

MAHLE

Industry

Suction Filter

Pi 160

1. Features

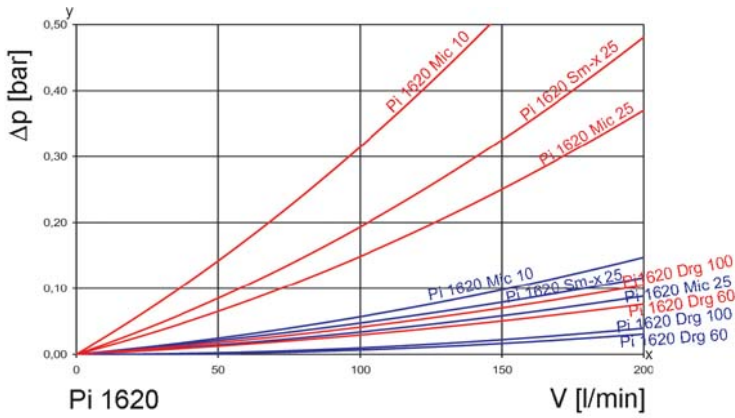
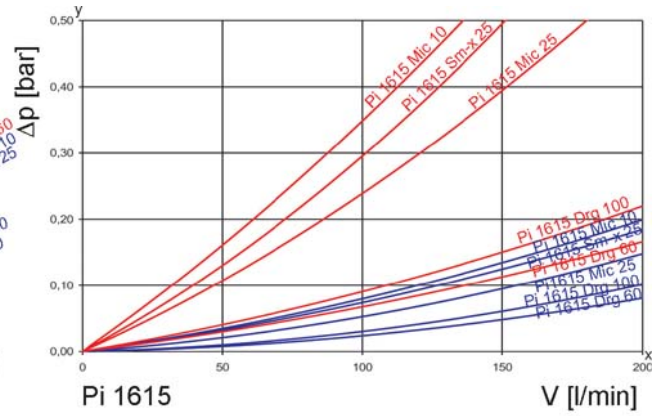
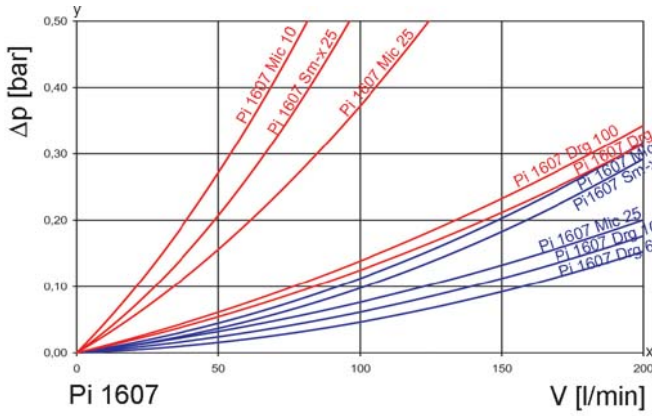
High performance filters for modern hydraulic systems

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



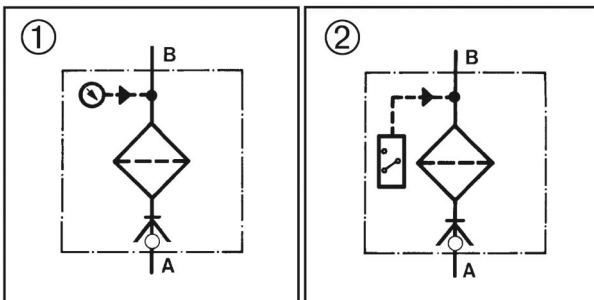
2. Flow rate/pressure drop curve complete filter

190 mm²/s
33 mm²/s



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

3. Symbols



4. Order numbers

Example for ordering filters:

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

4.1 Housing design

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

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

4.2 Filter element

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

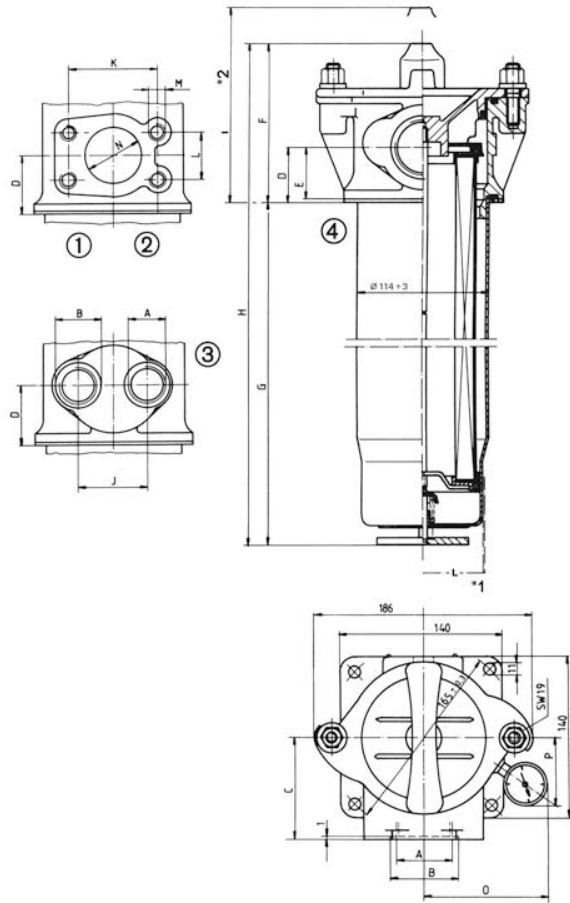
4.3 Filter elements wire mesh

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

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

5. Technical specifications

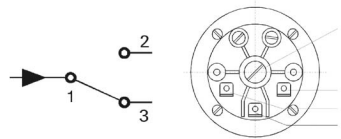
Design:	suction filter for tank mounting with shut off valve
Installation:	horizontally under oil level or vertically above oil level with optional extension pipe
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Filter head material:	GDAL
Filter housing material:	St
Sealing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



*1 Extension pipe available upon request
*2 Extension height min.

Connecting plan

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



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

Subject to technical alteration without prior notice.

6. Dimensions

Dimension	Pi 1607-...		Pi 1615-...		Pi 1615-...		Pi 1615-...		Pi 1620-...	
O/P	110/64	166	110/64	166	110/64	366	110/64	466	110/64	366
O/P	135/71	165	135/71	165	135/71	365	135/71	465	135/71	365
O/P	130/55	170	130/55	170	130/55	370	130/55	470	130/55	370
Fig.	4		4		2		3		1	
A	G1½		G2		SAE 2"		2 x G1		SAE 3"	
B	56		68				41			
C	87		87		87		87		95	
D	49		49		53		53		73	
E	46		46		50		50		70	
F	144		144		144		144		182	
G	178		471		471		471		433	
H	322		615		615		615		615	
I	375		680		680		680		710	
J							60			
K					77,8				106,4	
L					42,9				61,9	
M					M12				M16	
N					50				76	
Weight [kg]	2.7		3.5		3.5		3.5		5.0	

