, 3608, 3611	315 bar (4480 psi)
Test pressure: Pi 3615-3645	275 bar (3910 psi)
Pi 3605, 3608, 3611	410 bar (5830 psi)
Temperature range:	-10 °C to +120 °C
	(other temperature ranges on request)
Bypass setting:	Δ p 7 bar ± 10 %
Filter head material:	GGG
Filter housing material:	St
Sealing material:	NBR/PTFE
Maintenance indicator setting:	Δ p 5 bar ± 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 sleave:	M20x1.5

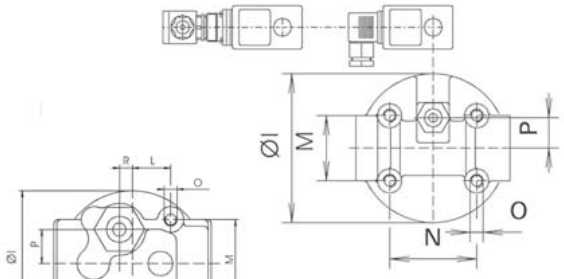
The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection ciruit should be considered. Further maintenance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





Pi 3615 - Pi 3645

Pi 3605 - Pi 3611

In = inlet
Out = outlet
Pos 1 - Visual maintenance indicator
Pos 2 - Electrical upper section connector according DIN EN 175301-803
Executions: Pis 3092, 3105, 3115
Pos 3 - Electrical upper section connector according DIN EN 175201-804
Executions: Pis 3102, 3122, 3110, 3132

*1 NG 300 and NG 450 with drain screw G¼

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 3605	78	31	G½	189	247	80	27	66	90	92	23.5	54	47	M8x16	21	8	4.1
Pi 3608	78	31	G¾	267	325	80	27	66	90	92	23.5	54	47	M8x16	21	8	5.0
Pi 3611	78	31	G¾	343	401	80	27	66	90	92	23.5	54	47	M8x16	21	8	5.9
Pi 3615	78	32	G1¼	257	312	110	30	109	137	142	-	60	80	M12x16	30	-	9.8
Pi 3630	78	32	G1¼	371	426	110	30	109	137	142	-	60	80	M12x16	30	-	12.5
Pi 3645	78	32	G1¼	487	542	110	30	109	137	142	-	60	80	M12x16	30	-	14.0

* 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 to normally closed position or vice versa.

10.3 When should the filter 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 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 (PS) cannot be cleaned.

10.4 Element replacement

1 . Stop system and relieve filter from pressure.

2 . Filter sizes 300 and 450: empty the filter housing by removing the drain plug.

3 . Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.

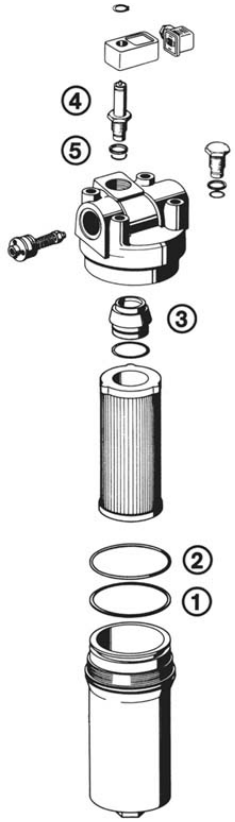
4 . Remove element by pulling down carefully.

5 . Check o-ring, spigot and o-ring in the element locator 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. 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.

7 . Lightly lubricate the threads of the filter housing a little bit and screw into the filter head. Maximum tightening torque for NG 50 to 110 = 60 Nm, for NG 150 to 450 = 100 Nm.

8 . Check seals of vent drain plug - if necessary, please replace.
Torque drain plug 30 Nm.



11. Spare parts list

Order numbers for spare parts		
Position	**Type**	**Order number**
① - ③	Seal kit	
	Pi 3605 - Pi 3611	
	NBR	77637150
	FPM	77637168
	EPDM	77637176
	Pi 3615 - Pi 3645	
	NBR	77637184
	FPM	77637192
	EPDM	77637200
④	Maintenance indicator	
	Visual PiS 3093/5	77669914
	Visual/electrical PiS 3092/5	77669864
	Electrical upper section only	77536550
⑤	Seal kit for maintenance indicator	
	NBR	77760275
	FPM	77760283
	EPDM	77760291

MAHLE Industry

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78356834.08/2012

MAHLE Industry

High Pressure Filter
Pi 4000

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

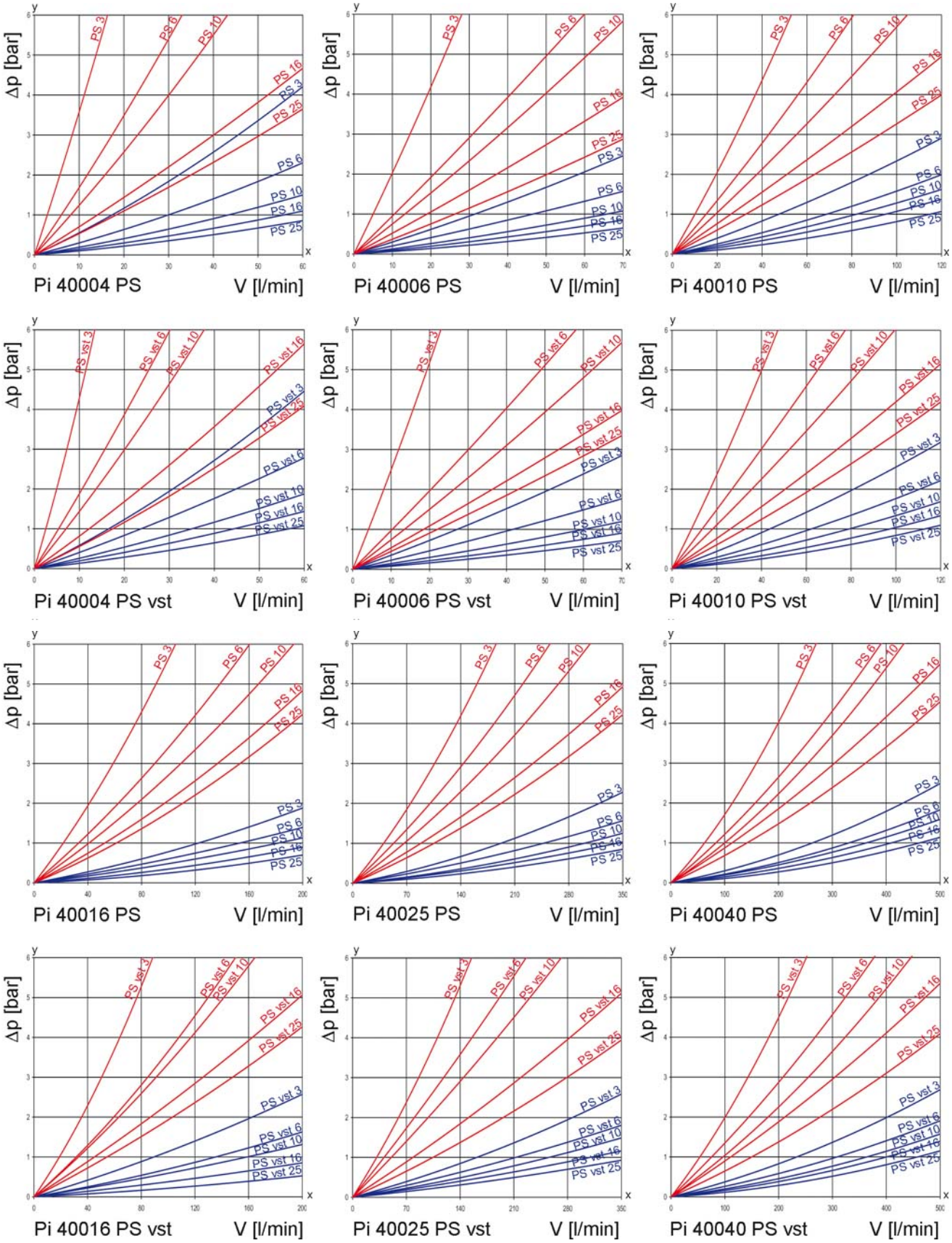
1. Features

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 PS filter elements
- Beta reated 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 (filter housing incl. element)

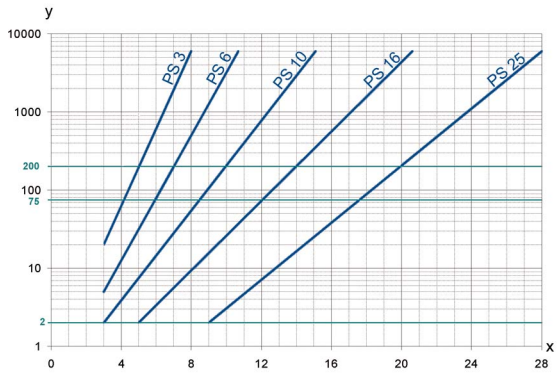
190 mm²/s
33 mm²/s



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)

PS elements with
max. Δ p 20 bar

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

values guaranteed up to
10 bar differential pressure

PS vst elements with
max. Δ p 210 bar

PS vst	3	$\beta_{5(C)}$	≥200
PS vst	6	$\beta_{7(C)}$	≥200
PS vst	10	$\beta_{10(C)}$	≥200
PS vst	16	$\beta_{15(C)}$	≥200
PS vst	25	$\beta_{20(C)}$	≥200

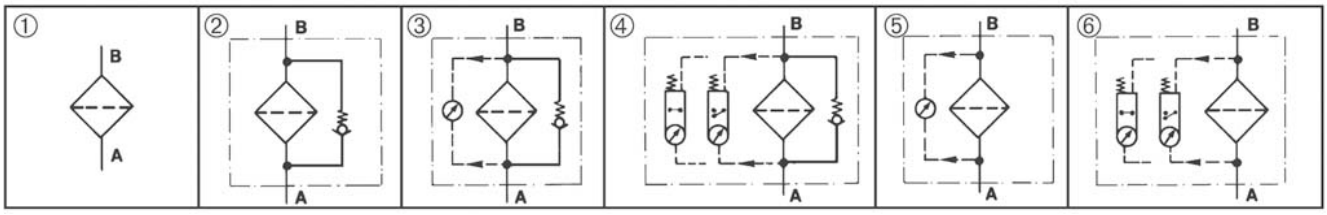
values guaranteed up to
20 bar differential pressure

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. Filter housing	2. Filter element
V = 100 l/min and electrical maintenance indicator Type: Pi 40010-015, Order number: 77978448	PS vst 3 Type: Pi 71010 DN PS 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	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. Δ p [bar]**	**Filter surface [cm²]**
40	78260929	Pi 21004 DN PS 3	PS 3	**20**	475
	77960859	Pi 22004 DN PS 6	PS 6		475
	77925571	Pi 23004 DN PS 10	PS 10		475
	78260937	Pi 24004 DN PS 16	PS 16		475
	78260945	Pi 25004 DN PS 25	PS 25		475
	78216079	Pi 71004 DN PS vst 3	PS vst 3	**210**	445
	77960156	Pi 72004 DN PS vst 6	PS vst 6		445
	77925654	Pi 73004 DN PS vst 10	PS vst 10		445
	78216087	Pi 74004 DN PS vst 16	PS vst 16		445
	78216095	Pi 75004 DN PS vst 25	PS vst 25		445
63	78260960	Pi 21006 DN PS 3	PS 3	**20**	835
	77960867	Pi 22006 DN PS 6	PS 6		835
	77925589	Pi 23006 DN PS 10	PS 10		835
	78260978	Pi 24006 DN PS 16	PS 16		835
	78260986	Pi 25006 DN PS 25	PS 25		835
	78216137	Pi 71006 DN PS vst 3	PS vst 3	**210**	780
	77960149	Pi 72006 DN PS vst 6	PS vst 6		780
	77925662	Pi 73006 DN PS vst 10	PSvst 10		780
	78216145	Pi 74006 DN PS vst 16	PS vst 16		780
	78216152	Pi 75006 DN PS vst 25	PS vst 25		780
100	78227472	Pi 21010 DN PS 3	PS 3	**20**	1375
	77960875	Pi 22010 DN PS 6	PS 6		1375
	77925597	Pi 23010 DN PS 10	PS 10		1375
	78261000	Pi 24010 DN PS 16	PS 16		1375
	78261018	Pi 25010 DN PS 25	PS 25		1375
	78227480	Pi 71010 DN PS vst 3	PS vst 3	**210**	1275
	77960131	Pi 72010 DN PS vst 6	PS vst 6		1275
	77925670	Pi 73010 DN PS vst 10	PS vst 10		1275
	78261281	Pi 74010 DN PS vst 16	PS vst 16		1275
	78216160	Pi 75010 DN PS vst 25	PS 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. Δ p [bar]**	**Filter surface [cm²]**
160	78261034	Pi 21016 DN PS 3	PS 3	**20**	2530
	77960826	Pi 22016 DN PS 6	PS 6		2530
	77925605	Pi 23016 DN PS 10	PS 10		2530
	78261042	Pi 24016 DN PS 16	PS 16		2530
	78261059	Pi 25016 DN PS 25	PS 25		2530
	77940638	Pi 71016 DN PS vst 3	PS vst 3	**210**	1885
	77960123	Pi 72016 DN PS vst 6	PS vst 6		1885
	77925688	Pi 73016 DN PS vst 10	PS vst 10		1885
	78269797	Pi 74016 DN PS vst 16	PS vst 16		1885
	78216178	Pi 75016 DN PS vst 25	PS vst 25		1885
250	78227514	Pi 21025 DN PS 3	PS 3	**20**	4020
	77960834	Pi 22025 DN PS 6	PS 6		4020
	77925613	Pi 23025 DN PS 10	PS 10		4020
	78261075	Pi 24025 DN PS 16	PS 16		4020
	78261083	Pi 25025 DN PS 25	PS 25		4020
	77940646	Pi 71025 DN PS vst 3	PS vst 3	**210**	3090
	77960115	Pi 72025 DN PS vst 6	PS vst 6		3090
	77925696	Pi 73025 DN PS vst 10	PS vst 10		3090
	78269813	Pi 74025 DN PS vst 16	PS vst 16		3090
	78216186	Pi 75025 DN PS vst 25	PS vst 25		3090
400	78227522	Pi 21040 DN PS 3	PS 3	**20**	6770
	77960842	Pi 22040 DN PS 6	PS 6		6770
	77925621	Pi 23040 DN PS 10	PS 10		6770
	78261109	Pi 24040 DN PS 16	PS 16		6770
	78261117	Pi 25040 DN PS 25	PS 25		6770
	77940653	Pi 71040 DN PS vst 3	PS vst 3	**210**	5240
	77960107	Pi 72040 DN PS vst 6	PS vst 6		5240
	77930829	Pi 73040 DN PS vst 10	PS vst 10		5240
	78269821	Pi 74040 DN PS vst 16	PS vst 16		5240
	78260903	Pi 75040 DN PS vst 25	PS 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:	Δ p 7 bar ± 10 %
Filter head material:	GGG
Filter housing material:	St
Sealing material:	NBR/PTFE
Maintenance indicator setting:	Δ p 5 bar ± 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 sleave:	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 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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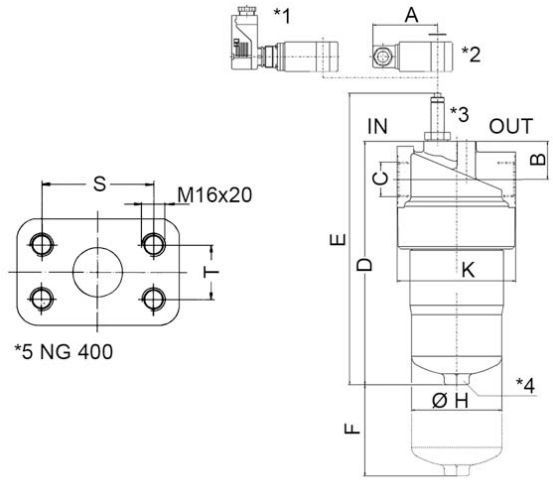

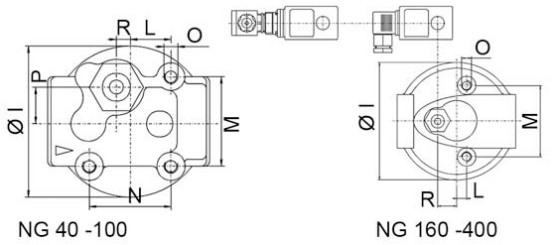

IN Inlet
OUT Outlet
*1 Electrical upper section connector acc. DIN EN 175301-804, Versions: PiS 3102, 3122, 3110
*2 Electrical upper section connector acc. DIN EN 175301-803, Versions: PiS 3092, 3105, 3115
*3 Visual maintenance indicator
*4 NG 250, 400 with drain screw G ¼ DIN 910
*5 DN 38 according to SAE 1½" 6000 psi. Flanges, bolts, o-rings are not included in 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	T	Weight [kg]
Pi 40004	78	31.5	G½	180	238	80	27	66	90	92	23.5	54	47	M8x16	21	8	-	-	4.2
Pi 40006	78	31.5	G¾	240	298	80	27	66	90	92	23.5	54	47	M8x16	21	8	-	-	4.9
Pi 40010	78	31.5	G1	330	388	80	27	66	90	92	23.5	54	47	M8x16	21	8	-	-	5.8
Pi 40016	78	46	G1¼	293	350	110	30	109	142	143.5	12	86	-	M12x15	-	23	-	-	12.6
Pi 40025	78	46	G1½	383	440	110	30	109	142	143.5	12	86	-	M12x15	-	23	-	-	14.2
Pi 40040 FL	78	46	DN 38	533	590	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?

