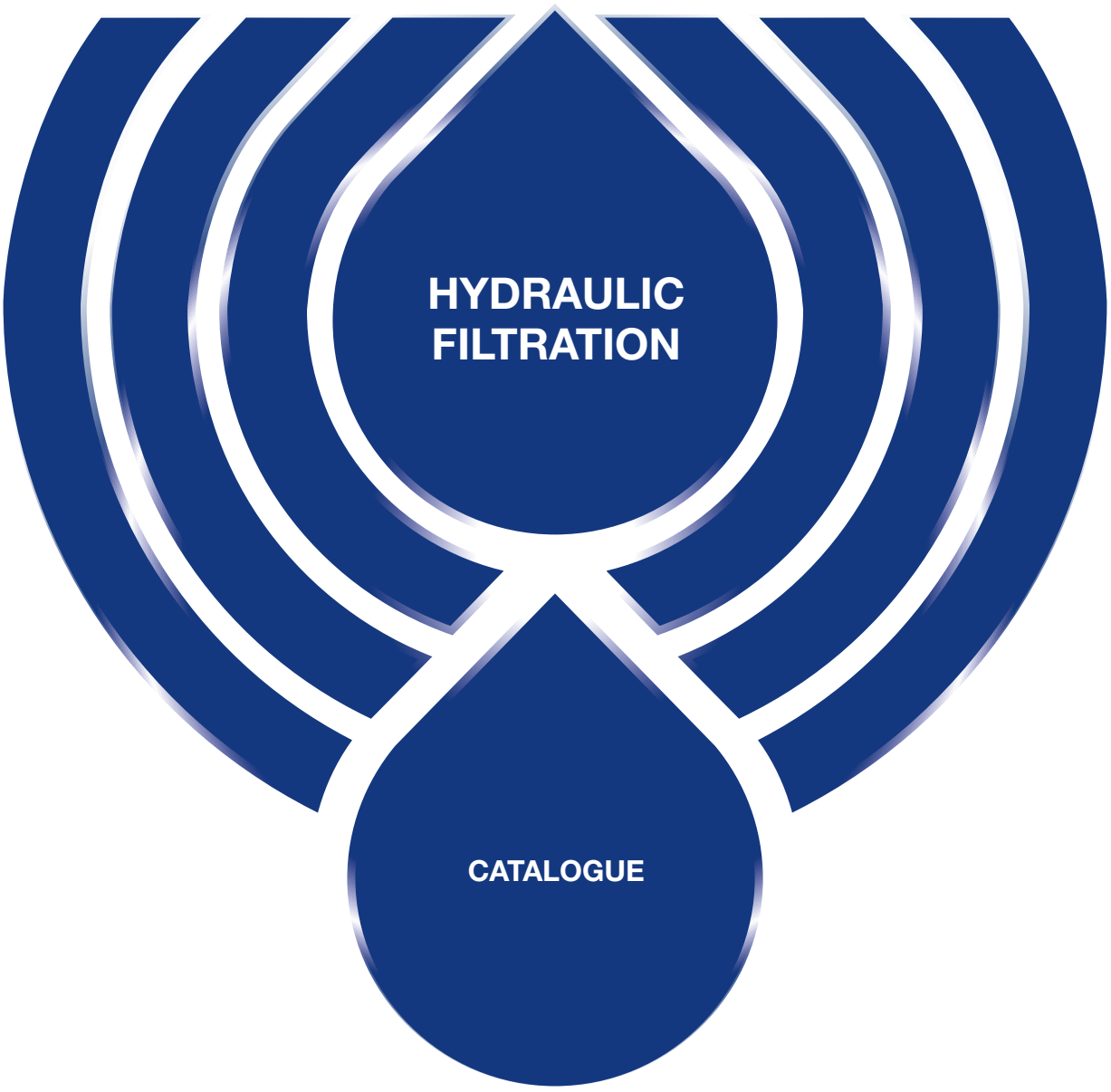
SUCTION FILTERS



MPFILTRI®

PASSION TO PERFORM

CONTAMINATION MANAGEMENT

INDEX

1 HYDRAULIC FLUIDS

The fluid is the vector that transmits power, energy within an oleodynamic circuit. In addition to transmitting energy through the circuit, it also performs additional functions such as lubrication, protection and cooling of the surfaces.
The classification of fluids used in hydraulic systems is coded in many regulatory references, different Standards.

The most important classification system for hydraulic fluids is the one defined by International Organization for Standardization (ISO), which established a classification system within their standard: "ISO 6743-4 Lubricants, Industrial Oils and Related Products" . In particular, the parts of interest for hydraulic fluids are:
- Lubricants, industrial oils and related products (class L)
- Classifications - Part 4L - Family H (Hydraulic systems)

The ISO 6743-4 classification system can be generally applied to the three primary classes of hydraulic fluids:

- Mineral Oils (i.e.: petroleum) Hydraulic Fluids (i.e.: HH: Mineral lubricants without corrosion inhibitors; HL: HH-type lubricants with oxidation reduction and anticorrosive additives; HM: HL-type lubricants with anti-wear additives; HV: HM-type lubricants with a higher viscosity grade and temperature properties; and others).

- Biodegradable Hydraulic Fluids (HExx), also defined as "Environmentally acceptable hydraulic fluids".

- Fire Resistant Hydraulic Fluids (HFxx), which could be further split into: Fire-resistant aqueous fluids (HFAx, HFB; HFC) ; Fire-resistant synthetic anhydrous fluids (HFDx).

The choice of fluid for an hydraulic system must take into account several parameters.
These parameters can adversely affect the performance of an hydraulic system, causing delay in the controls, pump cavitation, excessive absorption, excessive temperature rise, efficiency reduction, increased drainage, wear, jam/block or air intake in the plant.

The main properties that characterize hydraulic fluids and affect their choice are:
- DYNAMIC VISCOSITY
  It identifies the fluid's resistance to sliding due to the impact of the particles forming it.

- KINEMATIC VISCOSITY
  It is a widespread formal dimension in the hydraulic field.
  It is calculated with the ratio between the dynamic viscosity and the fluid density.
  Kinematic viscosity varies with temperature and pressure variations.

- VISCOSITY INDEX
  This value expresses the ability of a fluid to maintain viscosity when the temperature changes.
  A high viscosity index indicates the fluid's ability to limit viscosity variations by varying the temperature.

- FILTERABILITY INDEX
  It is the value that indicates the ability of a fluid to cross the filter materials.
  A low filterability index could cause premature clogging of the filter material.

- WORKING TEMPERATURE
  Working temperature affects the fundamental characteristics of the fluid.
  As already seen, some fluid characteristics, such as cinematic viscosity, vary with the temperature variation.
  When choosing a hydraulic oil, must therefore be taken into account of the environmental conditions in which the machine will operate.

- COMPRESSIBILITY MODULE
  Every fluid subjected to a pressure contracts, increasing its density.
  The compressibility module identifies the increase in pressure required to cause a corresponding increase in density.

- HYDROLYTIC STABILITY
  It is the characteristic that prevents galvanic pairs that can cause wear in the plant/system.

- ANTIOXIDANT STABILITY AND WEAR PROTECTION
  These features translate into the capacity of a hydraulic oil to avoid corrosion of metal elements inside the system.

- HEAT TRANSFER CAPACITY
  It is the characteristic that indicates the capacity of hydraulic oil to exchange heat with the surfaces and then cool them.

2 FLUID CONTAMINATION

Whatever the nature and properties of fluids, they are inevitably subject to contamination. Fluid contamination can have two origins:

- INITIAL CONTAMINATION
  Caused by the introduction of contaminated fluid into the circuit, or by incorrect storage, transport or transfer operations.

- PROGRESSIVE CONTAMINATION
  Caused by factors related to the operation of the system, such as metal surface wear, sealing wear, oxidation or degradation of the fluid, the introduction of contaminants during maintenance, corrosion due to chemical or electrochemical action between fluid and components, cavitation.
  The contamination of hydraulic systems can be of different nature:

- SOLID CONTAMINATION
  For example rust, slag, metal particles, fibers, rubber particles, paint particles or additives

- LIQUID CONTAMINATION
  For example, the presence of water due to condensation or external infiltration or acids

- GASEOUS CONTAMINATION
  For example, the presence of air due to inadequate oil level in the tank, drainage in suction ducts, incorrect sizing of tubes or tanks.

3 FLUID COMPATIBILITY CHARTS

For more detailed information on specific fluid compatibility please refer to the fluid compatibility charts on our website:

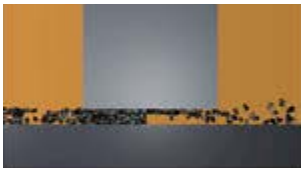
Scan or click me!

4 EFFECTS OF CONTAMINATION ON HYDRAULIC COMPONENTS

Solid contamination is recognized as the main cause of malfunction, failure and early degradation in hydraulic systems. It is impossible to delete it completely, but it can be effectively controlled by appropriate devices.

CONTAMINATION IN PRESENCE OF LARGE TOLERANCES

CONTAMINATION IN PRESENCE OF NARROW TOLERANCES



Solid contamination mainly causes surface damage and component wear.

- ABRASION OF SURFACES
  Cause of leakage through mechanical seals, reduction of system performance, failures.

- SURFACE EROSION
  Cause of leakage through mechanical seals, reduction of system performance, variation in adjustment of control components, failures.

- ADHESION OF MOVING PARTS
  Cause of failure due to lack of lubrication.

- DAMAGES DUE TO FATIGUE
  Cause of breakdowns and components breakdown.

ABRASION

EROSION

ADHESION

FATIGUE

Liquid contamination mainly results in decay of lubrication performance and protection of fluid surfaces.

DISSOLVED WATER

- INCREASING FLUID ACIDITY
  Cause of surface corrosion and premature fluid oxidation
- GALVANIC COUPLE AT HIGH TEMPERATURES
  Cause of corrosion

FREE WATER - ADDITIONAL EFFECTS

- DECAY OF LUBRICANT PERFORMANCE
  Cause of rust and sludge formation, metal corrosion and increased solid contamination
- BATTERY COLONY CREATION
  Cause of worsening in the filterability feature
- ICE CREATION AT LOW TEMPERATURES
  Cause damage to the surface
- ADDITIVE DEPLETION
  Free water retains polar additives

Gaseous contamination mainly results in decay of system performance.

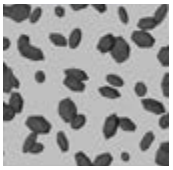
- CUSHION SUSPENSION
  Cause of increased noise and cavitation.
- FLUID OXIDATION
  Cause of corrosion acceleration of metal parts.
- MODIFICATION OF FLUID PROPERTIES
  (COMPRESSIBILITY MODULE, DENSITY, VISCOSITY)
  Cause of system's reduction of efficiency and of control.
  It is easy to understand how a system without proper contamination management is subject to higher costs than a system that is provided.
- MAINTENANCE
  Increase maintenance activities, spare parts, machine stop costs.
- ENERGY AND EFFICIENCY
  Efficiency and performance reduction due to friction, drainage, cavitation.

5 MEASURING THE SOLID CONTAMINATION LEVEL

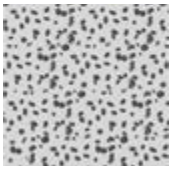
The level of contamination of a system identifies the amount of contaminant contained in a fluid. This parameter refers to a unit volume of fluid.
The level of contamination may be different at different points in the system. From the information in the previous paragraphs it is also apparent that the level of contamination is heavily influenced by the working conditions of the system, by its working years and by the environmental conditions.

What is the size of the contaminating particles that we must handle in our hydraulic circuit?

HUMAN HAIR
(75 µm)



MINIMUM DIMENSION VISIBLE WITH HUMAN EYES
(40 µm)



TYPICAL CONTAMINANT DIMENSION IN A HYDRAULIC CIRCUIT
(4 - 14 µm)

Contamination level analysis is significant only if performed with a uniform and repeatable method, conducted with standard test methods and suitably calibrated equipment. To this end, ISO has issued a set of standards that allow tests to be conducted and express the measured values in the following ways.

- GRAVIMETRIC LEVEL - ISO 4405

The level of contamination is defined by checking the weight of particles collected by a laboratory membrane. The membrane must be cleaned, dried and desiccated, with fluid and conditions defined by the Standard.
The volume of fluid is filtered through the membrane by using a suitable suction system. The weight of the contaminant is determined by checking the weight of the membrane before and after the fluid filtration.

CLEAN MEMBRANE

CONTAMINATED MEMBRANE

- CUMULATIVE DISTRIBUTION OF THE PARTICLES SIZE - ISO 4406

The level of contamination is defined by counting the number of particles of certain dimensions per unit of volume of fluid. Measurement is performed by Contamination Monitoring Products (CMP).
Following the count, the contamination classes are determined, corresponding to the number of particles detected in the unit of fluid.
The most common classification methods follow ISO 4406 and SAE AS 4059 (Aerospace Sector) regulations.
NAS 1638 is still used although obsolete.

Classification example according to ISO 4406

The International Standards Organization standard ISO 4406 is the preferred method of quoting the number of solid contaminant particles in a sample. The level of contamination is defined by counting the number of particles of certain dimensions per unit of volume of fluid. The measurement is performed by Contamination Monitoring Products (CMP).

The numbers represent a code which identifies the number of particles of certain sizes in 1ml of fluid. Each code number has a particular size range.
The first scale number represents the number of particles equal to or larger than 4 $\mu m_{(c)}$ per millilitre of fluid;
The second scale number represents the number of particles equal to or larger than 6 $\mu m_{(c)}$ per millilitre of fluid;
The third scale number represents the number of particles equal to or larger than 14 $\mu m_{(c)}$ per millilitre of fluid.

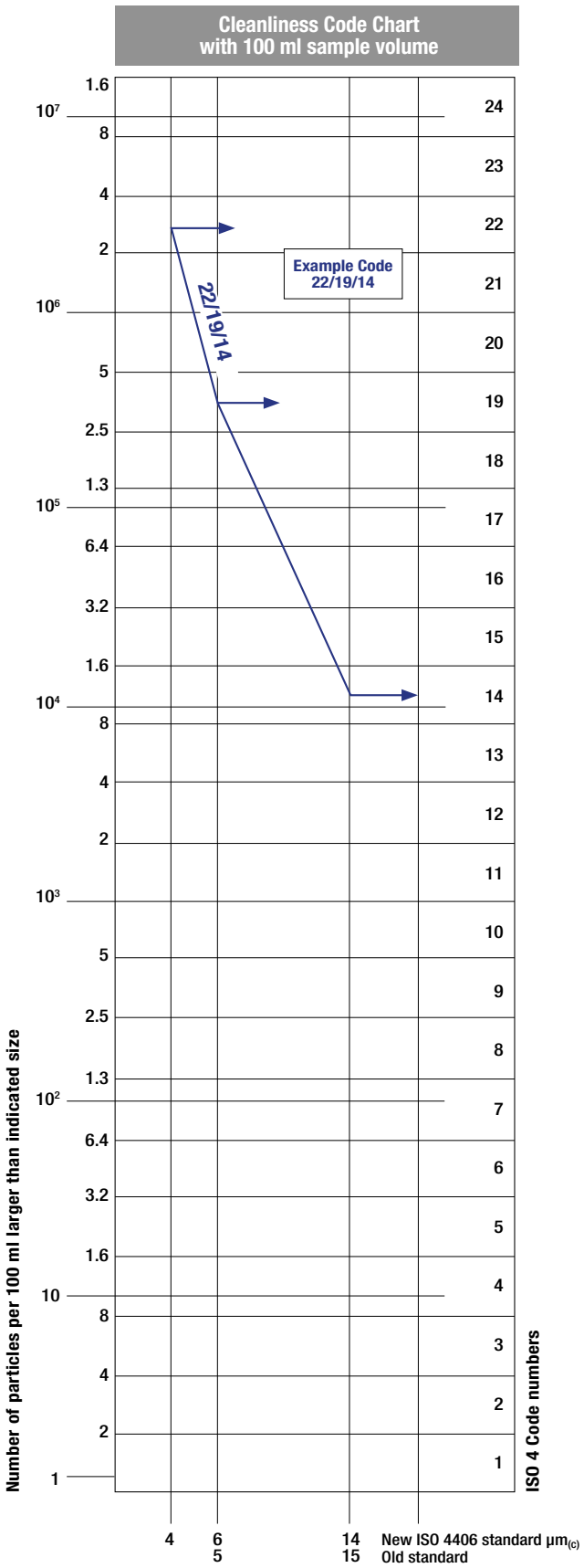
ISO 4406 - Allocation of Scale Numbers

Class	Number of particles per ml	
	Over	Up to
28	1 300 000	2 500 000
27	640 000	1 300 000
26	320 000	640 000
25	160 000	320 000
24	80 000	160 000
23	40 000	80 000
22	20 000	40 000
21	10 000	20 000
20	5 000	10 000
19	2 500	5 000
18	1 300	2 500
17	640	1 300
16	320	640
15	160	320
14	80	160
13	40	80
12	20	40
11	10	20
10	5	10
9	2.5	5
8	1.3	2.5
7	0.64	1.3
6	0.32	0.64
5	0.16	0.32
4	0.08	0.16
3	0.04	0.08
2	0.02	0.04
1	0.01	0.02
0	0	0.01

> 4 $\mu m_{(c)}$ = 350 particles
> 6 $\mu m_{(c)}$ = 100 particles
> 14 $\mu m_{(c)}$ = 25 particles
16 / 14 / 12

ISO 4406 Cleanliness Code System

Microscope counting examines the particles differently to Contamination Monitoring Products (CMP) and the code is given with two scale numbers only. These are at 5 µm and 15 µm equivalent to the 6 $\mu m_{(c)}$ and 14 $\mu m_{(c)}$ of Contamination Monitoring Products (CMP).



- CUMULATIVE DISTRIBUTION OF THE PARTICLES SIZE
  SAE AS4059-1 and SAE AS4059-2

Classification example according to SAE AS4059 - Rev. G

The code, prepared for the aerospace industry, is based on the size, quantity, and particle spacing in a 100 ml fluid sample. The contamination classes are defined by numeric codes, the size of the contaminant is identified by letters (A-F).

This SAE Aerospace Standard (AS) defines cleanliness levels for particulate contamination of hydraulic fluids and includes methods of reporting data relating to the contamination levels. Tables 1 and 2 below provide differential and cumulative particle counts respectively for counts obtained by an automatic particle counter, e.g. LPA3.

Table 1 - Class for differential measurement

Class	Dimension of contaminant Maximum Contamination Limits per 100 ml					(3)
	5-15 µm	15-25 µm	25-50 µm	50-100 µm	>100 µm	(1)
	6-14 $\mu m_{(c)}$	14-21 $\mu m_{(c)}$	21-38 $\mu m_{(c)}$	38-70 $\mu m_{(c)}$	>70 $\mu m_{(c)}$	(2)
00	125	22	4	1	0	
0	250	44	8	2	0	
1	500	89	16	3	1	
2	1 000	178	32	6	1	
3	2 000	356	63	11	2	
4	4 000	712	126	22	4	
5	8 000	1 425	253	45	8	
6	16 000	2 850	506	90	16	
7	32 000	5 700	1 012	180	32	
8	64 000	11 400	2 025	360	64	
9	128 000	22 800	4 050	720	128	
10	256 000	45 600	8 100	1 440	256	
11	512 000	91 200	16 200	2 880	512	
12	1 024 000	182 400	32 400	5 760	1 024	

6 - 14 $\mu m_{(c)}$ = 15 000 particles
14 - 21 $\mu m_{(c)}$ = 2 200 particles
21 - 38 $\mu m_{(c)}$ = 200 particles
38 - 70 $\mu m_{(c)}$ = 35 particles
> 70 $\mu m_{(c)}$ = 3 particles
SAE AS4059 REV G - Class 6

(1) Size range, optical microscope, based on longest dimension as measured per AS598 or ISO 4407. **(2)** Size range CMP calibrated per ISO 11171 or an optical or electron microscope with image analysis software, based on projected area equivalent diameter. **(3)** Contamination classes and particle count limits are identical to NAS 1638.

Table 2 - Class for cumulative measurement

Class	Dimension of contaminant Maximum Contamination Limits per 100 ml						(1)
	>1 µm	>5 µm	>15 µm	>25 µm	>50 µm	>100 µm	
	>4 $\mu m_{(c)}$	>6 $\mu m_{(c)}$	>14 $\mu m_{(c)}$	>21 $\mu m_{(c)}$	>38 $\mu m_{(c)}$	>70 $\mu m_{(c)}$	(2)
000	195	76	14	3	1	0	
00	390	152	27	5	1	0	
0	780	304	54	10	2	0	
1	1 560	609	109	20	4	1	
2	3 120	1 217	217	39	7	1	
3	6 250	2 432	432	76	13	2	
4	12 500	4 864	864	152	26	4	
5	25 000	9 731	1 731	306	53	8	
6	50 000	19 462	3 462	612	106	16	
7	100 000	38 924	6 924	1 224	212	32	
8	200 000	77 849	13 849	2 449	424	64	
9	400 000	155 698	27 698	4 898	848	128	
10	800 000	311 396	55 396	9 796	1 696	256	
11	1 600 000	622 792	110 792	19 592	3 392	512	
12	3 200 000	1 245 584	221 584	39 184	6 784	1 024	

> 4 $\mu m_{(c)}$ = 45 000 particles
> 6 $\mu m_{(c)}$ = 15 000 particles
> 14 $\mu m_{(c)}$ = 1 500 particles
> 21 $\mu m_{(c)}$ = 250 particles
> 38 $\mu m_{(c)}$ = 15 particles
> 70 $\mu m_{(c)}$ = 3 particle
SAE AS4059 REV G
cpc* Class 6 6/6/5/5/4/2

(1) Size range, optical microscope, based on longest dimension as measured per AS598 or ISO 4407. **(2)** Size range, CMP calibrated per ISO 11171 or an optical or electron microscope with image analysis software, based on projected area equivalent diameter. **(3)** Contamination classes and particle count limits are identical to NAS 1638.

