A WORLDWIDE LEADER IN THE FIELD OF HYDRAULIC FILTRATION EQUIPMENT.

Our company started life in 1964, when Bruno Pasotto decided to attempt to cater for the requests of a market still to be fully explored, with the study, design, development, production and marketing of a vast range of filters for hydraulic equipment, capable of satisfying the needs of manufacturers in all sectors. The quality of our products, our extreme competitiveness compared with major international producers and our constant activities of research, design and development has made us a worldwide leader in the field of hydraulic circuit filtering. Present for 50 years in the market, we have played a truly decisive role in defining our sector, and by now we are a group capable of controlling our entire chain of production, monitoring all manufacturing processes to guarantee superior quality standards and to provide concrete solutions for the rapidly evolving needs of customers and the market.
Our customer-oriented philosophy, which enables us to satisfy all customer requests rapidly and with personalized products according to specific market requests, makes us a dynamic and flexible enterprise. The possibility of constantly controlling and monitoring the entire production process is essential to allow us to guarantee the quality of our products.
WORLDWIDE PRESENCE

Our foreign Branches enable us to offer a diversified range of products that allow us to successfully face the aggressive challenge of international competition, and also to maintain a stable presence at a local level.

The Group boasts 8 business branches
TECHNOLOGY

Our constant quest for excellence in quality and technological innovation allows us to offer only the best solutions and services for applications in many fields, including general industry, test rigs, lubrication, heavy engineering, renewable energies, naval engineering, offshore engineering, aviation systems, emerging technologies and mobile plant (i.e. tractors, excavators, concrete pumps, platforms).
AND PRODUCTION

Our high level of technological expertise means we can rely entirely on our own resources, without resorting to external providers. This in turn enables us to satisfy a growing number of customer requests, also exploiting our constantly updated range of machines and equipment, featuring fully-automated workstations capable of 24-hour production.
SUCTION FILTERS

Flow rates up to 875 l/min
Mounting:
- Tank immersed
- In-Line
- In tank with shut off valve
- In tank with flooded suction

RETURN FILTERS

Flow rates up to 3650 l/min
Pressure up to 20 bar
Mounting:
- In-Line
- Tank top
- In single and duplex designs

RETURN / SUCTION FILTERS

Flow rates up to 300 l/min
Pressure up to 80 bar
Mounting:
- In-Line
- Tank top

SPIN-ON FILTERS

Flow rates up to 300 l/min
Pressure up to 80 bar
Mounting:
- In-Line

LOW & MEDIUM PRESSURE FILTERS

Flow rates up to 3000 l/min
Pressure up to 35 bar
Mounting:
- In-Line
- Tank top
- Tank immersed
- In-Line parallel manifold version
- In single and duplex designs

HIGH PRESSURE FILTERS

Flow rates up to 750 l/min
Pressure from 110 bar up to 560 bar
Mounting:
- In-Line
- Manifold
- In single and duplex designs
**PRODUCT RANGE**

MP Filtri can offer a vast and articulated range of products for the global market, suitable for all industrial sectors using hydraulic equipment. This includes filters (suction, in-line, pressure, stainless steel, spin-on and return) and structural components (motor/pump bell housings, transmission couplings, flexible inserts, damper rings, support feet, aluminium tanks, inspection hatches).

We can provide all the skills and solutions required by the modern hydraulics industry to monitor contamination levels and other fluid conditions.

Mobile filtration units and a full range of accessories allow us to supply everything necessary for complete hydraulic circuits.

