

# Duplex Filter

## Pi 210

Operating pressure 25 (63) bar, Nominal size up to 450

### 1. Features

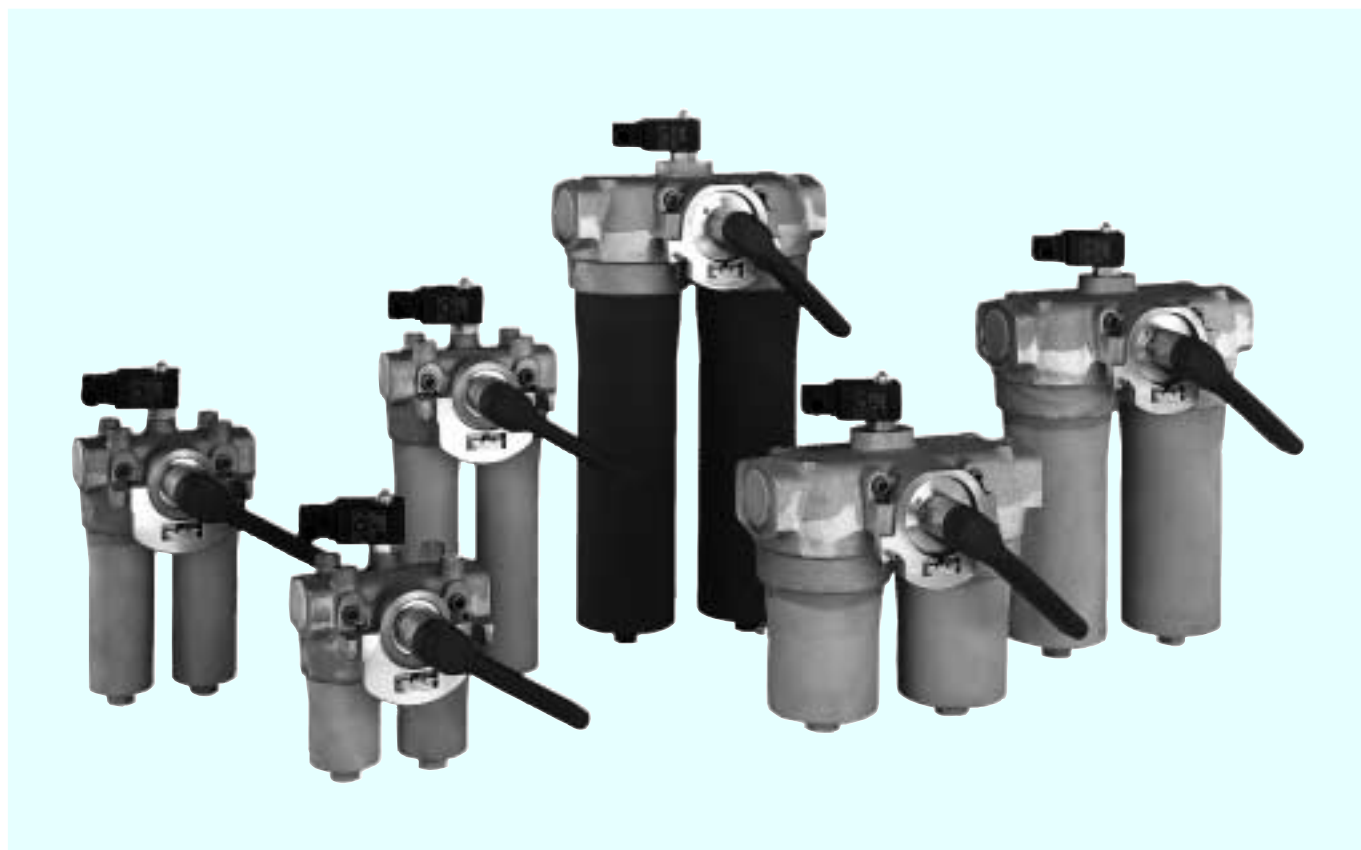
#### Efficient filters for modern hydraulic systems

- Modular design
- Minimal pressure loss
- Compact design
- Visual / electrical / electronic differential pressure indication
- Threaded or SAE 4 bolt flange ports
- Switching valve on upstream side
- Ergonomic switch-over handle with safety lock and pressure compensation
- User-optimized one-hand-operation