7. Installation, operating and maintenance instructions

7.1 Filter installation

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

7.2 When should the filter element be replaced or cleaned?

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

7.3 Element replacement

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

7.4 Cleaning methods for cleanable elements

a) Ultrasonic cleaning

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

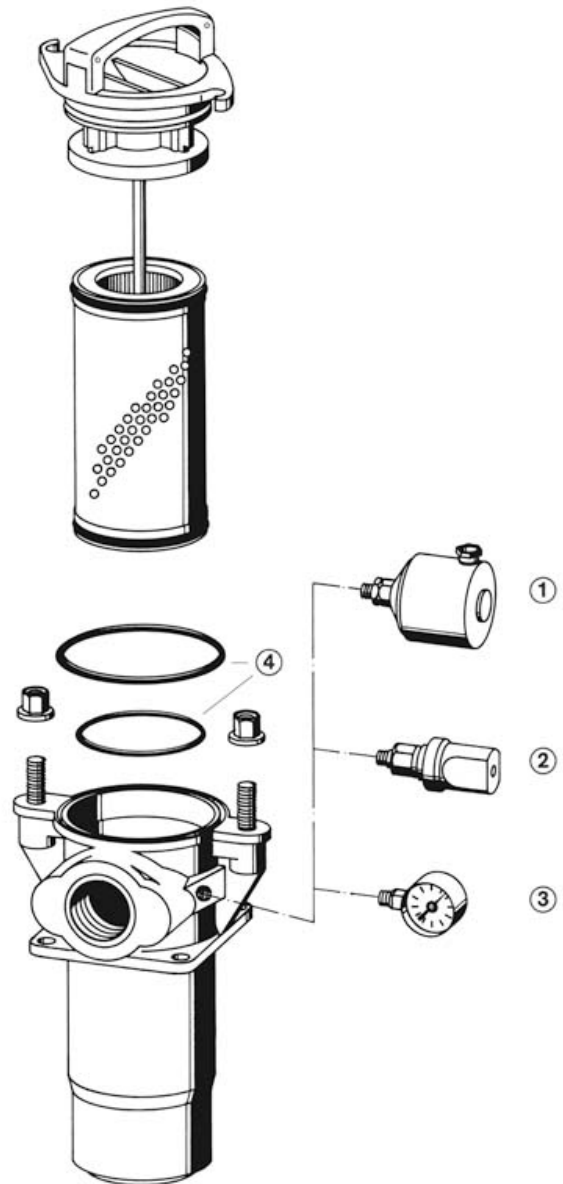
b) Manual cleaning

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

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

8. Spare parts list

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



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 78356396.03/2012

Suction Filters

Pi 1710

Nominal size up to 480

1. Features

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

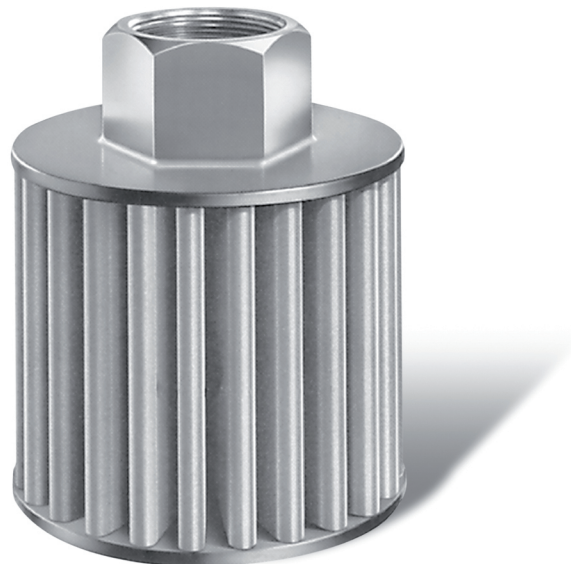
MAHLE suction filters, series Pi 1710, stand out for their rugged construction and large filter surface area.

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

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

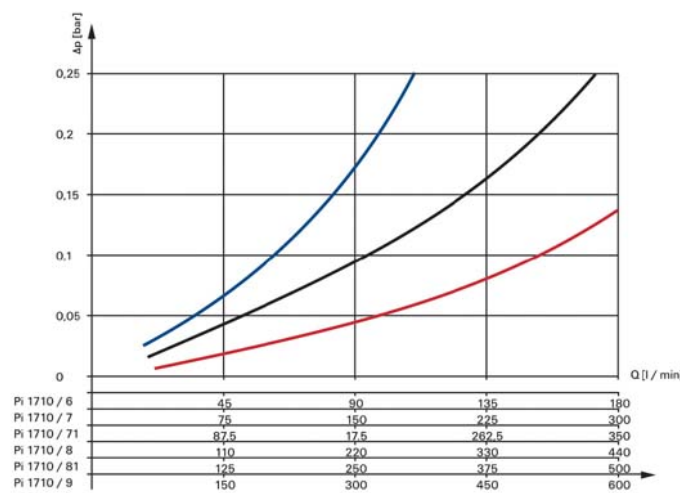
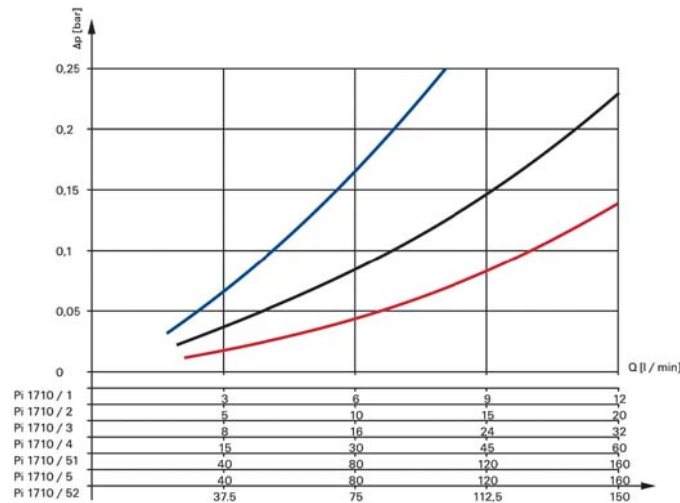
The standard filter material is a 100 µm stainless steel wire mesh.

- Rugged construction
- Large filtering surface area
- Worldwide distribution



2. Flow rates/pressure drop curve

— 500 mm²/s
— 190 mm²/s
— 33 mm²/s



3. Order numbers

3.1 Housing design

Nominal size NG [l/min]	Order number	Type	Filter surface [cm ²]
10	77661598	Pi 1710/1	104
15	77661606	Pi 1710/2	104
30	77661614	Pi 1710/3	170
50	77661622	Pi 1710/4	394
60	77661697	Pi 1710/51	510
80	77661630	Pi 1710/5	642
120	77661705	Pi 1710/52	940
150	77661648	Pi 1710/6	1104
240	77661655	Pi 1710/7	1484
290	77661689	Pi 1710/71	1858
360	77661663	Pi 1710/8	2738
410	77661713	Pi 1710/81	3434
480	77661671	Pi 1710/9	3422

4. Technical specifications

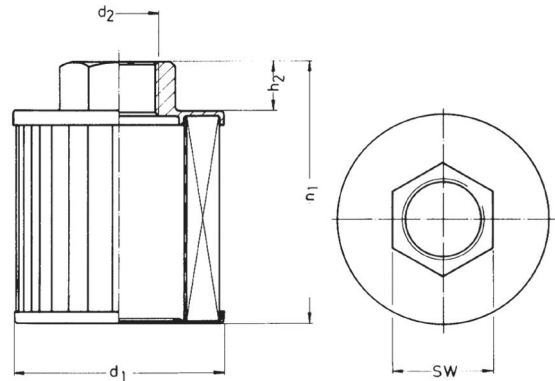
Flow capacity:	10 to 480 l/min at 33 mm ² /s viscosity and 0.1 bar Δ p
Temperature range:	-10 °C to +120 °C
Degree of filtration:	100 μ m
Other ratings:	on request
Material of connecting port + end cap:	PA 6 GF 30
Material of end cap:	galvanized steel
Material of inner tube:	galvanized steel
Material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

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

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

Subject to technical alteration.



5. Dimensions

All dimensions except "d₂" in mm.

Type	d ₁	d ₂	h ₁	h ₂	SW	Weight [kg]
Pi 1710/1	46	G¼	59.5	18	22	0.10
Pi 1710/2	46	G3/8	59.5	18	22	0.10
Pi 1710/3	61	G½	53.5	13	27	0.14
Pi 1710/4	61	G¾	86.5	13	32	0.20
Pi 1710/51	87	G1	86.5	21	41	0.32
Pi 1710/5	87	G1	107.5	21	41	0.35
Pi 1710/52	87	G1	152.5	21	41	0.40
Pi 1710/6	99	G1¼	122	21.5	46	1.00
Pi 1710/7	99	G1½	159	28	50	1.00
Pi 1710/71	99	G1½	189	28	50	1.05
Pi 1710/8	131	G2	161	30	65	1.20
Pi 1710/81	131	G2	191	30	65	1.40
Pi 1710/9	131	G2½	198	37.5	80	1.50

6. Cleaning methods

a) Ultrasonic cleaning

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

The cleaning effect is approximately 80-90 %.

