

## Particle Monitor

### PiC 1500

Nominal pressure 420 bar (6000 psi)

#### 1. Features

##### **Filtration Group PiC 1500 Particle Monitor for continuous monitoring of the particle contamination of hydraulic fluids**

- Use as a mobile and stationary system for quick and simple determination of the cleanliness of fluids
- Simple menu-prompted operation at the unit
- Laser sensor for precise and reproducible results
- Variable measurement mode (single and cyclic measurements) through internal programmable timer control, manual control or remote control via an electrical connection
- Output of the cleanliness classes via the illuminated, 180° swivelling display
- Evaluation to ISO 4406: 1999 and SAE AS 4059 E
- Measurement range 4 µm(c), 6 µm(c), 14 µm(c), 21 µm(c)
- Programmable alarm (exceeding or underrunning of the cleanliness classes) for control of external units
- Internal operating hourmeter and measurement value memory with capacity for 3000 measurement cycles each with 6 measured values for trend tracking of historical measurement data
- Includes "Count&Log 1500" measurement and evaluation software for evaluation and display of the measurement results on PC or notebook
- Data polling and control of the PiC 1500 via RS232 or CANopen
- Extensive accessories available

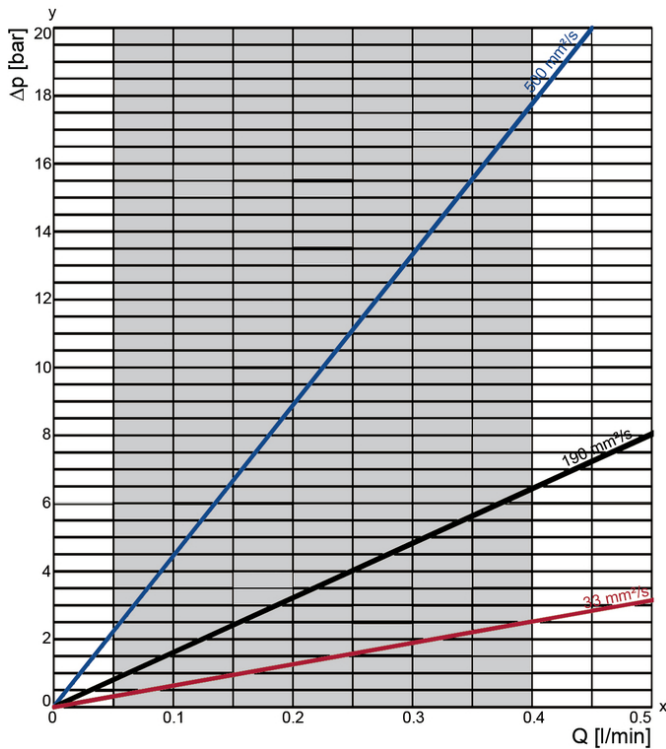


## 2. Technical data

Pressure connection:	2x G¼, Minimes M16x2
Nominal pressure:	420 bar (6000 psi)
Operating temperature:	-20 to +80 °C
Relative humidity:	0 to 95 %
Wetted materials:	stainless steel, sapphire glass, NBR
Seal material:	NBR
Monitored media:	mineral and ester fluids, polyal- phaolefins
Permissible flow rate:	50 to 400 ml/min
Measurement range to ISO 4406: 1999:	0 to 24
Calibrated measurement range to ISO 4406: 1999:	10 to 22
Measurement precision:	± 1
Electrical connection:	8-pin plug M12x1
Power supply:	9 to 36 V DC
Power consumption max.:	300 mA
Power outputs:	4 to 20 mA
Protection class:	IP67 in plugged and secured state
Interfaces:	RS 232, CANopen
Weight:	approx. 850 g

Subject to technical alteration without prior notice.

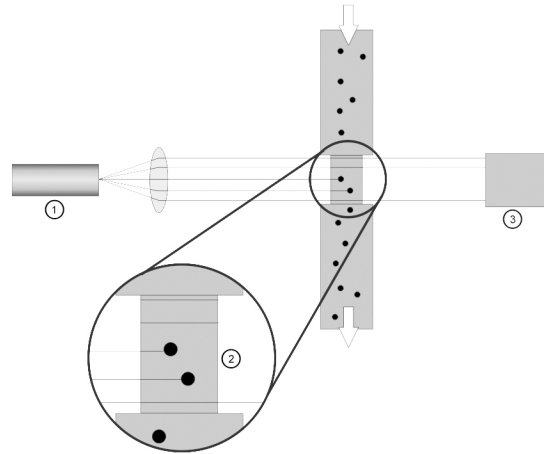
## 4. Characteristics curve



y = Differential pressure  $\Delta p$  [bar]

x = Volume flow Q [l/min]