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Introduction

**HYDRAULIC FILTRATION PRODUCTS**

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### RETURN / SUCTION FILTERS

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<td>Unique TANK-TOP filter for mobile machinery, with combined filtration on return and suction to the inlet at the hydrostatic transmissions in closed circuit.</td>
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<td>LMP 124 MULTIPORT</td>
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<td>277</td>
<td>MSH</td>
<td>In-line low and medium pressure filter available with single cartridge</td>
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<td>359</td>
<td>LMP 950 - 951 In-line modular filter, available with 2 and up to 6 different heads</td>
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<td>LMD 951 In-line duplex modular filter, available with 2 up to 6 different heads</td>
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### HIGH PRESSURE FILTERS

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<td>FHP Typical high pressure filter for mobile applications</td>
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<td>FHA 051 FHA 051: Filter optimized for use in high pressure operating systems</td>
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### STAINLESS STEEL HIGH PRESSURE FILTERS

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## Contamination management

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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 popular classification criterion divides them into the following families:
- MINERAL OILS
  Commonly used oil deriving fluids.
- FIRE RESISTANT FLUIDS
  Fluids with intrinsic characteristics of incombustibility or high flash point.
- SYNTHETIC FLUIDS
  Modified chemical products to obtain specific optimized features.
- ECOLOGICAL FLUIDS
  Synthetic or vegetable origin fluids with high biodegradability characteristics.

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.
- CINEMATIC 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. Cinematic 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 cinematics 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 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.

Solid contamination mainly causes surface damage and component wear.

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

CONTAMINATION IN PRESENCE OF LARGE TOLERANCES

CONTAMINATION IN PRESENCE OF NARROW TOLERANCES
CONTAMINATION MANAGEMENT

- 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, 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.

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 controllability. It is easy to understand how a system without proper contamination management is subject to higher costs than a system that is provided.

- MAINTENANCE
  Maintenance activities, spare parts, machine stop costs

- ENERGY AND EFFICIENCY
  Efficiency and performance reduction due to friction, drainage, cavitation.

4 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?

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

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 to conduct tests and express the measured values in the following ways.
CONTAMINATION MANAGEMENT

- 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.

- 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 Automatic Particle Counters (APC).

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 code refers to the number of particles of the same size or greater than 4, 6 or 14 µm in a 1 ml fluid.

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

> 4 µm < = 350 particles
> 6 µm < = 100 particles
> 14 µm < = 25 particles

ISO 4406:1999 Cleanliness Code System

Microscope counting examines the particles differently to APCs and the code is given with two scale numbers only.
These are at 5 µm and 15 µm equivalent to the 6 µm<sub>14</sub> and 14 µm<sub>14</sub> of APCs.
CONTAMINATION MANAGEMENT

- CUMULATIVE DISTRIBUTION OF THE PARTICLES SIZE - SAE AS 4059-1 and SAE AS 4059-2

Classification example according to SAE AS 4059-1 and SAE AS 4059-2

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).

It can be made a differential measurement (Table 1) or a cumulative measurement (Table 2). 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 100m volume at various size intervals (differential counts) rather than using cumulative counts as in ISO 4406:1999. 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 APC’s.

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.

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 predenominated number of areas and by counting the contaminant particles using a suitable laboratory microscope.

![Contamination Management](image)

### Table 1 - Class for differential measurement

<table>
<thead>
<tr>
<th>Class</th>
<th>Dimension of contaminant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6÷14 µm</td>
</tr>
<tr>
<td>00</td>
<td>125</td>
</tr>
<tr>
<td>0</td>
<td>250</td>
</tr>
<tr>
<td>1</td>
<td>500</td>
</tr>
<tr>
<td>2</td>
<td>1000</td>
</tr>
<tr>
<td>3</td>
<td>2000</td>
</tr>
<tr>
<td>4</td>
<td>4000</td>
</tr>
<tr>
<td>5</td>
<td>8000</td>
</tr>
<tr>
<td>6</td>
<td>16000</td>
</tr>
<tr>
<td>7</td>
<td>32000</td>
</tr>
<tr>
<td>8</td>
<td>64000</td>
</tr>
<tr>
<td>9</td>
<td>128000</td>
</tr>
<tr>
<td>10</td>
<td>256000</td>
</tr>
<tr>
<td>11</td>
<td>512000</td>
</tr>
<tr>
<td>12</td>
<td>1 024 000</td>
</tr>
</tbody>
</table>