#### Quality filters, easy to service

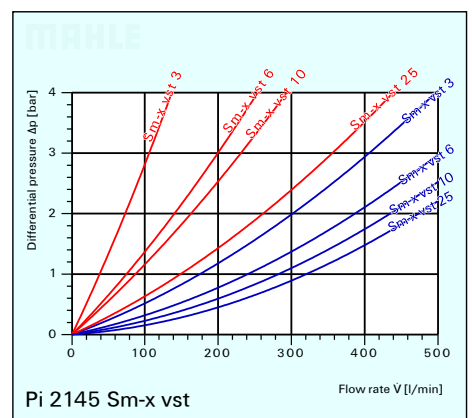
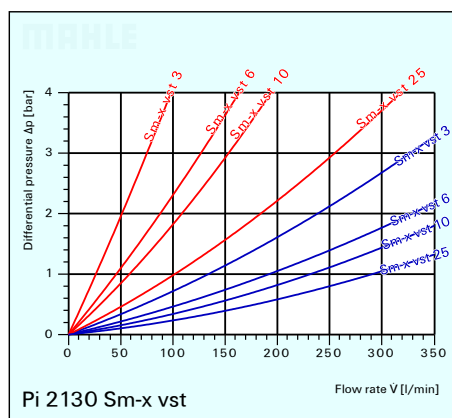
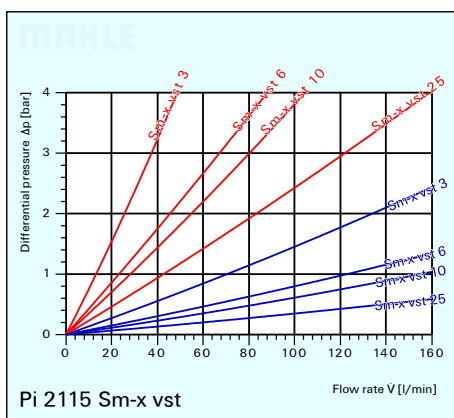
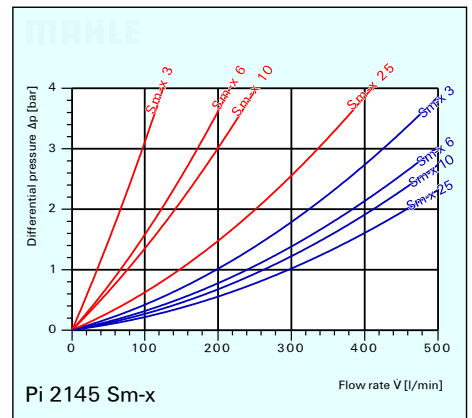
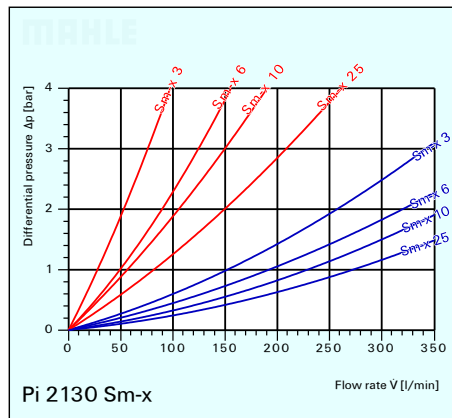
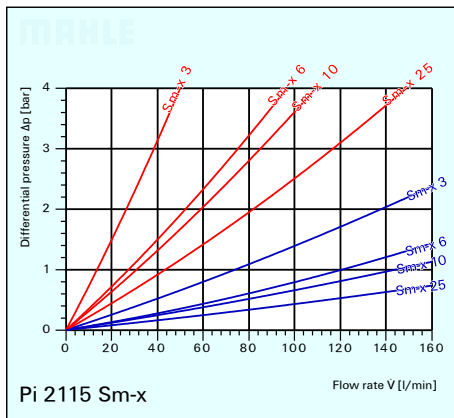
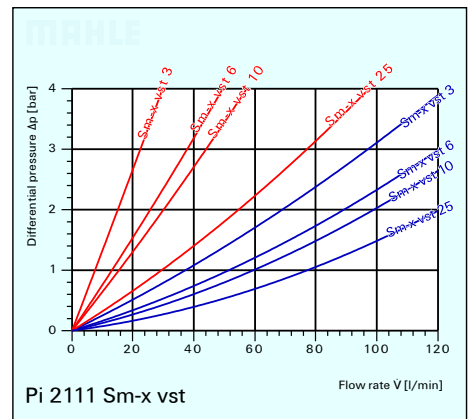
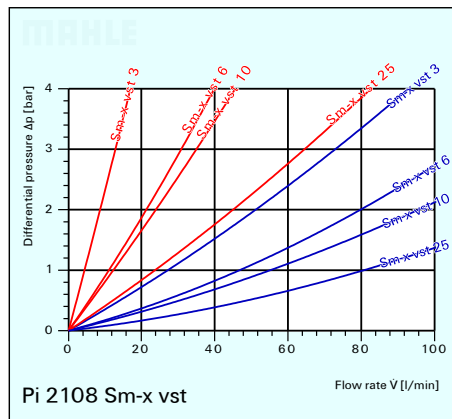
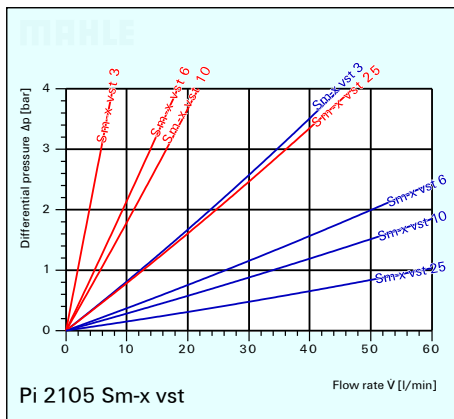
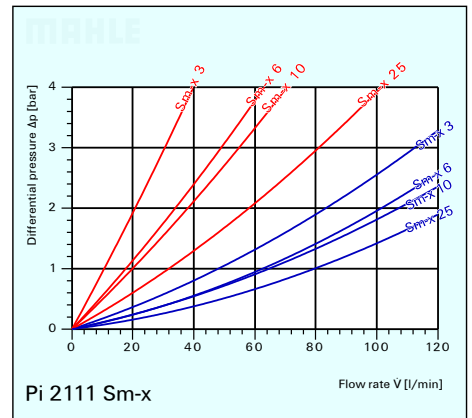
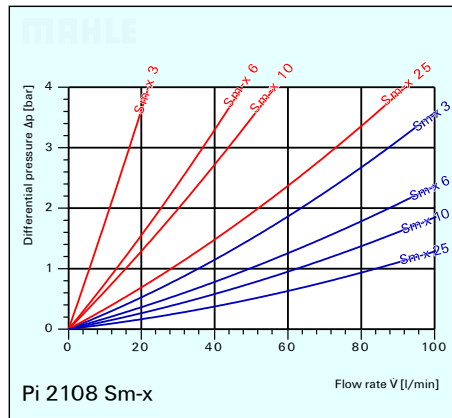
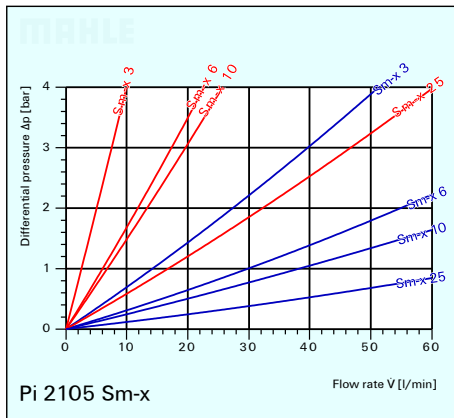
- Highly efficient Sm-x filter elements
- $\beta$ -rated elements per ISO 4572
- Large dirt holding capacity and high differential pressure stability providing optimal element service life