* cumulative particle count

- CLASSES OF CONTAMINATION ACCORDING TO NAS 1638 (January 1964)

The NAS system was originally developed in 1964 to define contamination classes for the contamination contained within aircraft components.
The application of this standard was extended to industrial hydraulic systems simply because nothing else existed at the time.
The coding system defines the maximum numbers permitted of 100 ml volume at various size intervals (differential counts) rather than using cumulative counts as in ISO 4406. Although there is no guidance given in the standard on how to quote the levels, most industrial users quote a single code which is the highest recorded in all sizes and this convention is used on MP Filtri Contamination Monitoring Products (CMP).

The contamination classes are defined by a number (from 00 to 12) which indicates the maximum number of particles per 100 ml, counted on a differential basis, in a given size bracket.

Size Range Classes (in microns)

Maximum Contamination Limits per 100 ml					
Class	5-15	15-25	25-50	50-100	>100
00	125	22	4	1	0
0	250	44	8	2	0
1	500	89	16	3	1
2	1 000	178	32	6	1
3	2 000	356	63	11	2
4	4 000	712	126	22	4
5	8 000	1 425	253	45	8
6	16 000	2 850	506	90	16
7	32 000	5 700	1 012	180	32
8	64 000	11 400	2 025	360	64
9	128 000	22 800	4 050	720	128
10	256 000	45 600	8 100	1 440	256
11	512 000	91 200	16 200	2 880	512
12	1 024 000	182 400	32 400	5 760	1 024

5-15 µm = 42 000 particles
15-25 µm = 2 200 particles
25-50 µm = 150 particles
50-100 µm = 18 particles
> 100 µm = 3 particles
Class NAS 8

- CUMULATIVE DISTRIBUTION OF THE PARTICLES SIZE - ISO 4407

The level of contamination is defined by counting the number of particles collected by a laboratory membrane per unit of fluid volume. The measurement is done by a microscope. The membrane must be cleaned, dried and desiccated, with fluid and conditions defined by the Standard. The fluid volume is filtered through the membrane, using a suitable suction system.
The level of contamination is identified by dividing the membrane into a predefined number of areas and by counting the contaminant particles using a suitable laboratory microscope.

MICROSCOPE CONTROL AND MEASUREMENT

Example figure 1and 2

COMPARISON PHOTOGRAPH'S
1 graduation = 10µm

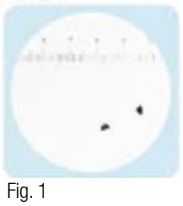


Fig. 1

Fig. 2

For other comparison photographs for contamination classes see the "*Filtration and Particle Analyser Handbook*".

Scan or click me!

- CLEANLINESS CODE COMPARISON

Although ISO 4406 standard is being used extensively within the hydraulics industry other standards are occasionally required and a comparison may be requested. The table below gives a very general comparison but often no direct comparison is possible due to the different classes and sizes involved.

ISO 4406	SAE AS4059 Table 2	SAE AS4059 Table 1	NAS 1638
> 4 µm(c) 6 µm(c) 14 µm(c)	> 4 µm(c) 6 µm(c) 14 µm(c)	4-6 6-14 14-21 21-38 38-70 >70	5-15 15-25 25-50 50-100 >100
23 / 21 / 18	13A / 12B / 12C	12	12
22 / 20 / 17	12A / 11B / 11C	11	11
21 / 19 / 16	11A / 10B / 10C	10	10
20 / 18 / 15	10A / 9B / 9B	9	9
19 / 17 / 14	9A / 8B / 8C	8	8
18 / 16 / 13	8A / 7B / 7C	7	7
17 / 15 / 12	7A / 6B / 6C	6	6
16 / 14 / 11	6A / 5B / 5C	5	5
15 / 13 / 10	5A / 4B / 4C	4	4
14 / 12 / 09	4A / 3B / 3C	3	3

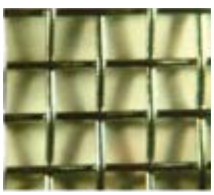
6 FILTRATION TECHNOLOGIES

Various mechanisms such as mechanical stoppage, magnetism, gravimetric deposit, or centrifugal separation can be used to reduce the level of contamination.
The mechanical stoppage method is most effective and can take place in two ways:

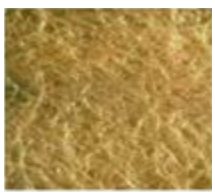
- SURFACE FILTRATION
  It is by direct interception. The filter prevents particles larger than the pores from continuing in the plant / system. Surface filters are generally manufactured with metal canvases or meshes.

- DEPTH FILTERING
  Filters are constructed by fiber interlacing. Such wraps form pathways of different shapes and sizes in which the particles remain trapped when they find smaller apertures than their diameter.
  Depth filters are generally produced with papers impregnated with phenolic resins, metal fibers or inorganic fibers.
  In inorganic fiber filtration, commonly called microfibre, the filtering layers are often overlapped in order to increase the ability to retain the contaminant.

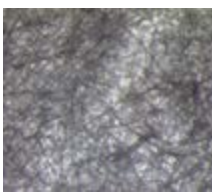
WIRE MESH FILTRATION

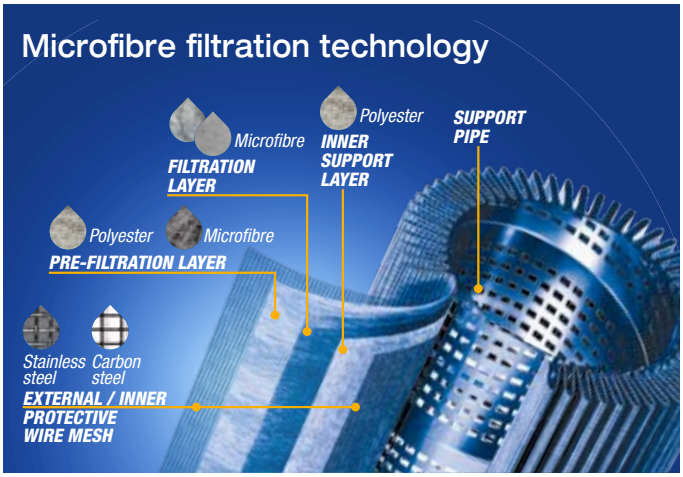


PAPER FILTRATION



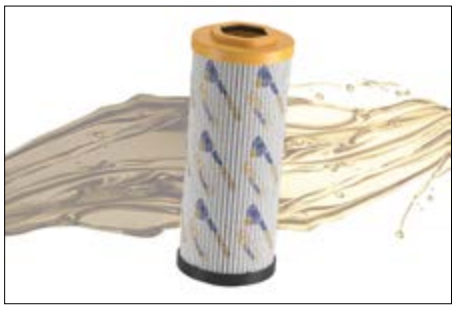
MICROFIBER FILTRATION





The filtration efficiency of metallic mesh filtrations is defined as the maximum particle size that can pass through the meshes of the filtering grid.
The efficiency of microfibre and paper filtration ($\beta_{x(c)}$) is defined through a lab test called Multipass Test. The efficiency value ($\beta_{x(c)}$) is defined as the ratio between the number of particles of certain dimensions detected upstream and downstream of the filter.

$$\frac{\text{Upstream particles number} > X\ \mu m_{(c)}}{\text{Downstream particles number} > X\ \mu m_{(c)}} = \beta_{x(c)}$$



Value ($\beta_{x(c)}$)	2	10	75	100	200	1000
Efficiency	50%	90%	98.7%	99%	99.5%	99.9%

Test conditions, such as type of fluid to be used (MIL-H-5606), type of contaminant to be used (ISO MTD), fluid viscosity, test temperature, are determined by ISO 16889.
In addition to the filtration efficiency value during the Multipass test, other important features, such as filtration stability (β stability) and dirt holding capacity (DHC), are also tested.
Poor filtration stability is the cause of the filtering quality worsening as the filter life rises. Low dirt holding capacity causes a reduction in the life of the filter.

Filtration ISO Standard Comparison		
$\beta_{x(c)}$ > 1000 ISO 16889	β_x > 200 ISO 4572	MP Filtri Filter media code
5 µm(c)	3 µm	A03
7 µm(c)	6 µm	A06
10 µm(c)	10 µm	A10
16 µm(c)	18 µm	A16
21 µm(c)	25 µm	A25

7 RECOMMENDED CONTAMINATION CLASSES

Any are the nature and the properties of fluids, they are inevitably subject to contamination. The level of contamination can be managed by using special components called filters.
Hydraulic components builders, knowing the problem of contamination, recommend the filtration level appropriate to the use of their products.

Example of recommended contamination levels for pressures below 140 bar.

Piston pumps with fixed flow rate	•					
Piston pumps with variable flow rate			•			
Vane pumps with fixed flow rate		•				
Vane pumps with variable flow			•			
Engines	•					
Hydraulic cylinders	•					
Actuators					•	
Test benches						•
Check valve	•					
Directional valves	•					
Flow regulating valves	•					
Proportional valves				•		
Servo-valves					•	
Flat bearings			•			
Ball bearings				•		
ISO 4406 CODE	20/18/15	19/17/14	18/16/13	17/15/12	16/14/11	15/13/10
Recommended filtration $\beta_{x(c)} \geq 1.000$	$\beta_{21(c)}$ >1000	$\beta_{15(c)}$ >1000	$\beta_{10(c)}$ >1000	$\beta_{7(c)}$ >1000	$\beta_{7(c)}$ >1000	$\beta_{5(c)}$ >1000
MP Filtri media code	A25	A16	A10	A06	A06	A03

The common classification of filters is determined by their position in the plant.

8 TYPES OF FILTERS

Suction filters
They are positioned before the pump and are responsible for protecting the pump from dirty contaminants. It also provides additional flow guidance to the pump suction line.
Being subject to negligible working pressures are manufactured with simple and lightweight construction.
They are mainly produced with gross grade surface filtrations, mainly 60 ÷ 125 µm.
They can be equipped with a magnetic filter for retaining ferrous particles.
They are generally placed under the fluid head to take advantage of the piezometric thrust of the fluid and reduce the risk of cavitation.

There are two types of suction filters:
- IMMERSION FILTERS
  Simple filter element screwed on the suction pipe

- FILTERS WITH CONTAINER
  Container filters that are more bulky, but provide easier maintenance of the tank

Delivery (or Pressure) filters
They are positioned between the pump and most sensitive regulating and controlling components, such as servo valves or proportional valves, and are designed to ensure the class of contamination required by the components used in the circuit.
Being subjected to high working pressures are manufactured with more robust and articulated construction. In particular situations of corrosive environments or aggressive fluids can be made of stainless steel.
They are mainly produced with filtering depths of 3 ÷ 25 µm.
They can be manufactured with in-line connections, with plate or flange connections or directly integrated into the circuit control blocks / manifolds.
They can also be manufactured in duplex configuration to allow the contaminated section to be maintained even when the plant / system is in operation without interruption of the working cycle.

Return filters
They are positioned on the return line to the tank and perform the task of filtering the fluid from particles entering the system from the outside or generated by the wear of the components.
They are generally fixed to the reservoir (for this reason also called top tank mounted), positioned semi-immersed or completely immersed.
The positioning of the return filters must guarantee in all operating conditions that the fluid drainage takes place in immersed condition; this is to avoid creating foams in the tank that can cause malfunctions or cavitation in the pumps.
For the sizing of the return filters, account must be taken of the presence of accumulators or cylinders that can make the return flow considerably greater than the pump suction flow rate.
Being subject to contained working pressures are manufactured with simple and lightweight construction.
Normally it is possible to extract the filter element without disconnecting the filter from the rest of the system.

Combined filters
They are designed to be applied to systems with two or more circuits. They are commonly used in hydrostatic transmission machines where they have a dual filtration function of the return line and suction line of the hydrostatic transmission pump.
The filter is equipped with a valve that keeps the 0.5 bar pressure inside the filter. A portion of the fluid that returns to the tank is filtered by the return filter element, generally produced with absolute filtration, and returns to the transmission booster pump.
Only excess fluid returns to the tank through the valve.
The internal pressure of the filter and the absolute filtration help to avoid the cavitation phenomenon inside the pump.

Off-line filters
They are generally used in very large systems / plants, placed in a closed circuit independent from the main circuit. They remain in operation regardless of the operation of the main circuit and are crossed by a constant flow rate.
They can also be manufactured in duplex configuration to allow the contaminated section to be maintained even when the unit is in operation without interruption of the work cycle.

Venting filters
During the operation of the plants, the fluid level present in the reservoir changes continuously.
The result of this continuous fluctuation is an exchange of air with the outside environment.
The venting filter function, positioned on the tank, is to filter the air that enters the tank to compensate for fluid level variations.

9 FILTER SIZING PARAMETERS

The choice of the filter system for an hydraulic system is influenced by several factors.
It is necessary to consider the characteristics of the various components present in the plant and their sensitivity to contamination.

It is also necessary to consider all the tasks that the filter will have to do within the plant:
- FLUID PROTECTION FROM CONTAMINATION
- PROTECTION OF OLEODYNAMIC COMPONENTS SENSITIVE TO CONTAMINATION
- PROTECTION OF OLEODYNAMIC PLANTS FROM ENVIRONMENTAL WASTE
- PROTECTION OF OLEODYNAMIC PLANTS FROM CONTAMINATION CAUSED BY COMPONENTS' FAILURES

The advantages of proper positioning and sizing of the filters are
- MORE RELIABILITY OF THE SYSTEM
- LONGER LIFE OF THE FLUID COMPONENTS
- REDUCTION OF STOP TIME
- REDUCTION OF FAILURE CASUALITIES

Each hydraulic filter is described by general features that identify the possibility of use in different applications.

- *MAXIMUM WORKING PRESSURE (Pmax)*
  The maximum working pressure of the filter must be greater than or equal to the pressure of the circuit section in which it will be installed.

- *PRESSURE DROP (ΔP)*
  The pressure drop depends on a number of factors, such as the working circuit temperature, the fluid viscosity, the filter element cleaning condition.

- *WORKING TEMPERATURE (T)*
  The working temperature deeply affect the choice of materials. Excessively high or low temperatures may adversely affect the strength of the materials or the characteristics of the seals.

- *FILTRATION EFFICIENCY (%) / FILTRATION RATIO ($ß_{x(c)}$)*
  Filtration efficiency is the most important parameter to consider when selecting a filter.
  When choosing the filtration performances, the needs of the most sensitive components in the system must be considered.

- *FLUID TYPE*
  The type of fluid influences the choice of filters in terms of compatibility and viscosity. It is always mandatory to check the filterability.

- *PLACEMENT IN THE PLANT*
  The position of the filter in the system conditions the efficiency of all filter performances.

10 APPLICABLE STANDARDS FOR FILTER DEVELOPMENT

In order to obtain unique criteria for development and verification of the filters performance, specific regulations for the filters and filter elements testing have been issued by ISO. These norms describe the target, the methodology, the conditions and the presentation methods for the test results.

ISO 2941
Hydraulic fluid power -- Filter elements -- Verification of collapse/burst pressure rating
This Standard describes the method for testing the collapse / burst resistance of the filter elements.
The test is performed by crossing the contaminated fluid filter element at a predefined flow rate. The progressive clogging of the filter element, determined by contamination, causes an increase in differential pressure.

ISO 2942
Hydraulic fluid power -- Filter elements -- Verification of fabrication integrity and determination of the first bubble point
This Standard describes the method to verify the integrity of the assembled filter elements.
It can be used to verify the quality of the production process or the quality of the materials by verifying the pressure value of the first bubble point.

ISO 2943
Hydraulic fluid power -- Filter elements -- Verification of material compatibility with fluids
This Standard describes the method to verify the compatibility of materials with certain hydraulic fluids.
The test is carried out by keeping the element (the material sample) immersed in the fluid under high or low temperature conditions for a given period of time and verifying the retention of the characteristics.

ISO 3723
Hydraulic fluid power -- Filter elements -- Method for end load test
This Standard describes the method for verifying the axial load resistance of the filter elements.
After performing the procedure described in ISO 2943, the designed axial load is applied to the filter element. To verify the test results, then the test described in ISO 2941 is performed.

ISO 3968
Hydraulic fluid power -- Filters -- Evaluation of differential pressure versus flow characteristics
This Standard describes the method for checking the pressure drop across the filter.
The test is carried out by crossing the filter from a given fluid and by detecting upstream and downstream pressures.
Some of the parameters defined by the Standard are the fluid, the test temperature, the size of the tubes, the position of the pressure detection points.

ISO 16889
Hydraulic fluid power -- Filters -- Multi-pass method for evaluating filtration performance of a filter element
This Standard describes the method to check the filtration characteristics of the filter elements.
The test is performed by constant introduction of contaminant (ISO MTD). The characteristics observed during the test are the filtration efficiency and the dirty holding capacity related to the differential pressure.

ISO 23181

Hydraulic fluid power -- Filter elements -- Determination of resistance to flow fatigue using high viscosity fluid

This Standard describes the method for testing the fatigue resistance of the filter elements. The test is carried out by subjecting the filter to continuous flow variations, thus differential pressure, using a high viscosity fluid.

ISO 11170

Hydraulic fluid power -- Sequence of tests for verifying performance characteristics of filter elements

The Standard describes the method for testing the performance of filter elements. The protocol described by the regulations provides the sequence of all the tests described above in order to verify all the working characteristics (mechanical, hydraulic and filtration).

ISO 10771-1

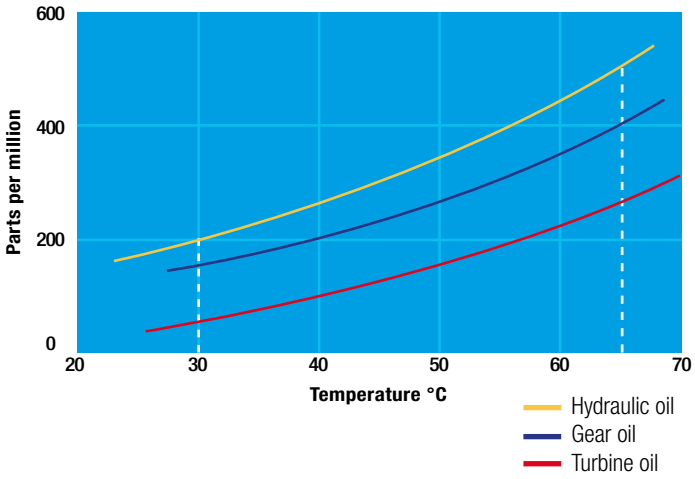
Hydraulic fluid power -- Fatigue pressure testing of metal pressure-containing envelopes -- Test method

This Standard describes the method to check the resistance of the hydraulic components with pulsing pressure.
It can be applied to all metal components (excluding tubes) subject to cyclic pressure used in the hydraulic field.

11 WATER IN HYDRAULIC AND LUBRICATING FLUIDS

Water Content

In mineral oils and non aqueous resistant fluids water is undesirable. Mineral oil usually has a water content of 50-300 ppm (@40°C) which it can support without adverse consequences.
Once the water content exceeds about 300ppm the oil starts to appear hazy. Above this level there is a danger of free water accumulating in the system in areas of low flow. This can lead to corrosion and accelerated wear.
Similarly, fire resistant fluids have a natural water which may be different to mineral oil.

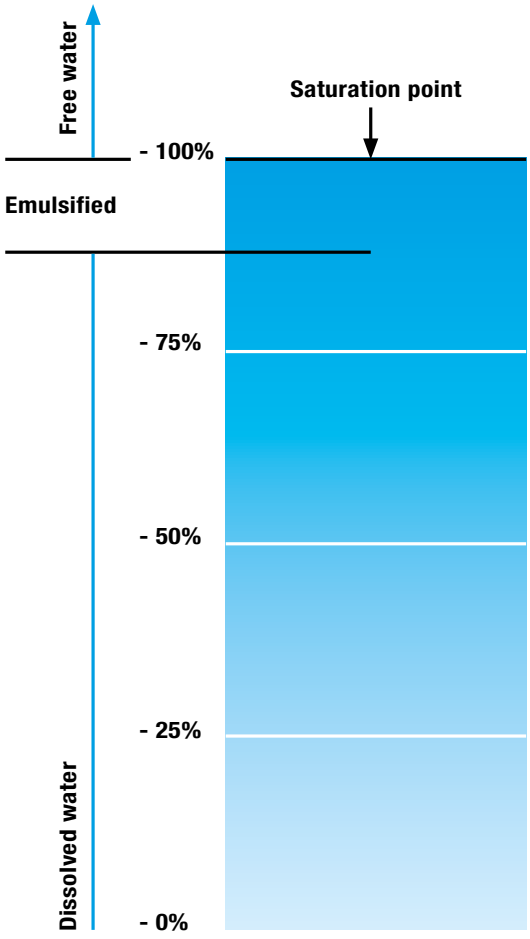


Saturation Levels

Since the effects of free (also emulsified) water is more harmful than those of dissolved water, water levels should remain well below the saturation point.

However, even water in solution can cause damage and therefore every reasonable effort should be made to keep saturation levels as low as possible. There is no such thing as too little water. As a guideline, we recommend maintaining saturation levels below 50% in all equipment.

TYPICAL WATER SATURATION LEVEL FOR NEW OILS
Examples:
Hydraulic oil @ 30°C = 200 ppm = 100% saturation
Hydraulic oil @ 65°C = 500 ppm = 100% saturation



WATER REMOVAL

Water is present everywhere, during storage, handling and servicing.

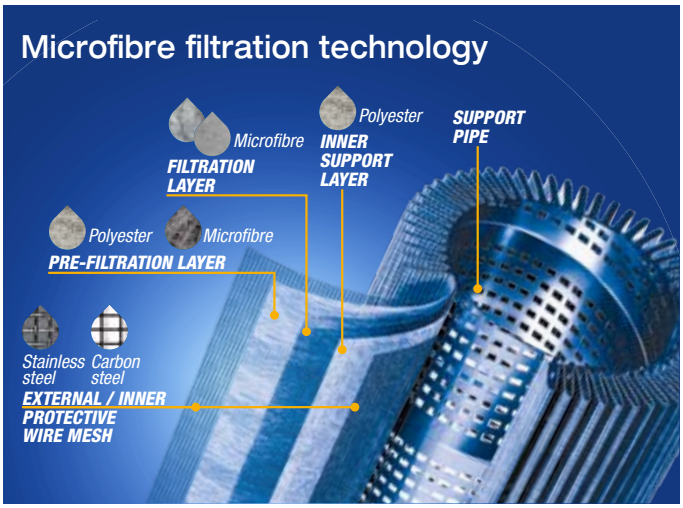
MP Filtri filter elements feature an absorbent media which protects hydraulic systems from both particulate and water contamination.
MP Filtri's filter element technology is available with inorganic microfiber media with a filtration rating 25 µm (therefore identified with media designation WA025), providing absolute filtration of solid particles to $\beta_{x(c)} = 1000$.
Absorbent media is made by water absorbent fibres which increase in size during the absorption process.
Free water is thus bonded to the filter media and completely removed from the system (it cannot even be squeezed out).