### Table 2 - Class for cumulative measurement

<table>
<thead>
<tr>
<th>Class</th>
<th>Dimension of contaminant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&gt;4 µm</td>
</tr>
<tr>
<td></td>
<td>&gt;6 µm</td>
</tr>
<tr>
<td></td>
<td>&gt;14 µm</td>
</tr>
<tr>
<td></td>
<td>&gt;21 µm</td>
</tr>
<tr>
<td></td>
<td>&gt;38 µm</td>
</tr>
<tr>
<td></td>
<td>&gt;70 µm</td>
</tr>
<tr>
<td>000</td>
<td>195</td>
</tr>
<tr>
<td>00</td>
<td>390</td>
</tr>
<tr>
<td>0</td>
<td>780</td>
</tr>
<tr>
<td>1</td>
<td>1560</td>
</tr>
<tr>
<td>2</td>
<td>3120</td>
</tr>
<tr>
<td>3</td>
<td>6250</td>
</tr>
<tr>
<td>4</td>
<td>12 500</td>
</tr>
<tr>
<td>5</td>
<td>25 000</td>
</tr>
<tr>
<td>6</td>
<td>50 000</td>
</tr>
<tr>
<td>7</td>
<td>100 000</td>
</tr>
<tr>
<td>8</td>
<td>200 000</td>
</tr>
<tr>
<td>9</td>
<td>400 000</td>
</tr>
<tr>
<td>10</td>
<td>800 000</td>
</tr>
<tr>
<td>11</td>
<td>1 600 000</td>
</tr>
<tr>
<td>12</td>
<td>3 200 000</td>
</tr>
</tbody>
</table>

# CUMULATIVE DISTRIBUTION OF THE PARTICLES SIZE - ISO 4407

The level of contamination is identified by dividing the membrane into a predetermined number of areas and by counting the contaminant particles using a suitable laboratory microscope.
CONTAMINATION MANAGEMENT

- CLEANLINESS CODE COMPARISON

Although ISO 4406:1999 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.

<table>
<thead>
<tr>
<th>ISO 4406:1999</th>
<th>SAE AS4059 Table 2</th>
<th>SAE AS4059 Table 1</th>
<th>NAS 1638</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 4 µm(c)</td>
<td>&gt; 4 µm(d)</td>
<td>4-6</td>
<td>5-15</td>
</tr>
<tr>
<td>6 µm(c)</td>
<td>6 µm(d)</td>
<td>14-14</td>
<td>15-25</td>
</tr>
<tr>
<td>14 µm(c)</td>
<td>14 µm(d)</td>
<td>21-38</td>
<td>25-50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>38-70</td>
<td>50-100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;70</td>
<td>&gt;100</td>
</tr>
<tr>
<td>23 / 21 / 18</td>
<td>13A / 12B / 12C</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>22 / 20 / 17</td>
<td>12A / 11B / 11C</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>21 / 19 / 16</td>
<td>11A / 10B / 10C</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>20 / 18 / 15</td>
<td>10A / 9B / 9B</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>19 / 17 / 14</td>
<td>9A / 8B / 8C</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>18 / 16 / 13</td>
<td>8A / 7B / 7C</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>17 / 15 / 12</td>
<td>7A / 6B / 6C</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>16 / 14 / 11</td>
<td>6A / 5B / 5C</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>15 / 13 / 10</td>
<td>5A / 4B / 4C</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>14 / 12 / 09</td>
<td>4A / 3B / 3C</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

5 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 microfiber, the filtering layers are often overlapped in order to increase the ability to retain the contaminant.

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.

Upstream particles number > $X$ µm(c)

Downstream particles number > $X$ µm(c) = $\beta_{x(c)}$

<table>
<thead>
<tr>
<th>Value ($\beta_{x(c)}$)</th>
<th>2</th>
<th>10</th>
<th>75</th>
<th>100</th>
<th>200</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td>50%</td>
<td>90%</td>
<td>98.7%</td>
<td>99%</td>
<td>99.5%</td>
<td>99.9%</td>
</tr>
</tbody>
</table>

Test conditions, such as type of fluid to be used (ML-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 ($\beta$ 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.