b) Manual cleaning

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

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

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MAHLE

Industry

Low Pressure Filter/Suction Filter

Pi 1941

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

1. Features

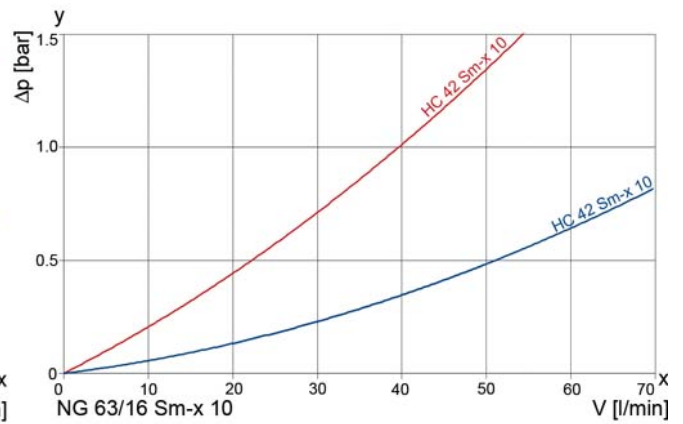
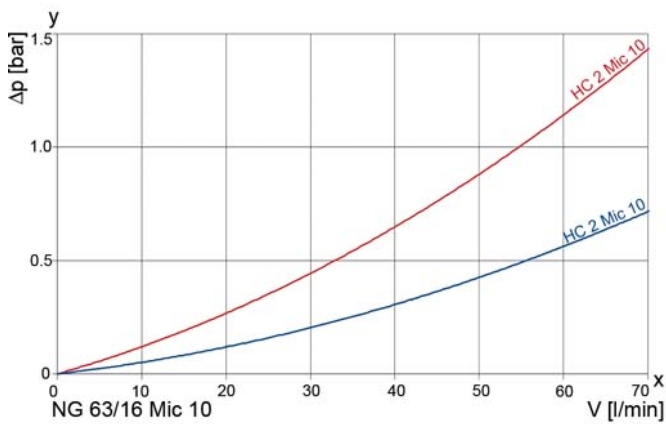
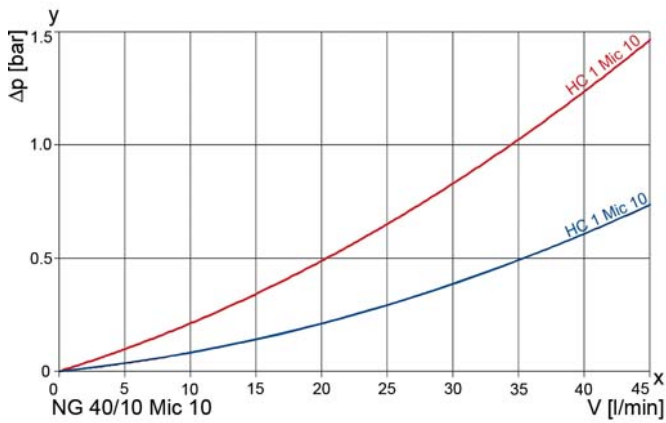
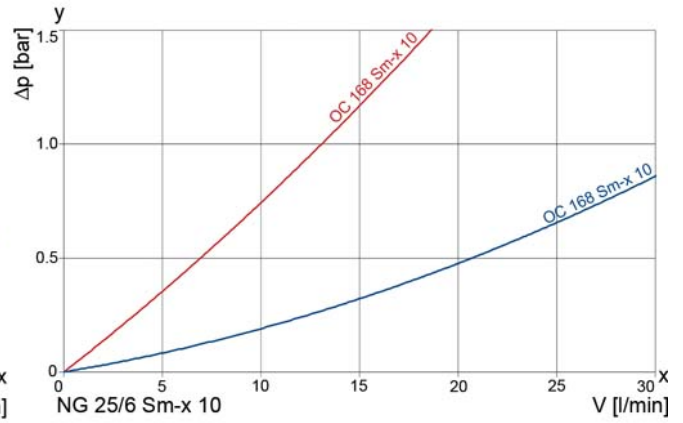
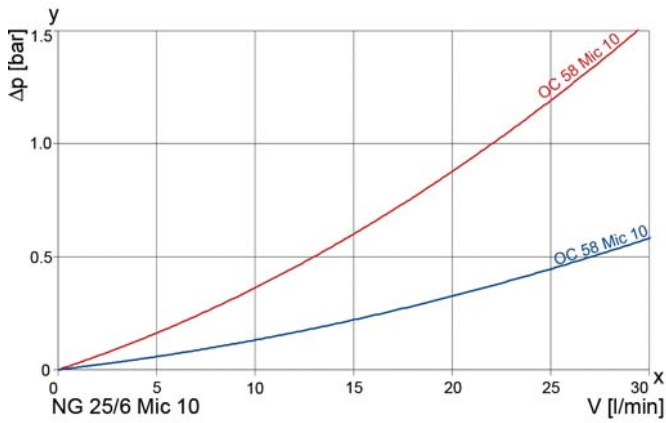
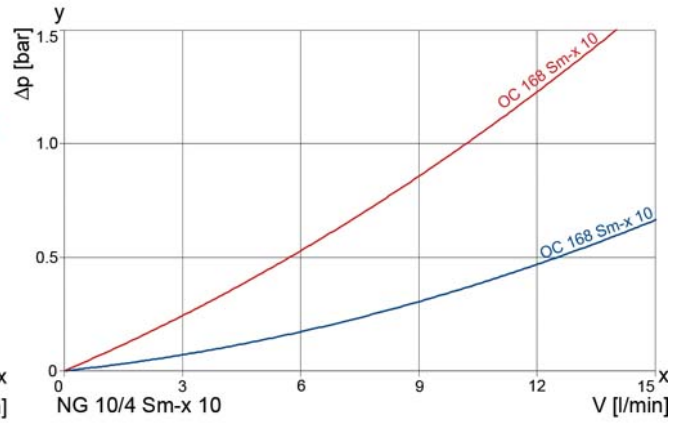
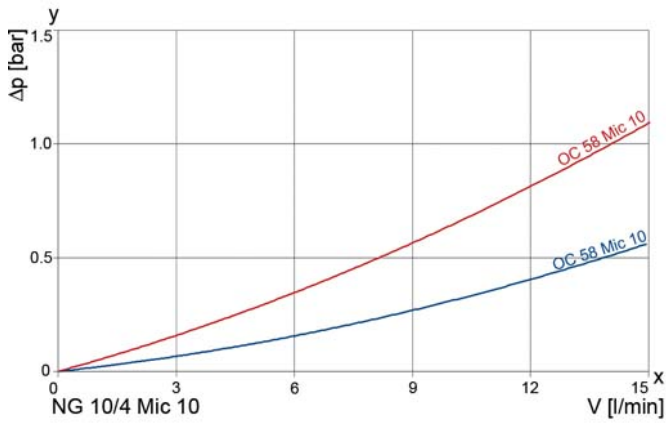
High performance filters for modern hydraulic systems

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



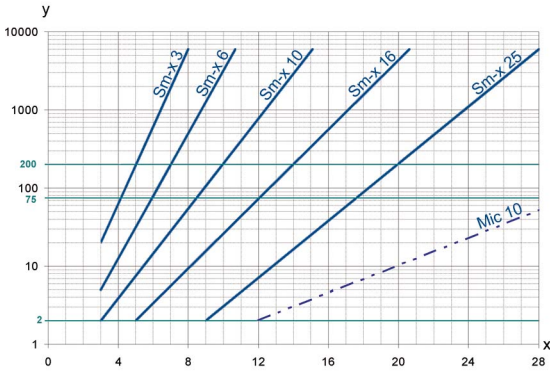
2. Flow rate/pressure drop curve complete filter

■ 190 mm²/s
■ 33 mm²/s



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

3. Separation grade characteristics



y = beta-value
x = particle size μm

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

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x elements with
max. Δp 5 bar

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

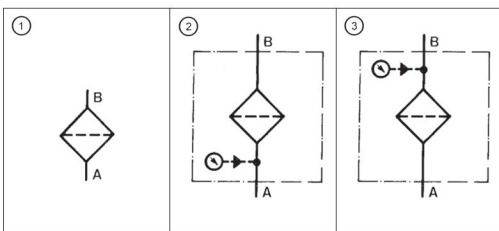
values guaranteed up to
5 bar differential pressure

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	②
			no options	with pressure gauge
10	77664360	Pi 1941/10/G¼		
	77812225	Pi 1941/10/G¼/DM		
25	77664386	Pi 1941/10/G3/8		
	77815509	Pi 1941/10/G3/8/DM		
40	77664394	Pi 1941/10/G½		
	77664402	Pi 1941/10/G½/DM		
63	77664378	Pi 1941/10/G¾		
	77807811	Pi 1941/10/G¾/DM		

7.2 Spin-on cartridges

Nominal flow rate NG [l/min] press-/suct. side	Order number	Type	Filter material	max. Δ p [bar]	Filter surface [cm²]
10/4	77785983	OC 58	Mic 10	5	1775
	77500184	OC 168	Sm-x 10		1309
25/6	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	③
			no options	with vacuum gauge
4	77664360	Pi 1941/10/G¼		
	77894033	Pi 1941/10/G¼/UM		
6	77664386	Pi 1941/10/G3/8		
	77894041	Pi 1941/10/G3/8/UM		
10	77664394	Pi 1941/10/G½		
	77894058	Pi 1941/10/G½/UM		
16	77664378	Pi 1941/10/G¾		
	77658966	Pi 1941/10/G¾/UM		

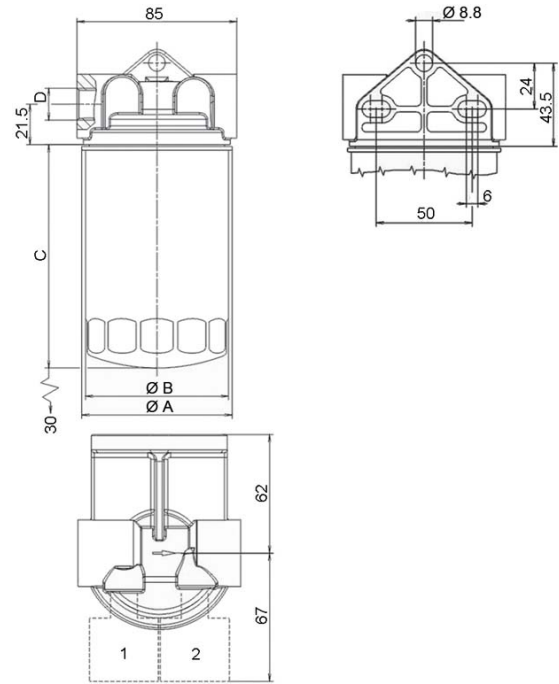
8. Technical specifications

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

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

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1 = pressure gauge

2 = vacuum gauge

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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.