#### World-wide sales

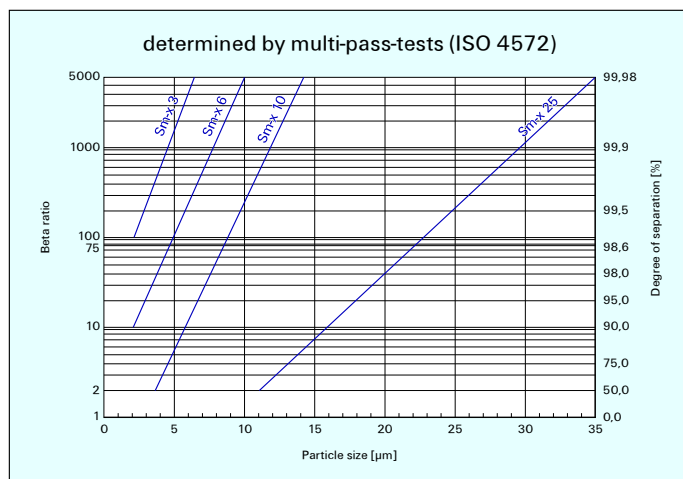


## 2. Flow rate / pressure drop curve compl. filter

■ 190 mm<sup>2</sup>/s (25 ° E)  
■ 33 mm<sup>2</sup>/s (4,5 ° E)



### 3. Separation characteristics



### 4. Filter performance data

tested according to ISO 4572 (multi-pass-test)