<table>
<thead>
<tr>
<th>Filtration ISO Standard Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP Filtri</td>
</tr>
<tr>
<td>Filter media code</td>
</tr>
<tr>
<td>$\beta_{x(c)} &gt; 1000$</td>
</tr>
<tr>
<td>ISO 16889</td>
</tr>
<tr>
<td>A03</td>
</tr>
<tr>
<td>A06</td>
</tr>
<tr>
<td>A10</td>
</tr>
<tr>
<td>A16</td>
</tr>
<tr>
<td>A25</td>
</tr>
</tbody>
</table>
### 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

<table>
<thead>
<tr>
<th>Types of filters</th>
<th>ISO 4406 CODE</th>
<th>20/18/15</th>
<th>19/17/14</th>
<th>18/16/13</th>
<th>17/16/12</th>
<th>16/14/11</th>
<th>15/13/10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piston pumps with fixed flow rate</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Piston pumps with variable flow rate</td>
<td></td>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vane pumps with fixed flow rate</td>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vane pumps with variable flow</td>
<td></td>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engines</td>
<td></td>
<td></td>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actuators</td>
<td></td>
<td></td>
<td></td>
<td>•</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test benches</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>•</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check valve</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Directional valves</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>Flow regulating valves</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportional valves</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Servo-valves</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flat bearings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ball bearings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommended filtration μ(x)less1.000</td>
<td>20/18/15</td>
<td>19/17/14</td>
<td>18/16/13</td>
<td>17/16/12</td>
<td>16/14/11</td>
<td>15/13/10</td>
<td></td>
</tr>
<tr>
<td>μ(20(c)) &gt;1000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>μ(15(c)) &gt;1000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>μ(10(c)) &gt;1000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>μ(7(c)) &gt;1000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>μ(5(c)) &gt;1000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>μ(5(c)) &gt;1000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

### 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.

#### 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. They are generally produced with filtration depths of 10 ± 25 µm. 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 working 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.
FILTER CHOICE 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 CASUALTIES

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

- MAXIMUM WORKING PRESSURE ($P_{max}$)
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 ($A_P$)
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 ($\beta_{核桃}$)
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.

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.
The correct filter sizing have to be based on the variable pressure drop depending by the application. For example, for the return filter the pressure drop have to be in the range 0.4 - 0.6 bar.

The pressure drop calculation is performed by adding together the value of the housing with the value of the filter element. The pressure drop in the housing is proportional to the fluid density (kg/dm³); all the graphs in the catalogue are referred to mineral oil with density of 0.86 kg/dm³.

The filter element pressure drop is proportional to its viscosity (mm²/s), the corrective factor Y is related to an oil viscosity different than 30 mm²/s.

**Sizing data for single cartridge, head at top**

\[ \Delta p_c = \text{Filter housing pressure drop (bar)} \]
\[ \Delta p_e = \text{Filter element pressure drop (bar)} \]
\[ Y = \text{Multiplication factor Y (see correspondent table),} \]
\[ V_1 = \text{Operating viscosity in mm²/s (cSt)} \]
\[ V_2 = \text{Operating viscosity in mm²/s (cSt)} \]
\[ \Delta p_e = Y \times Q \times (V_2/V_1) \]
\[ \Delta p_{Tot.} = \Delta p_c + \Delta p_e \]

**Calculation examples with HLP Mineral oil Variation in viscosity**

**Application data:**
Top tank return filter
Filter with in-line connections
Pressure Pmin = 10 bar
Flow rate Q = 120 l/min
Viscosity V1 = 46 mm²/s (cSt)
Viscosity V2 = 46 mm²/s (cSt)
Required filtration efficiency = 25 µm with absolute filtration
With bypass valve and 1 1/4" inlet connection
From the working pressure and the flow rate we understand it should be possible using the following top tank return filter series: MPT, MPH and FR1. Let’s proceed with MPT series.
The size 20 doesn’t achieve the required flow rate, therefore we have to consider the size 100. The full version of size 100 (101, 104, 110, 120 and 114) will be then defined in function of the mounting characteristics.

\[ \Delta p_c = 0.03 \text{ bar} \]
\[ \Delta p_e = (2A1: 1000) \times 120 \times 46(30) = 0.37 \text{ bar} \]
\[ \Delta p_{Tot.} = 0.03 + 0.37 = 0.4 \text{ bar} \]

The selection is correct because the total pressure drop value is inside the admissible range for top tank return filters. It is of course possible trying to find a different solution, according to the mounting position or to other commercial need, repeating the previous steps while using a different series or length.