## 3. Configuration

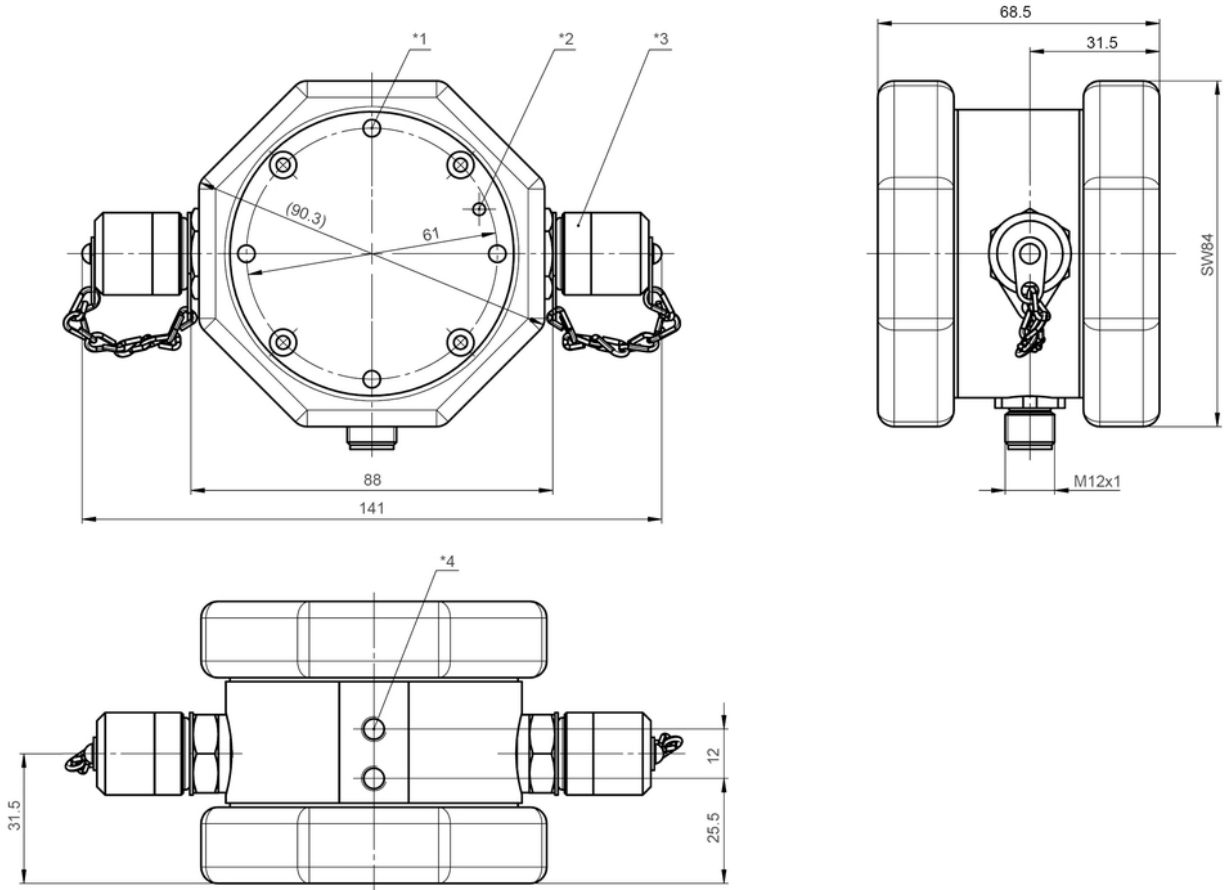


The unit is an optical particle monitor that operates on the principle of light extinction. It consists of a measurement cell (2) through which the fluid flows, a laser (1) and a photodiode (3). The particle monitor continuously measures the number of particles in a system and can trigger an alarm if the oil contamination exceeds a preset cleanliness class. The system operator is warned and can initiate corrective measures before faults or serious damage are caused by the contamination of the fluid. The PiC 1500 Particle Monitor allows condition-oriented maintenance and continuous monitoring of hydraulic oils.

The menu-prompted operation of the unit is via 4 sensor buttons. The cleanliness classes (ordinal numbers)  $> 4 \mu\text{m}(c)$ ,  $> 6 \mu\text{m}(c)$ ,  $> 14 \mu\text{m}(c)$ ,  $> 21 \mu\text{m}(c)$  to ISO 4406:99 or SAE AS 4059 E are displayed on the unit. The measurement mode of the PiC 1500 can be set to single or cyclic measurements. The measurement and pause times can be set for the cyclic measurements. The single measurements can be started manually or by remote control. The compact PiC 1500 Particle Monitor is normally connected to the fluid circuit via two MINIMESS® connections. The flow direction can be freely selected. The volume flow rate can be regulated between 50 and 400 ml/min by means of 3 separately available orifices. The flow rate can be read off at the display of the sensor. The particle monitor can be used as a stand-alone sensor or as a permanently installed detector for monitoring a machine or system. The PiC 1500 can be easily installed to suit the operating situation thanks to the different mounting points and the pivoting display.

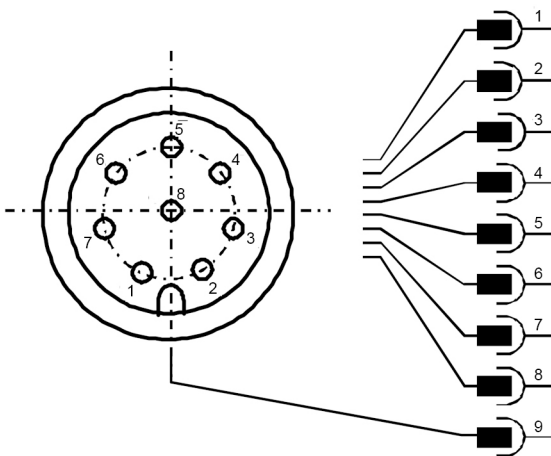
An 8-pin M12 plug is provided on the PiC 1500 for the electrical connection and communication. A selected cleanliness class can be transmitted continuously or all the cleanliness classes sequentially thanks to the integrated power outlet port (4 to 20 mA). The electric alarm contact allows external units to be activated if the fluid infringes set limits. Via the serial interface it is possible to upload the data from the memory of the PiC 1500 or to transmit commands via the RS 232 interface or the CANopen protocol. The Count&Log 1500 software included in the scope of supply allows the particle monitor to be controlled and monitored online from notebook or PC and the measurement values to be read out from the internal memory. The recorded data can be evaluated and presented in various forms, e.g. as tables and curves.