Sm-x-elements  
with  $\Delta p$  20 bar

Sm-x 3  $\beta_3 \geq 75$   
 Sm-x 6  $\beta_6 \geq 75$   
 Sm-x 10  $\beta_{10} \geq 75$   
 Sm-x 25  $\beta_{25} \geq 75$

at 7 bar differential pressure

Sm-x-vst-elements  
with  $\Delta p$  210 bar

Sm-x vst 3  $\beta_3 \geq 75$   
 Sm-x vst 6  $\beta_6 \geq 75$   
 Sm-x vst 10  $\beta_{10} \geq 75$   
 Sm-x vst 25  $\beta_{25} \geq 75$

at 16 bar differential pressure

Example for ordering filters:

Housing design with  $\dot{V} = 80$  l/min, electrical indicator  
 type no. **Pi 2108-069**

order-no. **781.028.6**

+ Filter element Sm-x vst 3  
 type no. **Pi 2208**

order-no. **768.020.0**

### 7. Order numbers

#### 7.1 Housing design

| Order number | Type number | Nominal size NG [l/min] | ①<br>with bypass valve<br>and visual<br>indicator | ②<br>with bypass valve<br>and visual/<br>electrical indicator | ③<br>with<br>visual<br>indicator | ④<br>with<br>visual/electrical<br>indicator |  |
|--------------|-------------|-------------------------|---------------------------------------------------|---------------------------------------------------------------|----------------------------------|---------------------------------------------|--|
| 781.021.1    | Pi 2105-057 | <b>50</b>               |                                                   |                                                               |                                  |                                             |  |
| 781.022.9    | Pi 2105-058 |                         |                                                   |                                                               |                                  |                                             |  |
| 781.023.7    | Pi 2105-068 |                         |                                                   |                                                               |                                  |                                             |  |
| 781.024.5    | Pi 2105-069 |                         |                                                   |                                                               |                                  |                                             |  |
| 781.025.2    | Pi 2108-057 | <b>80</b>               |                                                   |                                                               |                                  |                                             |  |
| 781.026.0    | Pi 2108-058 |                         |                                                   |                                                               |                                  |                                             |  |
| 781.027.8    | Pi 2108-068 |                         |                                                   |                                                               |                                  |                                             |  |
| 781.028.6    | Pi 2108-069 |                         |                                                   |                                                               |                                  |                                             |  |
| 820.408.3    | Pi 2111-057 | <b>110</b>              |                                                   |                                                               |                                  |                                             |  |
| 820.409.1    | Pi 2111-058 |                         |                                                   |                                                               |                                  |                                             |  |
| 820.410.9    | Pi 2111-068 |                         |                                                   |                                                               |                                  |                                             |  |
| 820.411.7    | Pi 2111-069 |                         |                                                   |                                                               |                                  |                                             |  |
| 777.457.3    | Pi 2115-057 | <b>150</b>              |                                                   |                                                               |                                  |                                             |  |
| 777.456.5    | Pi 2115-058 |                         |                                                   |                                                               |                                  |                                             |  |
| 777.455.7    | Pi 2115-068 |                         |                                                   |                                                               |                                  |                                             |  |
| 777.454.0    | Pi 2115-069 |                         |                                                   |                                                               |                                  |                                             |  |
| 777.453.2    | Pi 2130-057 | <b>300</b>              |                                                   |                                                               |                                  |                                             |  |
| 777.452.4    | Pi 2130-058 |                         |                                                   |                                                               |                                  |                                             |  |
| 777.451.6    | Pi 2130-068 |                         |                                                   |                                                               |                                  |                                             |  |
| 777.450.8    | Pi 2130-069 |                         |                                                   |                                                               |                                  |                                             |  |
| 777.449.0    | Pi 2145-057 | <b>450</b>              |                                                   |                                                               |                                  |                                             |  |
| 777.448.2    | Pi 2145-058 |                         |                                                   |                                                               |                                  |                                             |  |
| 777.447.4    | Pi 2145-068 |                         |                                                   |                                                               |                                  |                                             |  |
| 777.446.6    | Pi 2145-069 |                         |                                                   |                                                               |                                  |                                             |  |