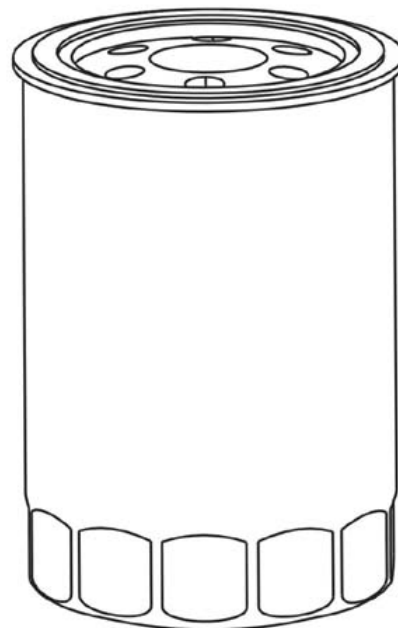
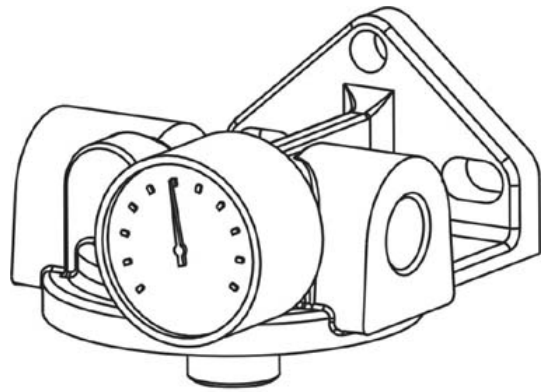
Preferably the filter should be installed with the spin-on cartridge pointing downwards.

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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MAHLE

Industry

Suction Filter

Pi 200

Nominal size up to 90

1. Features

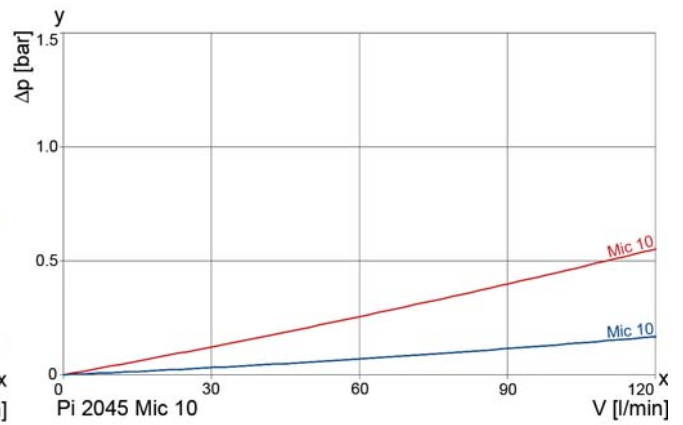
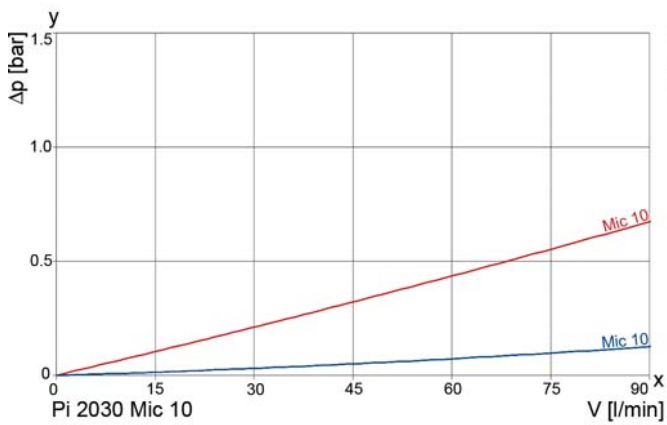
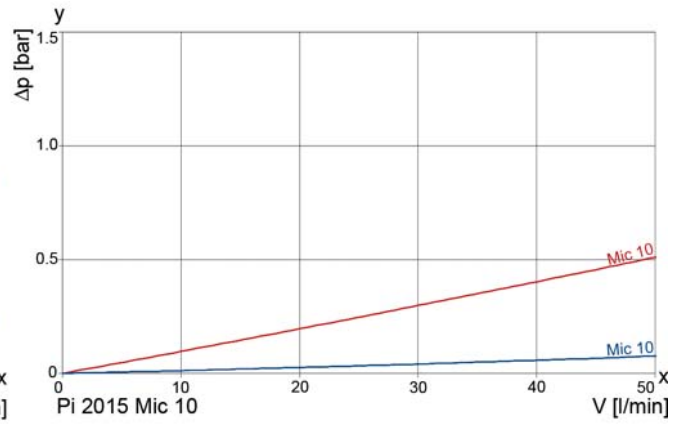
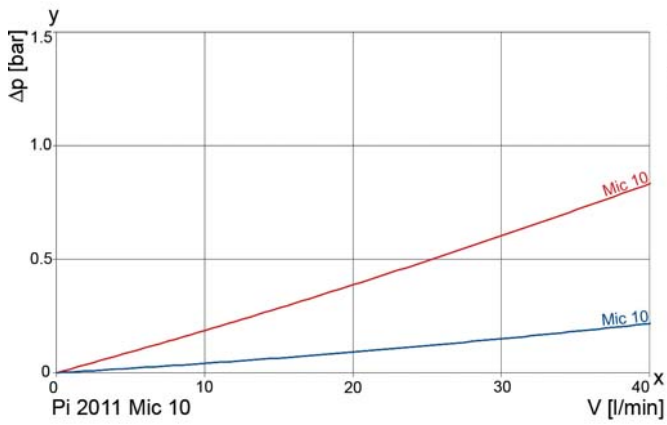
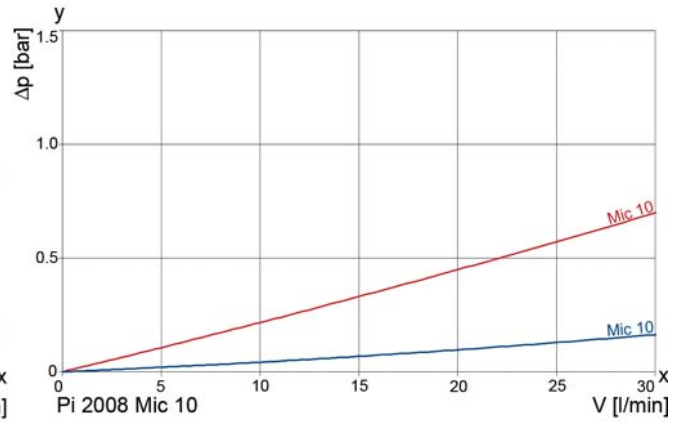
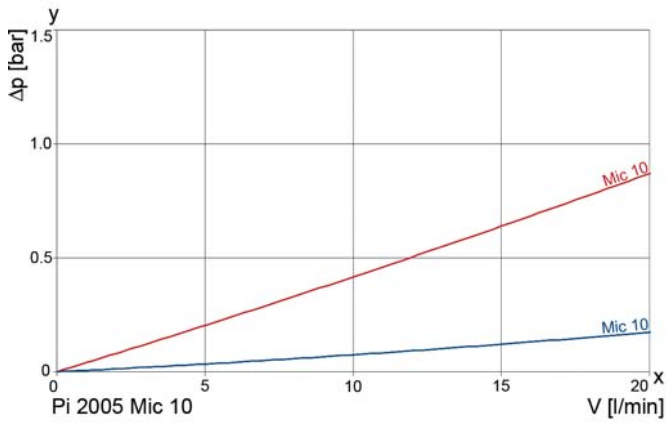
High performance filters for modern hydraulic systems

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



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

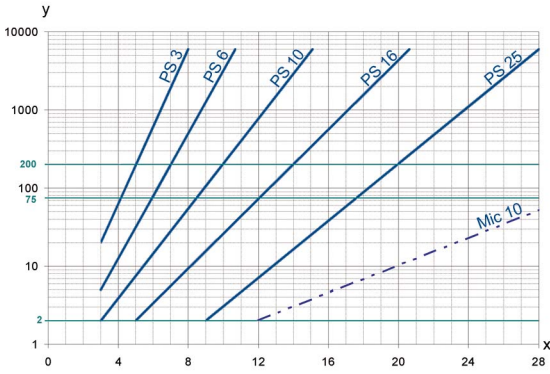
■ 190 mm²/s
■ 33 mm²/s



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

PS elements on request.