Filter Media

Fabric that absorbs water

Absorber media layer

The Filter Media has absorbed water



Microfibre filtration technology

By removing water from your fluid power system, you can prevent such key problems as:
- corrosion (metal etching)
- loss of lubricant power
- accelerated abrasive wear in hydraulic components
- valve-locking
- bearing fatigue
- viscosity variance (reduction in lubricating properties)
- additive precipitation and oil oxidation
- increase in acidity level
- increased electrical conductivity (loss of dielectric strength)
- slow/weak response of control systems

For more details please refer to our dedicate brochure "WATER REMOVAL"

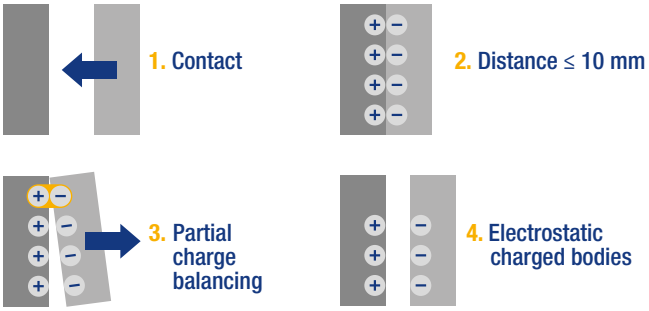
Scan or click me!

(12) THE ANTI-STATIC FILTERS

zerospark®

zerospark is a specialist solution designed to solve the problem of electrostatic discharge inside hydraulic filters. Caused by the electrical charge build-up due to the passage of oil through the filters, this can result in damage to filter elements, oils and circuit components. It can even cause fire hazards in environments where flammable materials are present.

THE TRIBOELECTRIC EFFECT
The body with the most electronegativity strips electrons from the other, generating a build-up of a net negative charge on itself. The other body is charged by the same amount but with the opposite sign, giving rise to very high potential differences. These, if not dissipated, can give rise to electrostatic discharges.



For more details please refer to our dedicate brochure "ZEROSPARK"

Scan or click me!

Filters sizing software

The web-based software program will allow you to select the most suitable MP Filtri's Filters, in accordance with your process design requirements.

The program will automatically check your input design process prior to propose you the acceptable solutions and create an output in PDF report style format.

The MP Filtri Selection Tool software program is easy to use with a flexible fast design method and provides improved layout formats with full descriptions.

The web-based tool is available at MP Filtri website at following link:
https://www.mpfiltri.com/tools/

The related, complete user guide is available as Manual and downloadable from the "Download" section of MP Filtri website, as well as scanning the following QR code

Scan or click me!

Suction filters are used as safety filters to protect pumps from gross contamination which can cause them to grip.

They are available in 3 families:
- Suction Strainers (STRC and MPAC)
- SFEX ELIXIR® series, for protection of the downstream pump against the coarse contamination
- SFMC and SFSC external filters, for mounting semi-immersed under the oil level

SFMC and SFSC semi-immersed filters, which shut-off oil flow while the filter element is being replaced, replace the butterfly valves usually used for servicing hydraulic pumps.

Suction filters

FILTER SIZING Calculation

THE CORRECT FILTER SIZING HAS TO BE BASED ON THE TOTAL PRESSURE DROP DEPENDING ON THE APPLICATION.

The pressure drop calculation is performed by adding together the value of the housing with the value of the filter element. The pressure drop Δpc of the housing is proportional to the fluid density (kg/dm³ / lb/ft³).
The filter element pressure drop Δpe is proportional to its viscosity (mm²/s / SUS), the corrective factor Y have to be used in case of an oil viscosity different than 30 mm²/s (cSt) / 150 SUS.

Sizing data for single filter element, head at top

Δpc = Filter housing pressure drop [bar / psi]
Δpe = Filter element pressure drop [bar / psi]
Y = Corrective factor Y (see correspondent table), depending on the filter type, on the filter element size, on the filter element length and on the filter media
Q = flow rate (l/min - gpm)
V1 reference oil viscosity = 30 mm²/s (cSt) /150 SUS
V2 = operating oil viscosity in mm²/s (cSt) / SUS

Filter element pressure drop calculation with an oil viscosity different than 30 mm²/s (cSt) / 150 SUS

International system:
Δpe = Y : 1000 x Q x (V2:V1)

Imperial system:
Δpe = Y : 17.2 x Q x (V2:V1)

Δp Tot. = Δpc + Δpe

Verification formula

Δp Tot. ≤ Δp max allowed

Maximum total pressure drop (Δp max) allowed by a new and clean filter

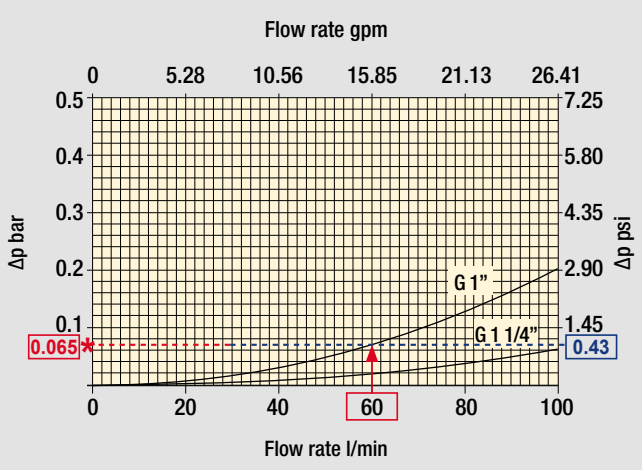
Filter family	Δp max	
	[bar]	[psi]
Suction filters	0.08 bar	1.15 psi

Filter pressure drop calculation example

Application data:
Selected filter: **SFEX 110 length 10**
Selected filter element: **FEX 110 length 10**
Selected connection: **G 1”**
Selected filtration rating: **90 µm** absolute filtration with wire mesh
Flow rate Q = **60 l/min / 15.85 gpm**
Viscosity V2 = 46 mm²/s (cSt) / 216 SUS
Oil density = 0.86 kg/dm³ / 53.68 lb/ft³

Calculation:
Δpc = 0.065 bar / 0.94 psi (see graphic below)

SFEX 110



Filter housings Δp pressure drop.
The curves are plotted using mineral oil with density of 0.86 kg/dm³ in compliance with ISO 3968. Δp varies proportionally with density.

Filter element		Nominal filtration Filter Elem. Δp Series: A - C					
Type	Length	P0010	P0025	M0025	M0060	M0090	M0250
FEX 110	10	1.33	1.12	0.22	0.18	0.14	0.14
	20	0.90	0.76	0.15	0.10	0.09	0.09

Δpe = (0.14 : 1000) x 60 x (46 : 30) = 0.01 bar
Δpe = (0.14 : 17.2) x 15.8 x (216 : 150) = 0.19 psi

√ **Δp Tot. = 0.065 + 0.01 = 0.075 bar**
Δp Tot. = 0.94 + 0.19 = 1.13 psi

The selection is correct because the total pressure drop value is inside the admissible range for suction filters.
In case the max allowed total pressure drop is not verified, it is necessary to repeat the calculation changing the filter and/or filter element length/size.

Filter element		Nominal filtration Filter element ΔP Series : A - C					
Type	Length	P0010	P0025	M0025	M0060	M0090	M0250
SMC 250	10	0.65	0.20	0.10	0.08	0.05	0.03
SSC 503	10	-	-	0.17	0.11	0.11	0.11
SSC 504	10	-	-	0.11	0.08	0.08	0.08
SSC 505	10	-	-	0.23	0.18	0.18	0.18
SSC 510	10	-	-	0.18	0.14	0.14	0.14
SSC 535	10	-	-	0.08	0.05	0.05	0.05
SSC 540	10	-	-	0.05	0.04	0.04	0.04
FEX 060	10	4.58	3.22	1.02	0.89	0.63	0.63
	20	1.97	1.38	0.62	0,45	0.29	0.29
FEX 110	10	1.33	1.12	0.22	0.18	0.14	0.14
	20	0.90	0.76	0.15	0.10	0.09	0.09

Corrective factor Y to be used for the filter element pressure drop calculation. The values depend to the filter size and length and to the filter media.
Reference oil viscosity 30 mm^2/s

STRC & MPAC series

Flow rate up to 1000 l/min

Description

Suction filters

Flow rate up to 1000 l/min

STRC

STRC is a range of suction strainers for protection of the downstream pump against the coarse contamination.
They are placed below the oil level directly connected to the suction line of the pump.

Available features:
- Female threaded connections up to 3", for a maximum flow rate of 1000 l/min
- Bypass valve, to relieve excessive pressure drop across the filter media

Common application:
- Mobile machines (Construction and Agriculture machines)
- Industrial equipment

MPAC

MPAC is a range of suction strainers for protection of the downstream pump against the coarse contamination.
They are placed below the minimum oil level, directly connected to the suction line of the pump.
The robust design allows the use of these filters in any heavy duty application.

Available features:
- Female threaded connections up to 3", for a maximum flow rate of 1000 l/min
- Magnetic filter (MPAC), to hold the ferrous particles

Common application:
Industrial equipment

Technical data

STRC materials
1 - Connection: Polyamide, GF reinforced
2 - Core tube: Tinned steel
3 - Wire mesh
4 - End cap: Polyamide, GF reinforced
5 - Bypass valve: Polyamide, GF reinforced - Steel

MPAC materials
1 - Connection: Aluminium
2 - Magnetic filter
3 - Tie rod: Galvanized steel
4 - End cap: Galvanized steel
5 - Core tube: Galvanized steel
6 - Filter media: Wire mesh
7 - Bottom: Galvanized steel
8 - Washer: Galvanized steel
9 - Self-locking nut: Galvanized steel - Polyamide

Bypass valve
Opening pressure 0.03 MPa (0.3 bar)

Filter element features

Filter		Filter element	
STRC- MPAC		n.a.	
Δp Element type			
Element media	Construction	Δp Series	Δp
M - Wire mesh	Standard	A	1 bar
Please see ordering code tables to check element Δp series availability based on filter features.			
Flow direction through the filter element: From OUT to IN			

Temperature
From -25 °C to +110 °C

Quantity

Series and size		pcs/pack
STRC	045 - 050	12
STRC	065 - 070 - 086 - 100	6
STRC	140 - 150	1
MPAC	050	12
MPAC	070 - 100	6
MPAC	140	1

Weights [kg]

Filter series	
STRC	see page 31
MPAC	see page 33

STRC
Without bypass

STRC
With bypass

MPAC
Without additional features

MPAC
With magnetic filter

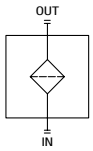
Flow rates [l/min]

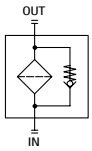
Filter series	Thread	l/min
STRC & MPAC	3/8”	19
	1/2”	28
	3/4”	67
	1”	126
	1 1/4”	167
	1 1/2”	258
	2”	480
	2 1/2”	854
	2”	480
	3”	995

Maximum flow rate for a complete suction filter with a pressure drop Δp = 0.08 bar.
The reference fluid has a kinematic viscosity of 30 mm^2/s (cSt) and a density of 0.86 kg/dm^3.
For different pressure drop or fluid viscosity we recommend to use our selection software available on www.mpfiltri.com.
You can also calculate the right size using the formulas present on the FILTER SIZING paragraph at the beginning of the full catalogue or at the beginning of the filter family brochure.
Please, contact our Sales Department for further additional information.

Filter series	00 - without bypass	03 - with bypass 0.3 bar
STRC	•	•
MPAC	•	-

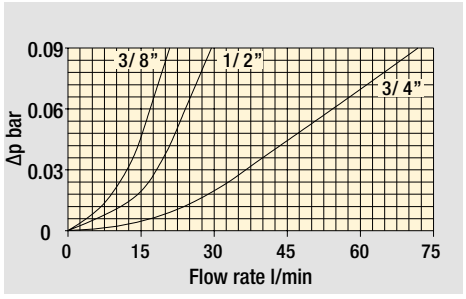
Hydraulic diagram

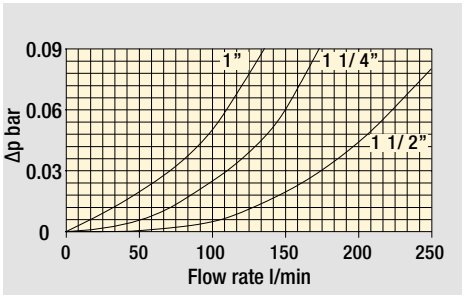


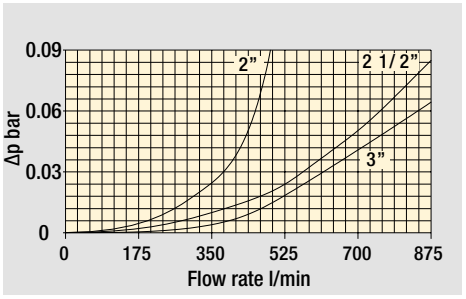


Pressure drop

Filter housings
Δp pressure drop







The curves are plotted using mineral oil with density of 0.86 kg/dm^3 in compliance with ISO 3968.
Δp varies proportionally with density.

STRC

Designation & Ordering code

COMPLETE FILTER

Example 1:	STRC	045	10	M0060	A	N	03	FG038	0	0N	NN	P01	NN
Example 2:	STRC	100	20	M0250	A	N	00	FN200	0	0N	NN	P01	NN

Series

STRC

Size

045	**086**
050	**100**
065	**140**
070	**150**

Length

Size:	045	050	065	070	086	100	140	150
10	•	•	•	•	•	•	•	•
20	-	-	•	•	•	•	•	•
30	-	-	-	-	•	-	•	•
40	-	-	-	-	-	-	•	-

Filtration rating (filter media)

M0025	Wire mesh	25 µm	**M0090**	Wire mesh	90 µm
M0060	Wire mesh	60 µm	**M0250**	Wire mesh	250 µm

Element Δp

A 1 bar

Seals and treatments

N Without seals

Bypass

00 Without bypass

03 With bypass 0.03 MPa (0.3 bar)

Connection type

FG Thread ISO 1179-2 (GAS)

FN Thread ANSI/ASME B 1.20.1 (NPT)

Nominal thread

Size:	045	050	065		070		086			100		140				150		
Length	10	10	10	20	10	20	10	20	30	10	20	10	20	30	40	10	20	30
038 3/8”	•	•	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
012 1/2”	•	•	•	-	•	•	-	-	-	-	-	-	-	-	-	-	-	-
034 3/4”	-	-	•	•	•	•	-	-	-	-	-	-	-	-	-	-	-	-
100 1”	-	-	-	•	-	•	-	-	-	-	-	-	-	-	-	-	-	-
114 1 1/4”	-	-	-	-	-	-	-	-	-	•	•	-	-	-	-	-	-	-
112 1 1/2”	-	-	-	-	-	-	•	•	•	•	•	•	-	-	-	-	-	-
200 2”	-	-	-	-	-	-	•	•	•	-	•	•	•	-	-	•	-	-
212 2 1/2”	-	-	-	-	-	-	-	-	-	-	-	-	-	•	-	-	•	-
300 3”	-	-	-	-	-	-	-	-	-	-	-	-	-	•	•	-	•	•

Additional connections

0 Without additional connections

Connections for clogging indicators

0N Without connection

Additional features

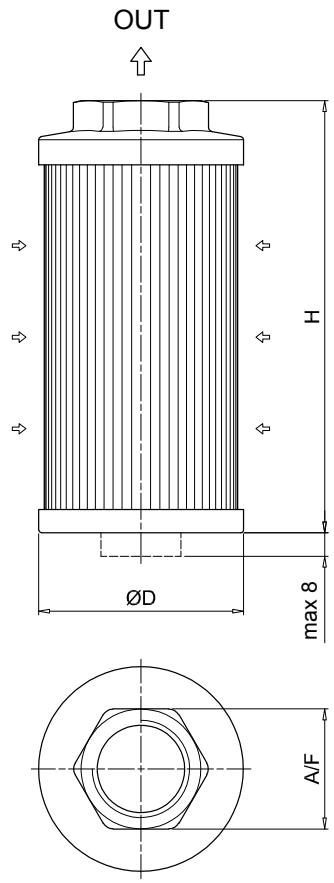
NN Without additional features

Version

P01 Standard catalogue item

Certificates

NN Without certificates



STRC

Size	ØD [mm]	Length	Nominal thread	H [mm]	A / F [mm]	Weight [kg]
045	46	10	3/8" 1/2"	105	30	0.19
050	52	10	3/8" 1/2"	79		0.11
065	65	10	1/2" 3/4"	110	41	0.22
		20	3/4" 1"	144		0.24
070	70	10	1/2" 3/4"	95		0.18
		20	1/2" 3/4" 1"	141		0.24
086	86	10	1 1/2" 2"	143	69	0.33
		20	1 1/2" 2"	201		0.43
		30	1 1/2" 2"	261		0.53
100	99	10	1 1/4" 1 1/2"	137		0.47
		20	1 1/4" 1 1/2" 2"	227		0.58
140	130	10	1 1/2" 2"	160		0.70
		20	2"	262		0.94
		30	2 1/2" 3"	272	101	1.10
		40	3"	330		1.17
150	150	10	2"	150	70	0.34
		20	2 1/2"	212	90	0.37
		30	3"	272	100	0.40

MPAC

Designation & Ordering code

COMPLETE FILTER

Example 1:	MPAC	070	10	M0060	A	N	00	FG034	0	0N	NN	P01	NN
Example 2:	MPAC	140	30	M0250	A	N	00	FN300	0	0N	MA	P01	NN

Series

MPAC

Size

050
070
100
140

Length

Size:	050	070	100	140
10	•	•	•	•
20	-	•	•	•
30	-	-	-	•

Filtration rating (filter media)

M0025	Wire mesh	25 µm	**M0090**	Wire mesh	90 µm
M0060	Wire mesh	60 µm	**M0250**	Wire mesh	250 µm

Element Δp

A 1 bar

Seals and treatments

N Without seals

Bypass

00 Without bypass

Connection type

FG Thread ISO 1179-2 (GAS)
FN Thread ANSI/ASME B 1.20.1 (NPT)

Nominal thread

Size:	050	070		100		140		
Length	10	10	20	10	20	10	20	30
038 3/8”	•	-	-	-	-	-	-	-
012 1/2”	•	•	-	-	-	-	-	-
034 3/4”	-	•	•	-	-	-	-	-
100 1”	-	-	•	•	-	-	-	-
114 1 1/4”	-	-	-	•	•	-	-	-
112 1 1/2”	-	-	-	-	•	•	-	-
200 2”	-	-	-	-	-	•	•	•
212 2 1/2”	-	-	-	-	-	-	•	-
300 3”	-	-	-	-	-	-	-	•

Additional connections

0 Without additional connections

Connections for clogging indicators

0N Without connection

Additional features

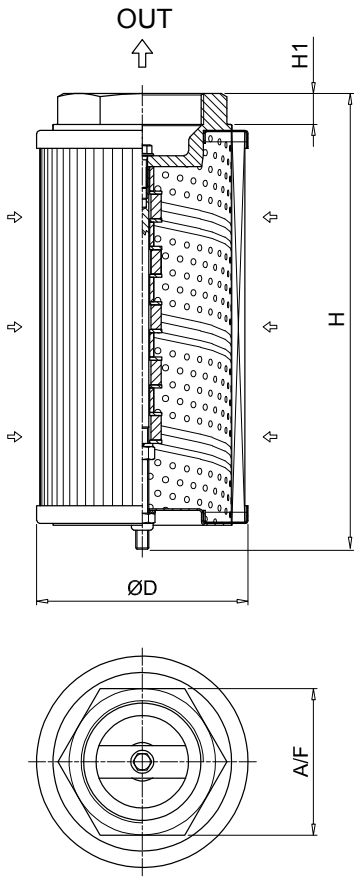
NN Without additional features
MA With magnetic filter

Version

P01 Standard catalogue item

Certificates

NN Without certificates



MPAC

Size	Ø D [mm]	Length	Nominal thread	H [mm]	H1 [mm]	A/F [mm]	Weight [kg]
050	50	10	3/8”	98	16	28	0.17
			1/2”	113			0.27
070	70	10	3/4”	115	18	42	0.36
		20		160			0.39
			1”				0.35
				145			0.54
100	99	10	1 1/4”	148	20	60	0.63
		20		239			0.95
			1 1/2”				0.91
				174			0.98
140	136	10	2”	162	13	80	1.00
		20		272			1.60
			2 1/2”	281	20	90	1.67
		30	2”	322	13	80	1.60
			3”	335	22	106	1.93

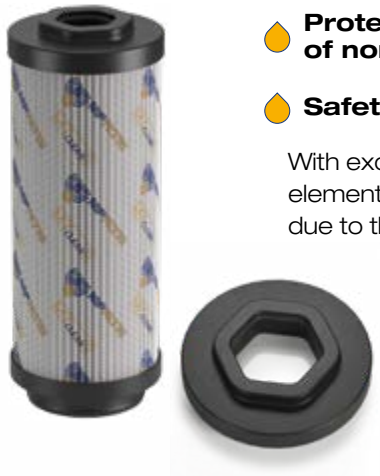
MYCLEAN

THE X CONCEPT FOR OUR FILTERS

**Protect the performance of your system with MYclean.
Quality and efficiency are fundamental for MP Filtri:
this exclusive new filter element possesses polygon shape geometry and specific seal that ensures only original spare parts can be used - ensuring correct operation and higher system reliability.**

SFEX series

with MYCLEAN FEX Filter Element



- **Protects the machine from improper use of non-original products.**
- **Safety of constant quality protection & reliability**

With exclusive filter element you are sure that only MP Filtri filter elements can be used, ensuring the best cleaning level of the oil due to the use of originals filter elements.