## 5. Dimensions



- \*1 = 4x mounting points M5x5.5
- \*2 = Vent opening with pressure balance element (fixed from the inside)
- \*3 = 2x G $\frac{1}{4}$ , Minimes M16x2
- \*4 = 2x mounting points M6x8

## 6. Electrical connections



Pin	Assignment	Standard cable colour
1	L+	white
2	L-	brown
3	TxD, CANL	green
4	RxD, CANH	yellow
5	Digital input	grey
6	IOut1	pink
7	Open collector alarm out	blue
8	SGND	red
9	Housing/screen	-

## 7. Order numbers and scope of supply

### 7.1 Scope of supply PiC 1500 Particle Monitor

Designation	Order number
Particle Monitor, power pack, calibration protocol, Count&Log 1500 software (on CD-ROM), operating manual	70560658

### 7.2 Description of the software

- Operation of the PiC 1500 Particle Monitor via PC or laptop computer
- Presentation of the current measurement values to ISO 4406: 1999 and SAE AS 4059 E on the notebook/PC
- Readout of the internal memory and creation of a data backup on PC/laptop
- Readout of the internal memory and creation of a data backup on PC/laptop
- Printout of measurement protocols
- Clear presentation of the technical parameters of the laser, measurement cell and volumetric flow rate

### 7.3 Options/accessories/spare parts

Designation	Description	Order number
Power pack	AC/DC adapter, input 100~240 VAC, output 24 VDC, 625mA, IP41	70570292
Measurement cable	Measurement cable L = 5 m, M12 jack - open end 8-pin	70570294
USB/Can adapter cable	CAN/USB adapter, 8-pin M12 jack - USB Type A	70573094
Y adapter	Distributor 3 connections M12 - 8-pin jack - jack - plug	70573114
0.18 orifice	Minimess screw-in coupling 1620 - G1/4" NBR with orifice diameter 0.18 for reducing the volume flow	70570295
0.22 orifice	Minimess screw-in coupling 1620 - G1/4" NBR with orifice diameter 0.22 for reducing the volume flow	70570296
0.30 orifice	Minimess screw-in coupling 1620 - G1/4" NBR with orifice diameter 0.30 for reducing the volume flow	70570297

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## Portable Particle Counter PiC 9300

max. nominal pressure 315 bar (4480 psi)

### 1. Features

- Rugged portable unit for quick and simple particle analysis on site
- Simple menu-driven operation via touch screen
- Laser sensor with for exact and reproducible results
- Demountable tank for the measured fluid with overflow safety device
- Suitable for suction side- and pressure side operation
- Integrated suction pump patented double pump system, viscosity and pressure independent flow control
- Prior to each measurement automatic flushing of the gauge head
- Long term measurements
- Adjustable measuring mode (single and cyclic measurements)
- Manual flush valve for quick internal hose flushing
- Calibration according to ISO 11171: 1999 (NIST)
- Analysis according to ISO 4406: 1999
- Measuring range 4  $\mu\text{m(c)}$ , 6  $\mu\text{m(c)}$ , 14  $\mu\text{m(c)}$
- Analysis according to SAE AS 4059
- Measuring range 4  $\mu\text{m(c)}$  – 70  $\mu\text{m(c)}$  in 6 channels
- Analysis according to NAS 1638
- Indication of the absolute numbers of particles in all channels
- Timer
- Definable measuring series
- USB and serial interface for further data processing via PC
- Integrated large printer (114 mm) for printing of clearly presented measuring data
- With evaluation software for PC



## 2. Technical specifications

Pressure connection:	Measuring connection M16, max. 315 bar (Minimess)
Suction connection:	Screw connection 6 L, max. 10 bar (140 psi)
Return line:	Screw connection 6 L
Pressure fluctuation:	permissible
Medium:	hydraulic fluids, fuels, water precondition of no second phase
Seals:	NBR, optionally FFKM
Viscosity range:	max. 500 mm <sup>2</sup> , on suction side max. 68 mm <sup>2</sup> /s
Temperature range ambience:	0 to +50 °C
Temperature range fluid:	0 to 80 °C
Sensor flow rate:	30 ml/min
Flushing volume flow:	30 ml/min
Measuring volume:	10 to 100 ml, adjustable (10 ml steps)
Volume prior to counting:	10 to 100 ml, adjustable in (10 ml steps)
Counting time:	30 s
Cycling time:	1 to 99 min
Sensor:	Laser diode sensor
Tank volume:	1 l
Indication acc. SAE AS 4059:	>4/>6/>14/>21/>38/>70 µm(c)
Measuring range acc. SAE classes:	000 to 12
Indication acc. ISO 4406: 1999	>4/>6/>14 µm(c)
Measuring range ISO classes:	1 to 24
Indication acc. NAS 1638	2-5/5-15/25-50/50-100 µm
Indication NAS class	1 to 12
Calibration:	acc. ISO 11171: 1999
Power supply:	100 to 230 VAC; 50/60 Hz; or integrated accumulator
Dimensions:	320x450x300 mm (HxWxD)
Weight:	approx. 12 kg

Subject to technical alteration without prior notice.