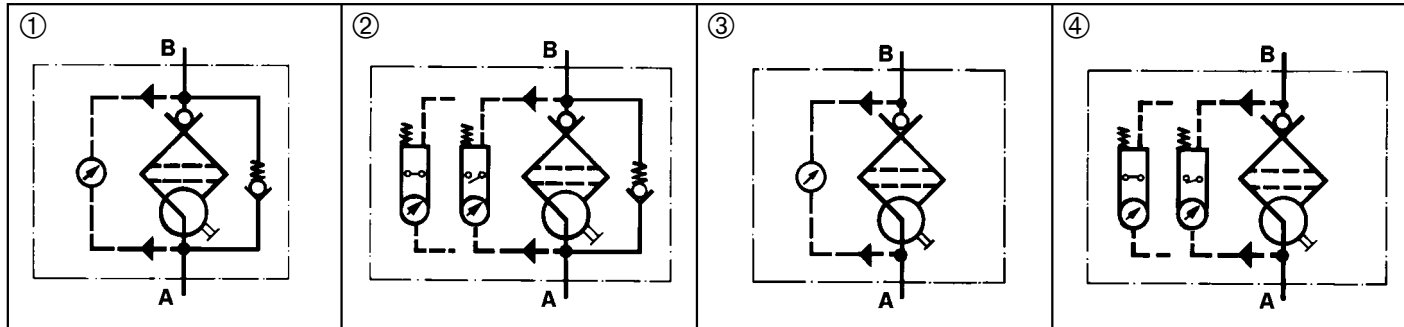
When filter with non bypass configuration is selected, the collapse pressure of the element may not be exceeded

## 5. Test regulations

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

| No.       | Designation                                                                             |
|-----------|-----------------------------------------------------------------------------------------|
| ISO 2941  | Hydraulic-filter elements: Verification of burst resistance                             |
| ISO 2942  | Hydraulic-filter elements: Determination of fabrication integrity                       |
| ISO 2943  | Hydraulic-filter elements: Verification of material compatibility with hydraulic fluids |
| ISO 3723  | Hydraulic-filter elements: Method for testing end-cap load                              |
| ISO 3724  | Hydraulic-filter elements: Verification of flow fatigue characteristics                 |
| ISO 39682 | Hydraulic-filters: Evaluation of pressure drop versus flow                              |
| ISO 4572  | Hydraulic-filter elements: Testing of filter performance (multi-pass-test)              |