**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.

**Refernce viscosity 30 mm²/s**

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**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.
Corrective factor Y, to be used for the filter element pressure drop calculation. The values depend on the filter size and length and to the filter media.
Reference viscosity 30 mm²/s

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### 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 viscosity 30 mm/s

#### High pressure filters

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#### Stainless steel high pressure filters

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Step 1: Select "FILTERS"

Step 2: Choose filter group (Return Filter, Pressure Filter, etc.)

Step 3: Choose filter type (MPF, MPT, etc.) in function of the max working pressure and the max flow rate

Step 4: Push "PROCEED"

Step 5: Insert all application data to calculate the filter size following the sequence:
- working pressure
- working flow rate
- working pressure drop
- working temperature
- fluid material and fluid type
- filtration media
- connection type

Step 6: Push "CALCULATE" to have result; in case of any mistake, the system will advice which parameter is out of range to allow to modify/adjust the selection

Step 7: Download PDF
  Datasheet “Report.aspx” pushing the button “Drawing”
Hydraulic combined filters for installation on the return and suction lines of hydrostatic transmissions (HSTs) for commercial vehicles, construction machinery, agricultural vehicles, and mobile work equipment with hydrostatic drive.

Advantage for the installation:
- Space-saving assembly
- Reduced assembly time
- Fewer connections to the tank
- Protection from the pollution of the tank

Advantages for the operativity:
- Absolute filtration of the oil for the hydrostatic drive
- Fulfilment of the purity requirements according to ISO 4406, as specified by the manufacturer of the driving drives.
- Protection against damages from cavitation even under adverse conditions, e.g. cold start
- Less formation of free air in the system
- Easier maintenance operations (one spare filter element instead of two)

FILTER SIZING
For the proper corrective factor Y see chapter at page 21
NEW FILTER ELEMENT WITH EXCLUSIVE INTERFACE CONNECTION

- 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 filter elements MP Filtri can be used, ensuring the best cleaning level of the oil due to the use of originals filter elements.

The products identified as MRSX and RSX are protected by one or more of the following patent applications:

- European Patent Pending: n° 16181725.9
- Italian Patent Pending: n° 102015000040473
- US Patent Pending: n° 15/224,337
- Canadian Patent Pending: n° 2,937,258
MRSX series

Maximum pressure up to 10 bar - Flow rate up to 300 l/min
MRSX GENERAL INFORMATION

Technical data

Return / Suction filter
Tank mounted

Filter housing materials
- Head: Aluminium
- Cover: Nylon (MRSX 116)
- Aluminium (MRSX 165-166)
- Bowl: Nylon

Seals
- Standard NBR series A
- Optional FPM series V

Pressure
Working pressure: 1 MPa (10 bar)

Temperature
From -25 °C to +110 °C

Δp element type
- RSX: 10 bar
- Oil flow from exterior to interior.

Weights [kg] and volumes [dm³]

<table>
<thead>
<tr>
<th></th>
<th>Weights [kg]</th>
<th>Volumes [dm³]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Length 1</td>
<td>2</td>
</tr>
<tr>
<td>MRSX 116</td>
<td>1.30</td>
<td>1.40</td>
</tr>
<tr>
<td>MRSX 165</td>
<td>3.40</td>
<td>3.80</td>
</tr>
<tr>
<td>MRSX 166</td>
<td>3.40</td>
<td>3.80</td>
</tr>
</tbody>
</table>

Hydraulic symbols
MRSX 116

Valves “A” option
Valves “B” option
Valves “C” option
Valves “D” option

Valves “E” option
Valves “F” option
Valves “G” option
Valves “H” option

Suitable only for tank side-wall mounting

Valves “I” option
Valves “L” option
Valves “M” option
Valves “N” option

Maximum pressure up to 10 bar - Flow rate up to 300 l/min

Return / Suction filters
The curves are plotted using mineral oil with density of 0.86 kg/dm³ in compliance with ISO 3968. Δp varies proportionally with density.