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 (PS) cannot be cleaned.

10.4 Element replacement

1. Stop system and relieve filter from pressure.
2. Filter sizes 250 and 400: empty the filter housing by removing the drain plug.
3. Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
4. Remove element by pulling down carefully.
5. Check o-ring and spigot 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. 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.
7. Oil the threads of the filter housing a little bit and screw into the filter head. Maximum tightening torque for NG 40 to 100 = 60 Nm, for NG 160 to 400 = 100 Nm.
8. Check seals of vent drain plug - if necessary, please replace.
   Torque drain plug 30 Nm.

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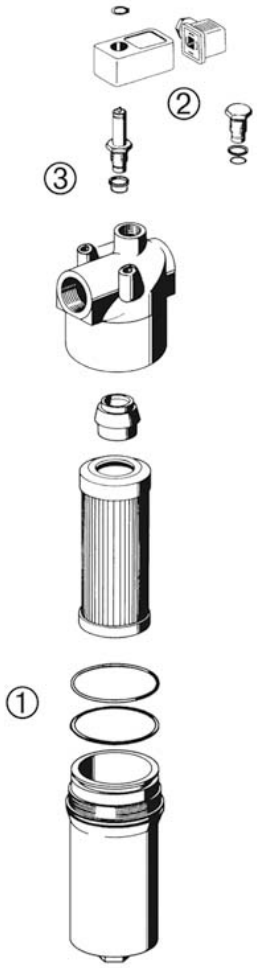


11. Spare parts list

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
	Electrical upper section only	77536550
③	Seal kit for maintenance indicator	
	NBR	77760275
	FPM	77760283
	EPDM	77760291

MAHLE Industry

High Pressure Filter
Pi 410

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

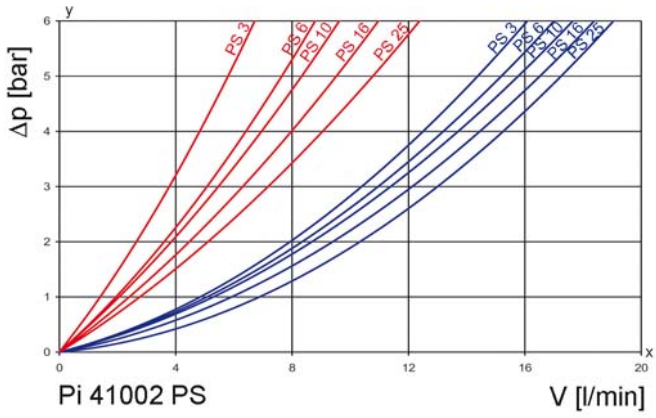
1. Features

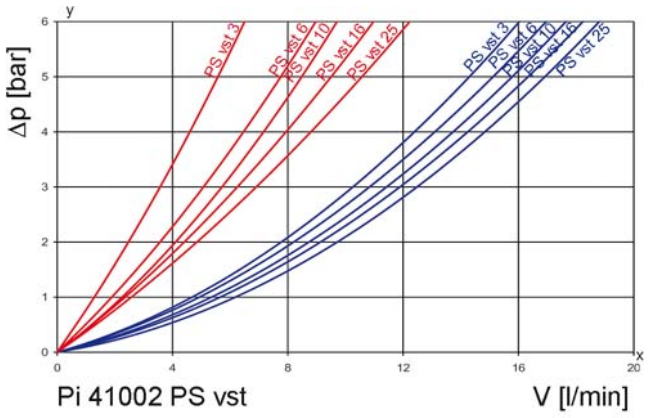
High performance filters for modern hydraulic systems

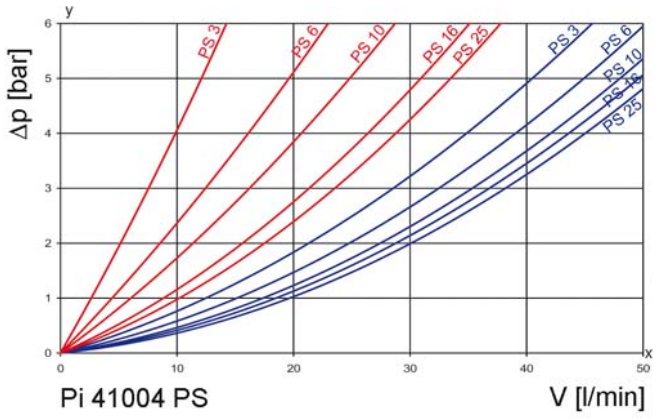
- Provided for valve block installation
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Connections according DIN 24340
- Quality filters, easy to service
- Equipped with highly efficient glass fibre PS filter 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

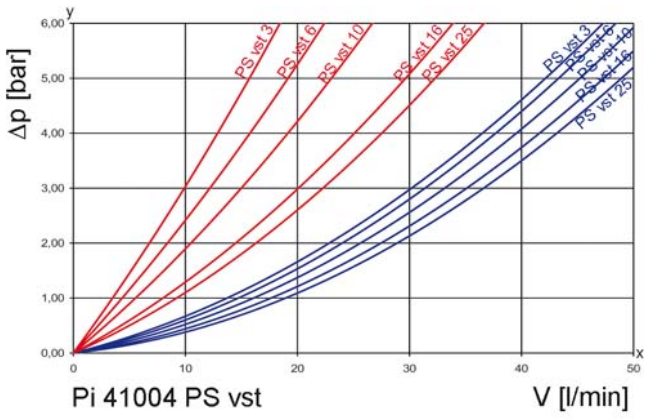
2. Flow rate/pressure drop curve complete filter

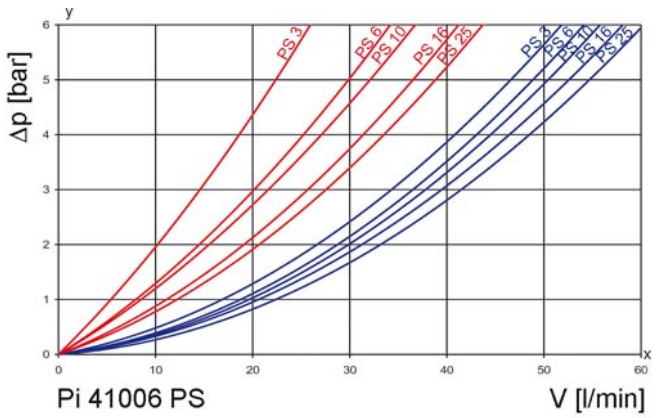
190 mm²/s
33 mm²/s

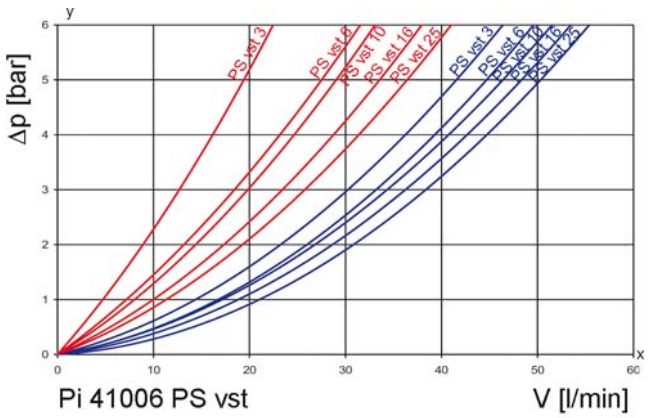






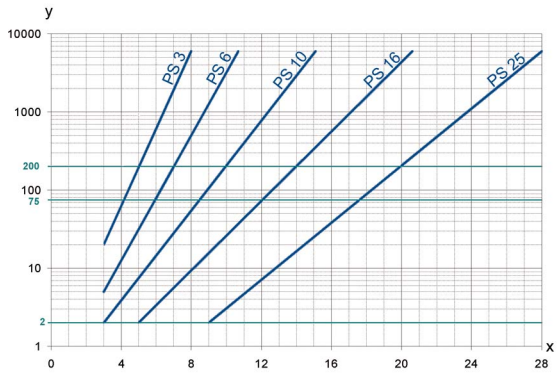






y = differential pressure Δp [bar]
x = flow rate V [l/min]

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)

PS elements with
max. Δ p 20 bar

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

values guaranteed up to
10 bar differential pressure

PS vst elements with
max. Δ p 210 bar

PS vst	3	$\beta_{5(C)}$	≥200
PS vst	6	$\beta_{7(C)}$	≥200
PS vst	10	$\beta_{10(C)}$	≥200
PS vst	16	$\beta_{15(C)}$	≥200
PS vst	25	$\beta_{20(C)}$	≥200

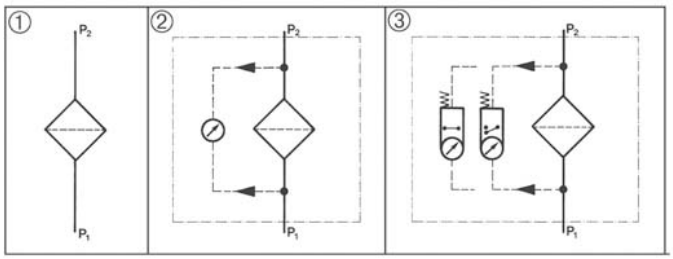
values guaranteed up to
20 bar differential pressure

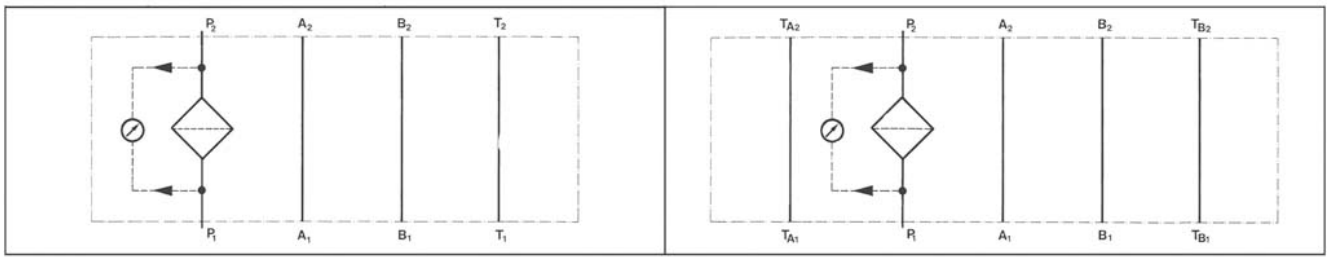
5. Quality assurance

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





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	PS 3 Type: Pi 21004 DN PS 3/Order number: 78260929

7.1 Housing design

NG [l/min]	Order number	Type	① with indicator cavity	② with visual indicator	③ with 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 [cm²]
20	77685407	852 243 PS 3	PS 3	20	305
	78216038	852 243 PS 6	PS 6		305
	77740327	852 243 PS 10	PS 10		305
	78216053	852 243 PS 16	PS 16		305
	77685415	852 243 PS 25	PS 25		305
	77685423	852 243 PS vst 3	PS vst 3	160	275
	78216046	852 243 PS vst 6	PS vst 6		275
	77685431	852 243 PS vst 10	PS vst 10		275
	78216061	852 243 PS vst 16	PS vst 16		275
	77685449	852 243 PS vst 25	PS vst 25		275
40	78260929	Pi 21004 DN PS 3	PS 3	20	475
	77960859	Pi 22004 DN PS 6	PS 6		475
	77925571	Pi 23004 DN PS 10	PS 10		475
	78260937	Pi 24004 DN PS 16	PS 16		475
	78260945	Pi 25004 DN PS 25	PS 25		475
	78216079	Pi 71004 DN PS vst 3	PS vst 3	210	445
	77960156	Pi 72004 DN PS vst 6	PS vst 6		445
	77925654	Pi 73004 DN PS vst 10	PS vst 10		445
	78216087	Pi 74004 DN PS vst 16	PS vst 16		445
	78216095	Pi 75004 DN PS vst 25	PS vst 25		445
63	78260960	Pi 21006 DN PS 3	PS 3	20	835
	77960867	Pi 22006 DN PS 6	PS 6		835
	77925589	Pi 23006 DN PS 10	PS 10		835
	78260978	Pi 24006 DN PS 16	PS 16		835
	78260986	Pi 25006 DN PS 25	PS 25		835
	78216137	Pi 71006 DN PS vst 3	PS vst 3	210	780
	77960149	Pi 72006 DN PS vst 6	PS vst 6		780
	77925662	Pi 73006 DN PS vst 10	PS vst 10		780
	78216145	Pi 74006 DN PS vst 16	PS vst 16		780
	78216152	Pi 75006 DN PS vst 25	PS 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:	Δ p 5 bar ± 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 sleave:	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.

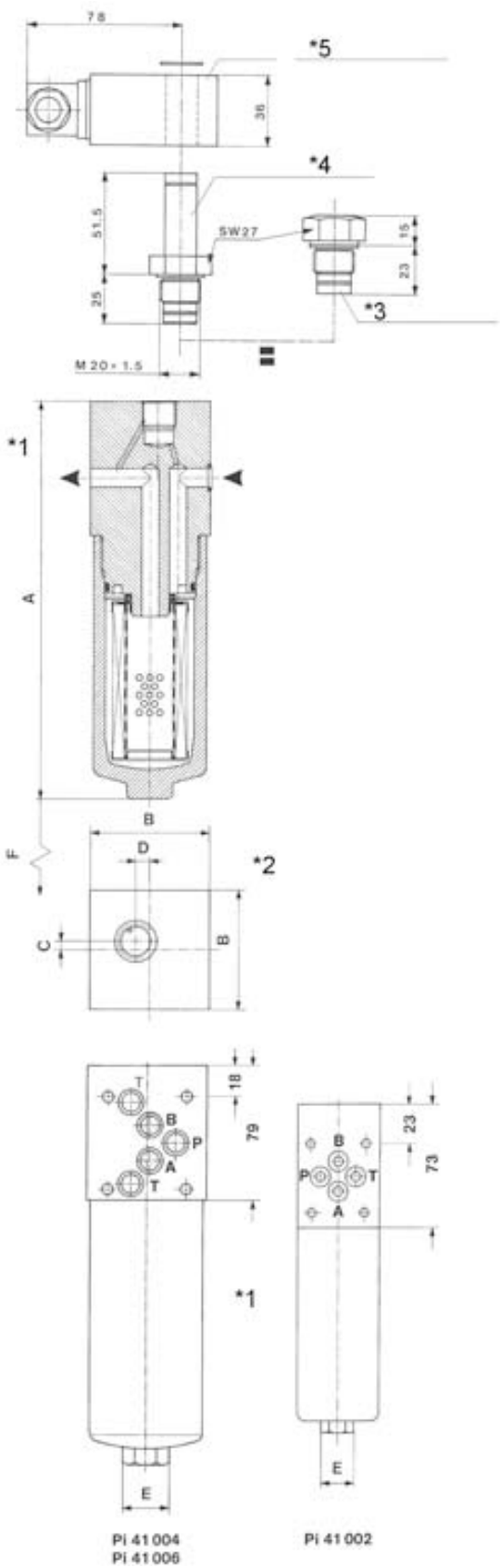
We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer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

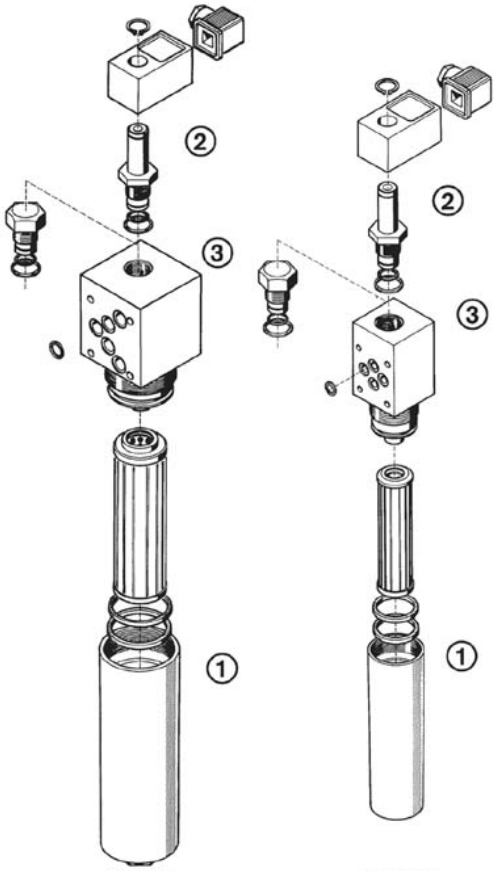
The electrical indicator is connected via a 2-pole appliance plug according to DIN EN 175301-803 with poles marked 1 and 2.
The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

10.3 When should the filter element be replaced?

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 (PS) cannot be cleaned.