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. Δp 20 bar

PS 10 $\beta_{10(C)} \geq 200$

PS 25 $\beta_{20(C)} \geq 200$

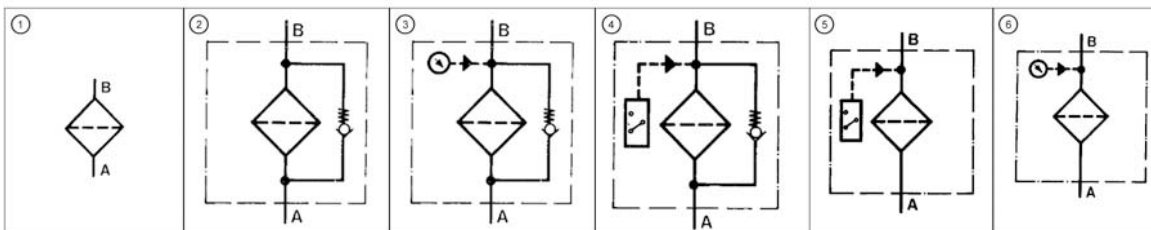
values guaranteed up to 10
bar differential pressure

5. Quality assurance

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

Norm	Designation
DIN ISO 2941	Hydraulic fluid power filter elements; verification of collapse/burst resistance
DIN ISO 2942	Hydraulic fluid power filter elements; verification of fabrication integrity
DIN ISO 2943	Hydraulic fluid power filter elements; verification of material compatibility with fluids
DIN ISO 3723	Hydraulic fluid power filter elements; method for end load test
DIN ISO 3724	Hydraulic fluid power 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=16 l/min and vacuum switch Type: Pi 2008-065 Order number: 77736937	PS 25 Type: Pi 4108 PS 25 Order number: 77680457

7.1 Housing design

Nominal size NG [l/min]	Order number	Type	①	②	③	④	⑤	⑥
			no options	with bypass valve	with bypass valve and vacuum gauge	with bypass valve and vacuum switch	with vacuum switch	with vacuum gauge
10	77665144	Pi 2005-060						
	77665151	Pi 2005-067						
	77736903	Pi 2005-062						
	77736911	Pi 2005-061						
	77736895	Pi 2005-065						
	77736887	Pi 2005-066						
16	77665235	Pi 2008-060						
	77665268	Pi 2008-067						
	77665243	Pi 2008-062						
	77736945	Pi 2008-061						
	77736937	Pi 2008-065						
	77665250	Pi 2008-066						
22	78205114	Pi 2011-060						
	70361602	Pi 2011-067						
	70361595	Pi 2011-062						
	79767013	Pi 2011-061						
	79373077	Pi 2011-065						
	76374318	Pi 2011-066						
30	77840580	Pi 2015-060						
	N.N.	Pi 2015-067						
	N.N.	Pi 2015-062						
	N.N.	Pi 2015-061						
	76387880	Pi 2015-065						
	N.N.	Pi 2015-066						
60	77665474	Pi 2030-060						
	77735921	Pi 2030-067						
	77665482	Pi 2030-062						
	77665490	Pi 2030-061						
	77665508	Pi 2030-065						
	77735939	Pi 2030-066						
90	77664881	Pi 2045-060						
	77736986	Pi 2045-067						
	77664907	Pi 2045-062						
	77664899	Pi 2045-061						
	77664915	Pi 2045-065						
	77736978	Pi 2045-066						

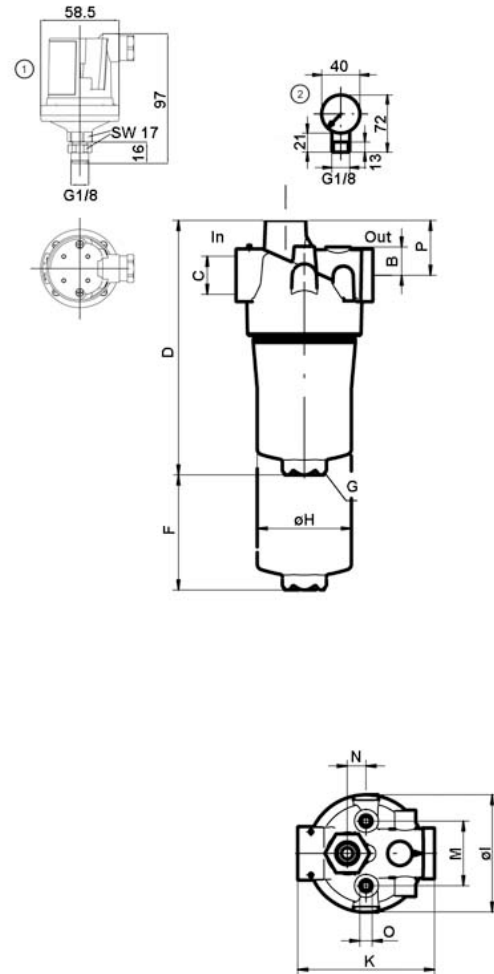
When filter with non bypass configuration is selected, the collapse pressure of the element must not be exceeded.

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

Nominal size NG [l/min]	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
10	77680325	Pi 3105 PS 10	PS 10	20	590
	77680440	Pi 4105 PS 25	PS 25		590
	77576630	Pi 1105 Mic 10	Mic 10		640
16	77680341	Pi 3108 PS 10	PS 10	20	1150
	77680457	Pi 4108 PS 25	PS 25		1150
	77680085	Pi 1108 Mic 10	Mic 10		1250
22	77680333	Pi 3111 PS 10	PS 10	20	1700
	77680465	Pi 4111 PS 25	PS 25		1700
	77680093	Pi 1111 Mic 10	Mic 10		1800
30	77680358	Pi 3115 PS 10	PS 10	20	2425
	77680473	Pi 4115 PS 25	PS 25		2425
	77680101	Pi 1115 Mic 10	Mic 10		2565
60	77680366	Pi 3130 PS 10	PS 10	20	4620
	77680481	Pi 4130 PS 25	PS 25		4620
	77680119	Pi 1130 Mic 10	Mic 10		4885
90	77680374	Pi 3145 PS 10	PS 10	20	6865
	77680499	Pi 4145 PS 25	PS 25		6865
	77680127	Pi 1145 Mic 10	Mic 10		7265

8. Technical specifications

Design:	in-line suction filter
Nominal pressure: Pi 2005 - 2011	63 bar (910 psi)
Pi 2015 - 2045	25 bar (360 psi)
Test pressure: Pi 2005 - 2011	82 bar (1190 psi)
Pi 2015 - 2045	33 bar (480 psi)
Temperature range:	-10 °C to +120 °C (other temperature ranges on request)
Bypass setting:	Δp 0.25 bar \pm 10 %
Filter head material:	GDAL
Filter housing material:	AL/St
Sealing material:	NBR/AL
Indicating range	
vacuum gauge:	-1 bar to -1.5 bar
Pressure setting vacuum switch:	-200 mbar
Electrical data of vacuum switch PiS 3070:	
Max. voltage:	230 V AC/DC
Max. current:	6 A
Contact:	change-over switch
Electrical connections:	AMP 6.3 DIN 46248 for bushings according to DIN 46247
Fitting position:	any fitting positions possible (fitting position has to be defined when ordering indicators with defined switch point)
Type of protection:	IP 00 without protecting cap IP 54 with protecting cap



In = Inlet
Out = Outlet

1 = Vacuum switch
2 = Vacuum gauge

Subject to technical alteration without prior notice.

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.

9. Dimensions

All dimensions except "C" in mm.

Type	B	C*	D	F	G SW	H	I	K	M	N	O	P	Weight [kg]
Pi 2005	19	G $\frac{1}{2}$	177	80	27	66	80	95	45	13.0	M8x10	37.5	0.9
Pi 2008	19	G $\frac{3}{4}$	253	80	27	66	80	95	45	13.0	M8x10	37.5	1.0
Pi 2011	19	G $\frac{3}{4}$	335	80	27	66	80	95	45	13.0	M8x10	37.5	1.1
Pi 2015	30	G1 $\frac{1}{4}$	244	110	32	109	128	150	60	24.5	M12x15	43.5	2.1
Pi 2030	30	G1 $\frac{1}{4}$	360	110	32	109	128	150	60	24.5	M12x15	43.5	2.4
Pi 2045	30	G1 $\frac{1}{4}$	475	110	24	109	128	150	60	24.5	M12x15	43.5	6.5

* NPT and SAE connections on request

10. Installation, operating and maintenance instructions

10.1 Filter installation

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

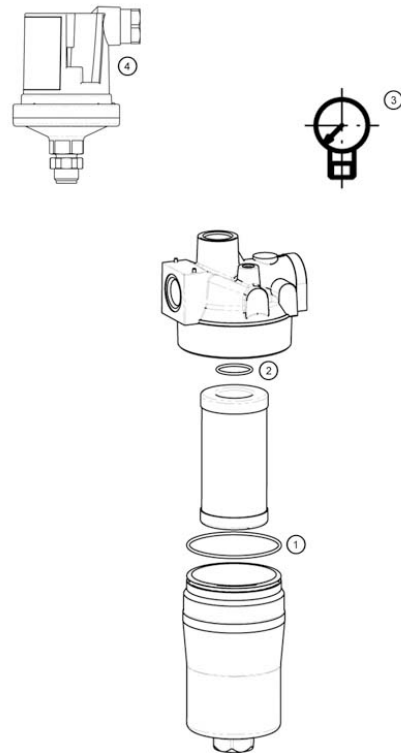
The maintenance indicator must be visible.