## 3. Technical manual

The portable particle counter PiC 9300 consists of a sensor with pump/volume regulation unit and tank with overflow safety device. The counted results are displayed on a touch screen monitor and can be printed with the integrated thermal printer. Thanks to the strengthened polyamide plastic moulding material, the housing has an optimal compatibility against all common pressure fluids. The electrical connections are placed at the backside of the unit and are therefore properly protected. For the electrical connecting cable, accumulator and hoses is a separate compartment available. Due to the removable cover is an optimal access to all control elements, a safe storage and transport ensured. For data transfer to a PC is an USB and a serial interface available. Also, it is possible to store the data via a second USB interface in an Excel compatible format. Monitoring available in languages German, English and French.

## 4. Order numbers and scope of supply

### 4.1 Scope of supply

Designation	Order number
PiC 9300 VP Particle counter with power pack, external mains charger, Measuring and analysing Software "Log and Show" Seals in NBR	70522924
PiC 9300 FFKM VP Particle counter with power pack, external mains charger, Measuring and analysing Software "Log and Show" Seals in in FFKM	70529640

### 4.2 Software description

- Reading out of measurement values from PiC 9300
- Monitoring of measurement values in schedule or graphic, time profile monitoring
- Monitoring selection acc. ISO 4406 (1999) or SAE AS 4059
- Indication of the absolute numbers of particles in all channels
- Data saving, commentary and printer control
- Remote control function of PiC 9300 and adjusting of all parameters
- Export of values to spreadsheet programs (e.g. Excel)
- PC configuration: Pentium processor, USB or COM-interface

### 4.3 Options/accessories/spare parts

Designation	Description	Order number
Fluid sampling	Fluid sampling and adapter kit for PiC 9100/PiC 9300	79392994

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70383722.03/2017



## Coalescer Filter

### PiW 1975

#### 1. Description

The Coalescer filter has been specially designed to separate water from hydraulic fluids.

According to VDMA standard sheet 24568, the amount of water in HE pressure fluids has to be kept below 1000 ppm (0.1 %). HLP fluids should not contain any free water at all. Free water always causes turbidity which can be seen by the human eye. Physically, turbidity is a two-phase mixture (emulsion) in which small droplets of water are present in the pressure fluid. For this reason, it is advisable to carry out a mechanical separation of these water droplets; this technique is based on the coalescer - principle. The droplets are collected in various layers and brought together into larger units. The water drops thus formed are several millimetres in diameter.

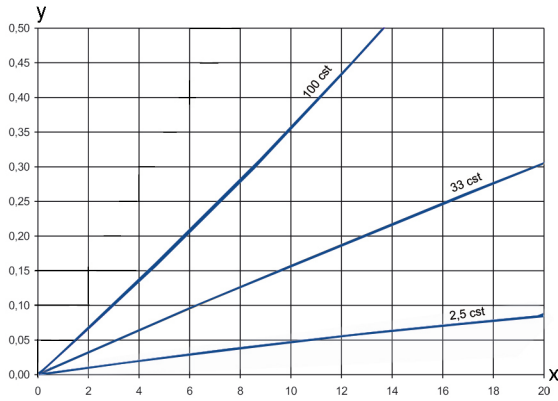
After leaving the coalescer layer, the drops come in contact with a special hydrophobic fabric, where the separation from the pressure fluid takes place. The water is removed from the circuit by means of sedimentation. It is important that a certain differential pressure is not exceeded during the process. The viscosity also needs to be taken into account to ensure proper operation. The maximum viscosity for effective water separation is approx. 68 mm<sup>2</sup>/s. The coalescer works best if the pressure fluids contain a minimal amount of emulsifying additives. The bottom line: in systems that are frequently at risk for water ingress, expensive special oils can be replaced by simple, cost-effective pressure fluids.

#### Characteristics:

- Mechanical separation of water droplets - coalescer principle
- Water removing by means of sedimentation
- Expensive special oils can be replaced by simple, cost-effective pressure fluids
- Worldwide distribution

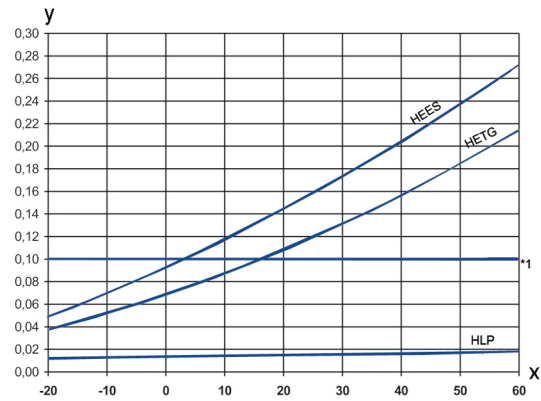


## 2. Flow rate



y = differential pressure in bar  
x = flow rate in l/min

## 3. Water solubility



X = temperature [°C]  
y = water solubility (%)

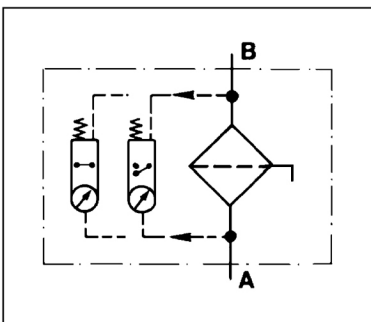
1\* VDMA-threshold

## 4. Quality assurance

Filtration Group 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. Order number