10.4 Element replacement

1. Stop system and relieve filter from pressure.
2. Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
3. Remove the filter element by pulling down carefully.
4. Check O-ring and spigot for damage. Replace, if necessary.
5. 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.
6. Lightly lubricate the threads of the filter housing a little bit and screw into the filter head. Maximum tightening torque for NG 50 to 110 = 60 Nm, for NG 150 to 450 = 100 Nm.



Pi 41 004
Pi 41 006

Pi 41 002

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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78356966.03/2012

MAHLE Industry

High Pressure Filter
Pi 420

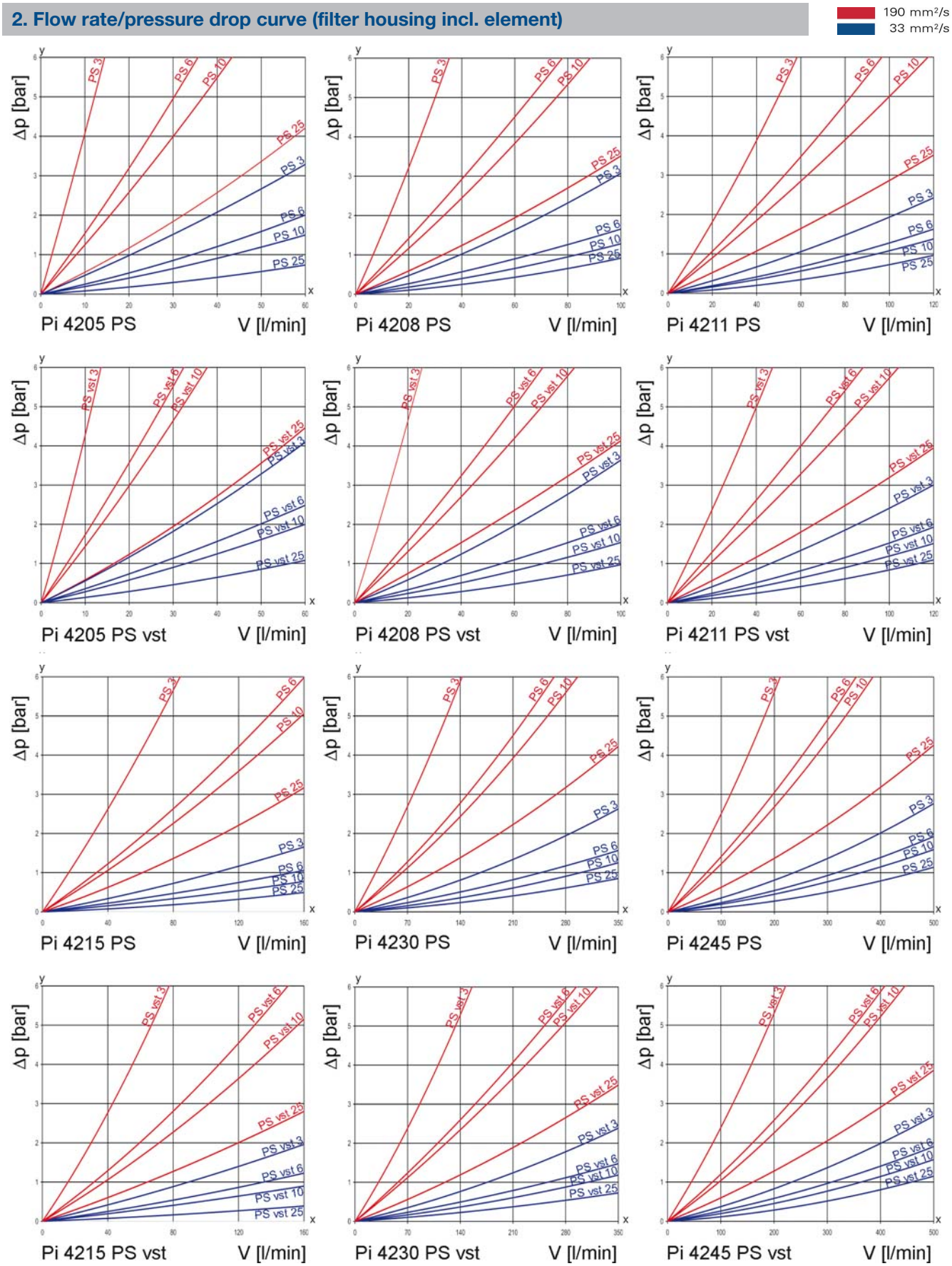
Nominal pressure 400 bar (5690 psi), nominal size up to 450
optional with reverse flow valve

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 PS 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

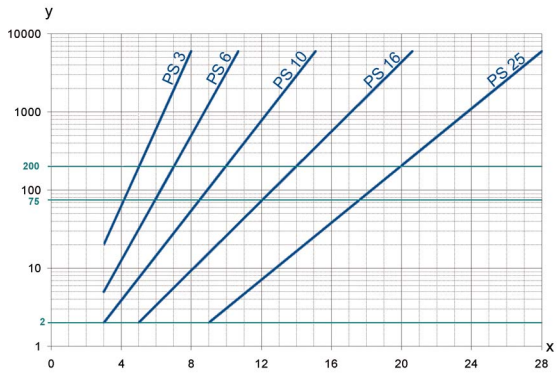
2. Flow rate/pressure drop curve (filter housing incl. element)



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)

PS elements with
max. Δ p 20 bar

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

values guaranteed up to
10 bar differential pressure

PS vst elements with
max. Δ p 210 bar

PS vst	3	$\beta_{5(C)}$	≥200
PS vst	6	$\beta_{7(C)}$	≥200
PS vst	10	$\beta_{10(C)}$	≥200
PS vst	25	$\beta_{20(C)}$	≥200

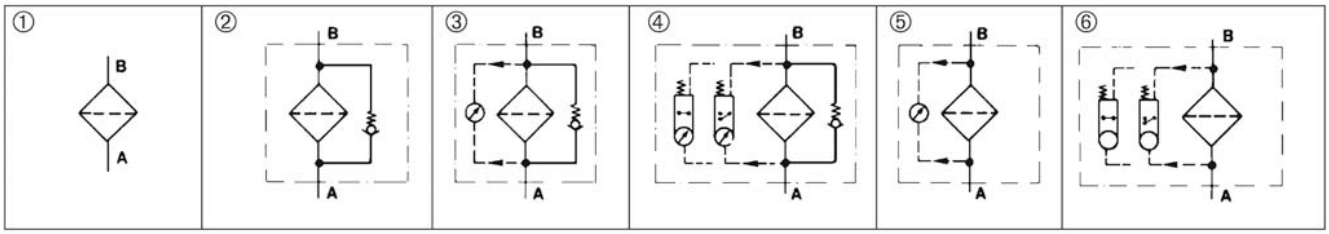
values guaranteed up to
20 bar differential pressure

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 elements
Housing design V = 80 l/min, electrical maintenance indicator Type: Pi 4208-015 Order number: 77666472	PS vst 3 Type: Pi 2208 PS vst 3 Order number: 77680200

7.1 Housing design

Nominal 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 [cm²]**
50	77680135	Pi 2105 PS 3	PS 3	**20**	590
	77943509	Pi 5105 PS 6	PS 6		590
	77680325	Pi 3105 PS 10	PS 10		590
	77680440	Pi 4105 PS 25	PS 25		590
	77680192	Pi 2205 PS vst 3	PS vst 3	**210**	425
	77943533	Pi 5205 PS vst 6	PS vst 6		425
	77680382	Pi 3205 PS vst 10	PS vst 10		425
	77680507	Pi 4205 PS vst 25	PS vst 25		425
80	77680143	Pi 2108 PS 3	PS 3	**20**	1150
	77943517	Pi 5108 PS 6	PS 6		1150
	77680341	Pi 3108 PS 10	PS 10		1150
	77680457	Pi 4108 PS 25	PS 25		1150
	77680200	Pi 2208 PS vst 3	PS vst 3	**210**	850
	77943541	Pi 5208 PS vst 6	PS vst 6		850
	77681190	Pi 3208 PS vst 10	PS vst 10		850
	77680515	Pi 4208 PS vst 25	PS vst 25		850
110	77680150	Pi 2111 PS 3	PS 3	**20**	1700
	77943525	Pi 5111 PS 6	PS 6		1700
	77680333	Pi 3111 PS 10	PS 10		1700
	77680465	Pi 4111 PS 25	PS 25		1700
	77680218	Pi 2211 PS vst 3	PS vst 3	**210**	1275
	77943558	Pi 5211 PS vst 6	PS vst 6		1275
	77680390	Pi 3211 PS vst 10	PS vst 10		1275
	77680523	Pi 4211 PS vst 25	PS vst 25		1275
150	77680168	Pi 2115 PS 3	PS 3	**20**	2425
	77955099	Pi 5115 PS 6	PS 6		2425
	77680358	Pi 3115 PS 10	PS 10		2425
	77680473	Pi 4115 PS 25	PS 25		2425
	77680226	Pi 2215 PS vst 3	PS vst 3	**210**	2010
	77955123	Pi 5215 PS vst 6	PS vst 6		2010
	77680408	Pi 3215 PS vst 10	PS vst 10		2010
	77680531	Pi 4215 PS vst 25	PS vst 25		2010
300	77680176	Pi 2130 PS 3	PS 3	**20**	4620
	77955107	Pi 5130 PS 6	PS 6		4620
	77680366	Pi 3130 PS 10	PS 10		4620
	77680481	Pi 4130 PS 25	PS 25		4620
	77680234	Pi 2230 PS vst 3	PS vst 3	**210**	3800
	77955131	Pi 5230 PS vst 6	PS vst 6		3800
	77680416	Pi 3230 PS vst 10	PS vst 10		3800
	77680549	Pi 4230 PS vst 25	PS vst 25		3800
450	77680184	Pi 2145 PS 3	PS 3	**20**	6865
	77955115	Pi 5145 PS 6	PS 6		6865
	77680374	Pi 3145 PS 10	PS 10		6865
	77680499	Pi 4145 PS 25	PS 25		6865
	77680242	Pi 2245 PS vst 3	PS vst 3	**210**	5600
	77955149	Pi 5245 PS vst 6	PS vst 6		5600
	77680424	Pi 3245 PS vst 10	PS vst 10		5600
	77680556	Pi 4245 PS vst 25	PS vst 25		5600

8. Technical specifications

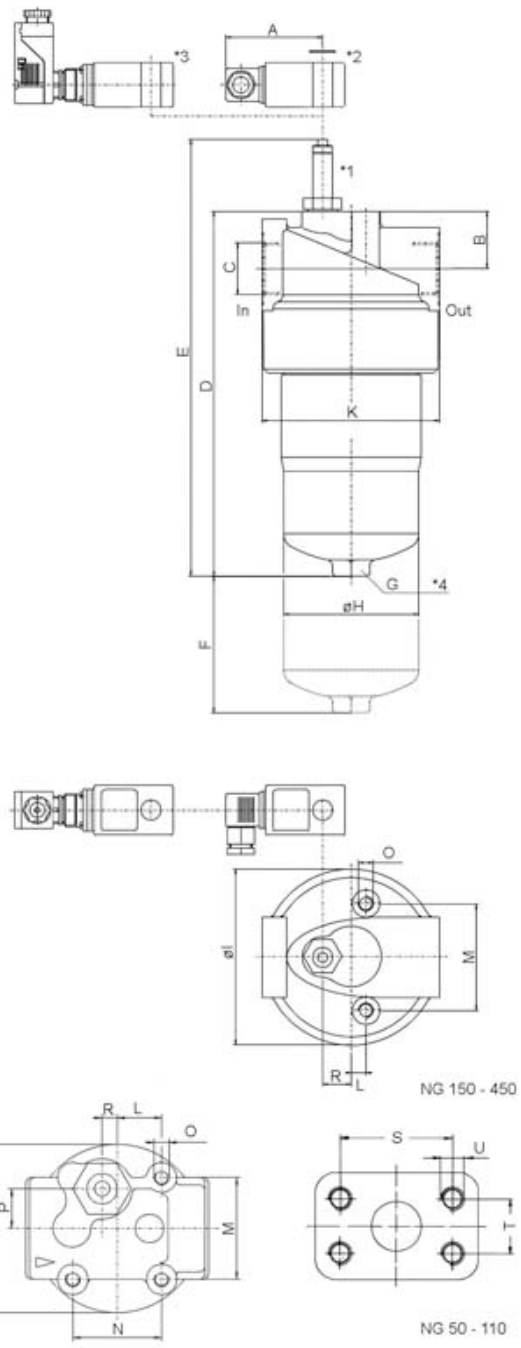
Design:	line mounting filter
Nominal pressure:	400 bar (5690 psi)
Test pressure:	520 bar (7400 psi)
Temperature range:	-10 °C to +120 °C
	(other temperature ranges on request)
Bypass setting:	Δ p 7 bar ± 10 %
Filter head material:	GGG
Filter housing material:	St
Sealing material:	NBR/PTFE
Maintenance indicator setting:	Δ p 5 bar ± 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.



In = Inlet
Out = Outlet
*1 = Visual maintenance indicator
*2 = Electrical upper section connector according DIN EN 175301-803, version: PiS 3092, 3105, 3115
*3 = Electrical upper section connector according DIN EN 175301-804, version: PiS3102, 3122, 3110
*4 = NG 300, 450 with drain screw G¼ DIN 910

DN25 according to SAE1" 6000 psi
DN38 according to SAE1½" 6000 psi
Flange, screw, o-ring not included in delivery.

9. Dimensions

All dimensions except "C" in mm.

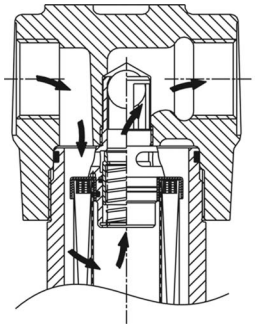
Type	A	B	C*	D	E	F	G SW	H	I	K
Pi 4205	78	31	G½	189	247	80	27	66	90	92.0
Pi 4205 FL		28	DN25	204	262				85	95.0
Pi 4208	78	31	G1	267	325	80	27	66	90	92.0
Pi 4208 FL		28	DN25	282	340				85	95.0
Pi 4211	78	31	G1	343	401	80	27	66	90	92.0
Pi 4211 FL		28	DN25	358	416				85	95.0
Pi 4215	78	46	G1¼	284	342	110	30	109	142	143.5
Pi 4215 FL			DN38							
Pi 4230	78	46	G1¼	409	467	110	30	109	142	143.5
Pi 4230 FL			DN38							
Pi 4245	78	46	G1½	525	583	110	30	109	142	143.5
Pi 4245 FL			DN38							

* NPT- und SAE-connections on request

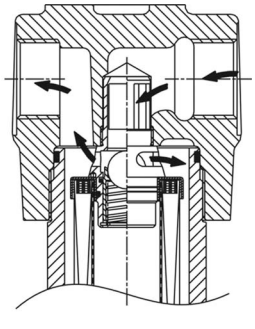
Type	L	M	N	O	P	R	S	T	U	Weight [kg]
Pi 4205	23.5	54	47	M8x14	21	8	57.1	27.8	M12x20	4.1
Pi 4205 FL	10.5		-			12				4.6
Pi 4208	23.5	54	47	M8x14	21	8	57.1	27.8	M12x20	4.9
Pi 4208 FL	10.5		-			12				5.3
Pi 4211	23.5	54	47	M8x14	21	8	57.1	27.8	M12x20	5.8
Pi 4211 FL	10.5		-			12				6.2
Pi 4215	12.0	86	-	M12x15	-	23	79.4	36.5	M16x20	12.3
Pi 4215 FL										13.3
Pi 4230	12.0	86	-	M12x15	-	23	79.4	36.5	M16x20	14.8
Pi 4230 FL										15.9
Pi 4245	12.0	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.