The products identified as SFEX are protected by:

- Italian Patent n° 102014902261205
- Canadian Patent n° 2,937,258
- European Patent n° 3 124 092 B1
- US Patent n° 20170030384 A1

SFEX series

Flow rate up to 100 l/min

INSTALLATION, SERVICE AND MAINTENANCE MANUAL AND SAFETY INSTRUCTIONS

Please scan or click the QR codes to get updated electronic version of the related document.

SFEX060 SFEX110

For all the QR codes: Scan or click me!

SFEX GENERAL INFORMATION

Description

Suction filters

Flow rate up to 100 l/min

SFEX are range of suction filters for protection of the downstream pump against the coarse contamination.
They are placed below the minimum oil level, directly connected to the suction line of the pump in-line mounted.

Available features:
- Female threaded connections up to 1 1/4" and SAE connections up to 1 5/8", for a maximum flow rate of 100 l/min
- Bypass valve, to relieve excessive pressure drop across the filter media
- Visual, electrical, axial and radial vacuum gauges
- MYclean interface connection for the filter element, to protect the product against non-original spare parts
- External protective wrap, to optimize the flow through the element and to save the element efficiency against non-proper handling

Common application:
- Mobile machines
- Industrial equipment

Technical data

Filter housing materials
- Head: Aluminium
- Bypass valve: Polyamide - Steel
- Bowl: Polyamide

Bypass valve
Opening pressure 0.03 MPa (0.3 bar) ±10%

Filter element features

Filter		Filter element	
SFEX		FEX	
Δp Element type			
Element media	**Construction**	**Δp Series**	**Δp**
M - Wire mesh	Standard	C	8 bar
P - Paper	Standard	C	8 bar
Please see ordering code tables to check element Δp series availability based on filter features.			
Flow direction through the filter element: From OUT to IN			

Seals
Standard NBR series A

Temperature
From -25 °C to +110 °C

Note
SFEX filters are provided for vertical mounting

Weights [kg] and volumes [dm³]

Filter series	Weights [kg]			Volumes [dm³]		
	Length	10	20	Length	10	20
SFEX 060		1.00	1.15		0.60	0.80
SFEX 110		1.90	2.10		1.60	2.00

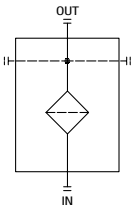
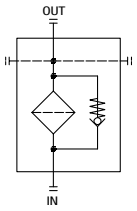
Flow rates [l/min]

		Filter element design - C Series				
Filter series	Length	M0060	M0090	M0250	P0010	P0025
SFEX 060	**10**	31	33	33	13	20
	20	34	35	35	24	30

		Filter element design - C Series				
Filter series	Length	M0060	M0090	M0250	P0010	P0025
SFEX 110	**10**	93	96	96	48	53
	20	98	99	99	60	65

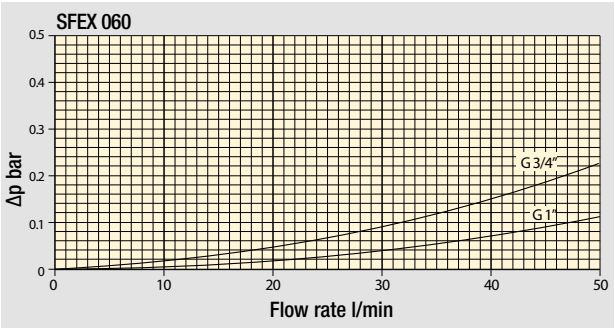
Maximum flow rate for a complete suction filter with a pressure drop Δp = 0.08 bar.
The reference fluid has a kinematic viscosity of 30 mm^2/s (cSt) and a density of 0.86 kg/dm^3.
For different pressure drop or fluid viscosity we recommend to use our selection software available on www.mpfiltri.com.
Please, contact our Sales Department for further additional information.

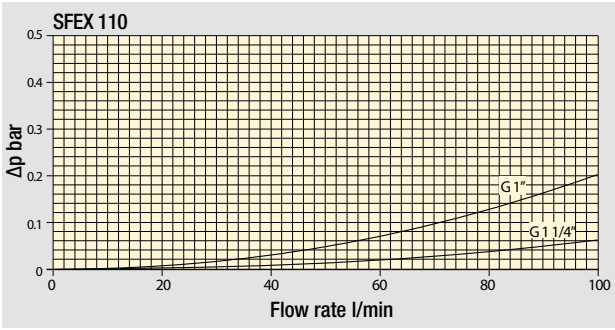
Hydraulic diagram

Filter series	00 - without bypass	03 - with bypass 0.3 bar
SFEX 060-110		

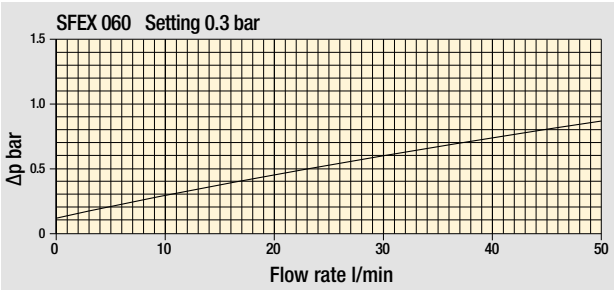
Pressure drop

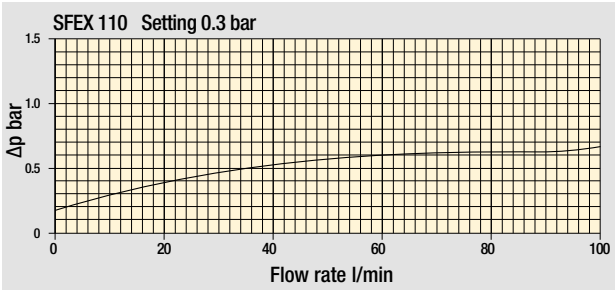
Filter housings
Δp pressure drop





Bypass valve pressure drop





The curves are plotted using mineral oil with density of 0.86 kg/dm^3 in compliance with ISO 3968.
Δp varies proportionally with density.

SFEX SFEX060 - SFEX110

Designation & Ordering code

COMPLETE FILTER

Example 1:	SFEX	060	10	M0060	C	A	03	FG034	0	6T	NN	P01	NN
Example 2:	SFEX	110	20	M0060	C	A	00	FS016	0	6T	NN	P01	NN

Series

SFEX Filter featuring MYCLEAN Filter Element

Size

060

110

Length

10

20

Filtration rating (filter media)

M0025 Wire mesh 25 µm

M0060 Wire mesh 60 µm

M0090 Wire mesh 90 µm

M0250 Wire mesh 250 µm

P0010 Resin-impregnated paper 10 µm

P0025 Resin-impregnated paper 25 µm

Element Δp

C 8 bar

Seals and treatments

A NBR

Bypass

00 Without bypass

03 With bypass 0.03 MPa (0.3 bar)

Connections

	060	110
FG034 G 3/4"	•	-
FG100 G 1"	•	•
FG114 G 1 1/4"	-	•

	060	110
FN034 3/4" NPT	•	-
FN100 1" NPT	•	•
FN114 1 1/4" NPT	-	•

	060	110
FS012 SAE 12 - 1 1/16" - 12 UN	•	-
FS016 SAE 16 - 1 5/16" - 12 UN	•	•
FS020 SAE 20 - 1 5/8" - 12 UN	-	•

Additional connections

0 Without additional connections

Connections for clogging indicators

6T With both side indicator connections, with metal plugs

Additional features

NN Without additional features

Version

P01 Standard catalogue item

Certificates

NN None

CLOGGING INDICATORS See page 775

VEB Electrical vacuum indicator

VLB Electrical / visual vacuum indicator

VVB Axial vacuum gauge

VVS Radial vacuum gauge

Designation & Ordering code

FILTER ELEMENT

Example 1:	FEX	060	10	M0060	C	A	00	NN	P01	NN
Example 2:	FEX	110	20	M0060	C	A	00	NN	P01	NN

Series
FEX Filter element with MYCLEAN feature

Size
060
110

Length
10
20

Filtration rating (filter media)
M0025 Wire mesh 25 µm
M0060 Wire mesh 60 µm
M0090 Wire mesh 90 µm
M0250 Wire mesh 250 µm
P0010 Resin-impregnated paper 10 µm
P0025 Resin-impregnated paper 25 µm

Element Δp
C 8 bar

Seals and treatments
A NBR

Bypass
00 Without bypass

Additional features
NN Without

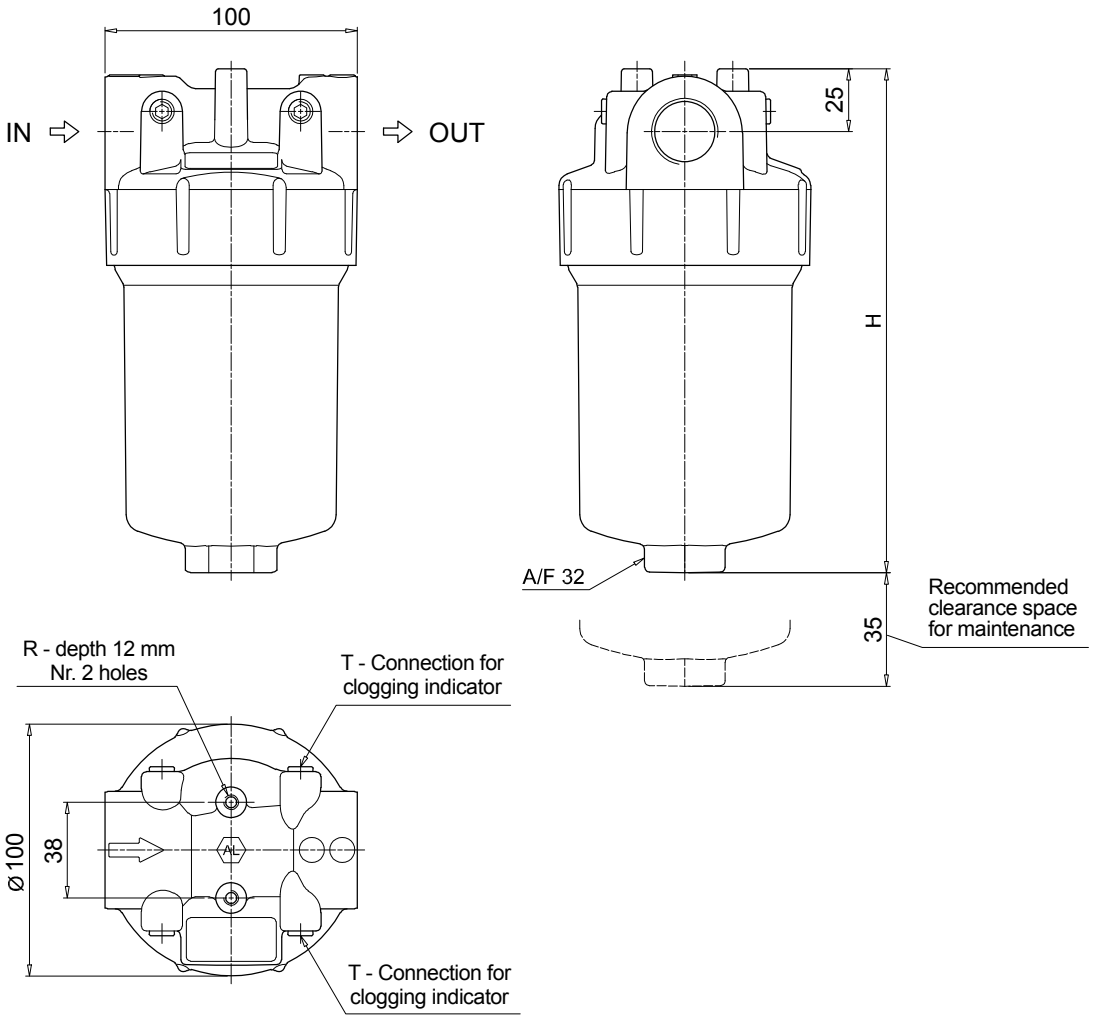
Version
P01 Standard catalogue item

Certificates
NN None

Dimensions

Filter length	H [mm]
10	202
20	265

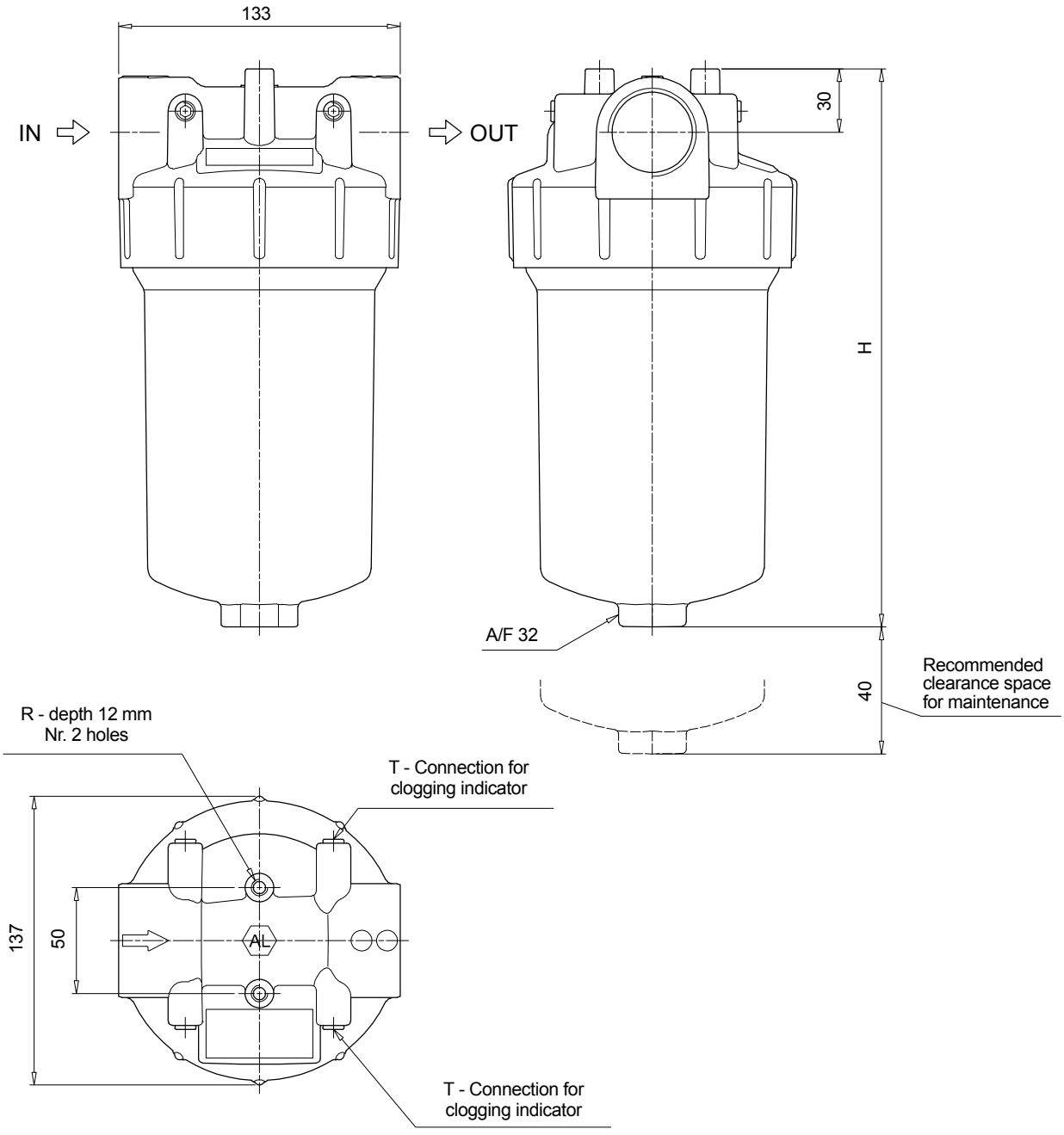
Connections	T	R
FG034	G 1/8"	M6
FG100	G 1/8"	M6
FN034	1/8" NPT	1/4" UNC
FN100	1/8" NPT	1/4" UNC
FS012	1/8" NPT	1/4" UNC
FS016	1/8" NPT	1/4" UNC



Dimensions

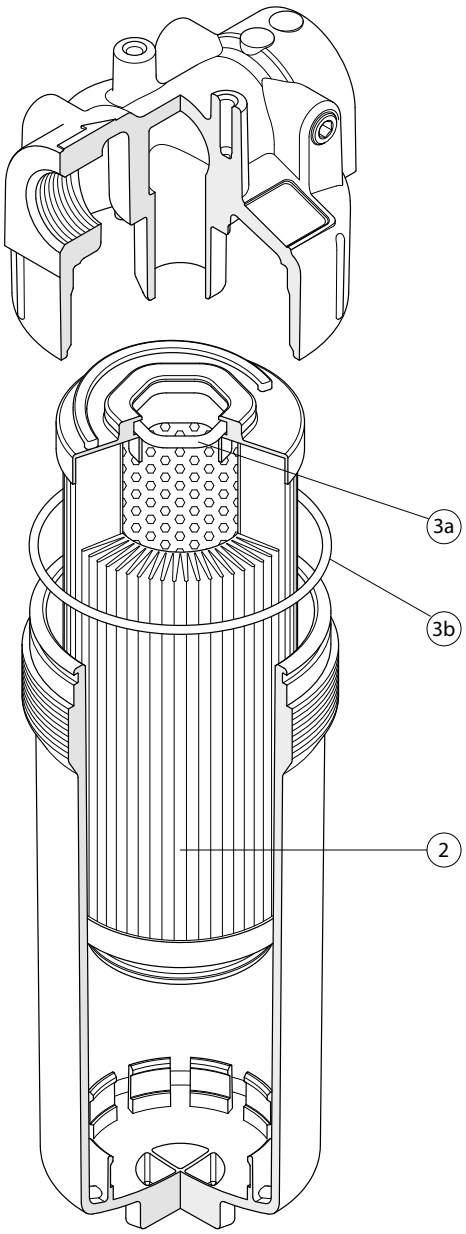
Filter length	H [mm]
10	266
20	315

Connections	T	R
FG100	G 1/8"	M8
FG114	G 1/8"	M8
FN100	1/8" NPT	5/16" UNC
FN114	1/8" NPT	5/16" UNC
FS016	1/8" NPT	5/16" UNC
FS020	1/8" NPT	5/16" UNC



SFEX SPARE PARTS

Order number for spare parts



Item:	Q.ty: 1 pc. (2)	Q.ty: 1 pc. (3) (3a ÷ 3b)
Filter series	**Filter element**	**Seal Kit code number NBR**
SFEX 060	See order table	02050771
SFEX 110		02050772

SFMC 250 series

Flow rate up to 160 l/min

SFMC 250 GENERAL INFORMATION

Description

Suction filters

Flow rate up to 160 l/min

SFMC 250 is a range of suction filters with integrated shut-off valve for protection of the downstream pump against the coarse contamination.
They are placed below the minimum oil level, directly connected to the suction line of the pump.
They can be fitted on the side or below the tank, allowing a more flexible design of the tank.
The shut-off valve closes automatically when the cover is removed, allowing the filter element replacement without the fluid drop.

Available features:

- Female threaded connections up to 1" and flanged connections up to 1 1/2", for a maximum flow rate of 160 l/min
- Multiple connections, to connect several suction lines
- Bypass valve, to relieve excessive pressure drop across the filter media
- Magnetic filter, to hold the ferrous particles
- Visual, electrical and electronic clogging indicators

Common application:

- Mobile machines
- Industrial equipment

Technical data

Filter housing materials

- Filter body: Aluminium
- Cover: Polyamide, GF reinforced
- Valve: Polyamide, GF reinforced - Steel
- Anti-Emptying valve: Steel

Bypass valve

Opening pressure 0.03 MPa (0.3 bar) ±10%

Filter element features

Filter		Filter element	
SFMC		SMC	
Δp Element type			
Element media	**Construction**	**Δp Series**	**Δp**
M - Wire mesh	Standard	A	1 bar
P - Paper	Standard	A	1 bar
Please see ordering code tables to check element Δp series availability based on filter features.			
Flow direction through the filter element: From IN to OUT			

Seals

- Standard NBR series A or W
- Optional FPM series V or Z

Temperature

From -25 °C to +110 °C

Note

SFMC 250 filters mounting, see the drawings on page 50 and following.

Weights [kg] and volumes [dm³]

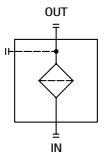
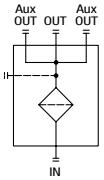
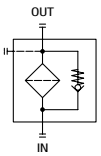
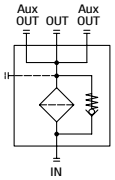
Filter series	Weights [kg]	Volumes [dm³]
SFMC 250	2.8	2.3
SFMC 250	2.8	2.4

Flow rates [l/min]

	Filter element design - N Series					
Filter series	M0025	M0060	M0090	M0250	P0010	P0025
SFMC 250	147	151	155	160	85	132

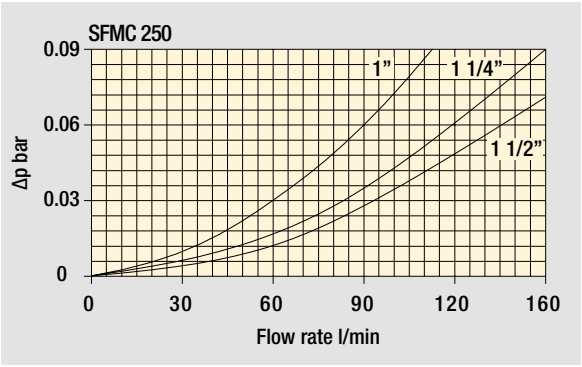
Maximum flow rate for a complete suction filter with a pressure drop Δp = 0.08 bar.
The reference fluid has a kinematic viscosity of 30 mm^2/s (cSt) and a density of 0.86 kg/dm^3.
For different pressure drop or fluid viscosity we recommend to use our selection software available on www.mpfiltri.com.
You can also calculate the right size using the formulas present on the FILTER SIZING paragraph at the beginning of the full catalogue or at the beginning of the filter family brochure.
Please, contact our Sales Department for further additional information.