**Hydraulic symbols**

**MRSX 165 - 166**

**Pressure drop**

Filter housing Δp pressure drop

Bypass valve pressure drop

Valves “A” option

Valves “B” option

Valves “C” option

Valves “D” option

Valves “E” option

Valves “F” option

Valves “G” option

Valves “H” option

Valves “I” option

Valves “L” option

Valves “M” option

Valves “N” option

Suitable only for tank side-wall mounting

GENERAL INFORMATION

MRSX
**COMPLETE FILTER**

**Series and size**

MR SX116 Filter element with private spigot

**Length**

1 | 2

**Hydraulic diagram configuration**

- **By pass valve to tank**
  - A | B | C | D
  - E | F | G | H
  - I | L
  - M | N

- **By pass valve to OUT**

**Connections IN**

- G1: G3/4”
- G2: G1”
- G3: 3/4” NPT
- G4: 1” NPT
- G5: SAE 12 - 1 1/16” - 12 UN
- G6: SAE 16 - 1 5/16” - 12 UN
- D1: G1”
- D2: 1” NPT
- D3: SAE 16 - 1 5/16” - 12 UN

**Connections OUT**

- G3/4”
- G1”
- 3/4” NPT
- 1” NPT
- SAE 12 - 1 1/16” - 12 UN
- SAE 16 - 1 5/16” - 12 UN
- G3/4”
- 3/4” NPT
- SAE 12 - 1 1/16” - 12 UN

**Aux IN connection**

- 0: Without aux IN connection

**Filtration rating (filter media)**

- A10: Inorganic microfiber 10 µm
- A16: Inorganic microfiber 16 µm
- A25: Inorganic microfiber 25 µm

**Mounting position**

- A: Standard
- B: Tank side-wall mounting

**Valves configuration**

- **Noaux IN connection**

**Seals and treatments**

- A: NBR, O-Ring on head
- B: NBR, flat seal on head
- V: FPM, O-Ring on head
- D: FPM, flat seal on head

**Filter element with private spigot**

MR SX116

**Element series and size**

RSX116 Filter element with private spigot

**Element length**

1 | 2

**Filtration rating (filter media)**

- A10: Inorganic microfiber 10 µm
- A16: Inorganic microfiber 16 µm
- A25: Inorganic microfiber 25 µm

**Seals**

- A: NBR
- V: FPM

**Accessories**

<table>
<thead>
<tr>
<th>Indicators on Return Line</th>
<th>page</th>
<th>Indicators on Suction Line</th>
<th>page</th>
</tr>
</thead>
<tbody>
<tr>
<td>BVA: Axial pressure gauge</td>
<td>250</td>
<td>VVB: Axial vacuum gauge</td>
<td>247</td>
</tr>
<tr>
<td>BVR: Radial pressure gauge</td>
<td>250</td>
<td>VVS: Radial vacuum gauge</td>
<td>247</td>
</tr>
<tr>
<td>BVP: Visual pressure indicator with automatic reset</td>
<td>251</td>
<td>VEB: Electrical vacuum indicator</td>
<td>245</td>
</tr>
<tr>
<td>BVO: Visual pressure indicator with manual reset</td>
<td>251</td>
<td>VLB: Electrical / visual vacuum indicator</td>
<td>245</td>
</tr>
</tbody>
</table>

**Bea**

- Electrical pressure indicator
- Electrical pressure indicator
- Electrical pressure indicator
- Electrical / visual pressure indicator
Dimensions

**MRSX116**

<table>
<thead>
<tr>
<th>Filter length</th>
<th>H1 [mm]</th>
<th>H2 [mm]</th>
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<tbody>
<tr>
<td>1</td>
<td>203</td>
<td>240</td>
</tr>
<tr>
<td>2</td>
<td>263</td>
<td>300</td>
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</table>