Filtration mode



Reverse mode

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?

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 (PS) cannot be cleaned.

11.4 Element replacement

1. Stop system and relieve filter from pressure.
2. Filter sizes 300 and 450: empty the filter housing by removing the drain plug.
3. Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
4. Remove element by pulling down carefully.
5. Check o-ring, spigot and o-ring in the element locator 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. 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.
7. Oil the threads of the filter housing a little bit and screw into the filter head. Maximum tightening torque for NG 50 to 110 = 60 Nm, for NG 150 to 450 = 100 Nm.
8. Check seals of vent drain plug - if necessary, please replace.
   Torque drain plug 30 Nm.

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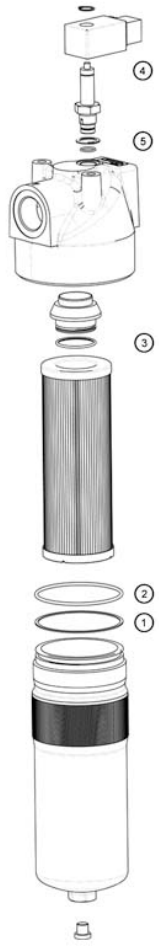


12. Spare parts list

Order numbers for spare parts		
Position	**Type**	**Order number**
① to 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

MAHLE Industry

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

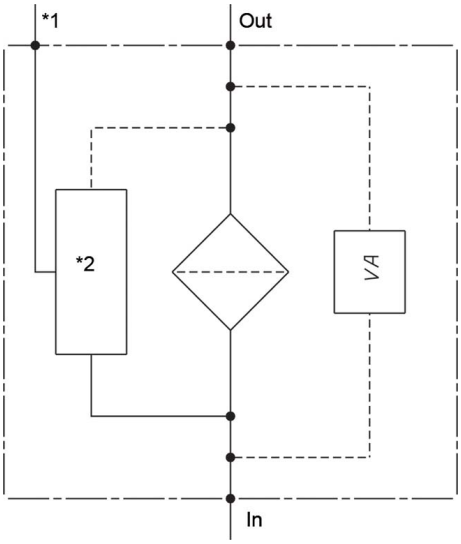
2. Technical specifications

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.

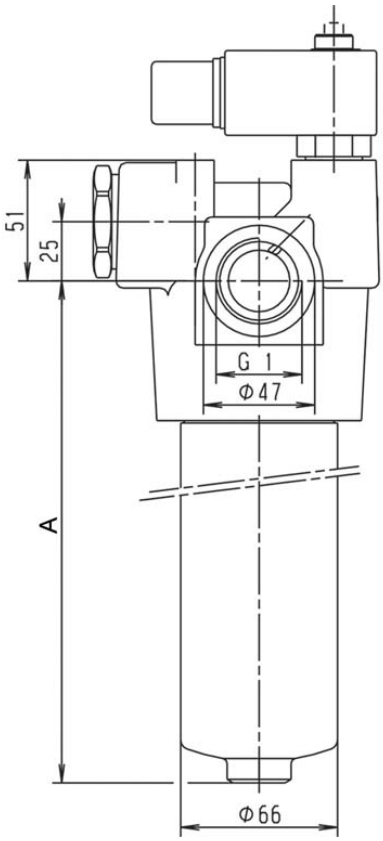
3. Symbols

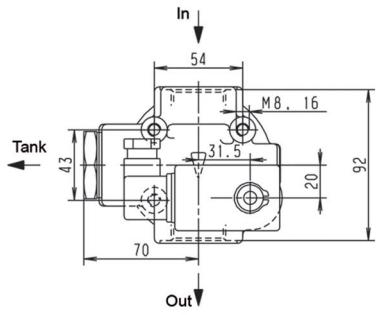


*1 Tank G½
*2 Cold start valve
VA = Maintenance indicator
In = G1
Out =G1

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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MAHLE Industry

High Pressure Filter
Pi 4220

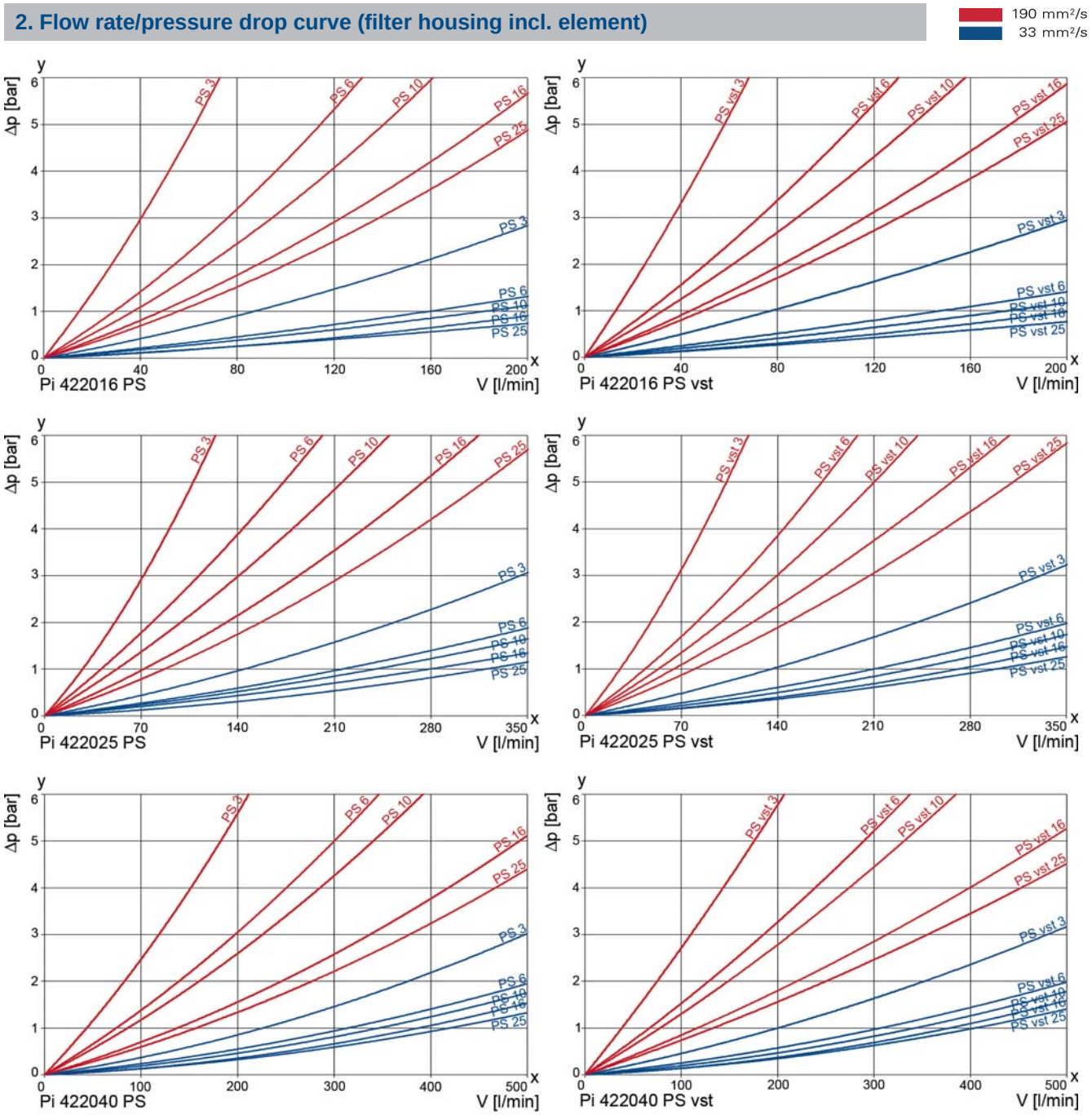
Nominal pressure 400 bar (5690 psi), nominal size up to 400
optional with reverse flow valve

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
- Quality filters, easy to service
- Inlet sideways, outlet sideways or at the top
- Equipped with highly efficient glass fibre PS 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

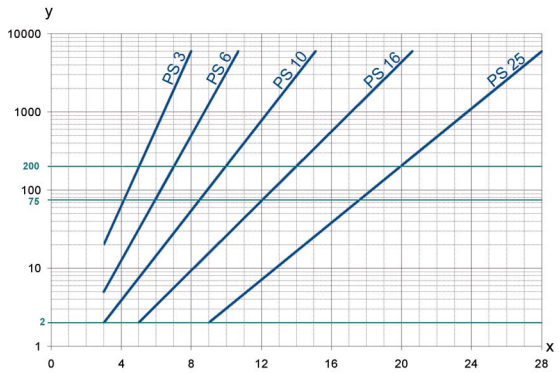
2. Flow rate/pressure drop curve (filter housing incl. element)



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)

PS elements with
max. Δ p 20 bar

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

values guaranteed up to
10 bar differential pressure

PS vst elements with
max. Δ p 210 bar

PS vst	3	$\beta_{5(C)}$	≥200
PS vst	6	$\beta_{7(C)}$	≥200
PS vst	10	$\beta_{10(C)}$	≥200
PS vst	16	$\beta_{15(C)}$	≥200
PS vst	25	$\beta_{20(C)}$	≥200

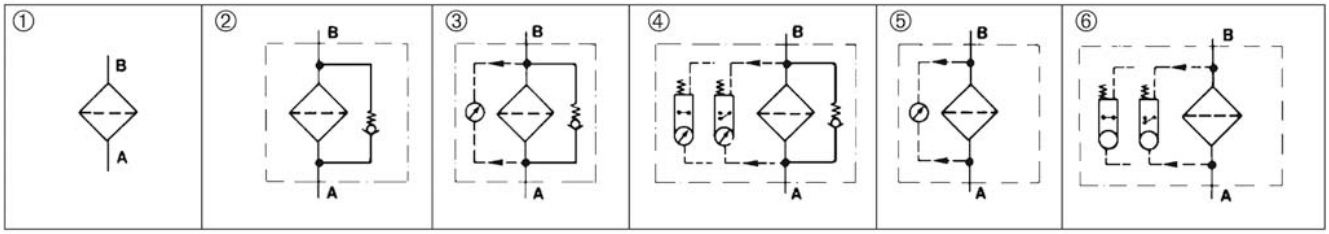
values guaranteed up to
20 bar differential pressure

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. Type number key, housing design, order numbers

7.1 Type number key

Type					
Pi 422	High pressure filter series				
	NG				
	16	nominal size 160			
	25	nominal size 250			
	40	nominal size 400			
		Connection variant 1st position			
		/1	inlet and outlet sideways		
		/2	inlet sideways, outlet at the top		
			Connection variant 2nd position		
			1	G1½	
			2	flange SAE 1¼ (only for inlet sideways/outlet at the top version)	
			3	flange SAE 1½	
			4	G1¼ (only for inlet sideways/outlet at the top version)	
				Housing design	
				-010	with hole for maintenance indicator
				-011	with bypass valve and Bohrung für Wartungsanzeige
				-012	with bypass valve and visual maintenance indicator
				-013	with bypass valve and electrical maintenance indicator
				-014	with visual maintenance indicator
				-015	with electrical maintenance indicator
Pi 422	**30**	**/1**	**2**	**-011**	**ordering example**

7.2 Housing design

Nominal size NG [l/min]	Type inlet sideways outlet sideways	Type inlet sideways outlet at the top	① with hole for indicator	② with bypass and hole for indicator	③ with bypass and visual indicator	④ with bypass and electrical indicator	⑤ with visual indicator	⑥ with electrical indicator
160	Pi 422016/1*-010	Pi 422016/2*-010	■					
	Pi 422016/1*-011	Pi 422016/2*-011		■				
	Pi 422016/1*-012	Pi 422016/2*-012			■			
	Pi 422016/1*-013	Pi 422016/2*-013				■		
	Pi 422016/1*-014	Pi 422016/2*-014					■	
	Pi 422016/1*-015	Pi 422016/2*-015						■
250	Pi 422025/1*-010	Pi 422025/2*-010	■					
	Pi 422025/1*-011	Pi 422025/2*-011		■				
	Pi 422025/1*-012	Pi 422025/2*-012			■			
	Pi 422025/1*-013	Pi 422025/2*-013				■		
	Pi 422025/1*-014	Pi 422025/2*-014					■	
	Pi 422025/1*-015	Pi 422025/2*-015						■
400	Pi 422040/1*-010	Pi 422040/2*-010	■					
	Pi 422040/1*-011	Pi 422040/2*-011		■				
	Pi 422040/1*-012	Pi 422040/2*-012			■			
	Pi 422040/1*-013	Pi 422040/2*-013				■		
	Pi 422040/1*-014	Pi 422040/2*-014					■	
	Pi 422040/1*-015	Pi 422040/2*-015						**LEER**

* Connection variants see type number key 2nd position

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

7.3 Filter elements					
Nominal size NG [l/min]	**Order number**	**Typen designation**	**Filter material**	**max. Δ p [bar]**	**Filter surface [cm²]**
160	78261034	Pi 21016 DN PS 3	PS 3	**20**	2530
	77960826	Pi 22016 DN PS 6	PS 6		2530
	77925605	Pi 23016 DN PS 10	PS 10		2530
	78261042	Pi 24016 DN PS 16	PS 16		2530
	78261059	Pi 25016 DN PS 25	PS 25		2530
	77940638	Pi 71016 DN PS vst 3	PS vst 3	**210**	1885
	77960123	Pi 72016 DN PS vst 6	PS vst 6		1885
	77925688	Pi 73016 DN PS vst 10	PS vst 10		1885
	78269797	Pi 74016 DN PS vst 16	PS vst 16		1885
	78216178	Pi 75016 DN PS vst 25	PS vst 25		1885
250	78227514	Pi 21025 DN PS 3	PS 3	**20**	4020
	77960834	Pi 22025 DN PS 6	PS 6		4020
	77925613	Pi 23025 DN PS 10	PS 10		4020
	78261075	Pi 24025 DN PS 16	PS 16		4020
	78261083	Pi 25025 DN PS 25	PS 25		4020
	77940646	Pi 71025 DN PS vst 3	PS vst 3	**210**	3090
	77960115	Pi 72025 DN PS vst 6	PS vst 6		3090
	77925696	Pi 73025 DN PS vst 10	PS vst 10		3090
	78269813	Pi 74025 DN PS vst 16	PS vst 16		3090
	78216186	Pi 75025 DN PS vst 25	PS vst 25		3090
400	78227522	Pi 21040 DN PS 3	PS 3	**20**	6770
	77960842	Pi 22040 DN PS 6	PS 6		6770
	77925621	Pi 23040 DN PS 10	PS 10		6770
	78261109	Pi 24040 DN PS 16	PS 16		6770
	78261117	Pi 25040 DN PS 25	PS 25		6770
	77940653	Pi 71040 DN PS vst 3	PSvst 3	**210**	5240
	77960107	Pi 72040 DN PS vst 6	PS vst 6		5240
	77930829	Pi 73040 DN PS vst 10	PS vst 10		5240
	78269821	Pi 74040 DN PS vst 16	PS vst 16		5240
	78260903	Pi 75040 DN PS vst 25	PS vst 25		5240

8. Technical specifications

Design:	in-line filter inlet sideways; outlet optional sideways or on top
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 7 bar ± 10 %
Filter head material:	GGG
Filter housing material:	St
Sealing material:	NBR/PTFE
Maintenance indicator setting:	Δ p 5 bar ± 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 sleave:	M20x1.5