10.2 When should the filter element be replaced?

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

10.3 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.



11. Spare parts list

Order numbers of spare parts		
Position	Type	Order number
① to ②	Seal kit for housing	
	Pi 2005 - Pi 2011	
	NBR	77550213
	FPM	77845795
	EPDM	77845803
	Pi 2015 - Pi 2045	
	NBR	77550221
	FPM	77845811
③	Vacuum gauge	
	NG 40 G 1/8	76345763
④	Vacuum switch	
	PiS 3070	77669724

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www.mahle-industriefiltration.com
70364038.05/2012

MAHLE

Industry

Low Pressure Filter/Suction Filter

Pi 220

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

1. Features

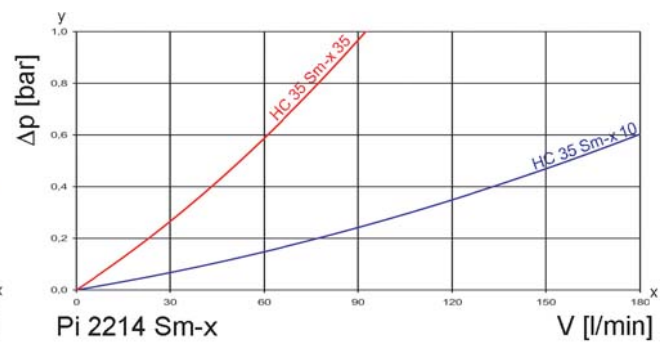
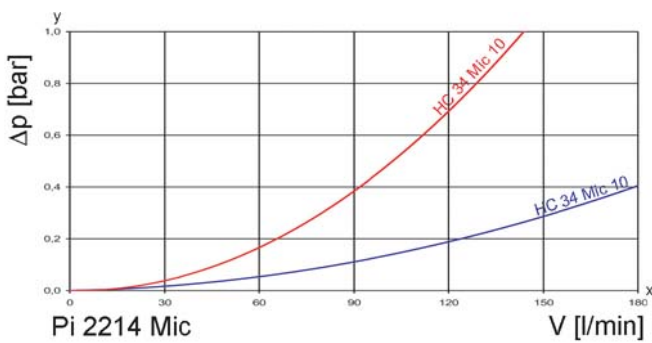
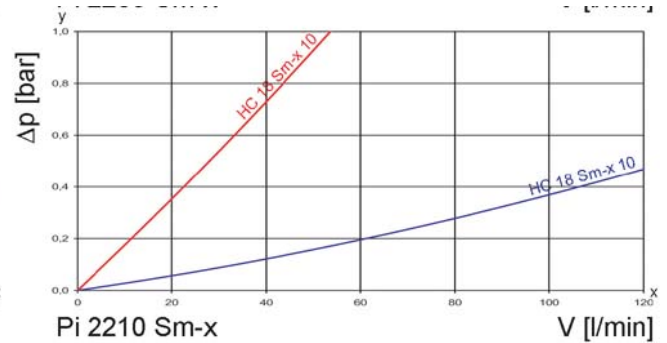
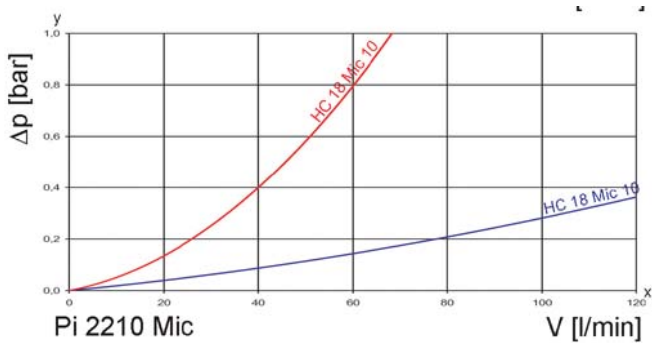
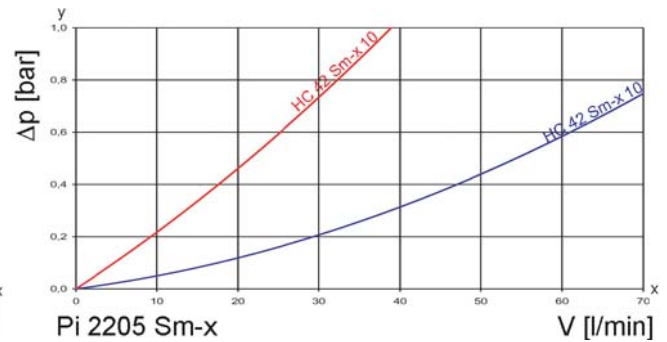
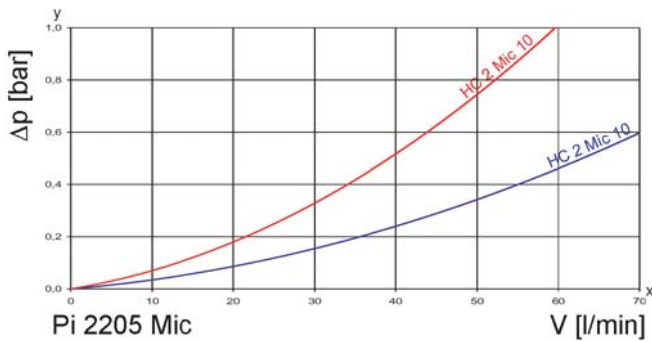
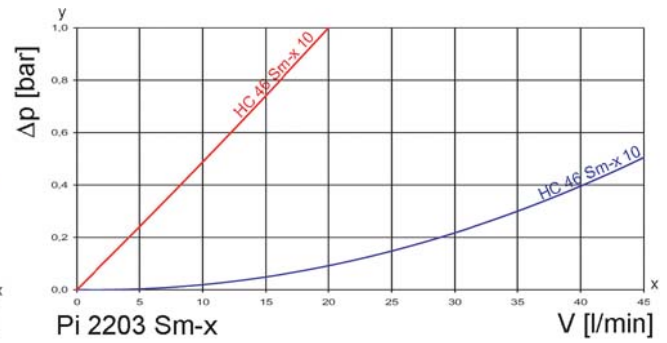
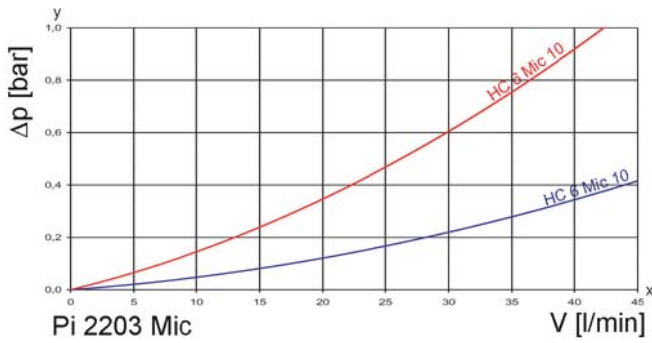
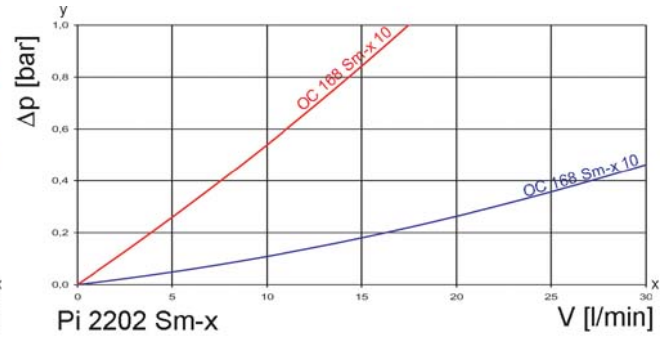
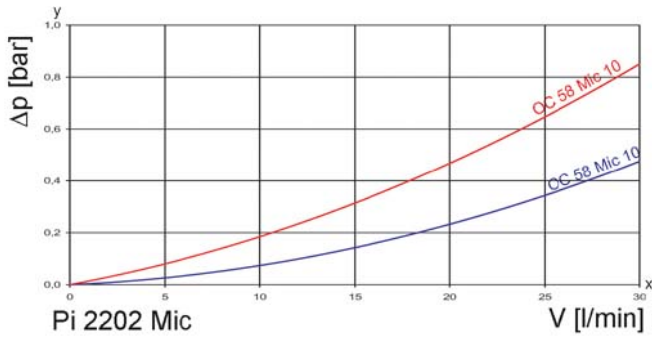
High performance filters for modern hydraulic systems