**Connections**

- **G1 - G2**: G1/8”
- **G3 - G4**: 1/8” NPT
- **G5 - G6**: 1/8” NPT
- **D1**: G1/8”
- **D2 - D3**: 1/8” NPT

**Connections**

- Return / Suction filters: 233

**Dimensions**

- **H2** - Recommended clearance space for maintenance
- **H1** - Total length immersed in the tank
- **O-Ring seal**
- **T - Connection for clogging indicator on Suction Line**
- **T - Connection for clogging indicator on Return Line**
- **Holes on the tank**
- **OUT**
- **IN**

**Diagram Details**

- Diameter: Ø73
- Diameter: Ø74
- Diameter: Ø14 - 116
### COMPLETE FILTER

<table>
<thead>
<tr>
<th>Series and size</th>
<th>Configuration example: MRSX166 2 C V G3 1 A10 S P01</th>
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<tbody>
<tr>
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<td>2</td>
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<tr>
<td>Hydraulic diagram configuration - see page 000</td>
<td></td>
</tr>
<tr>
<td>G1</td>
<td>G1 1/4”</td>
</tr>
<tr>
<td>G2</td>
<td>1 1/4” NPT</td>
</tr>
<tr>
<td>G3</td>
<td>SAE 20 - 1 5/8” - 12 UN</td>
</tr>
<tr>
<td>Aux IN connection</td>
<td>MRS 165</td>
</tr>
<tr>
<td>0 Without aux IN connection</td>
<td>•</td>
</tr>
<tr>
<td>1 With aux IN connection - see previous table</td>
<td>•</td>
</tr>
<tr>
<td>Filtration rating (filter media)</td>
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<tr>
<td>A10</td>
<td>Inorganic microfiber 10 µm</td>
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<tr>
<td>A16</td>
<td>Inorganic microfiber 16 µm</td>
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<tr>
<td>A25</td>
<td>Inorganic microfiber 25 µm</td>
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### FILTER ELEMENT

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<tr>
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<tr>
<td>A10</td>
<td>Inorganic microfiber 10 µm</td>
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<tr>
<td>A16</td>
<td>Inorganic microfiber 16 µm</td>
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<tr>
<td>A25</td>
<td>Inorganic microfiber 25 µm</td>
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### ACCESSORIES

<table>
<thead>
<tr>
<th>Indicators on Return Line</th>
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<tbody>
<tr>
<td>BVA</td>
<td>Axial pressure gauge</td>
</tr>
<tr>
<td>BVR</td>
<td>Radial pressure gauge</td>
</tr>
<tr>
<td>BVP</td>
<td>Visual pressure indicator with automatic reset</td>
</tr>
<tr>
<td>BVQ</td>
<td>Visual pressure indicator with manual reset</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Indicators on Suction Line</th>
<th>page</th>
</tr>
</thead>
<tbody>
<tr>
<td>VVB</td>
<td>Axial vacuum gauge</td>
</tr>
<tr>
<td>VVS</td>
<td>Radial vacuum gauge</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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<td>Visual pressure indicator with automatic reset</td>
</tr>
<tr>
<td>BVQ</td>
<td>Visual pressure indicator with manual reset</td>
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</tbody>
</table>

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>VVB</td>
<td>Axial vacuum gauge</td>
</tr>
<tr>
<td>VVS</td>
<td>Radial vacuum gauge</td>
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</table>
### Dimensions

#### MRSX165

<table>
<thead>
<tr>
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<th>H1 [mm]</th>
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<tr>
<td>1</td>
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<tr>
<td>2</td>
<td>378</td>
<td>430</td>
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<tr>
<td>3</td>
<td>445</td>
<td>500</td>
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#### Connections

<table>
<thead>
<tr>
<th></th>
<th>T</th>
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</thead>
<tbody>
<tr>
<td>G1</td>
<td>G1/8&quot;</td>
</tr>
<tr>
<td>G2 - G3</td>
<td>1/8&quot; NPT</td>
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</tbody>
</table>