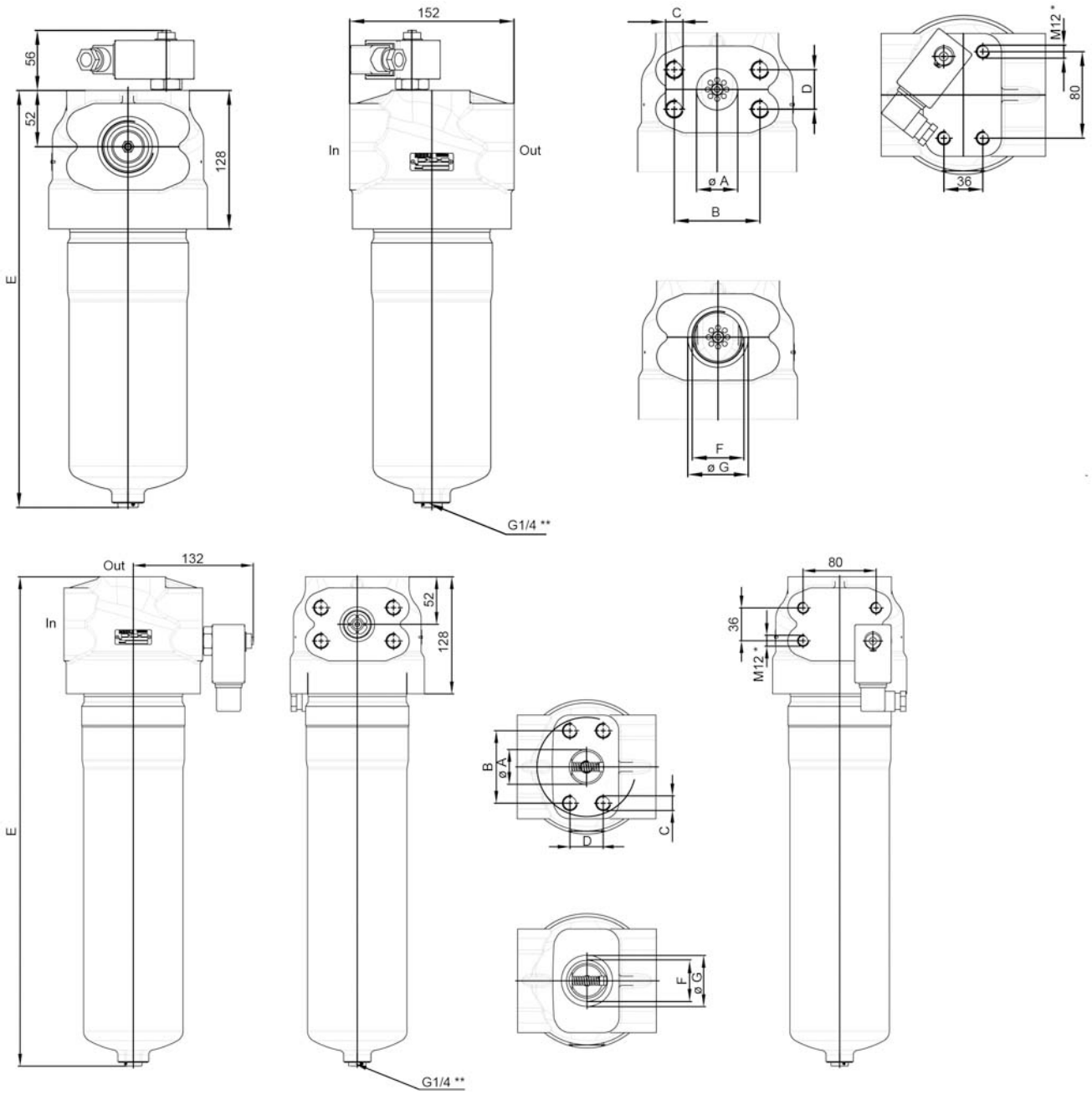
The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance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



In = Inlet
Out = Outlet
* Thread depth 17 mm
** NG 160 without drain screw

All dimensions except "NG" in mm.

Type	NG	E
Pi 422016/...	150	292
Pi 422025/...	300	385
Pi 422040/...	450	535

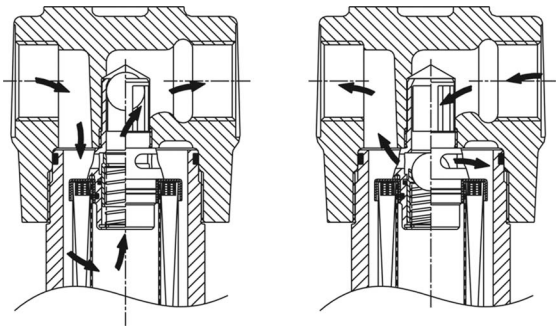
All dimensions except "F" in mm.

Con-nection	ø A	B	C	D	F	ø G
G1¼ *	-	-	-	-	1¼"	56
G1½	-	-	-	-	1½"	56
SAE1¼ *	32	66,6	M12	31,8	-	-
SAE1½	38	79,3	M16	36,8	-	-

* only for inlet sideways/outlet at the top version

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 4220 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.



Filtration mode | Reverse mode

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?

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 (PS) cannot be cleaned.

11.4 Element replacement

1. Stop system and relieve filter from pressure.
2. Filter sizes 250 and 400: empty the filter housing by removing the drain plug.
3. Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
4. Remove element by pulling down carefully.
5. Check o-ring and spigot 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. 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.
7. Oil the threads of the filter housing a little bit and screw into the filter head. Maximum tightening torque for NG 160 to 400 = 100 Nm.
8. Check seals of vent drain plug - if necessary, please replace. Torque drain plug 30 Nm.

12. Spare parts list

Order numbers for spare parts		
Position	**Type**	**Order number**
① - ②	Seal kit	
	NBR	78383838
	FPM	78383846
	EPDM	78383853
③	Maintenance indicator	
	Visual PiS 3093/5	77669914
	Electrical PiS 3092/5	77669864
	Electrical upper section only	77536550
④	Seal kit for maintenance indicator	
	NBR	77760275
	FPM	77760283
	EPDM	77760291

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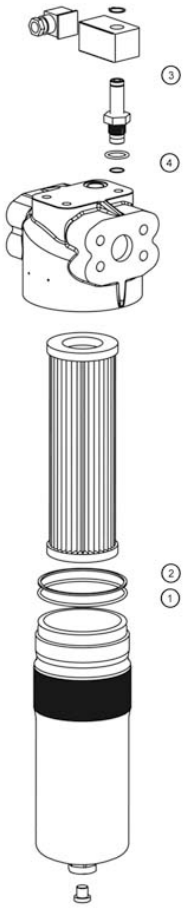

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MAHLE
Industry

High Pressure Filter
Pi 422

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

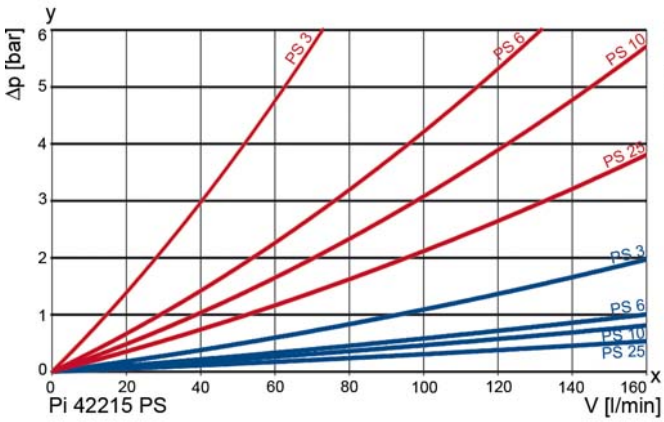
1. Features

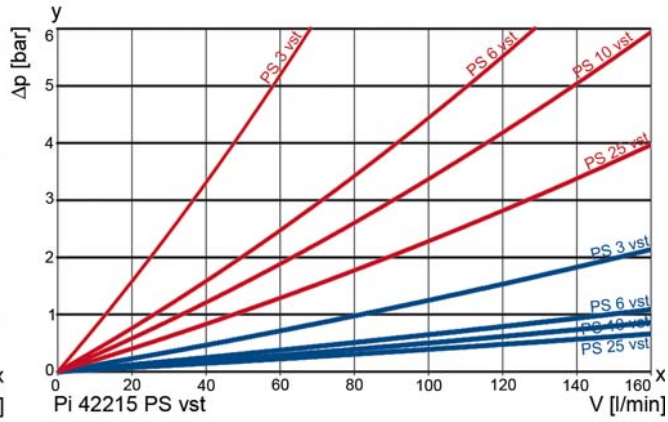
High performance filters for modern hydraulic systems

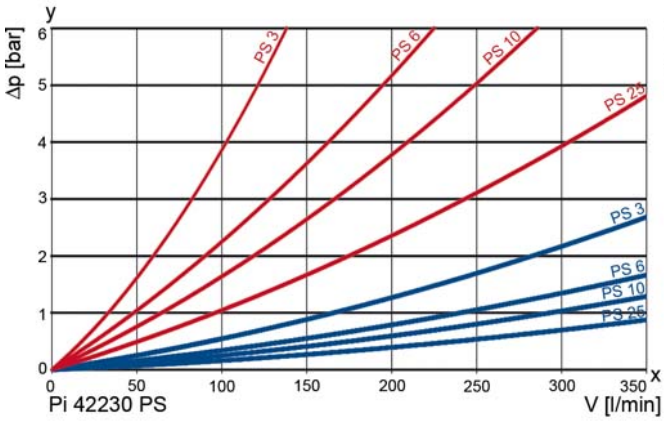
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded or flanged connections
- Quality filters, easy to service
- Inlet sideways, outlet sideways or at the top
- Equipped with highly efficient glass fibre PS 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

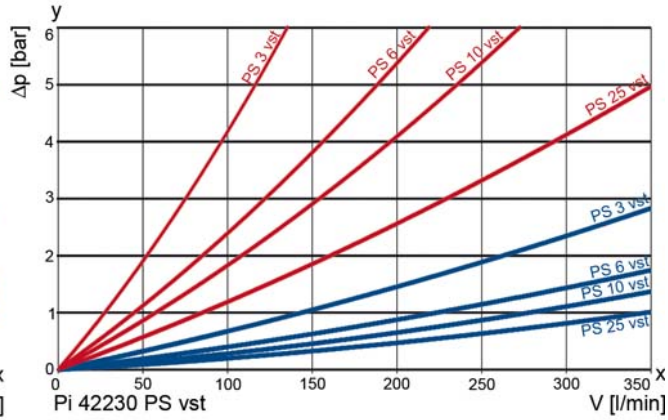
2. Flow rate/pressure drop curve (filter housing incl. element)

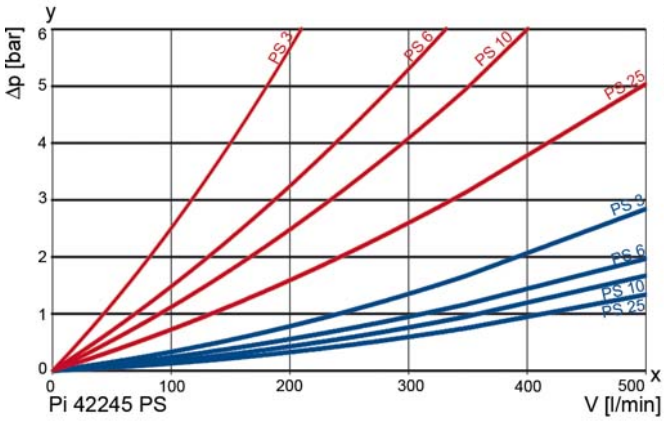
190 mm²/s
33 mm²/s

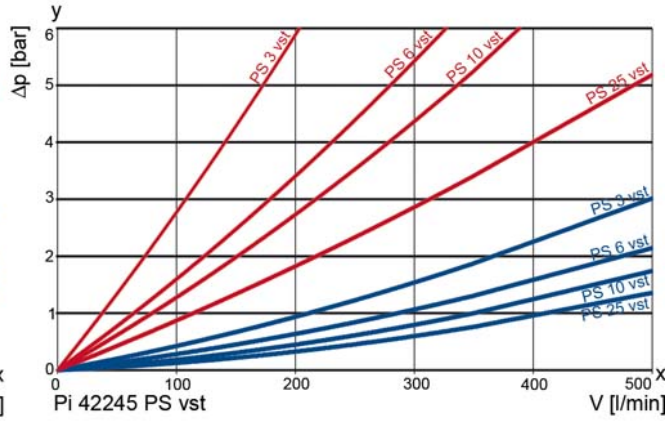








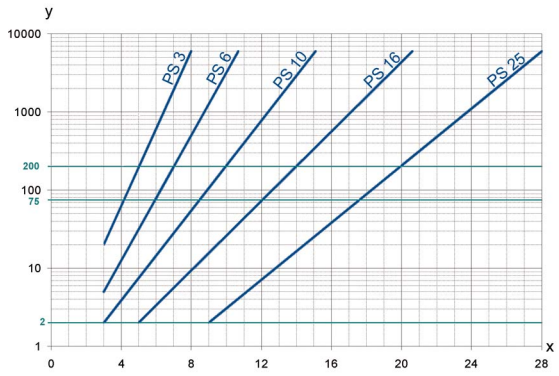




y = differential pressure Δp [bar]

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)

PS elements with
max. Δ p 20 bar

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

values guaranteed up to
10 bar differential pressure

PS vst elements with
max. Δ p 210 bar

PS vst	3	$\beta_{5(C)}$	≥200
PS vst	6	$\beta_{7(C)}$	≥200
PS vst	10	$\beta_{10(C)}$	≥200
PS vst	25	$\beta_{20(C)}$	≥200

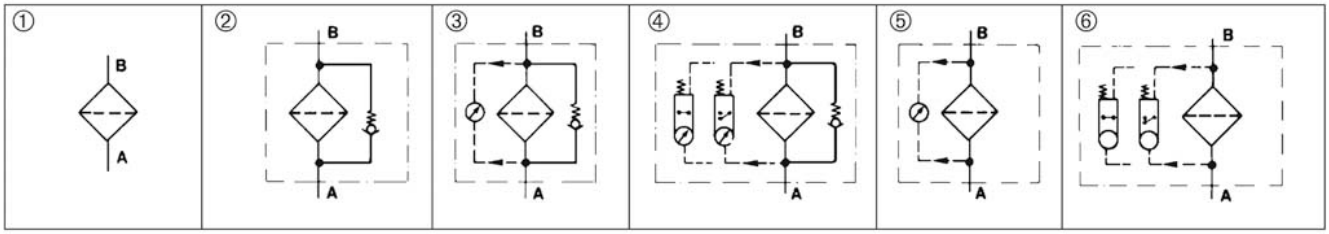
values guaranteed up to
20 bar differential pressure

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. Type number key, housing design, order numbers

7.1 Type number key

Type					
Pi 422	High pressure filter series				
	NG				
	15	nominal size 150			
	30	nominal size 300			
	45	nominal size 450			
		Connection variant 1st position			
		/1	inlet and outlet sideways		
		/2	inlet sideways, outlet at the top		
			Connection variant 2nd position		
			1	G1½	
			2	flange SAE 1¼ (only for inlet sideways/outlet at the top version)	
			3	flange SAE 1½	
			4	G1¼ (only for inlet sideways/outlet at the top version)	
				Housing design	
				-010	with hole for maintenance indicator
				-011	with bypass valve and Bohrung für Wartungsanzeige
				-012	with bypass valve and visual maintenance indicator
				-013	with bypass valve and electrical maintenance indicator
				-014	with visual maintenance indicator
				-015	with electrical maintenance indicator
Pi 422	**30**	**/1**	**2**	**-011**	**ordering example**

7.2 Housing design

Nominal size NG [l/min]	Type inlet sideways outlet sideways	Type inlet sideways outlet at the top	① with hole for indicator	② with bypass and hole for indicator	③ with bypass and visual indicator	④ with bypass and electrical indicator	⑤ with visual indicator	⑥ with electrical indicator
150	Pi 42215/1*-010	Pi 42215/2*-010	■					
	Pi 42215/1*-011	Pi 42215/2*-011		■				
	Pi 42215/1*-012	Pi 42215/2*-012			■			
	Pi 42215/1*-013	Pi 42215/2*-013				■		
	Pi 42215/1*-014	Pi 42215/2*-014					■	
	Pi 42215/1*-015	Pi 42215/2*-015						■
300	Pi 42230/1*-010	Pi 42230/2*-010	■					
	Pi 42230/1*-011	Pi 42230/2*-011		■				
	Pi 42230/1*-012	Pi 42230/2*-012			■			
	Pi 42230/1*-013	Pi 42230/2*-013				■		
	Pi 42230/1*-014	Pi 42230/2*-014					■	
	Pi 42230/1*-015	Pi 42230/2*-015						■
450	Pi 42245/1*-010	Pi 42245/2*-010	■					
	Pi 42245/1*-011	Pi 42245/2*-011		■				
	Pi 42245/1*-012	Pi 42245/2*-012			■			
	Pi 42245/1*-013	Pi 42245/2*-013				■		
	Pi 42245/1*-014	Pi 42245/2*-014					■	
	Pi 42245/1*-015	Pi 42245/2*-015						■