Housing Design	Spare parts
complete with visual/electrical indicator, demister and coalescer element Type: PiW 1975/E-Coalescer Order number: 76334031	Type: 853 275 Coalescer Order number: 76345300

## 7. Technical specifications

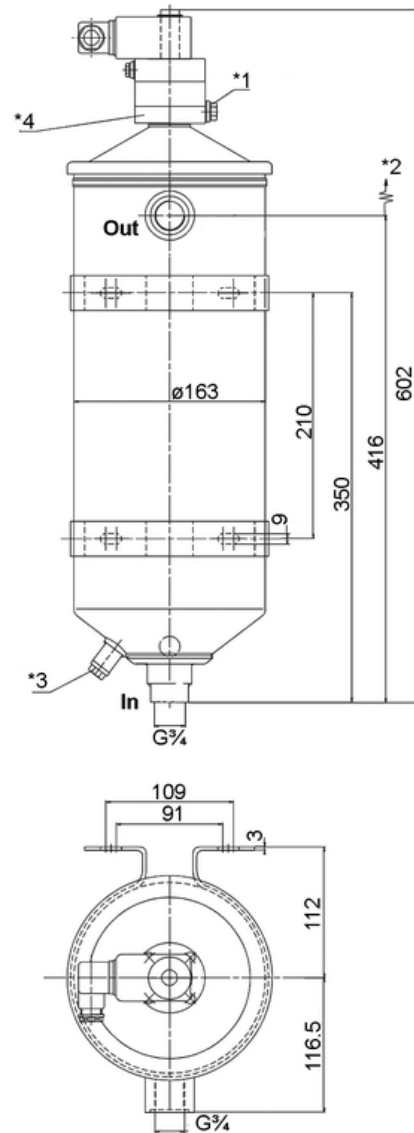
Design:	line mounting filter
Nominal pressure:	6 bar (90 psi)
Test pressure:	8 bar (110 psi)
Temperature range:	-10 °C to +80 °C (other temperature ranges on request)
Filter housing material:	St
Sealing material:	NBR/Cu
Maintenance indicator setting:	$\Delta p$ 1.2 bar $\pm$ 0.2 bar
Electrical data of maintenance indicator:	
Maximum voltage:	250 V AC/200 V DC
Maximum current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M 20 x 1.5

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

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

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

Subject to technical alteration without prior notice.



- In = Inlet
- Out = Outlet
- \*1 vent screw
- \*2 extension degree 400
- \*3 drain screw G $\frac{1}{2}$  drawn 90° shifted
- \*4 SW 36 for filter maintenance

Weight 8 kg

## 8. Installation, operating and maintenance instructions

### 8.1 Filter installation

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

Install filter vertical so that the separated water can flow down and can be discharged.

### 8.2 Connecting the electrical maintenance indicator

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

### 8.3 Operating instruction

The max. viscosity for an effective water separation should not exceed 68 mm<sup>2</sup>/s. The coalescer should run with a differential pressure of approx. 0.3 bar, that means that the volumetric flow is determined by the viscosity of the oil. To prevent premature contamination of the coalescer, a protective filter with a retention rate of  $\beta_{7(C)} \geq 200$  should be installed before the coalescer, because the coalescer element is so fine and therefore very sensitive to dirt. In order to recognise the separated water, a transparent water-detection device with a tap should be mounted to the cone of the filter housing.

### 8.4 When does the coalescer element need to be replaced?

A differential pressure indicator with a switching level of  $\Delta p$  1.2 bar is mounted at the top of the filter housing. As already mentioned above, the filter should run at  $\Delta p$  of approx. 0.3 bar. During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the coalescer must be replaced after the end of the shift.

**Remark:** Please note permissible operating pressure of the housing.

### 8.5 Replacing the coalescer element

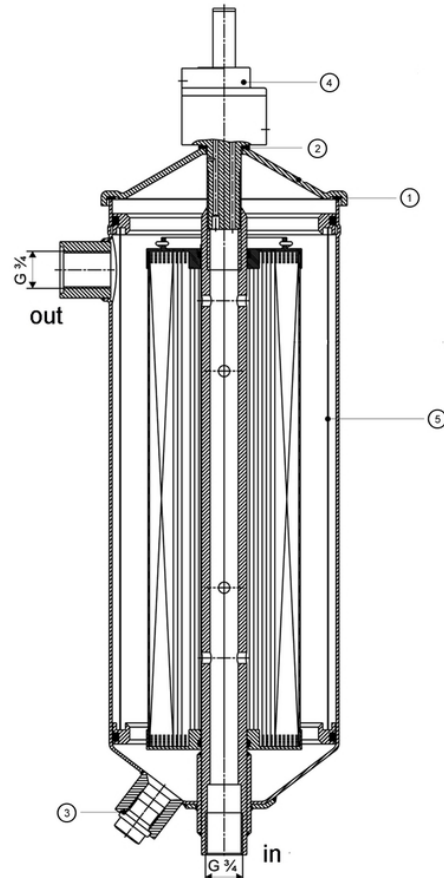
Before an element can be replaced, the entire system needs to be shut down and the filter released from the pressure. Use the water tap to empty the housing. The differential pressure indicator (1) also serves as a cover screw which needs to be removed to take off the cover (2). Remove the coalescer element (3) from the housing. The separator only needs to be replaced, if it is damaged.