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



2. Flow rate/pressure drop curve complete filter

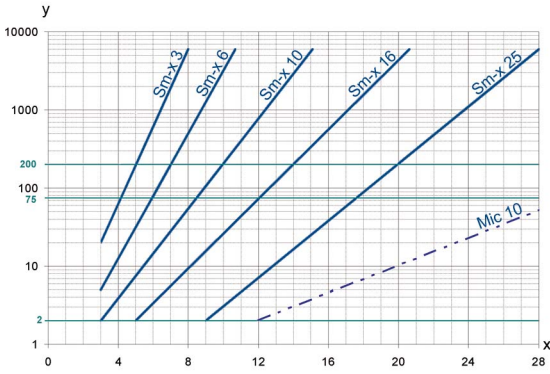
■ 190 mm²/s
■ 33 mm²/s



y = differential pressure Δp [bar]

x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value
x = particle size [µm]

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

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x-elements with
max. Δp 5 bar

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

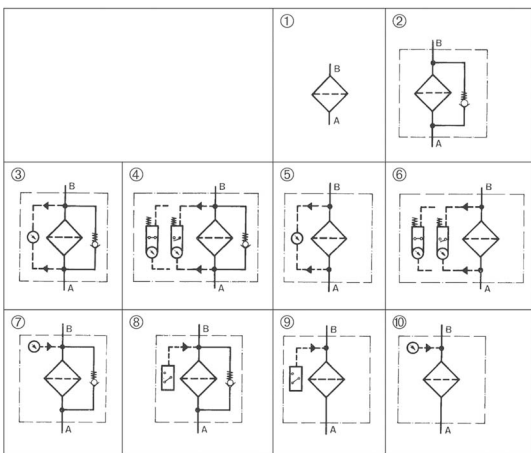
values guaranteed up to
5 bar differential pressure

5. Quality assurance

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

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

6. Symbols



7. Order numbers

Example for ordering filters:

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

7.1 Housing design/order number for pressure-side installation

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

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

7.2 Spin-on cartridges

Nominal size NG [l/min] Press./Suct. side	Order number	Type	Filter material	max. Δp [bar]	Filter surface [cm ²]
25/10	77785983	OC 58	Mic 10	5	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	⑦	⑧	⑨	⑩
				with bypass 0.25 bar	with bypass 0.25 bar and vacuum gauge	with bypass 0.25 bar and vacuum switch	with vacuum switch	with vacuum gauge
10	77665656	Pi 2202-060						
	77736614	Pi 2202-067						
	77736622	Pi 2202-062						
	77736630	Pi 2202-061						
	77736606	Pi 2202-065						
	77736598	Pi 2202-066						
16	77665714	Pi 2203-060						
	77665730	Pi 2203-067						
	77736689	Pi 2203-062						
	77736697	Pi 2203-061						
	77736671	Pi 2203-065						
	77665722	Pi 2203-066						
25	77665813	Pi 2205-060						
	77736747	Pi 2205-067						
	77665821	Pi 2205-062						
	77736754	Pi 2205-061						
	77665839	Pi 2205-065						
	77736739	Pi 2205-066						
40	77666001	Pi 2210-060						
	77735947	Pi 2210-067						
	77666027	Pi 2210-062						
	77666019	Pi 2210-061						
	77666035	Pi 2210-065						
	77666043	Pi 2210-066						
63	77666126	Pi 2214-060						
	77666175	Pi 2214-067						
	77666142	Pi 2214-062						
	77666134	Pi 2214-061						
	77666159	Pi 2214-065						
	77666167	Pi 2214-066						

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

8. Technical specifications

Design: line mounting filter
 Nominal pressure: 10 bar (140 psi)*
 Test pressure: 13 bar (180 psi)
 Temperature range: -10 °C to +120 °C
 (other temperature ranges on request)

Bypass setting:
 Pressure side: Δp 3.5 bar \pm 10%
 Suction side: Δp 0.25 bar \pm 10%
 Filter head material: GDAL
 Filter housing material: St
 Sealing material: NBR/AL
 Maintenance indicator setting: Δp 2.2 bar \pm 0.3 bar
 Indicating range vacuum meter: -1 bar to +1.5 bar
 Pressure setting vacuum switch: 200 mbar
 Type of protection (suction side): IP 54
 Electrical data of maintenance indicator:
 Max. voltage: 250 V AC/200 V DC
 Max. current: 1 A
 Contact load: 70 W
 Type of protection: IP 65 in inserted and secured status

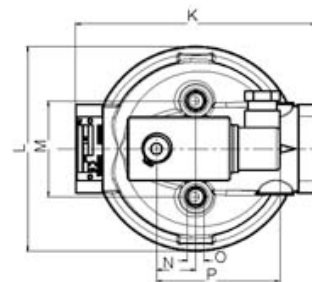
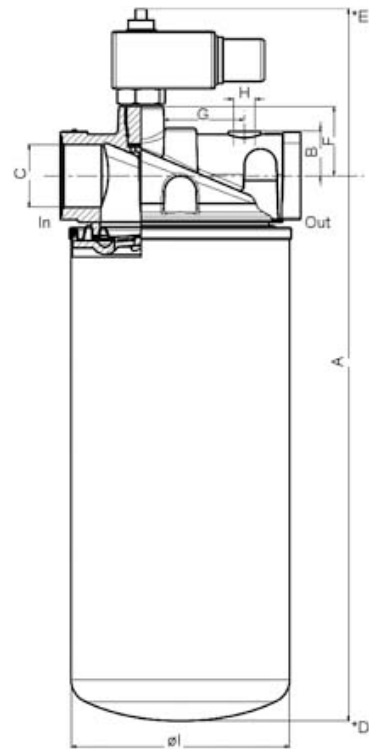
Contact: normally open/closed
 Cable sleeve: M20x1.5

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

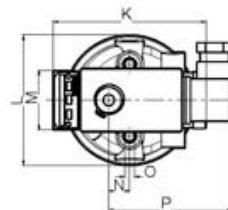
We draw attention to the fact that all values indicated are average values which do not always occur in specific cases of application. Our products are continually being further developed. Values, dimensions and weights can change as a result of this. Our specialized department will be pleased to offer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

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

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



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	G $\frac{1}{2}$	30	45	37.5	23.5	G $\frac{1}{8}$	76	95	80	45	13.0	M8x10	78	0.90
Pi 2203	261	19	G $\frac{1}{2}$	30	45	37.5	23.5	G $\frac{1}{8}$	93	95	80	45	13.0	M8x10	78	1.00
Pi 2205	328	19	G $\frac{3}{4}$	30	45	37.5	23.5	G $\frac{1}{8}$	93	95	80	45	13.0	M8x10	78	1.25
Pi 2210	302	30	G $\frac{1}{4}$	40	45	43.5	40.0	G $\frac{1}{8}$	136	150	128	60	24.5	M12x15	78	2.30
Pi 2214	442	30	G $\frac{1}{4}$	40	45	43.5	40.0	G $\frac{1}{8}$	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 cartridge. Filter should be installed with the spin-on cartridge pointing downwards.

The maintenance indicator must be visible.

10.2 Connecting the electrical maintenance indicator

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

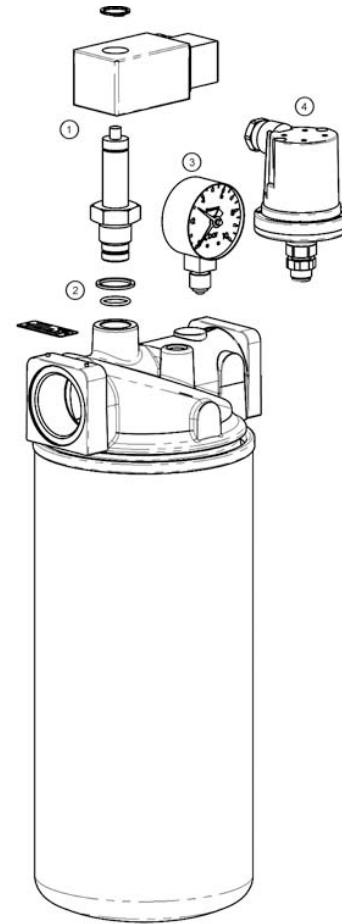
The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

10.3 When should the filter element be replaced?

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

10.4 Spin-on cartridge exchange

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



11. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
①	Maintenance indicator	
	Visual PiS 3098	77669971
	Electrical PiS 3097	77669948
	Electrical upper part only	77536550
②	Seal kit for maintenance indicator	
	NBR	77760309
③	Vacuum gauge	76345763
④	Vacuum switch PiS 3070	77669724