Hydraulic diagram

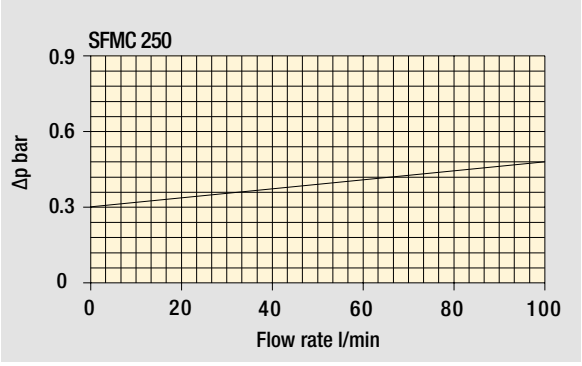
	00 - without bypass		03 - with bypass 0.3 bar	
Filter series	0 - without additional connections	1 - with smaller additional connections	0 - without additional connections	1 - with smaller additional connections
SFMC 250				

Pressure drop

Filter housings
Δp pressure drop



Bypass valve
pressure drop



The curves are plotted using mineral oil with density of 0.86 kg/dm^3 in compliance with ISO 3968.
Δp varies proportionally with density.

SFMC 250

Designation & Ordering code

COMPLETE FILTER

Example 1:	SFMC	250	10	M0025	A	A	00	FF112	0	5T	MA	P01	NN
Example 2:	SFMC	250	10	P0010	A	V	00	FG112	0	5T	NN	P01	NN

Series
SFMC

Size
250

Length
10

Filtration rating (filter media)

M0025	Wire mesh	25 µm	**P0010**	Resin-impregnated paper	10 µm
M0060	Wire mesh	60 µm	**P0025**	Resin-impregnated paper	25 µm
M0090	Wire mesh	90 µm			
M0250	Wire mesh	250 µm			

Element Δp
A 1 bar

Seals and treatments		M0xxx	P0xxx
A	NBR	•	•
V	FPM	•	•
W	NBR with filter and components surface treatment	•	-
Z	FPM with filter and components surface treatment	•	-

Bypass
00 Without bypass
03 With bypass 0.03 MPa (0.3 bar)

Connections

FG100	G 1”		**FS016**	SAE 16 - 1 5/16” - 12 UN	
FG114	G 1 1/4”		**FS020**	SAE 20 - 1 5/8” - 12 UN	
FG112	G 1 1/2”	G 1”	**FS024**	SAE 24 - 1 7/8” - 12 UN	SAE 16 - 1 5/16” - 12 UN
FN100	1” NPT		**FE112**	1 1/2” SAE 3000 psi/M	
FN114	1 1/4” NPT		**FF112**	1 1/2” SAE 3000 psi/UNC	
FN112	1 1/2” NPT		**Available additional connections**		

Additional connections	FG112	FS024
0 Without additional connections	-	-
1 With smaller additional connections	G1”	SAE 16 - 1 5/16” - 12 UN

Connections for clogging indicators
5T With rear indicator connection, with metal plugs

Additional features
NN Without additional features
MA With magnetic filter

Version
P01 Standard catalogue item

Certificates
NN None

CLOGGING INDICATORS See page 775

VEA Electrical vacuum indicator
VLA Electrical / visual vacuum indicator
VVA Axial vacuum gauge
VVR Radial vacuum gauge

FILTER ELEMENT

Example 1:	SMC	250	10	M0025	A	A	00	NN	P01	NN
Example 2:	SMC	250	10	P0010	A	V	00	NN	P01	NN

Series
SMC

Size
250

Length
10

Filtration rating (filter media)

M0025	Wire mesh	25 µm	**P0010**	Resin-impregnated paper	10 µm
M0060	Wire mesh	60 µm	**P0025**	Resin-impregnated paper	25 µm
M0090	Wire mesh	90 µm			
M0250	Wire mesh	250 µm			

Element Δp
A 1 bar

Seals and treatments
A NBR
V FPM

Bypass
00 Without bypass

Additional features
NN Without

Version
P01 Standard catalogue item

Certificates
NN None

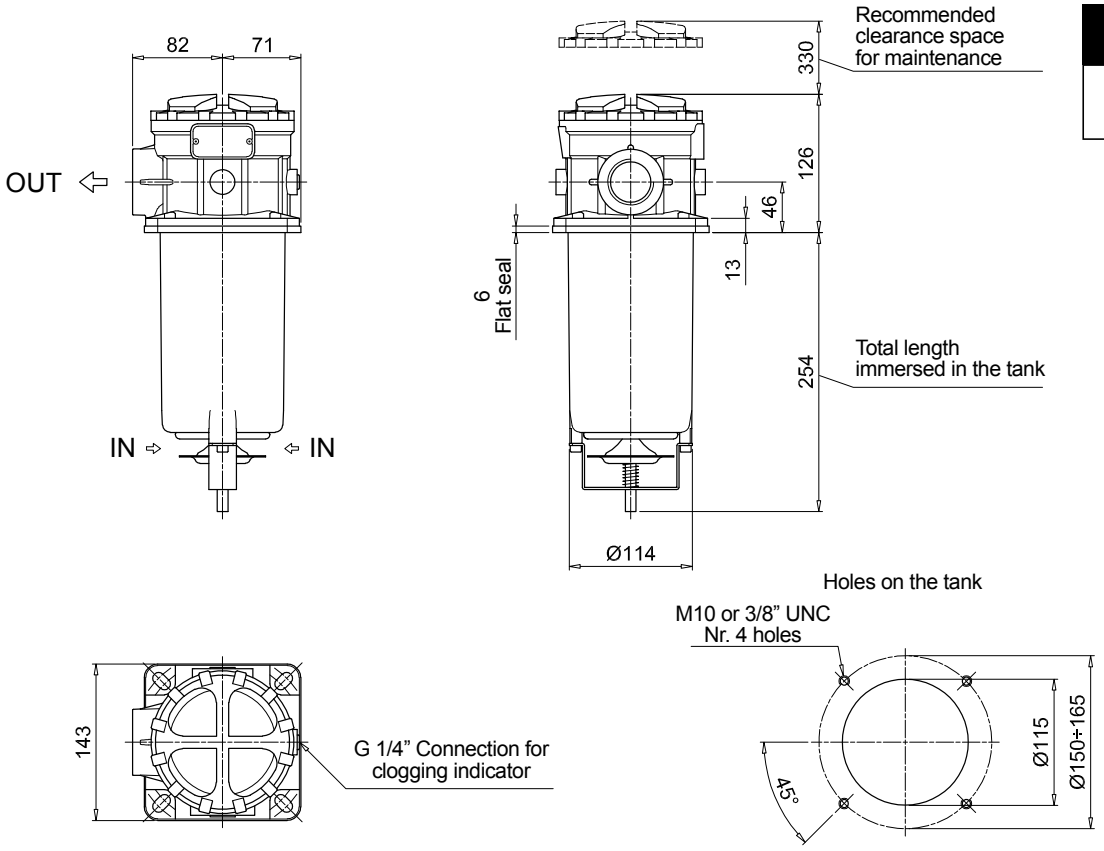
SFMC 250

Dimensions

SFMC 250

Threaded connections FG - FN - FS

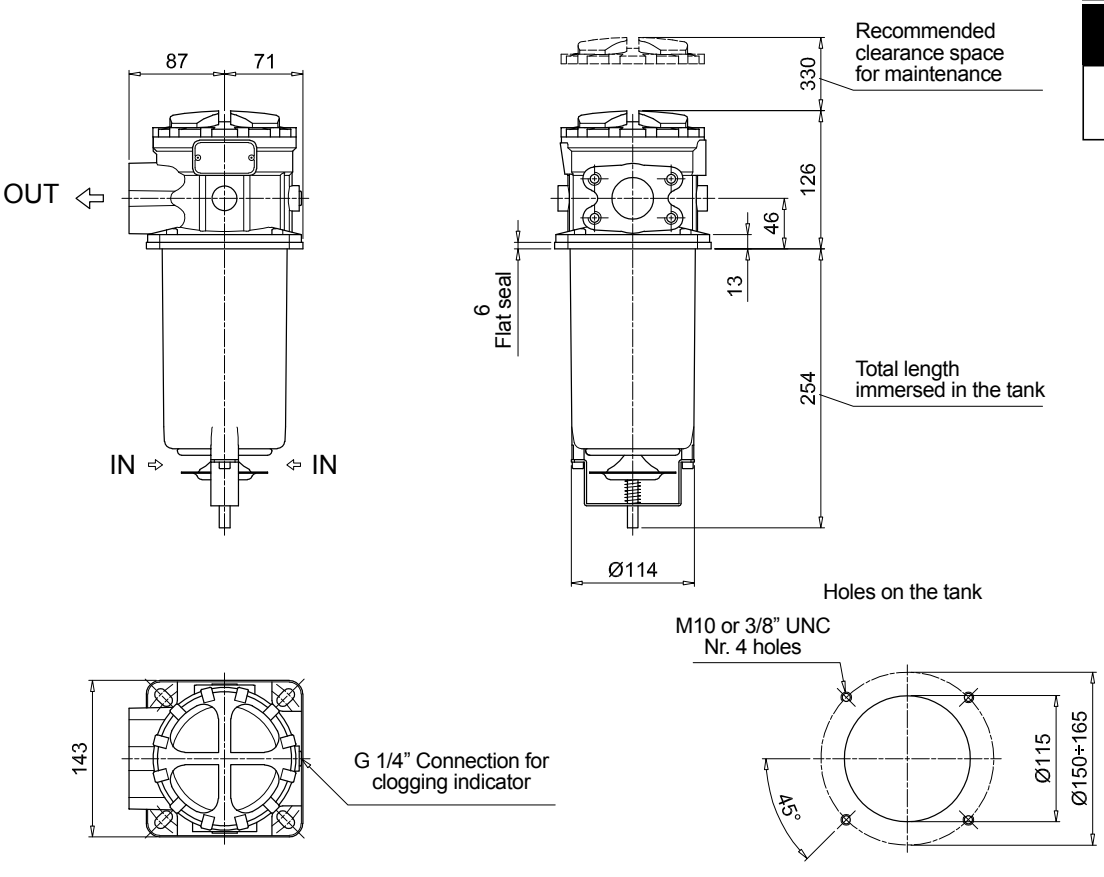
Without additional connection 0



SFMC 250

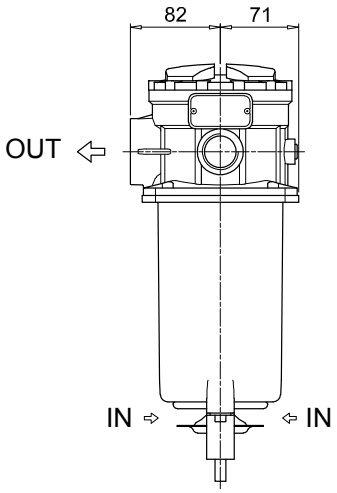
Flange connections FE - FF

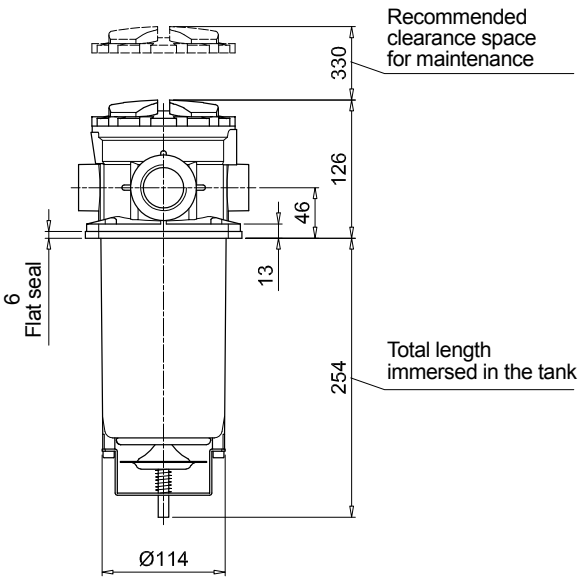
Without additional connection 0

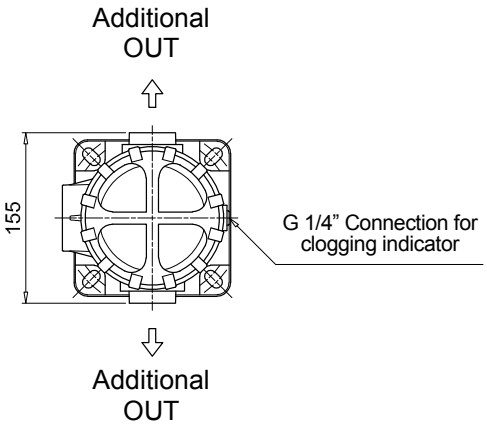


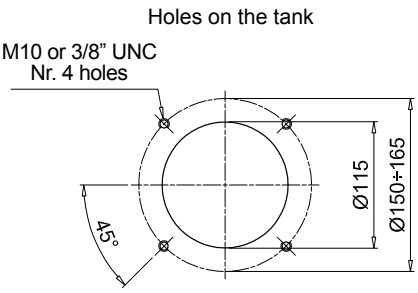
SFMC 250

With smaller additional connection 1





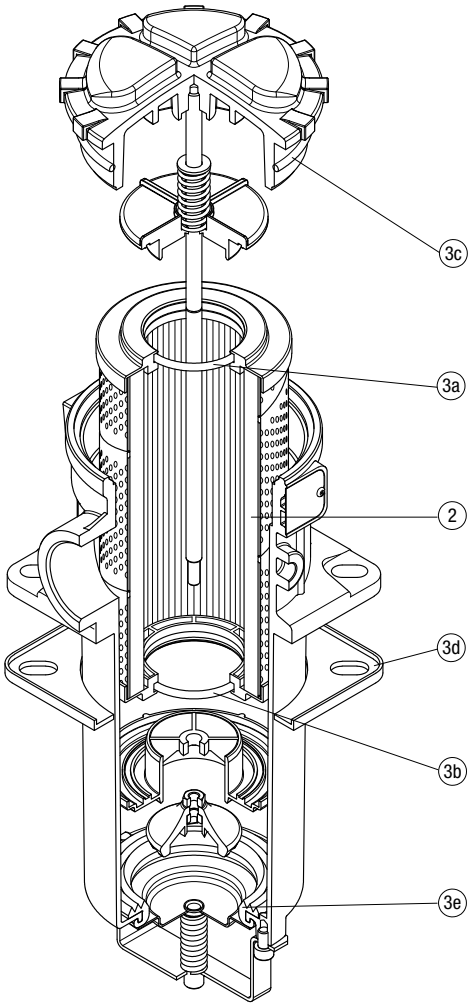




SFMC 250 SPARE PARTS

Order number for spare parts

SFMC 250



Item:	Q.ty: 1 pc. 2	Q.ty: 1 pc. 3 (3a ÷ 3e)	
Filter series	**Filter element**	**Seal Kit code number NBR**	**FPM**
SFMC 250	See order table	02050586	02050587

SFSC series

Flow rate up to 700 l/min

SFSC GENERAL INFORMATION

Description

Suction filters

Flow rate up to 700 l/min

SFSC is a range of suction filters with integrated shut-off valve for protection of the downstream pump against the coarse contamination.
They are placed below the minimum oil level, directly connected to the suction line of the pump.
They can be fitted on the side or below the tank, allowing a more flexible design of the tank.
The shut-off valve closes automatically when the cover is removed, allowing the filter element replacement without the fluid drop.

Available features:

- Flanged connections up to 4", for a maximum flow rate of 700 l/min
- Optional hose fitting installed, to connect the suction line without the use of flanges
- Magnetic filter, to hold the ferrous particles
- Plastic and metal handle, to close the shut-off valve before the cover removal
- Electrical switch, to signal the closed shut-off valve
- Visual, electrical and electronic clogging indicators

Common application:

Industrial equipment

Technical data

Filter housing materials

- Housing:
  Anodized Aluminium
  Steel (chemical heat treatment): only for SFSC 535 - 540

- Cover:
  Anodized Aluminium

- Optional hose barb:
  Anodized Aluminium

Filter element features

Filter		Filter element	
SFSC		SSC	
Δp Element type			
Element media	**Construction**	**Δp Series**	**Δp**
M - Wire mesh	Standard	A	1 bar
Please see ordering code tables to check element Δp series availability based on filter features.			
Flow direction through the filter element:			
From IN to OUT			

Seals

- Standard NBR series A or W
- Optional FPM series V or Z

Temperature

From -25 °C to +110 °C

Note

SFSC filters mounting, see the drawings on page 60 and following

Weights [kg] and volumes [dm³]

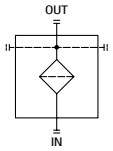
Filter series	Weights [kg]	Volumes [dm³]
SFSC 500	4.2	1.8
SFSC 503	6.2	2.9
SFSC 504	7.2	4.0
SFSC 505	4.3	1.6
SFSC 510	5.4	2.1
SFSC 535	16	4.4
SFSC 540	18.6	6.5

Flow rates [l/min]

Filter series	Filter element design - N Series	
	M0025	M0060 M0090 M0250
SFSC 500	219	234
SFSC 503	325	390
SFSC 504	484	543
SFSC 505	199	221
SFSC 510	259	282
SFSC 535	439	479
SFSC 540	644	688

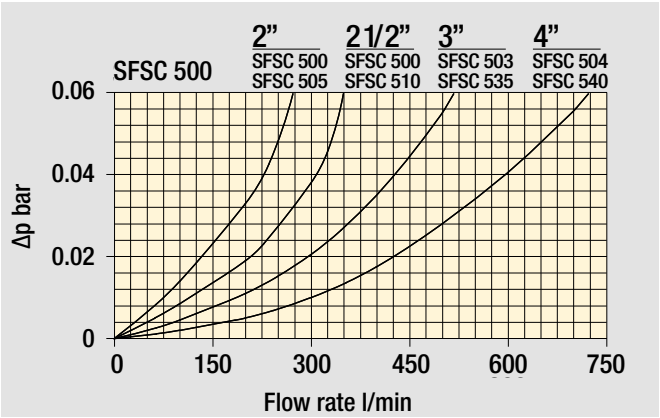
Maximum flow rate for a complete suction filter with a pressure drop Δp = 0.08 bar.
The reference fluid has a kinematic viscosity of 30 mm^2/s (cSt) and a density of 0.86 kg/dm^3.
For different pressure drop or fluid viscosity we recommend to use our selection software available on www.mpfiltri.com.
You can also calculate the right size using the formulas present on the FILTER SIZING paragraph at the beginning of the full catalogue or at the beginning of the filter family brochure.
Please, contact our Sales Department for further additional information.

Hydraulic diagram

Filter series	00 - without bypass
SFSC	

Pressure drop

Filter housings
Δp pressure drop



The curves are plotted using mineral oil with density of 0.86 kg/dm^3 in compliance with ISO 3968.
Δp varies proportionally with density.