Push a new coalescer element over the centre pipe in the housing. Check seals in the lid-cover for possible damages, replace if necessary.

Place the top cover back on top of the housing and tighten it together with the differential pressure indicator.

Close the water tap.

The venting of the filter will be accomplished by the vent screw on the  $\Delta p$  indicator. Please unscrew the vent screw 1-2 turn until fluid emerge. Tight vent screw.



## 9. Spare parts list

Order number for spare parts		
Pos.	Type	Order number
① - ②	Seal kit for housing	
	NBR	76375364
④	Maintenance indicator	
	Visual PiS 3503/1,2	76375372
	Electrical PiS 3304/1,2	76375380
	Electrical upper section only	77536550
	Seal kit for maintenance indicator	
	NBR	78389280
⑤	Demister	76333876

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## Coalescer Filter

### PiW 2175

#### 1. Features

The Coalescer filter has been specially designed to separate water from hydraulic fluids, diesel and marine diesel oil.

According to VDMA standard sheet 24568, the amount of water in HE pressure fluids has to be kept below 1000 ppm (0.1 %). HLP fluids should not contain any free water at all. Free water always causes turbidity which can be seen by the human eye. Physically, turbidity is a two-phase mixture (emulsion) in which small droplets of water are present in the pressure fluid. For this reason, it is advisable to carry out a mechanical separation of these water droplets; this technique is based on the coalescer - principle. The droplets are collected in various layers and brought together into larger units. The water drops thus formed are several millimetres in diameter.

After leaving the coalescer layer, the drops come in contact with a special hydrophobic fabric, where the separation from the pressure fluid takes place. The water is removed from the circuit by means of sedimentation. It is important that a certain differential pressure is not exceeded during the process. The viscosity also needs to be taken into account to ensure proper operation. The maximum viscosity for effective water separation is approx. 68 mm<sup>2</sup>/s. The coalescer works best if the pressure fluids contain a minimal amount of emulsifying additives. The bottom line: in systems that are frequently at risk for water ingress, expensive special oils can be replaced by simple, cost-effective pressure fluids.

#### Characteristics:

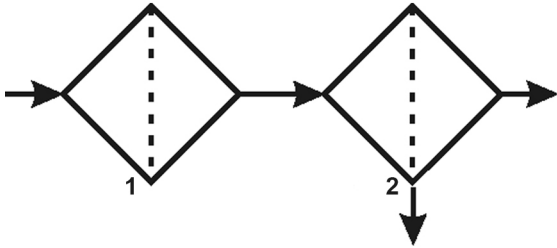
- Mechanical separation of water droplets - coalescer principle
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- Worldwide distribution



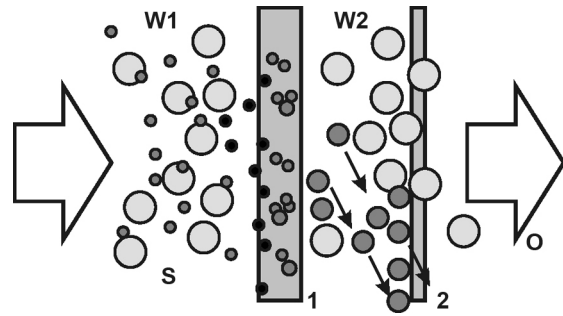
## 2. Functional description

### 2.1 Principle of the process

Liquid flows through the coalescer element. Minute water droplets "coalesce" there to form larger drops and any impurities are retained. These large drops then sink to the bottom and are guided to the water drain by a hydrophobic cloth.

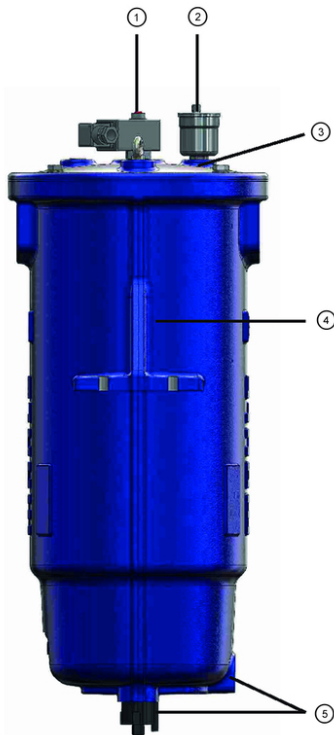


1 = Coalescer  
2 = Droplet separator



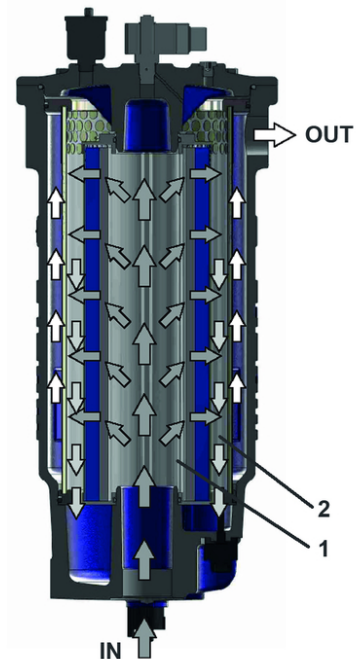
W1 = little droplets  
W2 = large droplets  
1 = Coalescer  
2 = Droplet separator  
O = Öl