## 6. Symbols



### 7.2 Filter elements\*

( ) = filter surface area [ ] = type number

| Sm-x 3<br>Δp 20 bar      | Sm-x 6<br>Δp 20 bar      | Sm-x 10<br>Δp 20 bar     | Sm-x 25<br>Δp 20 bar     | Sm-x vst 3<br>Δp 210 bar | Sm-x vst 6<br>Δp 210 bar | Sm-x vst 10<br>Δp 210 bar | Sm-x vst 25<br>Δp 210 bar |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|---------------------------|---------------------------|
| ( 590 cm <sup>2</sup> )  | ( 590 cm <sup>2</sup> )  | ( 590 cm <sup>2</sup> )  | ( 590 cm <sup>2</sup> )  | ( 470 cm <sup>2</sup> )  | ( 470 cm <sup>2</sup> )  | ( 470 cm <sup>2</sup> )   | ( 470 cm <sup>2</sup> )   |
| 768.013.5                | 794.350.9                | 768.032.5                | 768.044.0                |                          |                          |                           |                           |
| 768.013.5                | 794.350.9                | 768.032.5                | 768.044.0                | [Pi 2205]                | [Pi 5205]                | [Pi 3205]                 | [Pi 4205]                 |
| [Pi 2105]                | [Pi 5105]                | [Pi 3105]                | [Pi 4105]                | 768.019.2                | 794.353.3                | 768.038.2                 | 768.050.7                 |
|                          |                          |                          |                          | 768.019.2                | 794.353.3                | 768.038.2                 | 768.050.7                 |
| ( 1150 cm <sup>2</sup> ) | ( 1150 cm <sup>2</sup> ) | ( 1150 cm <sup>2</sup> ) | ( 1150 cm <sup>2</sup> ) | ( 900 cm <sup>2</sup> )  | ( 900 cm <sup>2</sup> )  | ( 900 cm <sup>2</sup> )   | ( 900 cm <sup>2</sup> )   |
| 768.014.3                | 794.351.7                | 768.034.1                | 768.045.7                |                          |                          |                           |                           |
| 768.014.3                | 794.351.7                | 768.034.1                | 768.045.7                | [Pi 2208]                | [Pi 5208]                | [Pi 3208]                 | [Pi 4208]                 |
| [Pi 2108]                | [Pi 5108]                | [Pi 3108]                | [Pi 4108]                | 768.020.0                | 794.354.1                | 768.119.0                 | 768.051.5                 |
|                          |                          |                          |                          | 768.020.0                | 794.354.1                | 768.119.0                 | 768.051.5                 |
| ( 1700 cm <sup>2</sup> ) | ( 1700 cm <sup>2</sup> ) | ( 1700 cm <sup>2</sup> ) | ( 1700 cm <sup>2</sup> ) | ( 1315 cm <sup>2</sup> ) | ( 1315 cm <sup>2</sup> ) | ( 1315 cm <sup>2</sup> )  | ( 1315 cm <sup>2</sup> )  |
| 768.015.0                | 794.352.5                | 768.033.3                | 768.046.5                |                          |                          |                           |                           |
| 768.015.0                | 794.352.5                | 768.033.3                | 768.046.5                | [Pi 2211]                | [Pi 5211]                | [Pi 3211]                 | [Pi 4211]                 |
| [Pi 2111]                | [Pi 5111]                | [Pi 3111]                | [Pi 4111]                | 768.021.8                | 794.355.8                | 768.039.0                 | 768.052.3                 |
|                          |                          |                          |                          | 768.021.8                | 794.355.8                | 768.039.0                 | 768.052.3                 |
| ( 2350 cm <sup>2</sup> ) | ( 2350 cm <sup>2</sup> ) | ( 2350 cm <sup>2</sup> ) | ( 2350 cm <sup>2</sup> ) | ( 2010 cm <sup>2</sup> ) | ( 2010 cm <sup>2</sup> ) | ( 2010 cm <sup>2</sup> )  | ( 2010 cm <sup>2</sup> )  |
| 768.016.8                | 795.509.9                | 768.035.8                | 768.047.3                |                          |                          |                           |                           |
| 768.016.8                | 795.509.9                | 768.035.8                | 768.047.3                | [Pi 2215]                | [Pi 5215]                | [Pi 3215]                 | [Pi 4215]                 |
| [Pi 2115]                | [Pi 5115]                | [Pi 3115]                | [Pi 4115]                | 768.022.6                | 795.512.3                | 768.040.8                 | 768.053.1                 |
|                          |                          |                          |                          | 768.022.6                | 795.512.3                | 768.040.8                 | 768.053.1                 |
| ( 4420 cm <sup>2</sup> ) | ( 4420 cm <sup>2</sup> ) | ( 4420 cm <sup>2</sup> ) | ( 4420 cm <sup>2</sup> ) | ( 3800 cm <sup>2</sup> ) | ( 3800 cm <sup>2</sup> ) | ( 3800 cm <sup>2</sup> )  | ( 3800 cm <sup>2</sup> )  |
| 768.017.6                | 795.510.7                | 768.036.6                | 768.048.1                |                          |                          |                           |                           |
| 768.017.6                | 795.510.7                | 768.036.6                | 768.048.1                | [Pi 2230]                | [Pi 5230]                | [Pi 3230]                 | [Pi 4230]                 |
| [Pi 2130]                | [Pi 5130]                | [Pi 3130]                | [Pi 4130]                | 768.023.4                | 795.513.1                | 768.041.6                 | 768.054.9                 |
|                          |                          |                          |                          | 768.023.4                | 795.513.1                | 768.041.6                 | 768.054.9                 |
| ( 6540 cm <sup>2</sup> ) | ( 6540 cm <sup>2</sup> ) | ( 6540 cm <sup>2</sup> ) | ( 6540 cm <sup>2</sup> ) | ( 5600 cm <sup>2</sup> ) | ( 5600 cm <sup>2</sup> ) | ( 5600 cm <sup>2</sup> )  | ( 5600 cm <sup>2</sup> )  |
| 768.018.4                | 795.511.5                | 768.037.4                | 768.049.9                |                          |                          |                           |                           |
| 768.018.4                | 795.511.5                | 768.037.4                | 768.049.9                | [Pi 2245]                | [Pi 5245]                | [Pi 3245]                 | [Pi 4245]                 |
| [Pi 2145]                | [Pi 5145]                | [Pi 3145]                | [Pi 4145]                | 768.024.2                | 795.514.9                | 768.042.4                 | 768.055.6                 |
|                          |                          |                          |                          | 768.024.2                | 795.514.9                | 768.042.4                 | 768.055.6                 |

\*further elements upon request

8. Specifications

|                                                                           |                                                             |
|---------------------------------------------------------------------------|-------------------------------------------------------------|
| Design:                                                                   | line mounting filter                                        |
| Nominal pressure:                                                         | 25 bar*                                                     |
| Test pressure:                                                            | 33 bar                                                      |
| Temperature range:                                                        | - 10 °C to +120 °C<br>(other temperature ranges on request) |
| Bypass opening pressure:                                                  | $\Delta p$ 3,5 bar $\pm$ 10 %                               |
| Filter head material:                                                     | GAL                                                         |
| Filter bowl material:                                                     | AL / St                                                     |
| Material of seals:                                                        | NBR / AL                                                    |
| Activating pressure of visual/electrical differential pressure indicator: | $\Delta p$ 2,2 bar $\pm$ 0,3 bar                            |
| Electrical data of contamination indicator:                               |                                                             |
| Maximum voltage:                                                          | 230 V ~/=                                                   |
| Maximum current on contact:                                               | 2,5 A                                                       |
| Maximum contact load:                                                     | 60 VA / 40 W                                                |
| Inrush current:                                                           | 70 VA                                                       |
| Type of protection:                                                       | IP 65 when inserted and secured                             |
| Contact:                                                                  | bistable                                                    |
| Cable connection:                                                         | PG 11 $\varnothing$ 6-10                                    |

The electrical indicator function can be changed from the Normally Open position to the Normally Closed position or visa versa by inverting the electrical section.