Designation & Ordering code

COMPLETE FILTER

Example 1:	SFSC	500	10	M0025	A	W	00	FE200	0	6T	MA	P01	NN
Example 2:	SFSC	535	10	M0060	A	V	00	HB089	0	9T	MC	P01	NN

Series
SFSC

Size
500 | 503 | 504 | 505 | 510 | 535 | 540

Length
10

Filtration rating (filter media)

M0025	Wire mesh	25 µm	**M0090**	Wire mesh	90 µm
M0060	Wire mesh	60 µm	**M0250**	Wire mesh	250 µm

Element Δp
A 1 bar

Seals and treatments
A NBR
V FPM
W NBR with filter and components surface treatment
Z FPM with filter and components surface treatment

Bypass
00 Without bypass

Connections

		500	505	510	503-535	504-540
FE200	2" SAE 3000 psi/M	•	•	-	-	-
FE212	2 1/2" SAE 3000 psi/M	•	-	•	-	-
FE300	3" SAE 3000 psi/M	-	-	-	•	-
FE400	4" SAE 3000 psi/M	-	-	-	-	•
FF200	2" SAE 3000 psi/UNC	•	•	-	-	-
FF212	2 1/2" SAE 3000 psi/UNC	•	-	•	-	-
FF300	3" SAE 3000 psi/UNC	-	-	-	•	-
FF400	4" SAE 3000 psi/UNC	-	-	-	-	•

		500	505	510	503-535	504-540
HB063	Hose barb Ø 63 mm	•	•	-	-	-
HB075	Hose barb Ø 75 mm	•	-	•	-	-
HB089	Hose barb Ø 89 mm	-	-	-	•	-
HB114	Hose barb Ø 114 mm	-	-	-	-	•

Additional connections
0 Without additional connections

Connections for clogging indicators

		500-503-504-540	505-510-535
6T	With both side indicator connections, with metal plugs	•	-
9T	With multiple indicator connections, with metal plugs	-	•

Additional features

		500-503-504	505-510-535-540
MA	With magnetic filter	•	•
MB	With magnetic filter + polyamide handwheel	•	-
MC	With magnetic filter + microswitch	-	•
MD	With magnetic filter + microswitch + polyamide handwheel	•	-
ME	With magnetic filter + microswitch + steel handwhee	•	-

Version
P01 Standard catalogue item

Certificates
NN None

CLOGGING INDICATORS See page 775

VEB Electrical vacuum indicator
VLB Electrical / visual vacuum indicator
VVA Axial vacuum gauge
VVR Radial vacuum gauge

Designation & Ordering code

FILTER ELEMENT

Example 1:	SSC	510	10	M0025	A	N	00	NN	P01	NN
Example 2:	SSC	535	10	M0060	A	N	00	NN	P01	NN

Series

SSC

Size

503	SFSC 503	**510**	SFSC 500	**540**	SFSC 540
504	SFSC 504		SFSC 510		
505	SFSC 505	**535**	SFSC 535		

Length

10

Filtration rating (filter media)

M0025	Wire mesh	25 µm	**M0090**	Wire mesh	90 µm
M0060	Wire mesh	60 µm	**M0250**	Wire mesh	250 µm

Element Δp

A 1 bar

Seals and treatments

N No seal

Bypass

00 Without bypass

Additional features

NN Without

Version

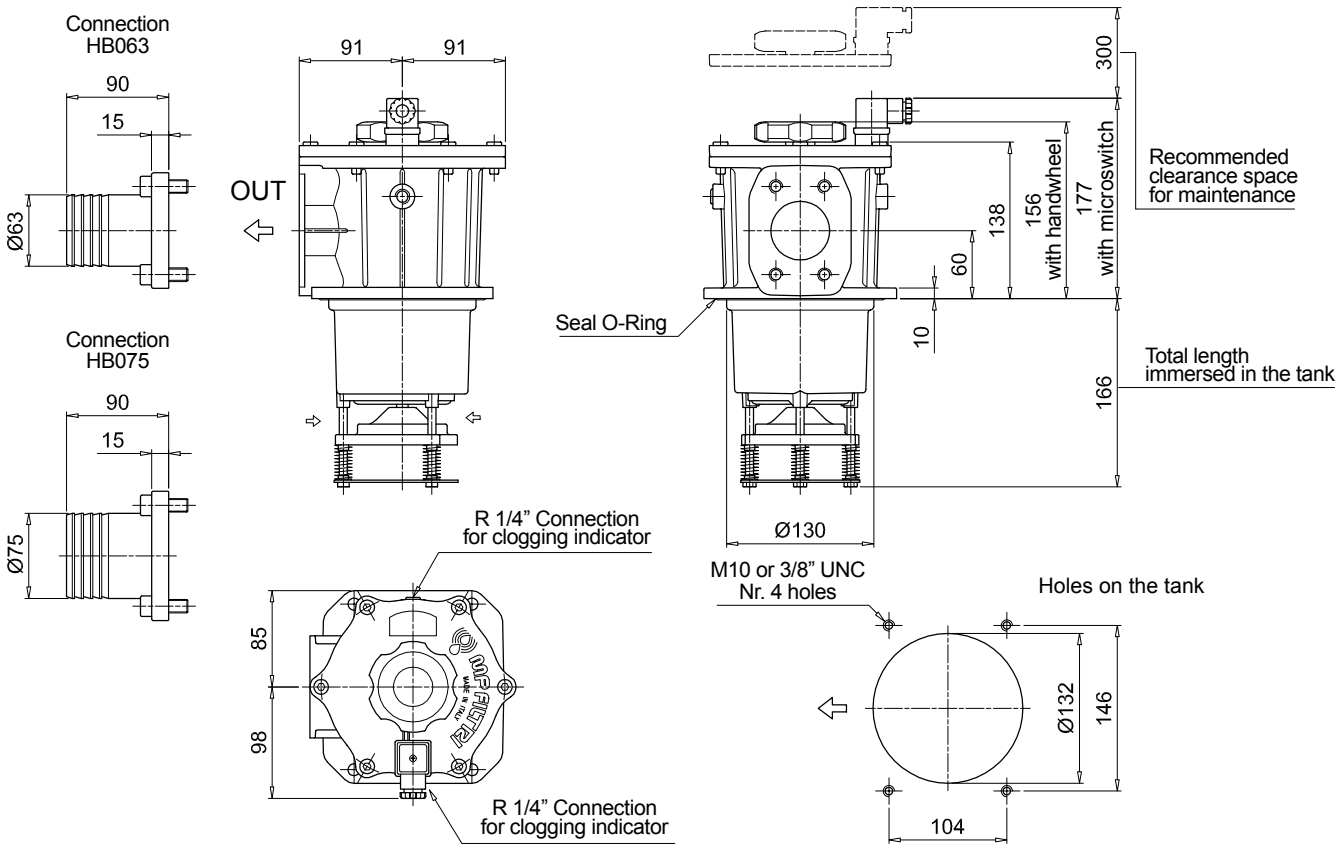
P01 Standard catalogue item

Certificates

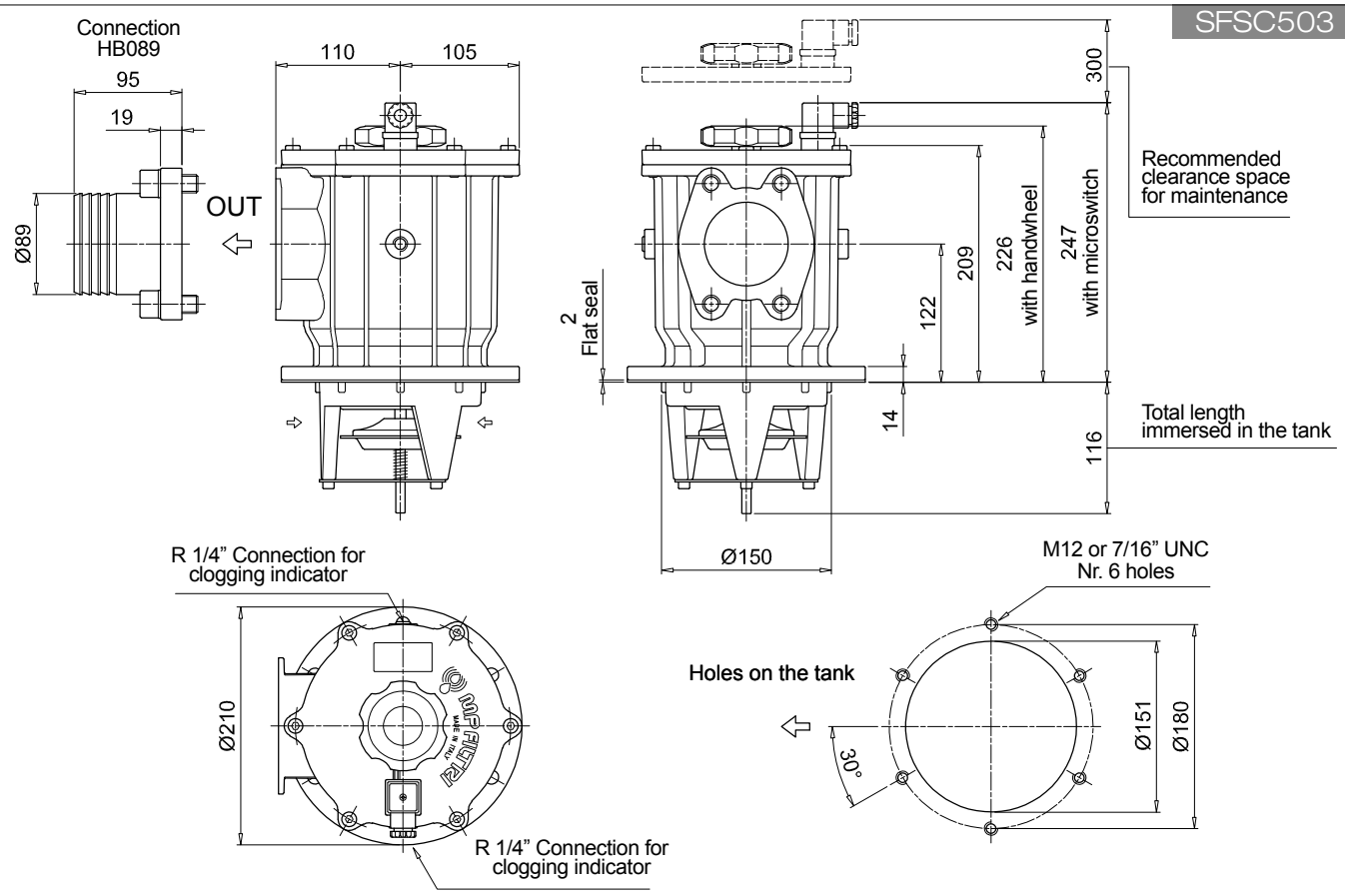
NN None

Dimensions

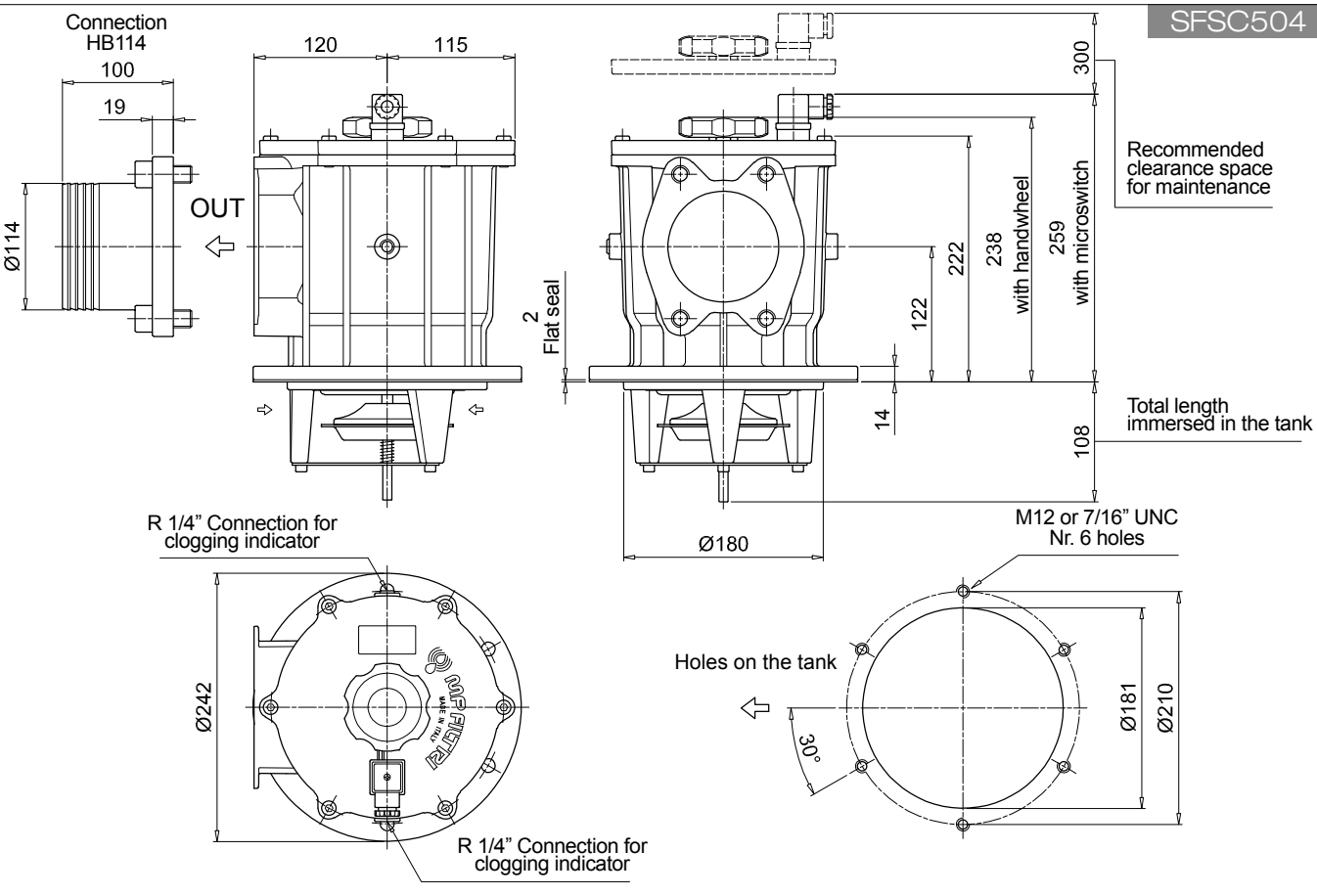
SFSC500



SFSC503

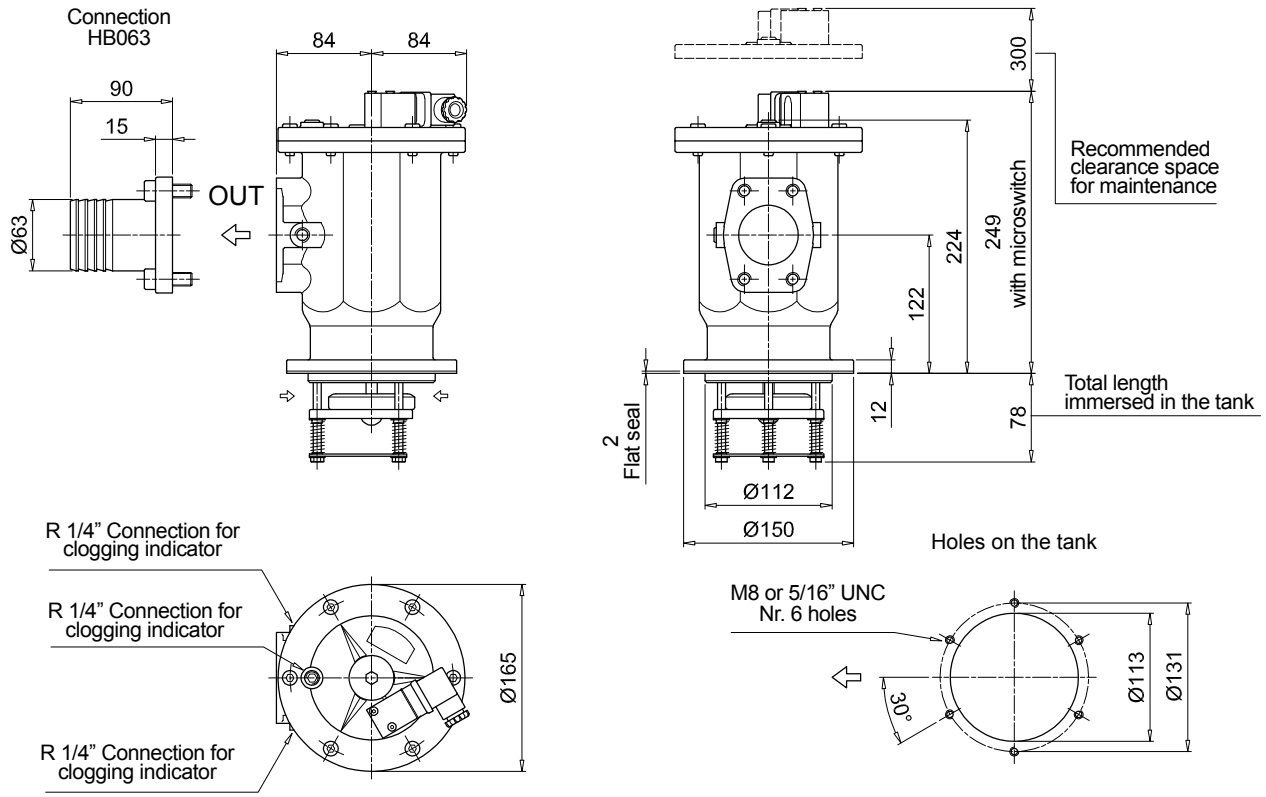


SFSC504



Dimensions

SFSC505



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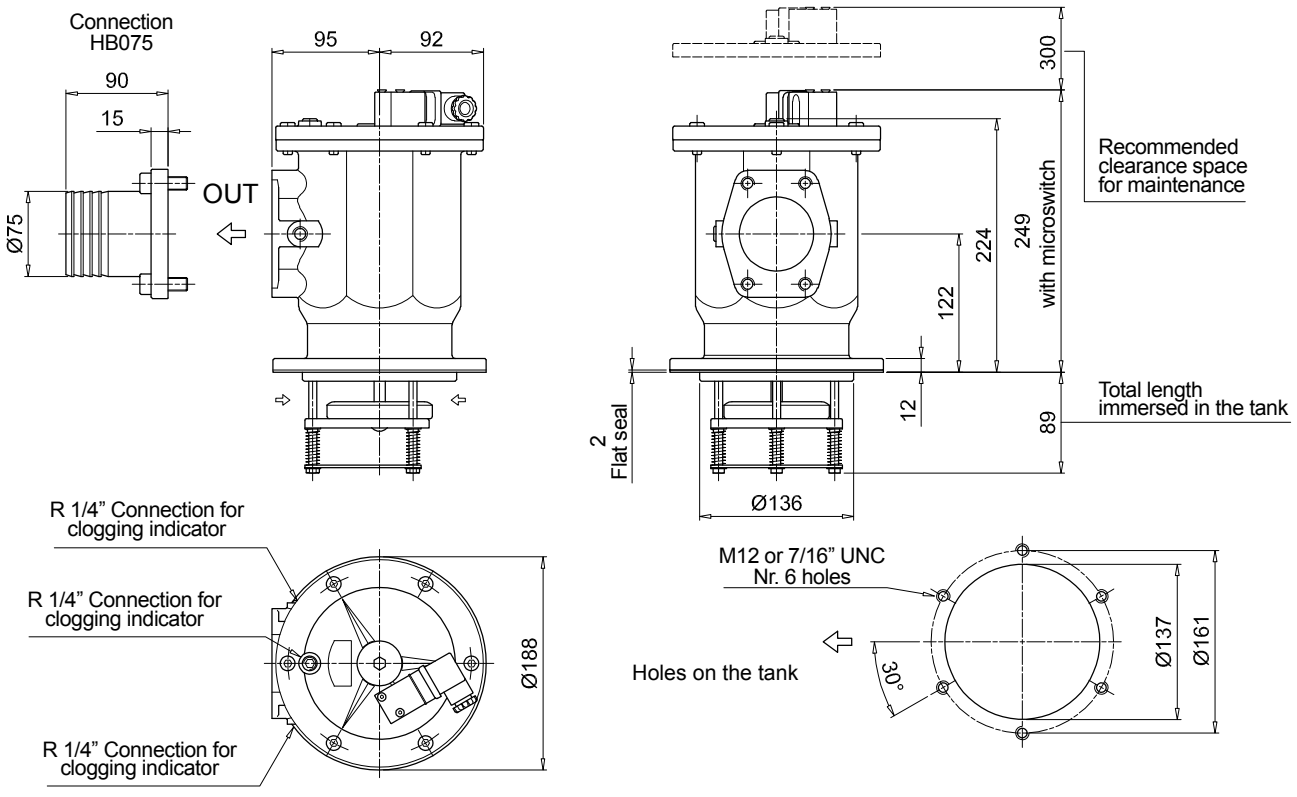
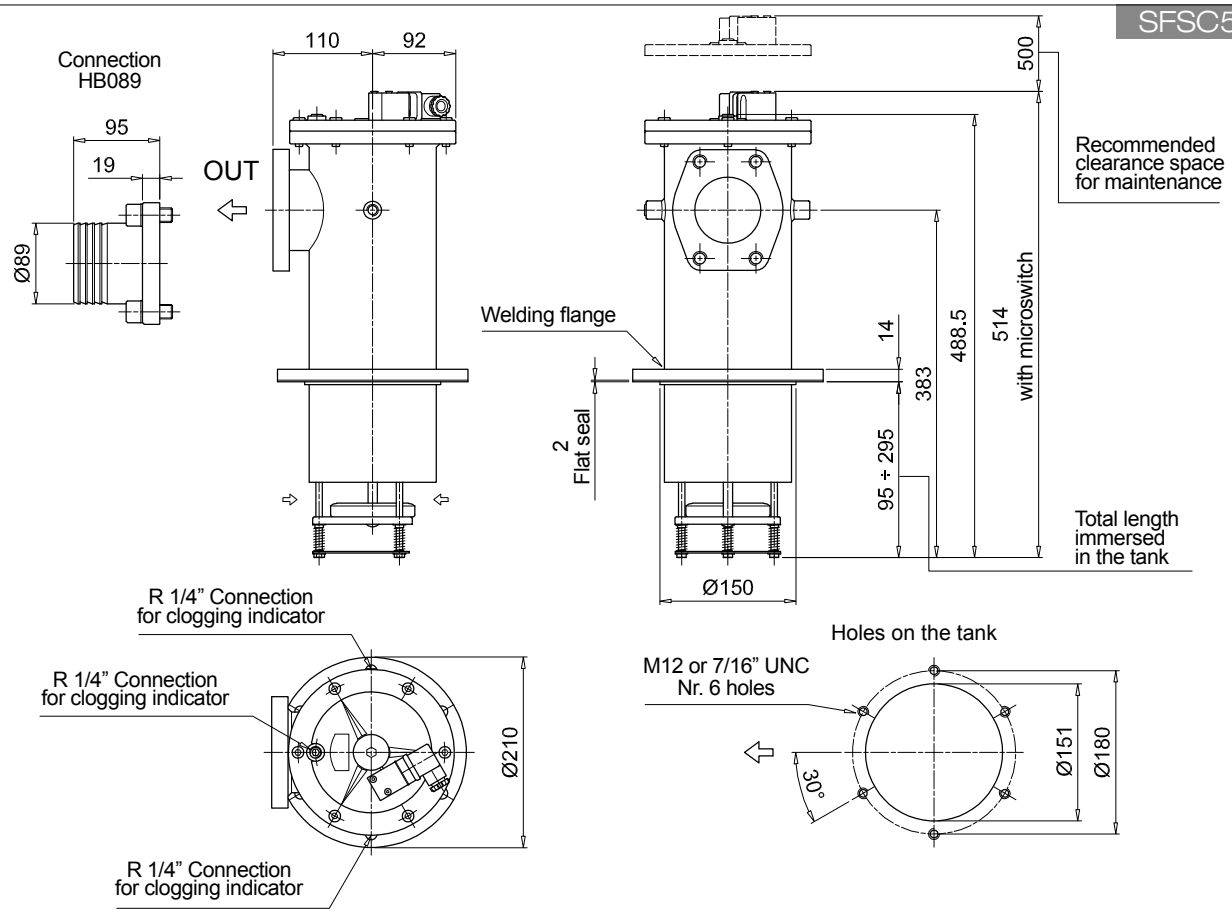
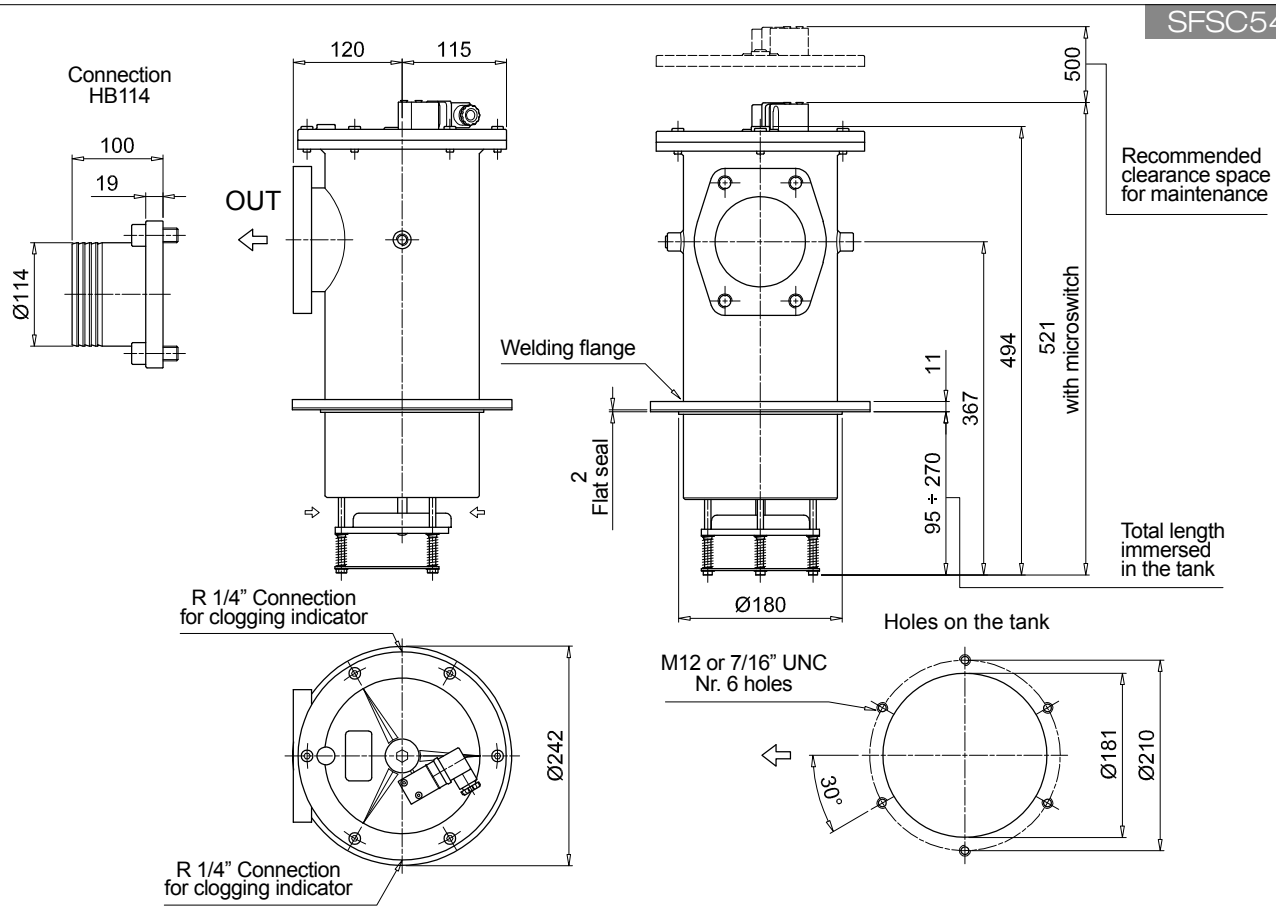