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78356610.03/2012

MAHLE

Industry

Low Pressure Filter/Suction Filter

Pi 270

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

1. Features

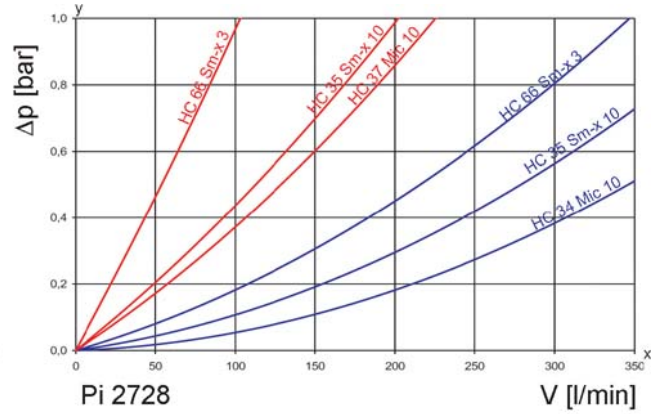
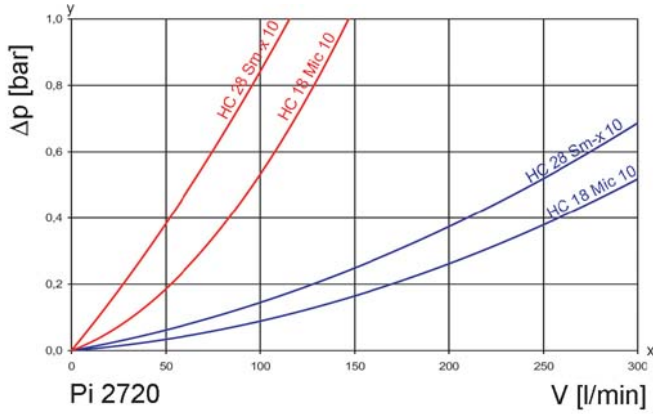
High performance filters for modern hydraulic systems

- 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

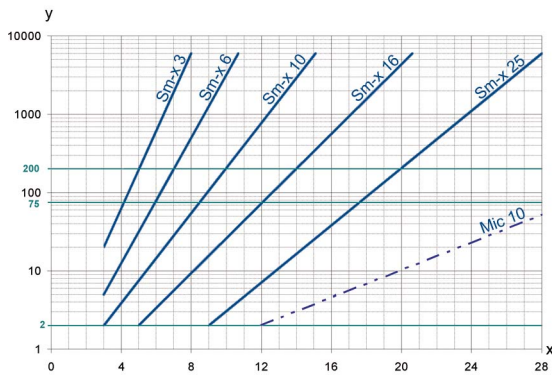
190 mm²/s
33 mm²/s



y = differential pressure Δp [bar]

x = flow rate V [l/min]

3. Separation grade characteristics



y = beta-value

x = particle size [μm]

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

4. Filter performance data

tested according to ISO 16889 (multipass test)

Sm-x elements with max. Δp 5 bar

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

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

values guaranteed up to 5 bar differential pressure

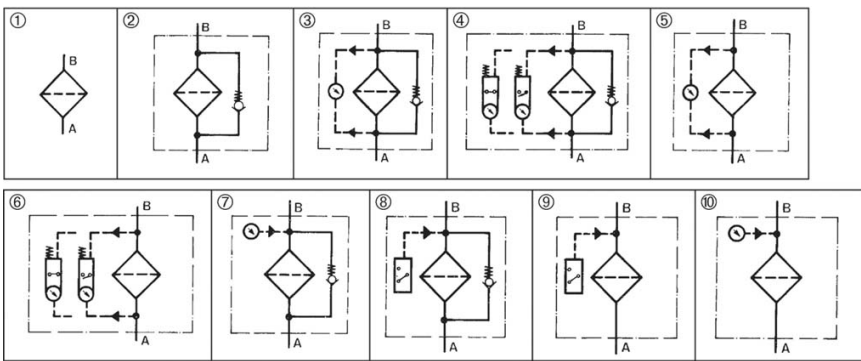
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5. Quality assurance

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

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

6. Symbols



7. Order numbers

Example for ordering filters:

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

7.1 Housing design/order numbers for pressure side installation

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

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

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

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

7.3 Housing design/order numbers for suction side installation

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

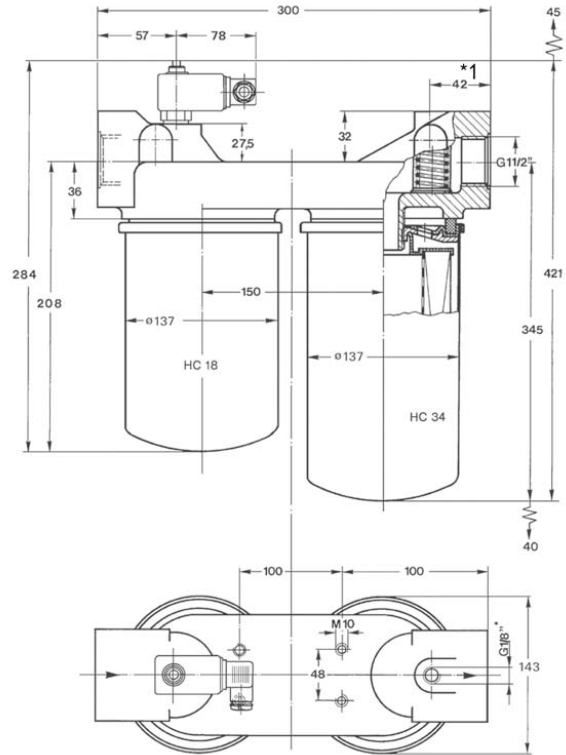
When filter with non bypass configuration is selected Δp of 5 bar may not be exceeded.

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

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

8. Technical specifications

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



*1 only existing at suction side design

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

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

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

Subject to technical alteration without prior notice.

9. Installation, operating and maintenance instructions

9.1 Filter installation

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

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.

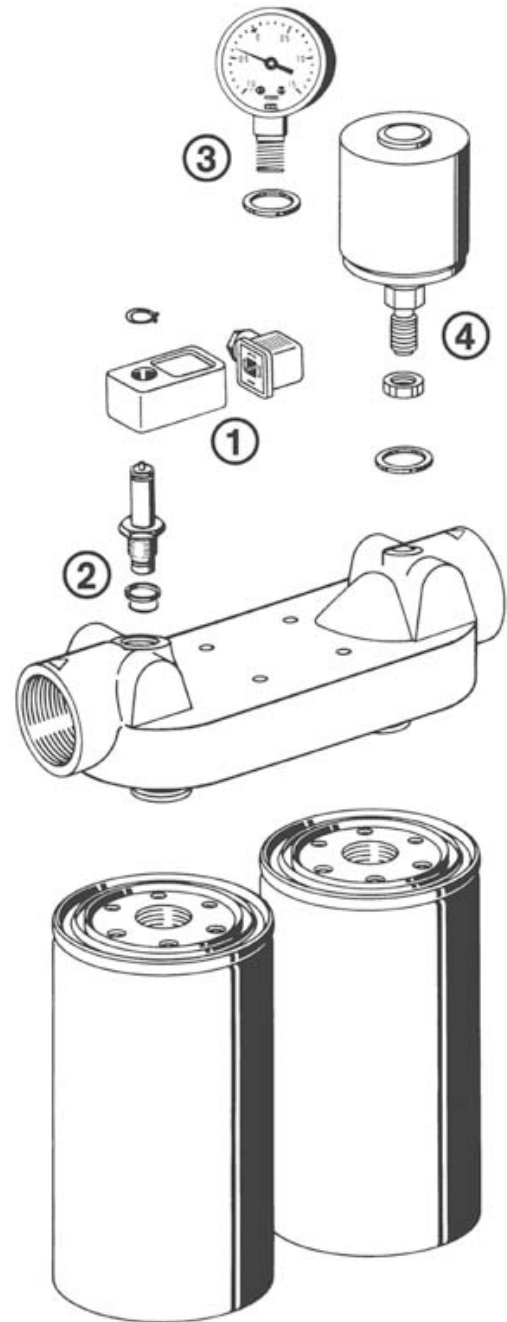
The electrical section can be inverted to change from normally open position to normally closed position or vice versa.

9.3 When should the filter element be replaced?

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

9.4 Spin-on cartridge replacement

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



10. Spare parts list

Order numbers for spare parts		
Position	Type	Order number
①	Maintenance indicator	
	Visual PiS 3098/2.2	77669971
	Electrical PiS 3097/2.2	77669948
②	Electrical upper section only	77536550
	Seal kit for maintenance indicator	
③	NBR	77760309
	Vacuum gauge	76345763
④	Vacuum switch	
	PiS 3070/200 mbar	77669724

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