* Connection variants see type number key 2nd position

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

7.3 Filter elements (other elements on request)					
Nominal size NG [l/min]	**Order number**	**Type designation**	**Filter material**	**Max. Δp [bar]**	**Filter surface [cm²]**
150	77680168	Pi 2115 PS 3	PS 3	**20**	2425
	77955099	Pi 5115 PS 6	PS 6		2425
	77680358	Pi 3115 PS 10	PS 10		2425
	77680473	Pi 4115 PS 25	PS 25		2425
	77680226	Pi 2215 PS vst 3	PS vst 3	**210**	2010
	77955123	Pi 5215 PS vst 6	PS vst 6		2010
	77680408	Pi 3215 PS vst 10	PS vst 10		2010
	77680531	Pi 4215 PS vst 25	PS vst 25		2010
300	77680176	Pi 2130 PS 3	PS 3	**20**	4620
	77955107	Pi 5130 PS 6	PS 6		4620
	77680366	Pi 3130 PS 10	PS 10		4620
	77680481	Pi 4130 PS 25	PS 25		4620
	77680234	Pi 2230 PS vst 3	PS vst 3	**210**	3800
	77955131	Pi 5230 PS vst 6	PS vst 6		3800
	77680416	Pi 3230 PS vst 10	PS vst 10		3800
	77680549	Pi 4230 PS vst 25	PS vst 25		3800
450	77680184	Pi 2145 PS 3	PS 3	**20**	6865
	77955115	Pi 5145 PS 6	PS 6		6865
	77680374	Pi 3145 PS 10	PS 10		6865
	77680499	Pi 4145 PS 25	PS 25		6865
	77680242	Pi 2245 PS vst 3	PS vst 3	**210**	5600
	77955149	Pi 5245 PS vst 6	PS vst 6		5600
	77680424	Pi 3245 PS vst 10	PS vst 10		5600
	77680556	Pi 4245 PS vst 25	PS vst 25		5600

8. Technical specifications

Design:	in-line filter inlet sideways; outlet optional sideways or on the top
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 7 bar ± 10 %
Filter head material:	GGG
Filter housing material:	St
Sealing material:	NBR/PTFE
Maintenance indicator setting:	Δ p 5 bar ± 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 sleave:	M20x1.5

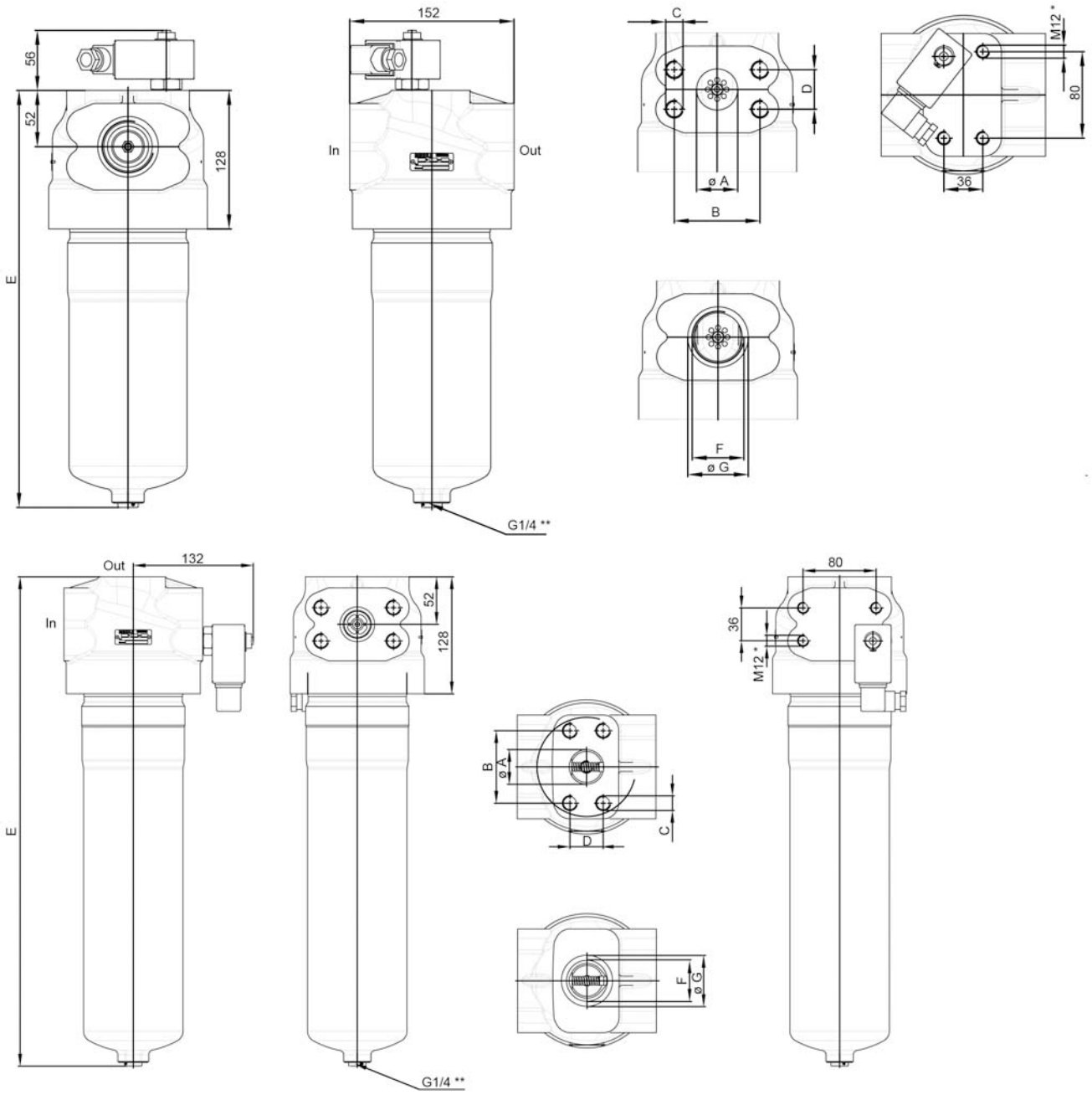
The switching function can be changed by turning the electric upper part by 180° (normally closed contact or normally open contact). The state on delivery is a normally closed contact. By inductivity in the direct current circuit the use of suitable protection circuit should be considered. Further maintenance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



In = Inlet
Out = Outlet
* Thread depth 17 mm
** NG 150 without drain screw

All dimensions except "NG" in mm.

Type	NG	E
Pi 42215/...	150	281
Pi 42230/...	300	399
Pi 42245/...	450	515

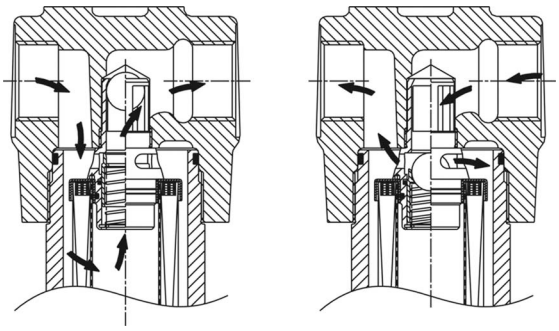
All dimensions except "F" in mm.

Con-nection	ø A	B	C	D	F	ø G
G1¼ *	-	-	-	-	1¼"	56
G1½	-	-	-	-	1½"	56
SAE1¼ *	32	66,6	M12	31,8	-	-
SAE1½	38	79,3	M16	36,8	-	-

* only for inlet sideways/outlet at the top version

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 422 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.



Filtration mode | Reverse mode

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?

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 (PS) cannot be cleaned.

11.4 Element replacement

1. Stop system and relieve filter from pressure.
2. Filter sizes 300 and 450: empty the filter housing by removing the drain plug.
3. Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
4. Remove element by pulling down carefully.
5. Check o-ring, spigot and o-ring in the element locator 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. 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.
7. Oil the threads of the filter housing a little bit and screw into the filter head. Maximum tightening torque for NG 150 to 450 = 100 Nm.
8. Check seals of vent drain plug - if necessary, please replace. Torque drain plug 30 Nm.

12. Spare parts list

Order numbers for spare parts		
Position	**Type**	**Order number**
① - ③	Seal kit	
	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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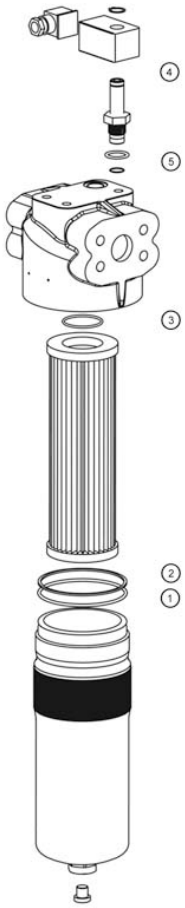

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MAHLE Industry

High Pressure Filter
Pi 4230

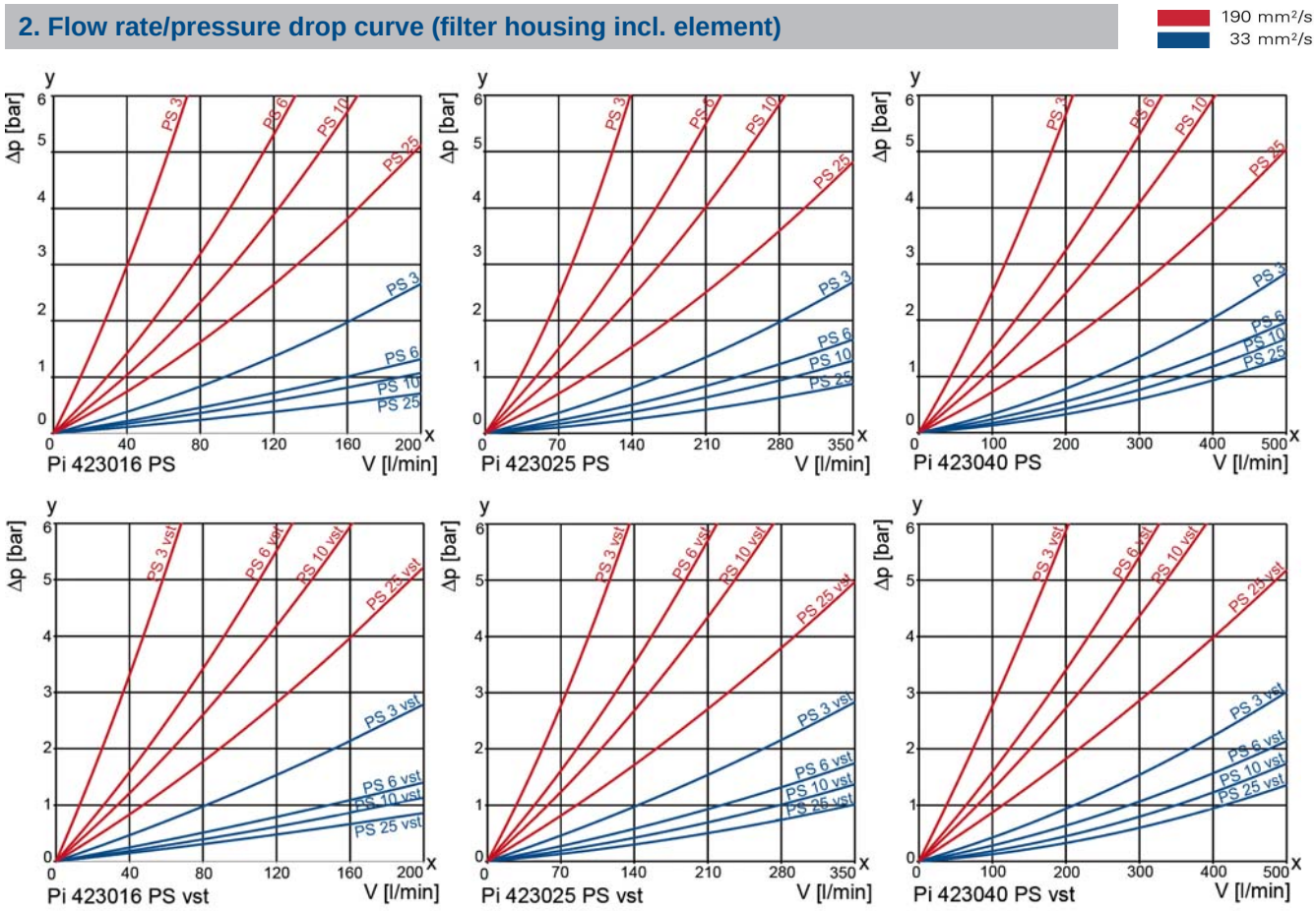
Nominal pressure 315 bar (4570 psi), nominal size 160 to 400
according DIN 24550

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
- Filter element removal upwards
- Equipped with highly efficient glass fibre PS filter elements
- Beta rated elements according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Worldwide distribution

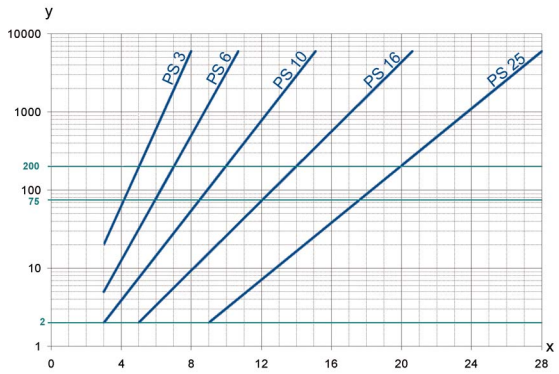
2. Flow rate/pressure drop curve (filter housing incl. element)



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)

PS elements with
max. Δ p 20 bar

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

values guaranteed up to
10 bar differential pressure

PS vst elements with
max. Δ p 210 bar

PS vst	3	$\beta_{5(C)}$	≥200
PS vst	6	$\beta_{7(C)}$	≥200
PS vst	10	$\beta_{10(C)}$	≥200
PS vst	25	$\beta_{20(C)}$	≥200

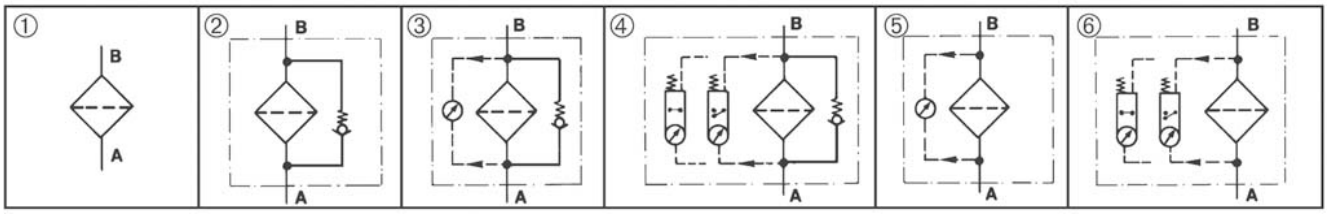
values guaranteed up to
20 bar differential pressure

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 elements
V = 250 l/min, electrical maintenance indicator Type: Pi 423025-015 Order number: 70382542	PS vst 3 Type: Pi 71025 DN PS vst 3 Order number: 77940646