SFSC535



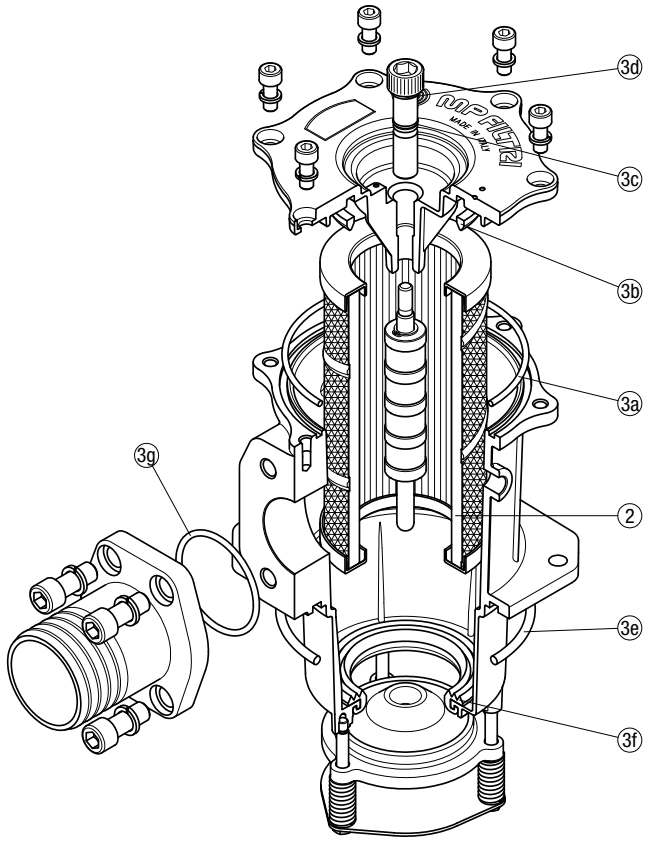
SFSC540



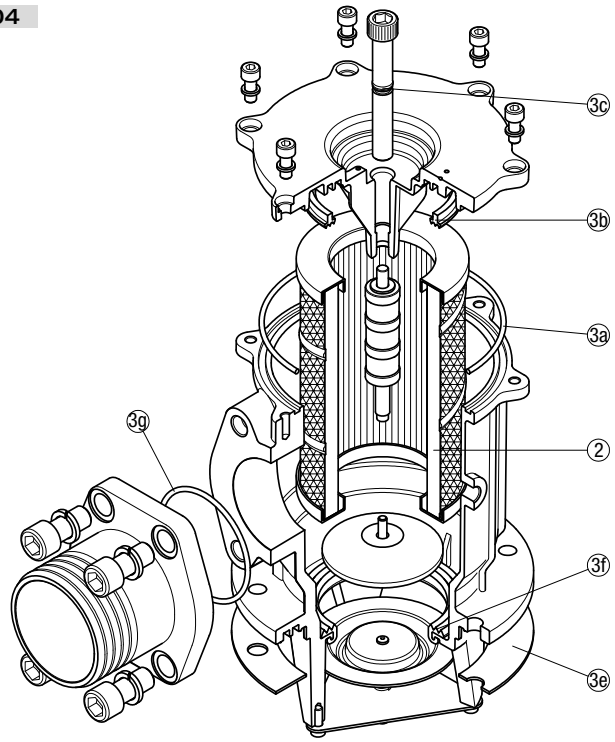
SFSC SPARE PARTS

Order number for spare parts

SFSC 500

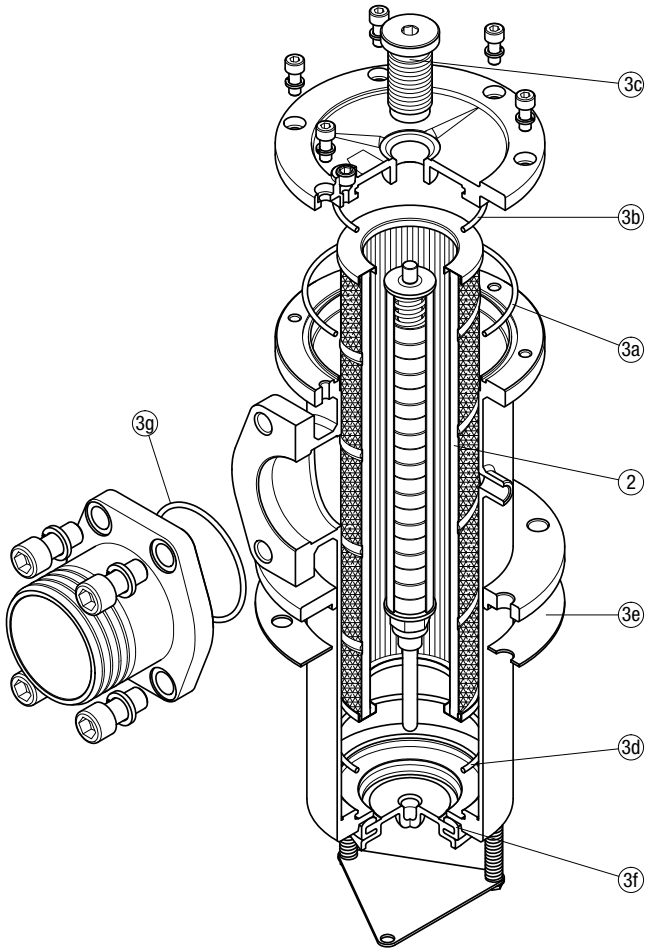


SFSC 503
SFSC 504

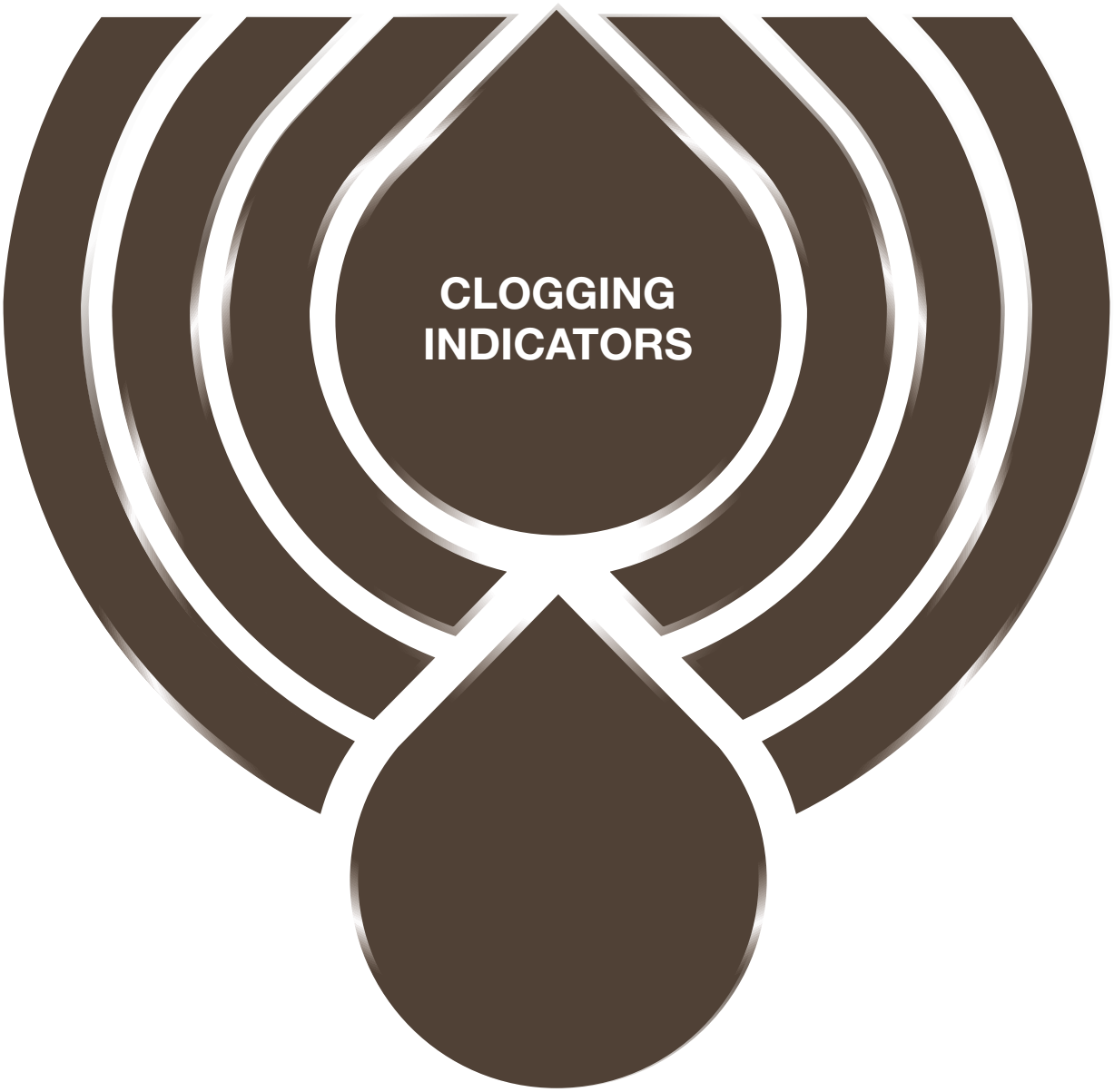


Item:	Q.ty: 1 pc. (2)	Q.ty: 1 pc. (3) (3a ÷ 3g)	
Filter series	**Filter element**	**Seal Kit code number NBR**	**FPM**
SFSC 500	See	02050141	02050142
SFSC 503	order	02050070	02050071
SFSC 504	table	02050072	02050073

SFSC 505
SFSC 510
SFSC 535
SFSC 540



Item:	Q.ty: 1 pc. 2	Q.ty: 1 pc. 3 (3a ÷ 3g)	
Filter series	**Filter element**	**Seal Kit code number NBR**	**FPM**
SFSC 505	See order table	02050043	02050044
SFSC 510		02050045	02050046
SFSC 535		02050051	02050052
SFSC 540		02050053	02050054


CLOGGING
INDICATORS

Clogging indicators are devices that check the life time of the filter elements. They measure the pressure drop through the filter element directly connected to the filter housing.
These devices trip when the clogging of the filter element causes a pressure drop increasing across the filter element.
Filter elements are efficient only if their Dirt Holding Capacity is fully exploited. This is achieved by using filter housings equipped with clogging indicators.
The indicator is set to alarm before the element becomes fully clogged.

MP Filtri can supply indicators of the following designs:
- Vacuum switches and gauges
- Pressure switches and gauges
- Differential pressure indicators

These type of devices can be provided with a visual, electrical or both signals. The electronic differential pressure clogging indicator is also available. It provides both analogical 4-20 mA output and digital warning (75% of clogging) and alarm (clogging) outputs.

In the following pages you can find a reference guide about the types of clogging indicators available in the different families of MP Filtri's Hydraulic Filtration range of products.

Clogging Indicators

DESIGNATION, ORDERING CODES & TECHNICAL DATA

INDEX

QUICK REFERENCE GUIDE

Ordering codes

Filter family	Filter series		Visual indicators	Electrical indicators	Electronic / Electrical-Visual indicators
SUCTION FILTERS		ELIXIR® SFEX 060-110	VVB20P01 VVS20P01	VEB21AA50P01	VLB21AA51P01 VLB21AA52P01 VLB21AA53P01 VLB21AA71P01
SUCTION FILTERS	Suction Line	SFMC250	VVA20P01 VVR20P01	VEA21xA50P01 VEA21xA50P01UL	VLA21xA51P01 VLA21xA52P01 VLA21xA53P01 VLA21xA71P01
SUCTION FILTERS	Without bypass	SFSC 500 - 503 - 504 - 505 SFSC 510 - 535 - 540	VVA20P01 VVR20P01	VEA21xA50P01 VEA21xA50P01UL	VLA21xA51P01 VLA21xA52P01 VLA21xA53P01 VLA21xA71P01
RETURN FILTERS	With bypass 1.75 bar	ELIXIR® RFEX 060-110	BVA14P01 BVR14P01 BVP15HP01 BVQ15HP01	BEA15HA50P01 BEA15HA50P01UL BEM15HA41P01	BLA15HA51P01 BLA15HA52P01 BLA15HA53P01 BLA15HA71P01
RETURN FILTERS	Without bypass	ELIXIR® RFEX 060-110	BVA25P01 BVR25P01 BVP20HP01 BVQ20HP01	BEA20HA50P01 BEA20HA50P01UL BEM20HA41P01	BLA20HA51P01 BLA20HA52P01 BLA20HA53P01 BLA20HA71P01
RETURN FILTERS	With bypass 1.75 bar	MDHC 250	BVA14P01 BVR14P01 BVP15HP01 BVQ15HP01 DVS12HP01	BEA15HA50P01 BEA15HA50P01UL BEM15HA41P01 DES12HA10P01 DES12HA30P01 DES12HA80P01	BLA15HA51P01 BLA15HA52P01 BLA15HA53P01 BLA15HA71P01
RETURN FILTERS	With bypass 3 bar	MDHC 250	BVA25P01 BVR25P01 BVP20HP01 BVQ20HP01 DVS25HP01	BEA20HA50P01 BEA20HA50P01UL BEM20HA41P01 BET20HF10P01 BET20HF30P01 BET25HF10P01 BET25HF30P01 DES25HA10P01 DES25HA30P01 DES25HA80P01	BLA20HA51P01 BLA20HA52P01 BLA20HA53P01 BLA20HA71P01
RETURN FILTERS	With bypass 1.75 bar	MPFX MPTX MPHC	BVA14P01 BVR14P01 BVP15HP01 BVQ15HP01	BEA15HA50P01 BEA15HA50P01UL BEM15HA41P01	BLA15HA51P01 BLA15HA52P01 BLA15HA53P01 BLA15HA71P01
RETURN FILTERS	With bypass 3 bar With bypass 2.5 bar	MPFX MPTX MPHC	BVA25P01 BVR25P01 BVP20HP01 BVQ20HP01	BEA20HA50P01 BEA20HA50P01UL BEM20HA41P01 BET20HF10P01 BET20HF30P01	BLA20HA51P01 BLA20HA52P01 BLA20HA53P01 BLA20HA71P01
RETURN FILTERS	With bypass 4.5 bar Return line	MPLX FRIC 025 - 040 - 100 - 250 - 630 - 850	DVA20xP01 DVM20xP01	DEA20xA50P01 DEM20xx10P01 DEM20xx20P01 DEM20xx30P01 DEM20xx35P01 DEU20VA50P01UL	DLA20xA51P01 DLA20xA52P01 DLA20xA71P01 DLE20xA50P01 DLE20xF50P01 DTA20xF70P01 DTI20xA70P01
RETURN FILTERS	Return line	FRIC 255	BVA25P01 BVR25P01 BVP20HP01 BVQ20HP01	BEA20HA50P01 BEA20HA50P01UL BEM20HA41P01	BLA20HA51P01 BLA20HA52P01 BLA20HA53P01 BLA20HA71P01

Ordering codes

Filter family	Filter series		Visual indicators	Electrical indicators	Electronic / Electrical-Visual indicators
RETURN / SUCTION FILTERS	With bypass 2.5 bar	MRSX 116 - 165 - 166 Suction line	VVB20P01 VVS20P01	VEB21AA50P01	VLB21AA51P01 VLB21AA52P01 VLB21AA53P01 VLB21AA71P01
		MRSX 116 - 165 - 166 Return line	BVA25P01 BVR25P01 BVP20HP01 BVQ20HP01	BEA20HA50P01 BEA20HA50P01UL BEM20HA41P01 BET25HF10P01 BET25HF30P01 BET25HF50P01	BLA20HA51P01 BLA20HA52P01 BLA20HA53P01 BLA20HA71P01
	With bypass 2.5 bar	LMP 124 MULTIPORT	BVA25P01 BVR25P01 BVP20HP01 BVQ20HP01 DVA20xP01 DVM20xP01	BEA20HA50P01 BEA20HA50P01UL BEM20HA41P01 BET25HF10P01 BET25HF30P01 BET25HF50P01 DEA20xA50P01 DEM20xx10P01 DEM20xx20P01 DEM20xx30P01 DEM20xx35P01 DEU20VA50P01UL	BLA20HA51P01 BLA20HA52P01 BLA20HA53P01 BLA20HA71P01 DLA20xA51P01 DLA20xA52P01 DLA20xA71P01 DLE20xA50P01 DLE20xF50P01 DTA20xF70P01 DTI20xA70P01
SPIN-ON FILTERS	Suction line	MPS 050 - 070 - 100 - 150 MPS 200 - 250 - 300 - 350	VVB20P01 VVS20P01	VEB21AA50P01	VLB21AA51P01 VLB21AA52P01 VLB21AA53P01 VLB21AA71P01
	Return line	MPS 050 - 070 - 100 - 150 MPS 200 - 250 - 300 - 350	BVA14P01 BVR14P01 BVP15HP01 BVQ15HP01	BEA15HA50P01 BEA15HA50P01UL BEM15HA41P01	BLA15HA51P01 BLA15HA52P01 BLA15HA53P01 BLA15HA71P01
	In-line	MPS 051 - 071 - 101 - 151 MPS 301 - 351	DVA12xP01 DVM12xP01 DVA20xP01 DVM20xP01	DEA12xA50P01 DEM12xAxxP01 DEA20xA50P01 DEM20xAxxP01 DEU20VA50P01UL	DLA12xA51P01 DLA12xA52P01 DLA12xA71P01 DLA20xA51P01 DLA20xA52P01 DLA20xA71P01 DLE12xA50P01 DLE12xF50P01 DLE20xF50P01 DLE20xF50P01 DTA12xF70P01 DTA20xF70P01 DTI12xA70P01 DTI20xA70P01