### 2.2 Main components



① Maintenance indicator  
② Vent screw / air release valve (optional)  
③ Cover  
④ Housing  
⑤ 2 water level sensors

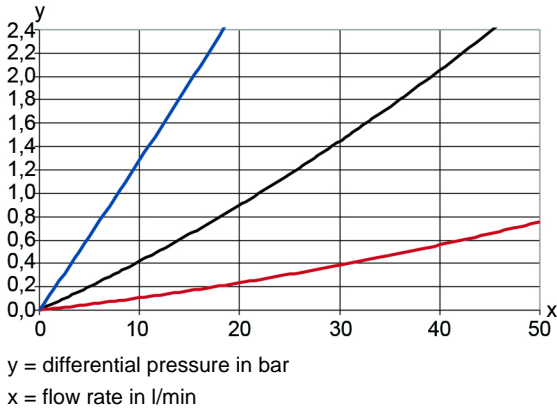
### 2.3 Functional description



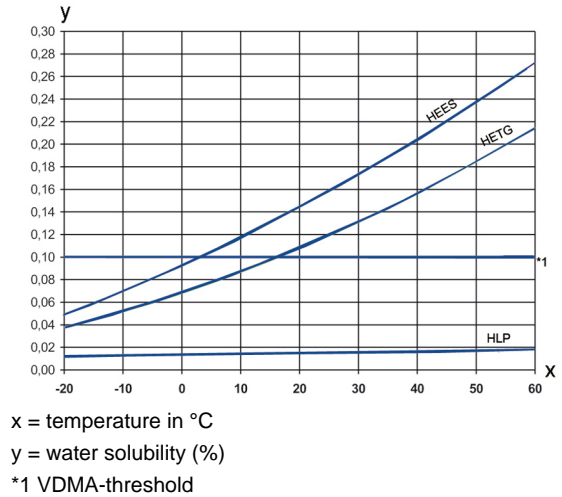
- Dirty liquid flows into the housing (IN).
- The water droplets coalesce to form larger drops and any impurities are retained by the coalescer element (depth filter).
- Water is separated by the hydrophobic cloth and collects in a reservoir at the bottom of the filter housing.
- Clean liquid flows through the outlet (OUT).

### 3. Flow rate

— 500 mm<sup>2</sup>/s  
— 190 mm<sup>2</sup>/s  
— 33 mm<sup>2</sup>/s



### 4. Water solubility

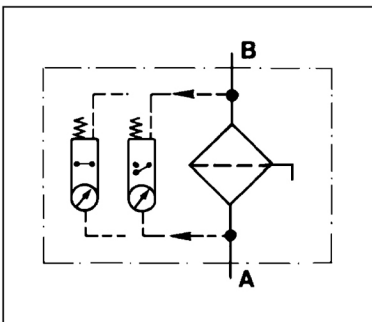


### 5. Quality assurance

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

### 6. Symbol



### 7. Order numbers

Example for ordering filters:

1. Filter housing	2. Filter element
complete with visual/electrical maintenance indicator, droplet separator and coalescer element Type: PiW 2175 Order number: 72356609	Type: KE 2629 E1 COA Order number: 76361281

## 8. Technical specifications

Design:	in-line filter
Nominal pressure:	16 bar (230 psi)
Test pressure:	24 bar (340 psi)
Temperature range:	+5 °C to +90 °C (other temperature ranges on request)
Filter housing material:	nodular cast iron
Sealing material:	NBR
Water collection chamber:	approx. 2 l
Maintenance indicator setting:	$\Delta p$ 2.2 bar $\pm$ 0,2 bar
Electrical data of maintenance indicator:	
Max. voltage:	250 V AC/200 V DC
Max. current:	1 A
Contact load:	70 W
Type of protection:	IP 65 in inserted and secured status
Contact:	normally open/closed
Cable sleeve:	M20x1.5