7.1 Housing design

Nominal 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 visual/electrical indicator	⑤ with visual indicator	⑥ with visual/electrical indicator
160	70382531	Pi 423016-010	70382566	Pi 423016-010 FL	■					
	70382532	Pi 423016-011	70382567	Pi 423016-011 FL		■				
	70382533	Pi 423016-012	70382568	Pi 423016-012 FL			■			
	70382534	Pi 423016-013	70382569	Pi 423016-013 FL				■		
	70382535	Pi 423016-014	70382570	Pi 423016-014 FL					■	
	70382536	Pi 423016-015	70382571	Pi 423016-015 FL						■
250	70382537	Pi 423025-010	70382572	Pi 423025-010 FL	■					
	70382538	Pi 423025-011	70382573	Pi 423025-011 FL		■				
	70382539	Pi 423025-012	70382574	Pi 423025-012 FL			■			
	70382540	Pi 423025-013	70382575	Pi 423025-013 FL				■		
	70382541	Pi 423025-014	70382576	Pi 423025-014 FL					■	
	70382542	Pi 423025-015	70382577	Pi 423025-015 FL						■
400	70382543	Pi 423040-010	70382578	Pi 423040-010 FL	■					
	70382544	Pi 423040-011	70382579	Pi 423040-011 FL		■				
	70382545	Pi 423040-012	70382580	Pi 423040-012 FL			■			
	70382546	Pi 423040-013	70382581	Pi 423040-013 FL				■		
	70382547	Pi 423040-014	70382582	Pi 423040-014 FL					■	
	70382548	Pi 423040-015	70382583	Pi 423040-015 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. Δ p [bar]**	**Filter surface [cm²]**
160	78261034	Pi 21016 DN PS 3	PS 3	**20**	2530
	77960826	Pi 22016 DN PS 6	PS 6		2530
	77925605	Pi 23016 DN PS 10	PS 10		2530
	78261042	Pi 24016 DN PS 16	PS 16		2530
	78261059	Pi 25016 DN PS 25	PS 25		2530
	77940638	Pi 71016 DN PS vst 3	PS vst 3	**210**	1885
	77960123	Pi 72016 DN PS vst 6	PS vst 6		1885
	77925688	Pi 73016 DN PS vst 10	PS vst 10		1885
	78269797	Pi 74016 DN PS vst 16	PS vst 16		1885
	78216178	Pi 75016 DN PS vst 25	PS vst 25		1885
250	78227514	Pi 21025 DN PS 3	PS 3	**20**	4020
	77960834	Pi 22025 DN PS 6	PS 6		4020
	77925613	Pi 23025 DN PS 10	PS 10		4020
	78261075	Pi 24025 DN PS 16	PS 16		4020
	78261083	Pi 25025 DN PS 25	PS 25		4020
	77940646	Pi 71025 DN PS vst 3	PS vst 3	**210**	3090
	77960115	Pi 72025 DN PS vst 6	PS vst 6		3090
	77925696	Pi 73025 DN PS vst 10	PS vst 10		3090
	78269813	Pi 74025 DN PS vst 16	PS vst 16		3090
	78216186	Pi 75025 DN PS vst 25	PS vst 25		3090
400	78227522	Pi 21040 DN PS 3	PS 3	**20**	6770
	77960842	Pi 22040 DN PS 6	PS 6		6770
	77925621	Pi 23040 DN PS 10	PS 10		6770
	78261109	Pi 24040 DN PS 16	PS 16		6770
	78261117	Pi 25040 DN PS 25	PS 25		6770
	77940653	Pi 71040 DN PS vst 3	PS vst 3	**210**	5240
	77960107	Pi 72040 DN PS vst 6	PS vst 6		5240
	77930829	Pi 73040 DN PS vst 10	PS vst 10		5240
	78269821	Pi 74040 DN PS vst 16	PS vst 16		5240
	78260903	Pi 75040 DN PS vst 25	PS vst 25		5240

* a wider range of element types is available on request

8. Technical specifications

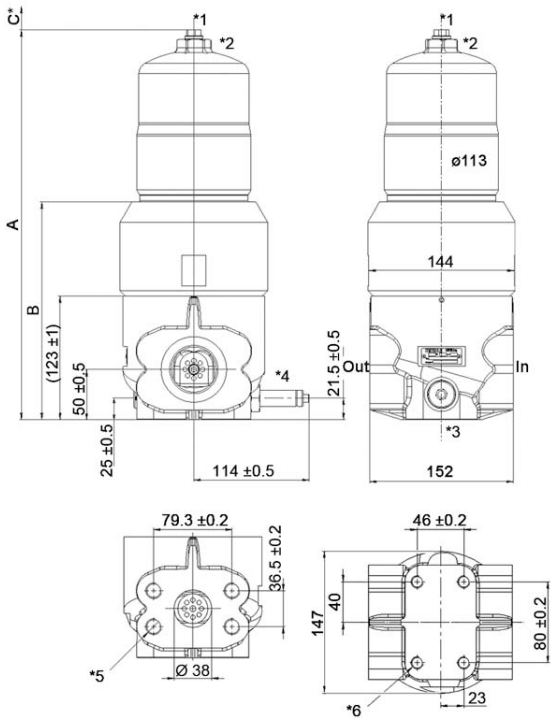
Design:	in-line filter
Nominal pressure:	315 bar (4570 psi)
Test pressure:	410 bar (5940 psi)
Temperature range:	-10 °C to +120 °C
	(other temperature ranges on request)
Bypass setting:	Δ p 7 bar ± 10 %
Filter head material:	GGG
Filter housing material:	St
Sealing material:	NBR/PTFE/Cu
Maintenance indicator setting:	Δ p 5 bar ± 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 sleave:	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 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.



DN 38 according to SAE 1½" 6000 psi
Flanges, bolts, o-rings not included in delivery!

C* = Minimum clearence
In = Inlet
Out = Outlet
*1 = Venting G¼
*2 = SW 30
*3 = Drain G½
*4 = Visual maintenance indicator
*5 = Mounting holes SAE flange 4x M16, 20 mm depth
*6 = Mounting holes 4x M12, 17 mm depth

9. Dimensions

All dimensions except connection "G..." in mm.

Typ	Connection	A ±5	B ±2	C
Pi 423016	G1½	299	-	180
Pi 423016 FL	DN 38			
Pi 423025	G1½	386	224	180
Pi 423025 FL	DN 38			
Pi 423040	G1½	538	376	300
Pi 423040 FL	DN 38			

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 housingl. 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 position to normally closed position or vice versa.

10.3 When should the filter element be replaced?

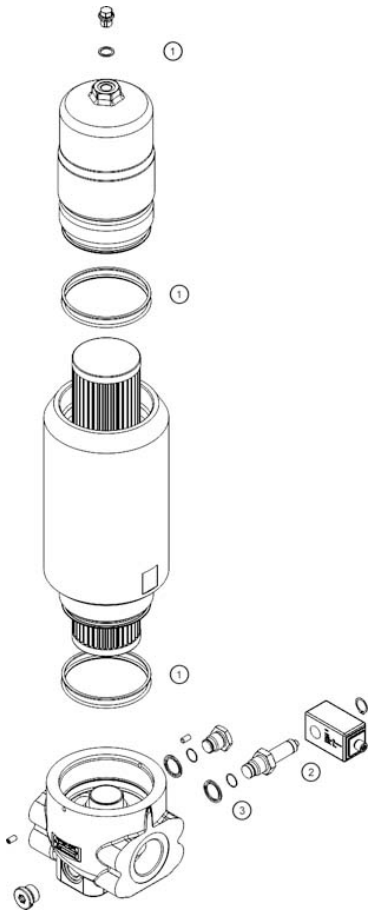
1 . Filters equipped with visual and electrical maintenance indicator:
During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical 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 (PS) cannot be cleaned.

10.4 Element replacement

1 . Stop system and relieve filter from pressure.
2 . Remove vent and drain plug and empty the filter housing.
3 . Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
4 . Remove element by pulling up carefully.
5 . Check o-ring and spigot 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. 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.
7 . Oil the threads of the filter housing a little bit and screw into the filter head. Maximum tightening torque for NG 50 to 110 = 60 Nm, for NG 150 to 450 = 100 Nm.
8 . Check seals of vent and drain plug - if necessary, please replace. Vent the filter housing in pressureless status.
Torque vent plug 30 Nm.
Torque drain plug 110 Nm.



11. Spare parts list

Order numbers for spare parts		
Position	**Type**	**Order number**
①	Seal kit	
	NBR	70382630
	FPM	70382632
	EPDM	70382634
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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70382799.03/2013

MAHLE

Industry

Stainless steel-high pressure filter
Pi 480

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

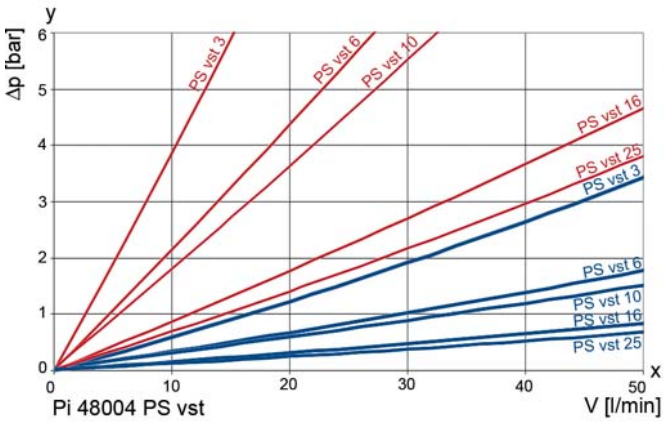
1. Features

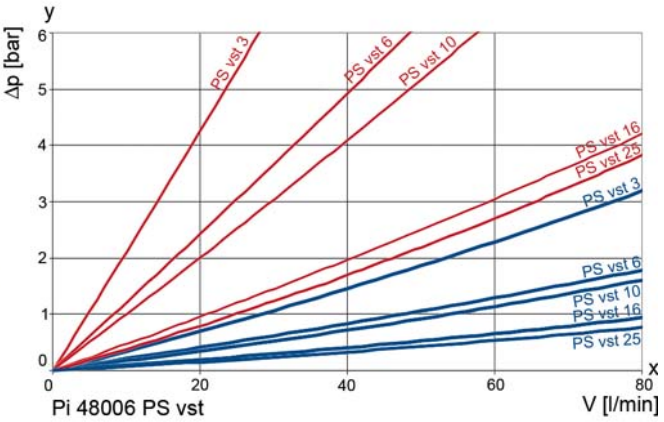
High performance filters for modern hydraulic systems

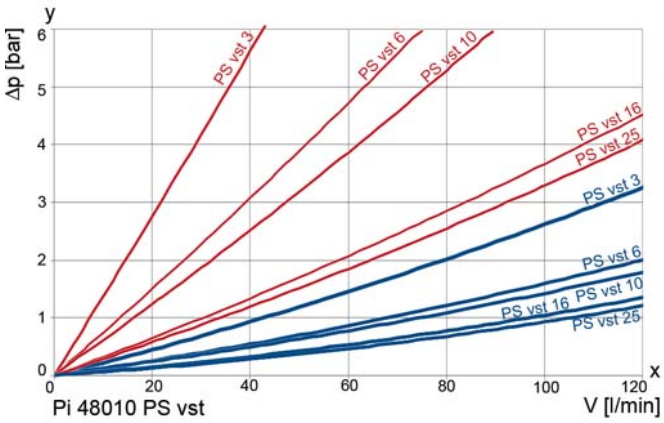
- Modular system
- Compact design
- Minimal pressure drop through optimal flow design
- Visual/electrical/electronic maintenance indicator
- Threaded connections
- Quality filters, easy to service
- Equipped with highly efficient glass fibre PS filter elements according to DIN 24550
- Beta rated elements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

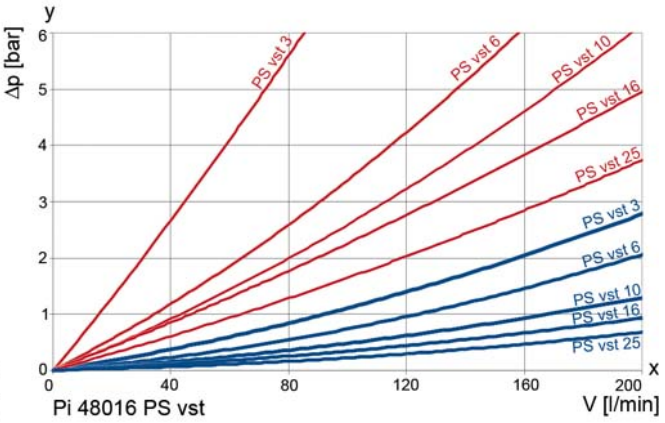
2. Flow rate/pressure drop curve complete filter

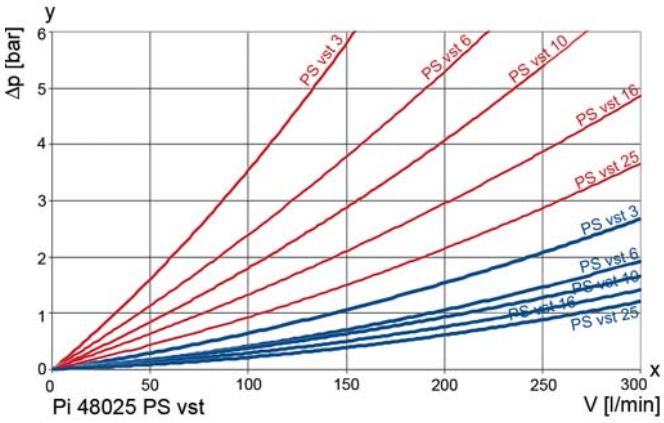
190 mm²/s
33 mm²/s





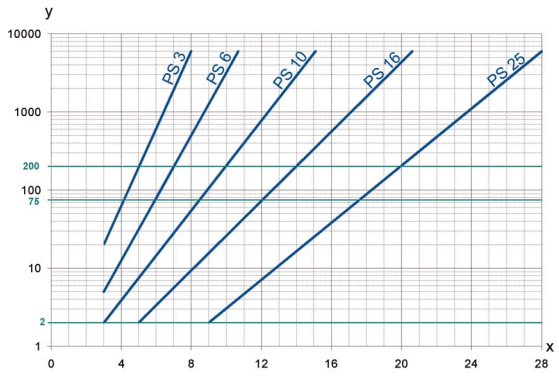






y = differential pressure Δ p [bar]
x = flow rate V [l/min]

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)

PS vst elements with
max. Δ p 210 bar

PS vst	3	$\beta_{5(C)}$	≥200
PS vst	6	$\beta_{7(C)}$	≥200
PS vst	10	$\beta_{10(C)}$	≥200
PS vst	16	$\beta_{15(C)}$	≥200
PS vst	25	$\beta_{20(C)}$	≥200

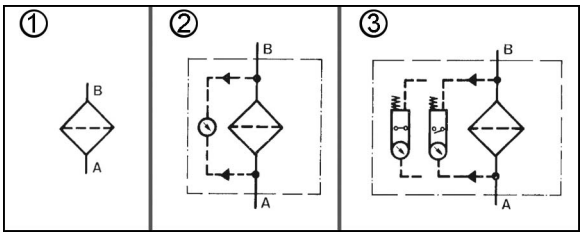
values guaranteed up to 20 bar
differential pressure

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-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	PS vst 6 Type: Pi 71010 DN PS 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			■

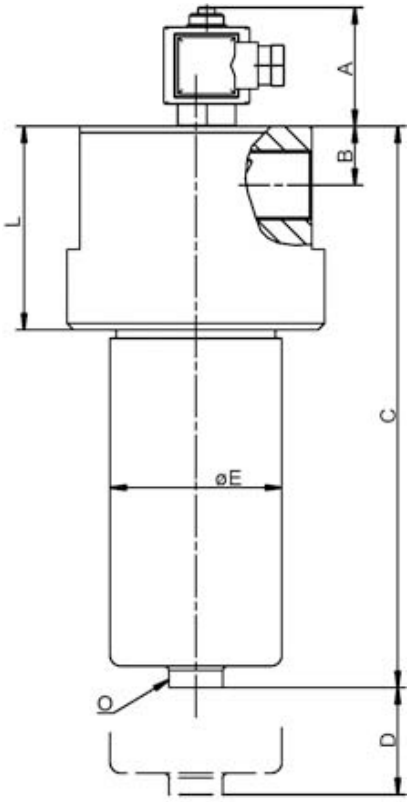
7.2 Filter elements*					
Nominal size NG [l/min]	**Order number**	**Type**	**Filter material**	**max. Δ p [bar]**	**Filter surface [cm²]**
40	78216079	Pi 71004 DN PS vst 3	PS vst 3	**210**	445
	77960156	Pi 72004 DN PS vst 6	PS vst 6		445
	77925654	Pi 73004 DN PS vst 10	PS vst 10		445
	78216087	Pi 74004 DN PS vst 16	PS vst 16		445
	78216095	Pi 75004 DN PS vst 25	PS vst 25		445
63	78216137	Pi 71006 DN PS vst 3	PS vst 3	**210**	780
	77960149	Pi 72006 DN PS vst 6	PS vst 6		780
	77925662	Pi 73006 DN PS vst 10	PS vst 10		780
	78216145	Pi 74006 DN PS vst 16	PS vst 16		780
	78216152	Pi 75006 DN PS vst 25	PS vst 25		780
100	78227480	Pi 71010 DN PS vst 3	PS vst 3	**210**	1275
	77960131	Pi 72010 DN PS vst 6	PS vst 6		1275
	77925670	Pi 73010 DN PS vst 10	PS vst 10		1275
	78261281	Pi 74010 DN PS vst 16	PS vst 16		1275
	78216160	Pi 75010 DN PS vst 25	PS vst 25		1275
160	77940638	Pi 71016 DN PS vst 3	PS vst 3	**210**	1885
	77960123	Pi 72016 DN PS vst 6	PS vst 6		1885
	77925688	Pi 73016 DN PS vst 10	PS vst 10		1885
	78269797	Pi 74016 DN PS vst 16	PS vst 16		1885
	78216178	Pi 75016 DN PS vst 25	PS vst 25		1885
250	77940646	Pi 71025 DN PS vst 3	PS vst 3	**210**	3090
	77960115	Pi 72025 DN PS vst 6	PS vst 6		3090
	77925696	Pi 73025 DN PS vst 10	PS vst 10		3090
	78269813	Pi 74025 DN PS vst 16	PS vst 16		3090
	78216186	Pi 75025 DN PS vst 25	PS vst 25		3090

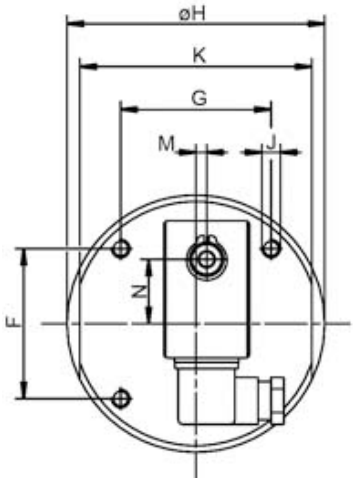
*a wider range of element types is available on request

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)
	TP 316/TP 316 L
Filter head and housing material:	(1.4401/1.4404)
	(other materials on request)
Sealing material:	NBR/PTFE
Maintenance indicator setting:	Δ p 5 bar ± 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
Type of protection:	and secured status
Contact:	normally open/closed
Cable sleave:	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 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 ± 5	D	E	F	G	H	J	K	L	M	N	O (SW)
Pi 48004	60	27.5	202	100	80	70	70	120	M8	108	95	5	30.0	30
Pi 48006	60	27.5	262	100	80	70	70	120	M8	108	95	5	30.0	30
Pi 48010	60	27.5	352	100	80	70	70	120	M8	108	95	5	30.0	30
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 housingl. 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?