QUICK REFERENCE GUIDE

Ordering codes

Filter family	Filter series		Visual indicators	Electrical indicators	Electronic / Electrical-Visual indicators
LOW & MEDIUM PRESSURE FILTERS		ELIXIR® HFEX 060-110	DVS25HP01	DES25HA50P01	
		ELIXIR® LFEX 060-080-110-160	DVS25HP01	DES25HA10P01 DES25HA30P01 DES25HA50P01 DES25HA80P01	
	With bypass 3.5 bar	LMP 110 LMP 112 - 116 - 118 - 119 MULTIPORT LMP 120 - 122 - 123 MULTIPORT LMP 210 - 211 - LDP LMP 400 - 401 & 430 - 431 LMP 900 - 901 LMP 902 - 903 LMP 950 - 951 LMP 952 - 953 - 954 LMD 211 - 400 - 401 - 431 - 951 - LDD	DVA20xP01 DVM20xP01	DEA20xA50P01 DEM20xx10P01 DEM20xx20P01 DEM20xx30P01 DEM20xx35P01 DEU20VA50P01UL	DLA20xA51P01 DLA20xA52P01 DLA20xA71P01 DLE20xA50P01 DLE20xF50P01 DTA20xF70P01 DTI20xA70P01
	With bypass 2.5 bar	LPH 630	DVA20xP01 DVM20xP01	DEA20xA50P01 DEM20xx10P01 DEM20xx20P01 DEM20xx30P01 DEM20xx35P01 DEU20VA50P01UL	DLA20xA51P01 DLA20xA52P01 DLA20xA71P01 DLE20xA50P01 DLE20xF50P01 DTA20xF70P01 DTI20xA70P01
	With bypass 1.75 bar	LPH 630	DVA12xP01 DVM12xP01	DEA12xA50P01 DEM12xx10P01 DEM12xx20P01 DEM12xx30P01 DEM12xx35P01	DLA12xA51P01 DLA12xA52P01 DLA12xA71P01 DLE12xA50P01 DLE12xF50P01 DTA12xF70P01 DTI12xA70P01
	Without bypass	ELIXIR® HFEX 060-110	DVS40HP01	DES40HA50P01	
		ELIXIR® LFEX 060-080-110-160	DVS40HP01	DES40HA10P01 DES40HA30P01 DES40HA50P01 DES40HA80P01	
	Without bypass	LMP 110 LMP 112 - 116 - 118 - 119 MULTIPORT LMP 120 - 122 - 123 MULTIPORT LMP 210 - 211 - LDP LMP 400 - 401 & 430 - 431 LMP 900 - 901 LMP 902 - 903 LMP 950 - 951 LMP 952 - 953 - 954 LMD 211 - 400 - 401 - 431 - 951 - LDD LPH 630	DVA50xP01 DVM50xP01	DEA50xA50P01 DEM50xx10P01 DEM50xx20P01 DEM50xx30P01 DEM50xx35P01 DEU50VA50P01UL	DLA50xA51P01 DLA50xA52P01 DLA50xA71P01 DLE50xA50P01 DLE50xF50P01 DTA50xF70P01 DTI50xA70P01
HIGH CAPACITY INDUSTRIAL FILTERS	With bypass 3.5 bar	MLPX MLDX	DVA20xP01 DVM20xP01	DEA20xA50P01 DEM20xx10P01 DEM20xx20P01 DEM20xx30P01 DEM20xx35P01v	DLA20xA51P01 DLA20xA52P01 DLA20xA71P01 DLE20xA50P01 DLE20xF50P01 DTA20xF70P01 DTI20xA70P01
	With bypass 1.75 bar	MLPC MLDC	DVA12xP01 DVM12xP01	DEA12xA50P01 DEM12xx10P01 DEM12xx20P01 DEM12xx30P01 DEM12xx35P01	DLA12xA51P01 DLA12xA52P01 DLA12xA71P01 DLE12xA50P01 DLE12xF50P01 DTA12xF70P01 DTI12xA70P01
	Without bypass	MLDC MLPC	DVA50xP01 DVM50xP01	DEA50xA50P01 DEM50xx10P01 DEM50xx20P01 DEM50xx30P01 DEM50xx35P01	DLA50xA51P01 DLA50xA52P01 DLA50xA71P01 DLE50xA50P01 DLE50xF50P01 DTA50xF70P01 DTI50xA70P01

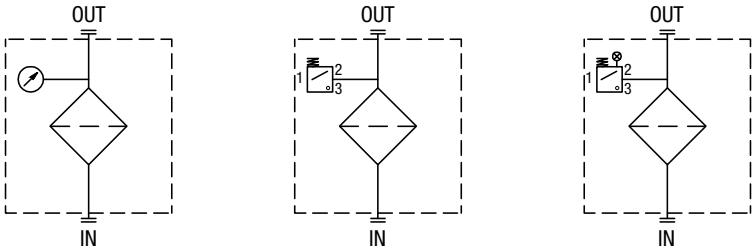
Ordering codes

Filter family	Filter series		Visual indicators	Electrical indicators	Electronic / Electrical-Visual indicators
HIGH PRESSURE FILTERS	With bypass 6 bar	FMP 039 - 065 - 135 - 320 FHP 010 - 011 - 065 - 135 - 350 - 351 - 500 FMMX 050 - 150 FMM 050 - 150 FHA 051 FHM 006 - 007 - 010 - 050 - 065 - 135 - 320 - 500 FHB 050 - 135 - 320 FHF 325 FHD 021 - 051 - 326 - 333	DVA50xP01 DVM50xP01	DEA50xA50P01 DEM50xx10P01 DEM50xx20P01 DEM50xx30P01 DEM50xx35P01 DEU50VA50P01UL	DLA50xA51P01 DLA50xA52P01 DLA50xA71P01 DLE50xA50P01 DLE50xF50P01 DTA50xF70P01 DTI50xA70P01
	Without bypass	FMP 039 - 065 - 135 - 320 FHP 010 - 011 - 065 - 135 - 350 - 351 - 500 FMMX 050 - 150 FMM 050 - 150 FHA 051 FHM 006 - 007 - 010 - 050 - 065 - 135 - 320 - 500 FHB 050 - 135 - 320 FHF 325 FHD 021 - 051 - 326 - 333	DVA70xP01 DVA95xP01 DVM70xP01 DVM95xP01	DEA70xA50P01 DEA95xA50P01 DEM70xx10P01 DEM70xx20P01 DEM70xx30P01 DEM70xx35P01 DEU70VA50P01UL DEM95xx10P01 DEM95xx20P01 DEM95xx30P01 DEM95xx35P01	DLA70xA51P01 DLA70xA52P01 DLA70xA71P01 DLA95xA51P01 DLA95xA52P01 DLA95xA71P01 DLE70xA50P01 DLE70xF50P01 DLE95xA50P01 DLE95xF50P01 DTA70xF70P01 DTA95xF70P01 DTI70xA70P01 DTI95xA70P01
STAINLESS STEEL HIGH PRESSURE FILTERS	With bypass 6 bar	FZH 012 - 040	DVZ50xP01	DEZ50xA50P01	DLZ50xA51P01 DLZ50xA52P01
	Without bypass	FZH 012 - 040	DVZ70xP01 DVZ95xP01	DEZ70xA50P01 DEZ95xA50P01	DLZ70xA51P01 DLZ70xA52P01 DLZ95xA51P01 DLZ95xA52P01
	With bypass 6 bar	FZP 039 - 136 FZB 039 FZM 039 FZD 051	DVX50xP01 DVY50xP01	DEX50xA50P01	DLX50xA51P01 DLX50xA52P01
	Without bypass	FZP 039 - 136 FZB 039 FZM 039 FZD 010 - 021 - 051	DVX70xP01 DVX95xP01 DVY70xP01 DVY95xP01	DEX70xA50P01 DEX95xA50P01	DLX70xA51P01 DLX70xA52P01 DLX95xA51P01 DLX95xA52P01
FILTERS FOR POTENTIALLY EXPLOSIVE ATMOSPHERE	With bypass 6 bar	FMMX 050 - 150	DVA50xP01 DVM50xP01	DEH50xA48P01 DEH50xA49P01 DEH50xA70P01	
	Without bypass	FMMX 050 - 150	DVA70xP01 DVA95xP01 DVM70xP01 DVM95xP01	DEH70xA48P01 DEH70xA49P01 DEH70xA70P01	
	With bypass 6 bar	FZP 039 - 136	DVX50xP01 DVY50xP01	DEH50xA48P01 DEH50xA49P01 DEH50xA70P01	
	Without bypass	FZP 039 - 136	DVX70xP01 DVX95xP01 DVY70xP01 DVY95xP01	DEH70xA48P01 DEH70xA49P01 DEH70xA70P01	
	With bypass 6 bar	FZH 012 - 040	DVZ50xP01		
	Without bypass	FZH 012 - 040	DVZ70xP01 DVZ95xP01		

Suitable indicator types

V ACUUM INDICATORS

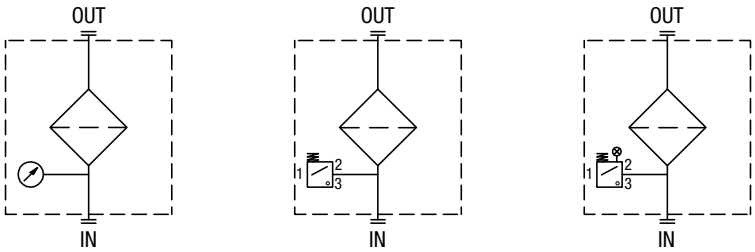
Vacuum indicators are used on the Suction line to check the efficiency of the filter element.
They measure the pressure downstream of the filter element.
Standard items are produced with R 1/4" EN 10226 connection.
Available products with R 1/8" EN 10226 to be fitted on MPS series.
Vacuum indicators are identified in the Hydraulic Filtration catalogue and in the Quick Reference Guide table by the letter "V".



Example:
V VVB20P01

B AROMETRIC (PRESSURE) INDICATORS

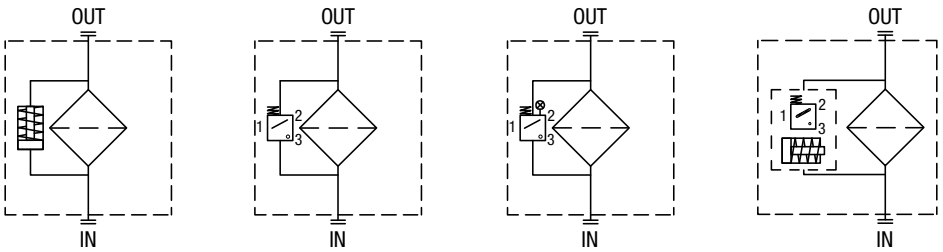
Pressure indicators are used on the Return line to check the efficiency of the filter element.
They measure the pressure upstream of the filter element.
Standard items are produced with R 1/8" EN 10226 connection.
Barometric (pressure) indicators are identified in the Hydraulic Filtration catalogue and in the Quick Reference Guide table by the letter "B"



Example:
B BVA14P01

D IFFERENTIAL PRESSURE INDICATORS

Differential pressure indicators are used on the Pressure line to check the efficiency of the filter element.
They measure the pressure upstream and downstream of the filter element (differential pressure).
Standard items are produced with special connection G 1/2" size.
Also available in Stainless Steel models.
Differential pressure indicators are identified in the Hydraulic Filtration catalogue and in the Quick Reference Guide table by the letter "D"



Example:
D DVA20xP01

Designation & Ordering code

APPLICABLE VACUUM INDICATORS BY FILTER SERIES

Filter Series	VEA	VEB	VLA	VLB	VVA	VVB	VVR	VVS
STRC	-	-	-	-	-	-	-	-
MPAC	-	-	-	-	-	-	-	-
SFEX	-	•	-	•	-	•	-	•
SFMC	•	-	•	-	•	-	•	-
SFSC	•	-	•	-	•	-	•	-

VACUUM INDICATORS

Configuration example 1:	VE	A	21	V	A	50	P01	EX
Configuration example 2:	VL	B	21	A	A	71	P01	
Configuration example 3:	VV	R	20				P01	

Series

VE Electrical vacuum indicator
VL Electrical/Visual vacuum indicator
VV Vacuum gauge

Type VE - VL

A Connection EN 10226 - R1/4”
B Connection EN 10226 - R1/8”

Type VV	SFxC	SFEX
A Axial connection EN 10226 - R1/4”	•	-
B Axial connection EN 10226 - R1/8”	-	•
R Radial connection EN 10226 - R1/4”	•	-
S Radial connection EN 10226 - R1/8”	-	•

Vacuum setting	VE	VL	VVA	VVB	VVR	VVS
20 0.20 bar	-	-	•	•	•	•
21 0.21 bar	•	•	-	-	-	-

Seals	VEA - VLA	VEB - VLB	VV
A NBR	•	•	-
V FPM	•	-	-

Thermostat	VE	VL	VV
A Without	•	•	-

Electrical connections	VE	VL	VV
50 Connection EN 175301-803	•	-	-
51 Connection EN 175301-803, transparent base with lamps 24 Vdc	-	•	-
52 Connection EN 175301-803, transparent base with lamps 110 Vdc	-	•	-
53 Connection EN 175301-803, transparent base with lamps 230 Vac	-	•	-
71 Connection IEC 61076-2-101 D (M12), black base with lamps 24 Vdc	-	•	-

Option

P01 MP Filtri standard
Pxx Customized

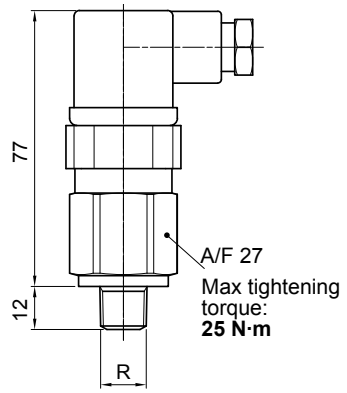
Certifications	VEA21A	VEA21V	VEB	VL	VV
Without	•	•	•	•	•
EX ATEX certification	•	•	•	-	-
UL UL certification	•	-	-	-	-

Technical data

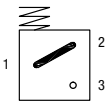
VE*50 (EX)

Electrical Vacuum Indicator
Connection: EN 175301-803

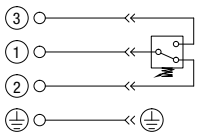
R	Ordering code
EN 10226 - R1/4"	VE A 21 x A 50 P01
	VE A 21 x A 50 P01 EX
EN 10226 - R1/8"	VE B 21 A A 50 P01
	VE B 21 A A 50 P01 EX



Hydraulic symbol



Electrical symbol



- Certification: ATEX, IECEx
- Certification included in EX version

Materials
- Body: Brass
- Base: Black polyamide
- Contacts: Silver
- Seal: VEA: NBR/FPM
  VEB: NBR

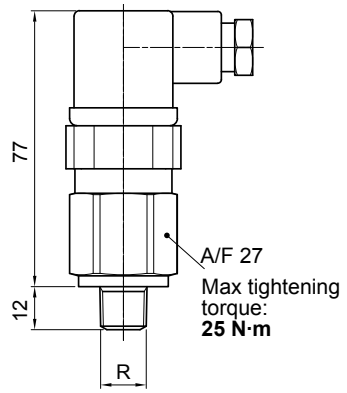
Technical data
- Vacuum setting: 0.21 bar ±10%
- Max working pressure: 10 bar
- Proof pressure: 15 bar
- Working temperature: From -25 °C to +80 °C
- Compatibility with fluids: Mineral oils, Synthetic fluids
  HFB and HFC according to ISO 2943
- Degree of protection: IP65 according to EN 60529

Electrical data
- Electrical connection: EN 175301-803
- Resistive load: 5 A / 14 Vdc
  4 A / 30 Vdc
  5 A / 125 Vac
  4 A / 250 Vac

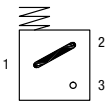
VEA50 UL

Electrical Vacuum Indicator
Connection: EN 175301-803

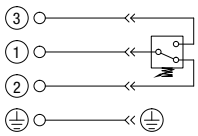
R	Ordering code
EN 10226 - R1/4"	VE A 21 A A 50 P01 UL



Hydraulic symbol



Electrical symbol



- Certification: UL
- Certification included as standard

Materials
- Body: Brass
- Base: Black polyamide
- Contacts: Silver
- Seal: VEA: NBR/FPM
  VEB: NBR

Technical data
- Vacuum setting: 0.21 bar ±10%
- Max working pressure: 10 bar
- Proof pressure: 15 bar
- Working temperature: From -25 °C to +80 °C
- Compatibility with fluids: Mineral oils, Synthetic fluids
  HFB and HFC according to ISO 2943
- Degree of protection: IP65 according to EN 60529

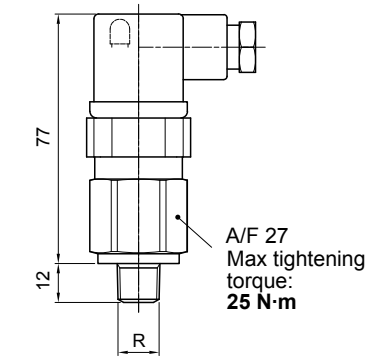
Electrical data
- Electrical connection: EN 175301-803
- Resistive load: 5 A / 14 Vdc
  4 A / 30 Vdc
  5 A / 125 Vac
  4 A / 250 Vac

VL*51 - VL*52 - VL*53

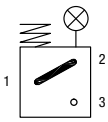
Electrical/Visual Vacuum Indicator
Connection: EN 175301-803

51: Transparent base with lamps 24 Vdc
52: Transparent base with lamps 110 Vdc
53: Transparent base with lamps 230 Vac

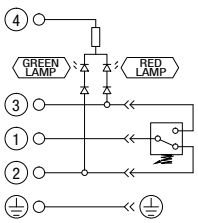
R	Ordering code
EN 10226 - R1/4"	VL A 21 x A xx P01
EN 10226 - R1/8"	VL B 21 A A xx P01



Hydraulic symbol



Electrical symbol



Materials
- Body: Brass
- Base: Transparent polyamide
- Contacts: Brass - Polyamide
- Seal: VLA: NBR/FPM
  VLB: NBR

Technical data
- Vacuum setting: 0.21 bar ±10%
- Max working pressure: 10 bar
- Proof pressure: 15 bar
- Working temperature: From -25 °C to +80 °C
- Compatibility with fluids: Mineral oils, Synthetic fluids
  HFB and HFC according to ISO 2943
- Degree of protection: IP65 according to EN 60529

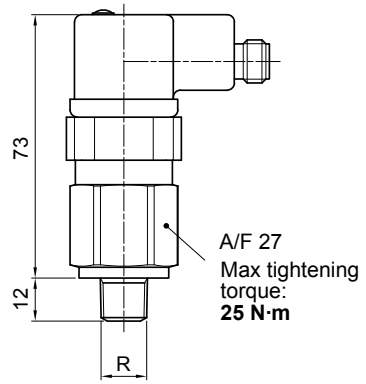
Electrical data
- Electrical connection: EN 175301-803

- Type	51	52	53
- Lamps	24 Vdc	110 Vdc	230 Vac
- Resistive load:	1 A / 24 Vdc	1 A / 110 Vdc	1 A / 230 Vac

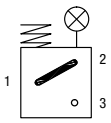
VL*71

Electrical/Visual Vacuum Indicator
Connection IEC 61076-2-101 D (M12), black base with lamps 24 Vdc

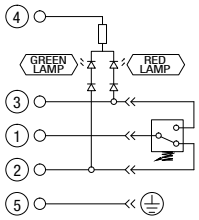
Connections	Indicator code
EN 10226 - R1/4"	VL A 21 x A 71 P01
EN 10226 - R1/8"	VL B 21 A A 71 P01



Hydraulic symbol



Electrical symbol



Materials
- Body: Brass
- Base: Black polyamide
- Contacts: Silver
- Seal: VLA: NBR/FPM; VLB: NBR

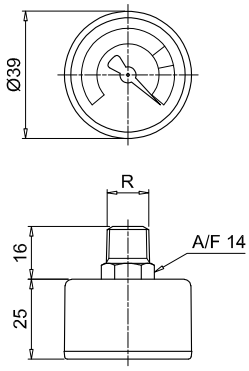
Technical data
- Vacuum setting: 0.21 bar ±10%
- Max working pressure: 10 bar
- Proof pressure: 15 bar
- Working temperature: From -25 °C to +80 °C
- Compatibility with fluids: Mineral oils, Synthetic fluids HFB and HFC according to ISO 2943
- Degree of protection: IP65 according to EN 60529

Electrical data
- Electrical connection: IEC 61076-2-101 D (M12)
- Lamps: 24 Vdc (black base)
- Resistive load: 0.4 A / 24 Vdc

VVA - VVB

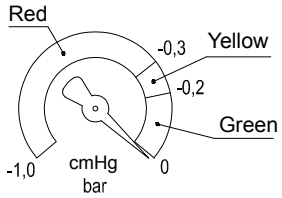
Axial Vacuum Gauge

R	Ordering code
EN 10226 - R1/4"	VVA 20 P01
EN 10226 - R1/8"	VVB 20 P01



Hydraulic symbol

Dial scale



Conversion to SI units

[cmHg]	[bar]
-12	-0.16
-18	-0.24
-76	-1.01

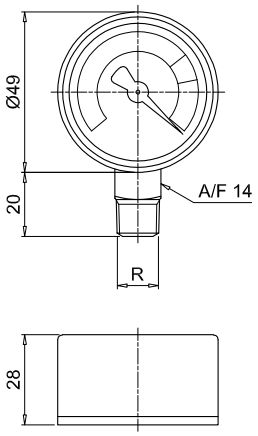
Materials
- Case: Black plastic
- Window: Clear plastic
- Dial: White plastic
- Pointer: Black plastic
- Pressure connection: Cu-alloy
- Pressure element: Bourdon tube Cu-alloy soft soldered, C type
- Movement: Cu-alloy

Technical data
- Max working pressure: Steady: -0.7 bar; Fluctuating: -0.6 bar; Short time: -1.0 bar
- Working temperature: Ambienti from -40 °C to +60 °C; Fluid max + 60 °C; Storage from -40 °C to +60 °C
- Compatibility with fluids: Mineral oils, Synthetic fluids HFB and HFC according to ISO 2943
- Accuracy: Class 2.5 according to EN 13190
- Degree of protection: IP31 according to EN 60529

VVR - VVS

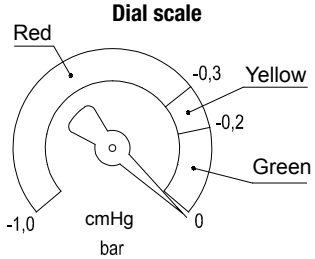
Radial Vacuum Gauge

R	A/F	Ordering code
EN 10226 - R1/4"	14	VVR 20 P01
EN 10226 - R1/8"	11	VVS 20 P01



Hydraulic symbol

Dial scale



Conversion to SI units

[cmHg]	[bar]
-12	-0.16
-18	-0.24
-76	-1.01

Materials
- Case: Black plastic
- Window: Clear plastic
- Dial: White plastic
- Pointer: Black plastic
- Pressure connection: Cu-alloy
- Pressure element: Bourdon tube Cu-alloy soft soldered, C type
- Movement: Cu-alloy

Technical data
- Max working pressure: Steady: -0.7 bar; Fluctuating: -0.6 bar; Short time: -1.0 bar
- Working temperature: Ambienti from -40 °C to +60 °C; Fluid max + 60 °C; Storage from -40 °C to +60 °C
- Compatibility with fluids: Mineral oils, Synthetic fluids HFB and HFC according to ISO 2943
- Accuracy: Class 2.5 according to EN 13190
- Degree of protection: IP31 according to EN 60529

NOTES

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