With the inrush current of 70 VA the indicator can trigger small contactors or contactor relays.

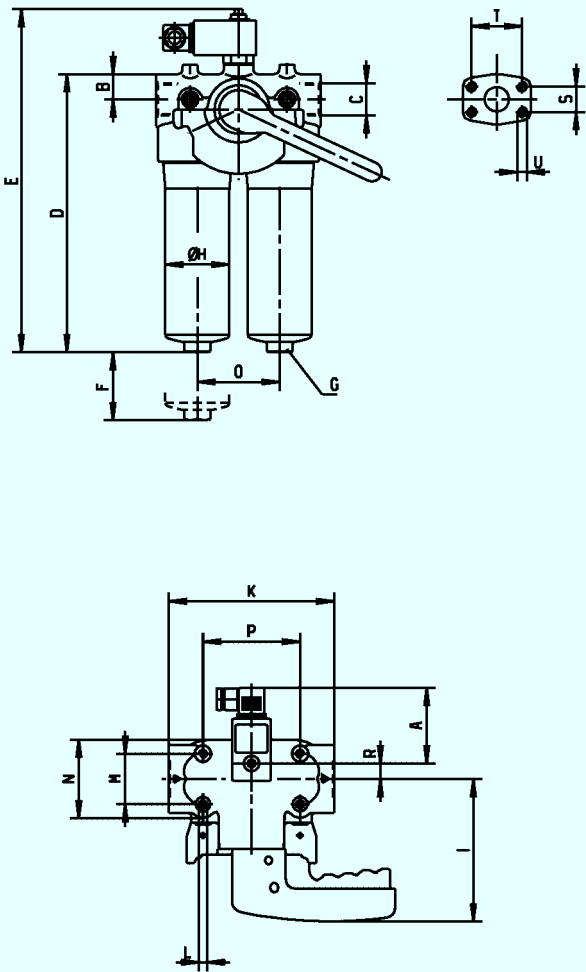
Inductivity in the direct current may require the use of a signal eraser.

For further information and executions please see our leaflet: "Contamination indicators".

Filters compatible with standard mineral oils.

Please contact us in case of using other media.

\*The housings Pi 2105, Pi 2108 and Pi 2111 are approved for 63 bar operating pressure (test pressure 82 bar).



9. Dimensions

All dimensions (except "C") in mm

| Dimension<br>Type | A  | B  | C     | D   | E   | F   | G     | H   | I   | K   | L         | M  | N   | O   | P   | R  | Weight<br>[kg] |
|-------------------|----|----|-------|-----|-----|-----|-------|-----|-----|-----|-----------|----|-----|-----|-----|----|----------------|
| Pi 2105           | 78 | 38 | G 1*  | 200 | 258 | 80  | SW 27 | 66  | 139 | 168 | M 8 x 16  | 52 | 81  | 85  | 100 | 16 | 2,6            |
| Pi 2108           | 78 | 38 | G 1*  | 276 | 334 | 80  | SW 27 | 66  | 139 | 168 | M 8 x 16  | 52 | 81  | 85  | 100 | 16 | 2,9            |
| Pi 2111           | 78 | 38 | G 1*  | 358 | 416 | 80  | SW 27 | 66  | 139 | 168 | M 8 x 16  | 52 | 81  | 85  | 100 | 16 | 3,3            |
| Pi 2115           | 78 | 40 | G 1½* | 269 | 327 | 110 | SW 32 | 109 | 165 | 280 | M 10 x 20 | 62 | 140 | 140 | 210 | 19 | 7,1            |
| Pi 2130           | 78 | 40 | G 1½* | 386 | 444 | 110 | SW 32 | 109 | 165 | 280 | M 10 x 20 | 62 | 140 | 140 | 210 | 19 | 8,0            |
| Pi 2145           | 78 | 40 | G 1½* | 501 | 559 | 110 | SW 24 | 109 | 165 | 280 | M 10 x 20 | 62 | 140 | 140 | 210 | 19 | 16,0           |

\*SAE flange connections (3000 PSI) on request

## 10. Installation, Operating and Servicing Instructions

### 10.1 Filter installation

Install filter in accordance with the identified flow direction. The filter head is provided with threaded holes for mounting the filter. Ascertain that the required removal height is provided so that the filter element and the filter bowl can be removed.