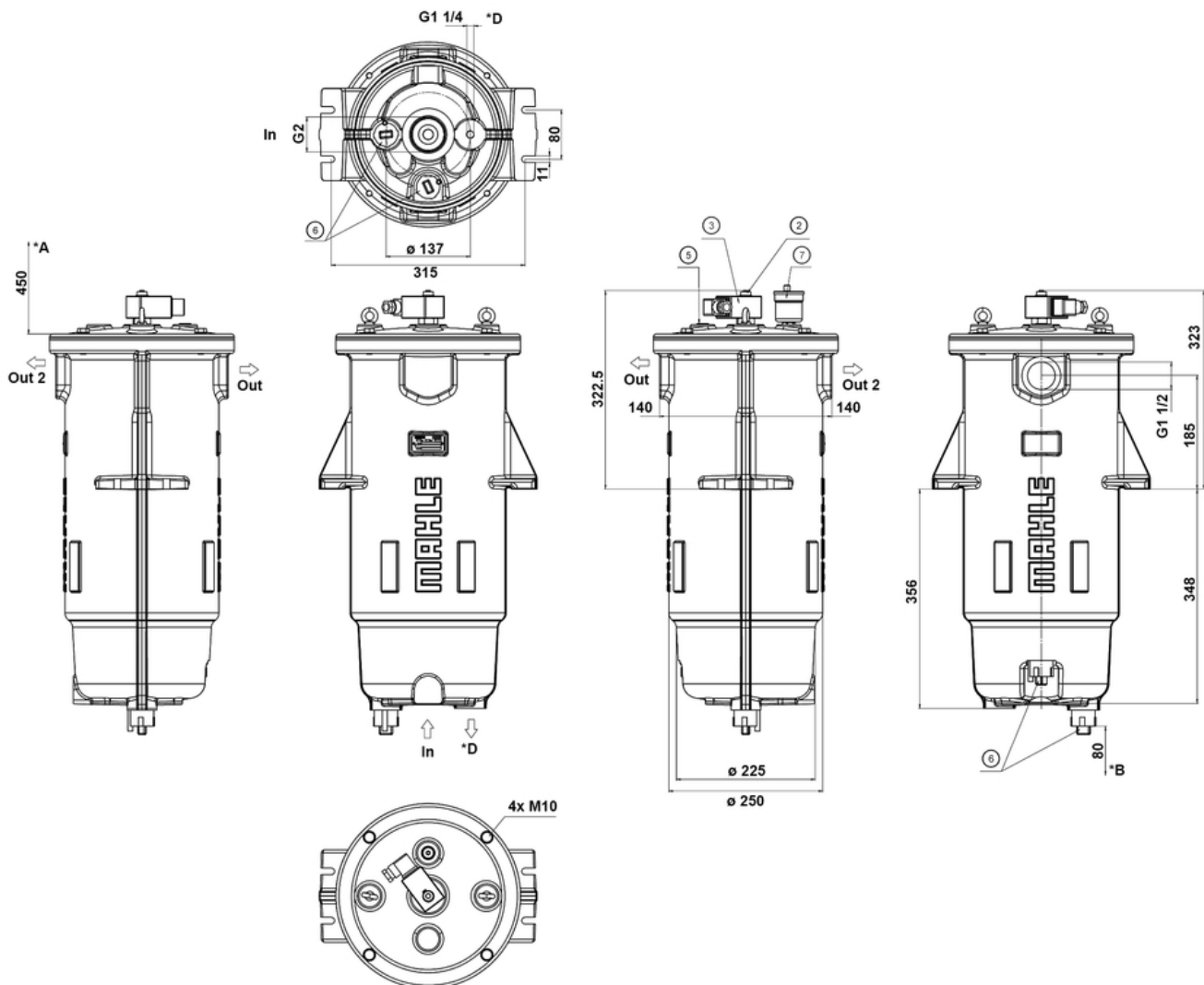
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## 9. Dimensions





## 9.1 Caption for dimensions

In	Inlet	②	Maintenance indicator visual
Out	Outlet	③	Maintenance indicator electrical upper section
Out 2	Outlet optional	⑤	Vent screw (30 Nm)
*A	Clearance required for filter element	⑥	Water level sensors
*B	Clearance required for wires	⑦	Air release valve optional
*D	Water drain		

## 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. Install filter vertical so that the separated water can flow down and can be discharged.

### 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 Operating instruction

The max. viscosity for an effective water separation should not exceed 68 mm<sup>2</sup>/s. The coalescer should run with a differential pressure of approx. 0.3 bar, that means that the volumetric flow is determined by the viscosity of the oil. The separated water will be collected in the PiW 2175 (max. 2 l). The Water can be discharged automatically by using the water level sensor. In order to recognize the separated water, a transparent water-detection device with a tap or so called warning indicator should be mounted.

**Remark:** Please note permissible operating pressure of the housing.

### 10.4 When should the coalescer element be replaced?

A differential pressure indicator with a switching level of  $\Delta p$  2.2 bar is mounted at the top of the filter housing. During cold starts, the indicator may give a warning signal. Press the red button of the visual indicator once again only after operating temperature has been reached. If the red button immediately pops up again and/or the electrical signal has not switched off after reaching operating temperature, the coalescer must be replaced after the end of the shift.

As already mentioned above, the filter should run at  $\Delta p$  of approx. 0.3 bar. The flow rate/pressure drop curves show the flow rates according to the viscosity. If the indicator may give a warning signal, the coalescer element have to be changed.

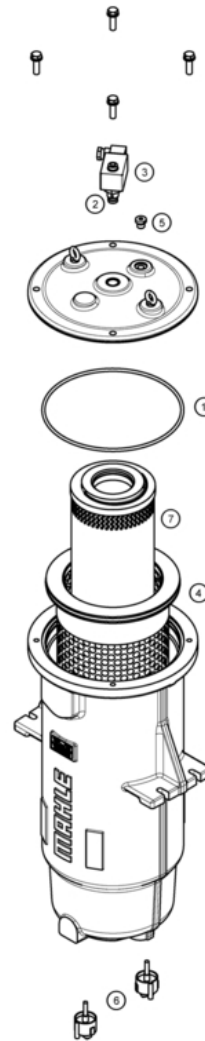
### 10.5 Element replacement

Stop system and relieve filter from pressure. Use the water tap to empty the housing. Unscrew the cover and change the coalescer element. Check seals in the lid-cover for possible damages, replace if necessary. Place the top cover back on top of the housing and tighten it. Close the water tap.

The venting occurs by a venting screw. Tighten the venting screw when the fluid flows out of the venting bore.

## 11. Spare parts list

Order numbers of spare parts		
Position	Type	Order number
① ② ⑤	Seal kit for filter housing incl. visual maintenance indicator and venting screw	72348122
	Maintenance indicator	
③	Electrical PiS 3092/2.2	77669856
	Electrical upper section only	77536550
④	Droplet separator	72356964
⑥	Water level sensor	72348133
⑦	Coalescer element	76361281



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