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 (PS) cannot be cleaned.

10.4 Element replacement

1 . Stop system and relieve filter from pressure.
2 . Unscrew the filter housing by turning counter-clockwise. Clean the housing using a suitable cleaning solvent.
3 . Remove element by pulling down carefully.
4 . Check o-ring and spigot for damage. Replace, if necessary.
5 . 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.
6 . Lightly lubricate the threads of the filter housing a little bit and screw into the filter head. Maximum tightening torque for NG 50 to 110 = 60 Nm, for NG 150 to 450 = 100 Nm.

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

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MAHLE

Industry

Low Pressure Filter
Spin-on Cartridges HC/OC

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

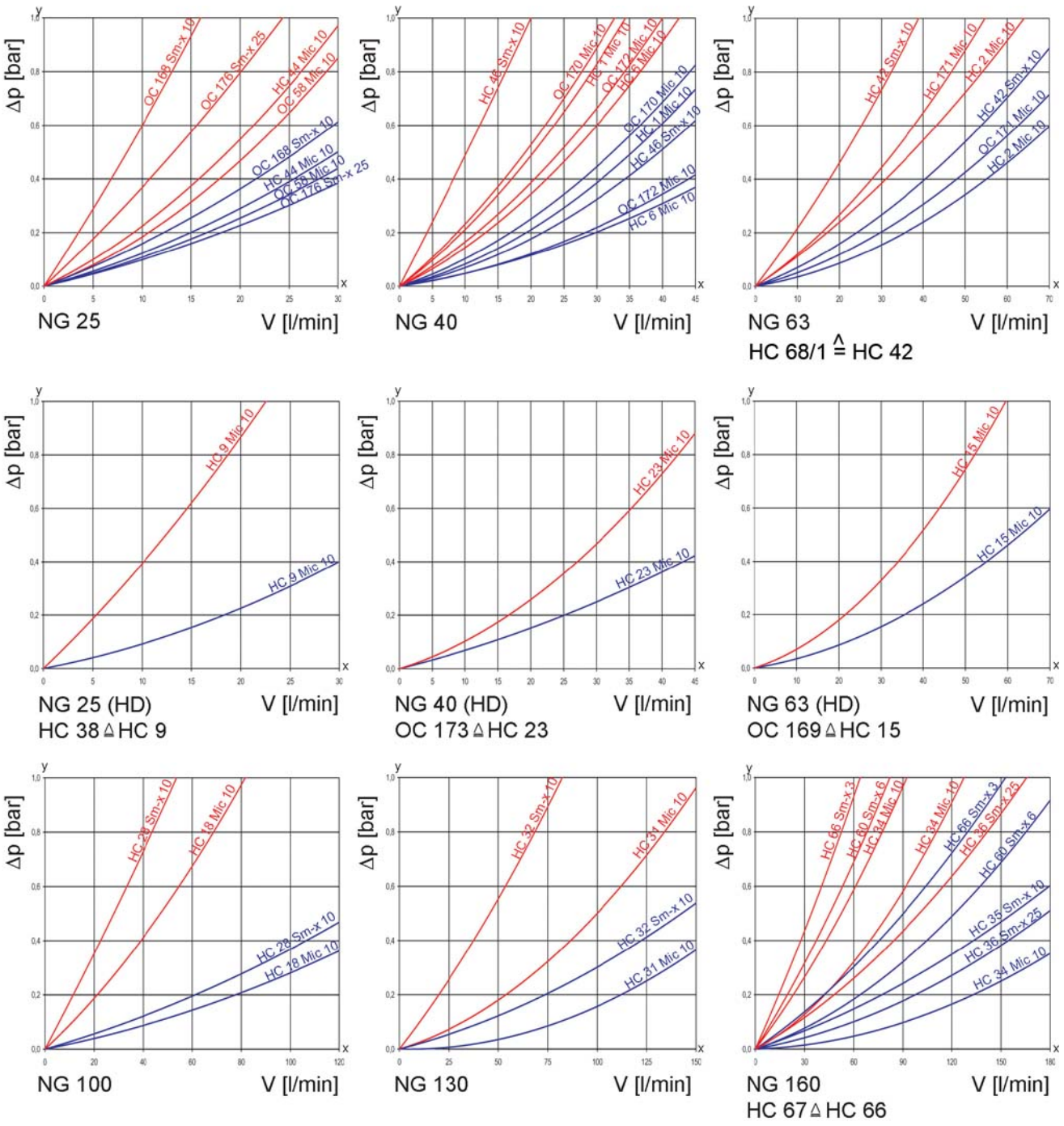
1. Features

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 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

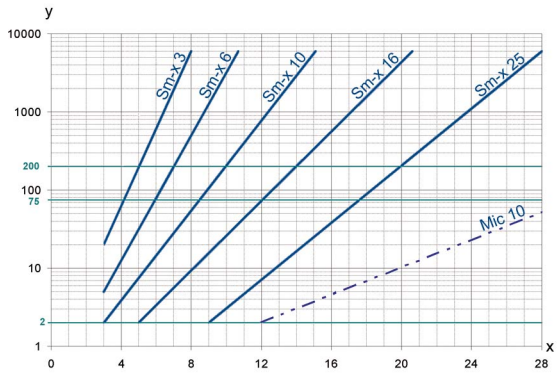
2. Flow rate/pressure drop curve complete filter

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

measured according to ISO 16889 (multipass test)

Sm-x elements with max. Δ p 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

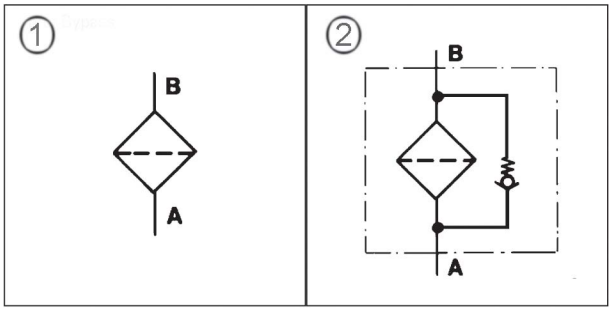
Subject to technical alteration without prior notice.

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



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 [cm²]	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)
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:	Δ p ≥ 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.

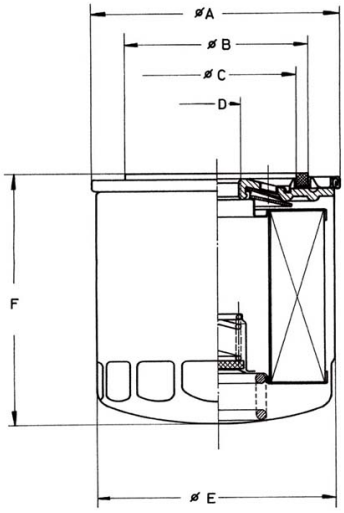


Figure shows spin-on cartridge with relief valve and check valve (optional).

9. Dimensions

All dimensions except "D" in mm.

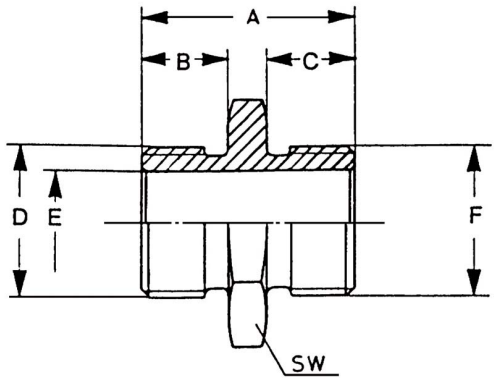
Type	Ø A	Ø B	Ø C	D	Ø E	F	Weight [kg]
OC 58	80	72	62	¾'' 16 UNF 2B	76	120	0.40
OC 168	80	72	62	¾'' 16 UNF 2B	76	120	0.55
OC 176	80	72	62	¾'' 16 UNF 2B	76	120	0.55
HC 44	80	72	62	¾'' 16 UNF 2B	76	120	0.40
HC 1	95	72	62	¾'' 16 UNF 2B	93	141	0.55
OC 170	95	72	62	¾'' 16 UNF 2B	93	141	0.55
HC 6	95	72	62	1'' 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.

	Adapter						
Order number	A	B	C	D	E	SW	F
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	1 ½'' 16 UNF 2A	25	41	M38x1.5

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



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MAHLE Industry

Low pressure filter
Spin-on cartridges PX

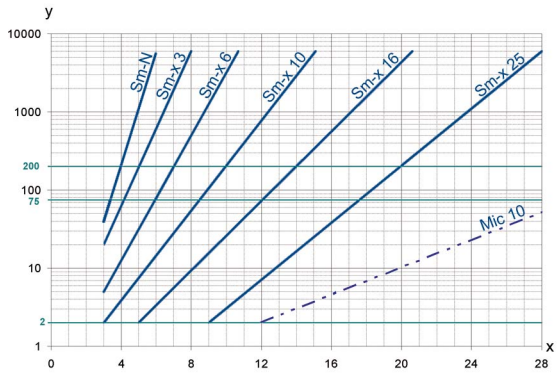
Nominal pressure 16/10 bar (230/140 psi), nominal size up to 160

1. Short description

Efficient filter for modern hydraulic systems

- Modular system for optimum filter selection
- Small space requirement through compact design
- Minimal pressure drop through optimal flow design of components
- Equipped with highly efficient Mic, Sm-N or Sm-x filter elements
- Guaranteed separation according to ISO 16889 multipass test
- Elements with high differential pressure stability and dirt holding capacity
- Customer-specific printing on request
- Worldwide sales

2. Separation characteristics



y = beta value
x = particle size [µm]

determined by multipass measurements (ISO 16889)
Calibration according to ISO 11171 (NIST)

3. Filter performance data

measured according to ISO 16889 (multipass test)

Sm-x/Sm-N 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

up to 5 bar differential
pressure

4. Quality assurance

MAHLE Filter and filter elements are manufactured and tested according to the following international standards:

Standard	Title
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 compatibility with hydraulic fluid
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

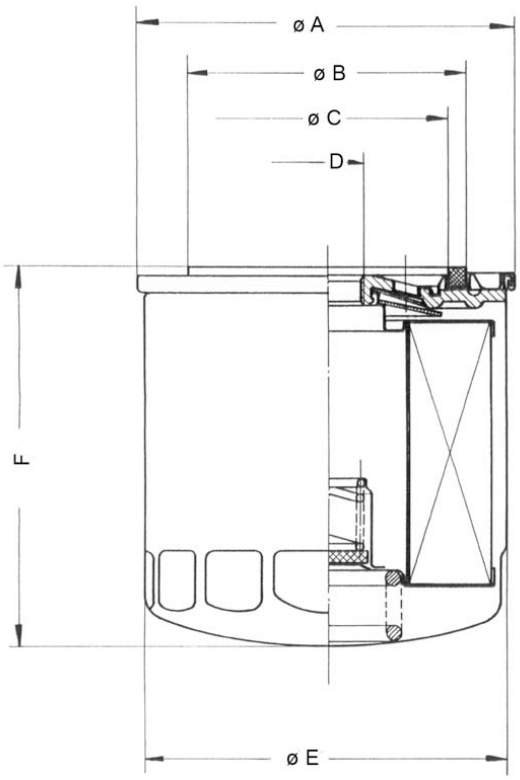
5.1 Type number key

Type									
PX	Spin-on cartridge								
	Housing diameter								
	1	76 mm							
	2	93 mm							
	3	136 mm							
		Length							
		1	120 mm						
		2	141 mm						
		3	172 mm						
		4	180 mm						
		5	210/215 mm						
		6	240 mm						
		7	310 mm						
			Type of cover disc						
			1	Standard					
				Connection thread					
				1	¾“ 16UNF-2B				
				2	1“ 12UNF-2B				
				3	1½“ 16UNF-2B				
				4	G1¼“				
				5	M39x1.5				
					Nominal pressure				
					1	10 bar (140 psi)			
					2	16 bar (230 psi)			
					3	20 bar (290 psi)			
					4	25 bar (360 psi)			
						Options			
						Vx.x	Bypass valve with x.x bar		
						R	Non-return device		
							Filter material		
							SmN		
							Smx		
							Mic		
								Fineness	
								3	3 µm
								6	6 µm
								10	10 µm
								25	25 µm
PX	**3**	**7-**	**1**	**3-**	**2**	-	**-Smx**		

5.2 Housing design					
Nominal size NG [l/min]	**Order number**	**Type designation**	**Nominal pressure [bar]**	**Filter material**	**Filter surface [cm²]**
100	70548477	PX33-13-2-SmN2	16	Sm-N 2	3400
	70541521	PX33-13-2-Smx3		Sm-x 3	3400
	70541522	PX33-13-2-Smx6		Sm-x 6	3400
	70541523	PX33-13-2-Smx10		Sm-x 10	3400
	70541524	PX33-13-2-Smx25		Sm-x 25	3400
	70541525	PX33-13-2-Mic10		Mic 10	7000
	70541527	PX33-13-2-Mic25		Mic 25	7000
	70541528	PX33-14-1-Mic10	10	Mic 10	7000
130	70553366	PX36-13-2-SmN2	16	Sm-N 2	5400
	70541529	PX36-13-2-Smx3		Sm-x 3	5400
	70541531	PX36-13-2-Smx6		Sm-x 6	5400
	70541532	PX36-13-2-Smx10		Sm-x 10	5400
	70541533	PX36-13-2-Smx25		Sm-x 25	5400
	70541534	PX36-13-2-Mic10		Mic 10	9700
	70541535	PX36-13-2-Mic25		Mic 25	9700
160	70553384	PX37-13-2-SmN2	16	Sm-N 2	7400
	70541536	PX37-13-2-Smx3		Sm-x 3	7400
	70541537	PX37-13-2-Smx6		Sm-x 6	7400
	70541538	PX37-13-2-Smx10		Sm-x 10	7400
	70541539	PX37-13-2-Smx25		Sm-x 25	7400
	70541540	PX37-13-2-Mic10		Mic 10	13500
	70541541	PX37-13-2-Mic25		Mic 25	13500
	70541543	PX37-14-1-Smx3	10	Smx3	7400

6. Technical data

Nominal pressure:	16/10 bar (230/140 psi)
Burst pressure:	35 bar (500psi)
Temperature range:	-10 °C to +120 °C
Filter housing material:	Steel
Sealing material:	Perbunan
Fitting position:	preferably upright
Collapse pressure of elements:	Δ p ≥ 5 bar
Creep strength:	min. 10^5 LW at nominal pressure



We draw attention to the fact that all values indicated are average values. 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 help you.

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!

7. Dimensions

All dimensions in mm except "D".

Type designation	Ø A	Ø B	Ø C	D	Ø E	F
PX33-13	140	111	100	1½" 16 UN 2B	136	172
PX36-13	140	111	100	1½" 16 UN 2B	136	240
PX37-13	140	111	100	1½" 16 UN 2B	136	310
PX33-14	140	111	100	G1¼	136	172
PX37-14	140	111	100	G1¼	136	310

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