Preferably the filter should be installed with the filter bowl pointing down.

The contamination indicator must be well visible.

### 10.2 Connecting the electrical contamination 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 visa versa.

### 10.3 When must the filter element be replaced?

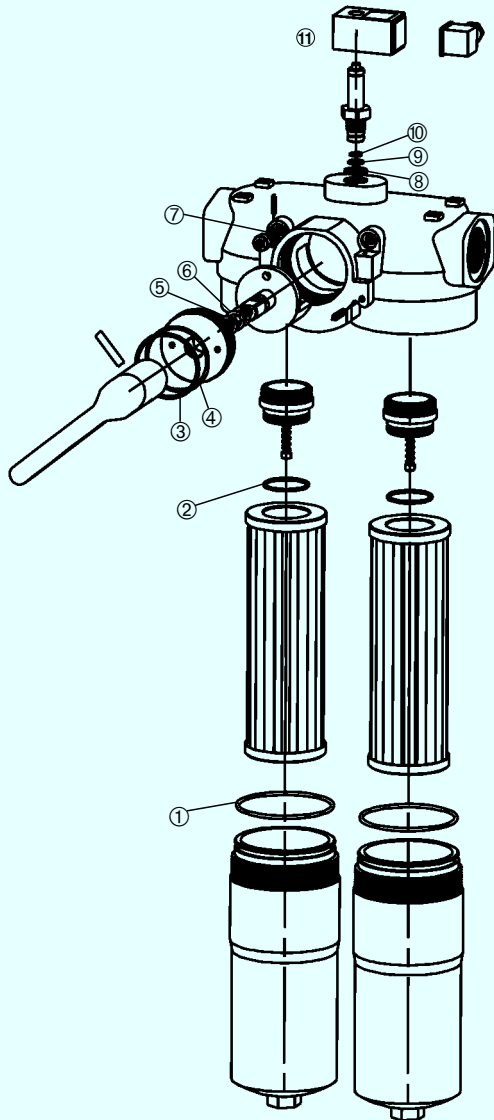
1. During cold starts, the indicator may give a warning signal. Depress the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops out again and/or the electrical signal has not switched off after reaching operating temperature,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

### 10.4 Element replacement

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

1. Operate and hold pressure equalizing lever located in the switching lever. Swivel switching lever. Engage the catch. Place trough or drip pan underneath to collect leaking oil.
2. Loosen vent screw of the filter side not in use by 2–3 turns; maximum back out against safety stop.
3. Unscrew filter bowl by rotating same counterclockwise and clean with a suitable medium.
4. Remove filter element with a side-to-side motion.
5. Check O-ring on the filter bowl and the spigot for damage. Replace, if necessary.
6. Make sure that the part number on the spare element corresponds with the part number on the filter label. Open the plastic bag and push element over the spigot in the filter head. Now remove plastic bag.
7. Complete installation by screwing on the bowl, turning clockwise until it comes to a full stop. Back off the bowl  $\frac{1}{8}$  to  $\frac{1}{2}$  turn.
8. To refill the filter chamber, operate only the pressure equalizing lever long enough for the medium to emerge bubble-free from the vent bore.
9. Tighten vent screw. Check filter for leaks by operating the pressure equalizing lever once again.

Subject to technical alteration.



## 11. Spare parts list

| Pos.   | Type number/housing                                                                      |                                                              |                                      |
|--------|------------------------------------------------------------------------------------------|--------------------------------------------------------------|--------------------------------------|
|        | Pi 2105–Pi 2111                                                                          | Pi 2115–Pi 2145                                              |                                      |
| ① to ⑦ | Seal kit<br>NBR 976.127.1<br>FPM 976.128.9<br>EPDM 976.129.7                             | Seal kit<br>NBR 976.123.0<br>FPM 976.124.8<br>EPDM 976.125.5 |                                      |
| ⑧ to ⑩ | Seal kit for contamination indicator<br>NBR 776.030.9<br>FPM 776.031.7<br>EPDM 776.032.5 |                                                              |                                      |
| ⑪      | Contamination indicator<br>visual 766.997.1<br>Pis 3098 / 2,2                            | electrical 766.994.8<br>Pis 3097 / 2,2                       | electrical upper part only 753.655.0 |

Please return filter for sealing replacement of switch-over unit!



**MAHLE**  
Industriefilter

KNECHT Filtergruppe

KNECHT Filterwerke GmbH

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