#### Diagrams

- **O-Ring seal**
- **H1 - Total length immersed in the tank**
- **H2 - Recommended clearance space for maintenance**
- **Return / Suction filters**
  - G1/8" 235
  - 1/8" NPT
- **Holes on the tank**
  - M10 - 3/8" UNC
  - Ø101
  - Ø164-168

#### Without Aux IN connection

- IN ↔
- OUT

#### With Aux IN connection

- IN ↔
- OUT
  - Aux IN
Dimensions

MRSX166

<table>
<thead>
<tr>
<th>Filter length</th>
<th>H1 [mm]</th>
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</table>

Connections

<table>
<thead>
<tr>
<th>T</th>
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</thead>
<tbody>
<tr>
<td>G1</td>
<td>G1/8&quot;</td>
</tr>
<tr>
<td>G2 - G3</td>
<td>1/8&quot; NPT</td>
</tr>
</tbody>
</table>

Return / Suction filters

Holes on the tank

M10 - 3/8" UNC

IN IN

OUT Aux OUT IN
### MRSX 116

<table>
<thead>
<tr>
<th></th>
<th></th>
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<tbody>
<tr>
<td>Filter series</td>
<td>Filter element</td>
<td>Safety filter element</td>
<td>Seal Kit code number NBR</td>
<td>Optional head seal (molded gasket) FPM</td>
</tr>
<tr>
<td>MRSX 116</td>
<td>See order table</td>
<td>S116M60P01</td>
<td>02050617</td>
<td>02050619</td>
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### MRSX 165 - 166

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<tr>
<td>Filter series</td>
<td>Filter element</td>
<td>Safety filter element</td>
<td>Seal Kit code number NBR</td>
<td>Optional head seal (molded gasket) FPM</td>
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<td>MRSX 165</td>
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<td>S165M60P01</td>
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<td>02050630</td>
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</table>
LMP 124 series
MULTIPOINT

Maximum pressure up to 80 bar - Flow rate up to 200 l/min
Technical data

**Return / Suction filter**

In-line

**Filter housing materials**
- Head: Aluminium
- Housing: Cataphoresis - Painted Steel
- Bypass valve: Brass - Aluminium

**Maximum pressure up to 80 bar - Flow rate up to 200 l/min**

**Seals**
- Standard NBR series A
- Optional FPM series V

**Pressure**
- Working pressure: 8 MPa (80 bar)
- Test pressure: 12 MPa (120 bar)
- Burst pressure: 38 MPa (380 bar)
- Pulse pressure fatigue test: 1,000,000 cycles with pressure from 0 to 80 bar (8 MPa)

**Temperature**
From -25 °C to +110 °C

**Bypass valve**
- Opening pressure 250 kPa (2.5 bar)
- Other opening pressures on request.

**Δp element type**
- Microfibre filter elements - series N - W: 20 bar
- Fluid flow through the filter element from OUT to IN.

**Weights [kg] and volumes [dm³]**

<table>
<thead>
<tr>
<th>Length</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Length</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tr>
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<td>1.70</td>
<td>1.90</td>
<td>2.20</td>
<td>2.70</td>
<td>0.75</td>
<td>0.81</td>
<td>1.11</td>
<td>1.53</td>
<td></td>
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</tbody>
</table>

**Multiport styles**

**Style C - D - E - F**

- C Return
- B Tank
- C Pump

**Style G - H**

- A Return
- B Pump
- A Tank

**Note**
LMP124 filters are provided for vertical mounting.
The curves are plotted using mineral oil with density of 0.86 kg/dm³ in compliance with ISO 3968. Δp varies proportionally with density.
## COMPLETE FILTER

<table>
<thead>
<tr>
<th>Series and size</th>
<th>Configuration example: LMP124 4 C A F 1 A10 N P01</th>
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</thead>
<tbody>
<tr>
<td>Filter length</td>
<td>1</td>
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<tr>
<td>Hydraulic diagram configuration - see previous page</td>
<td>C</td>
</tr>
</tbody>
</table>

### Seals and treatments
- A NBR
- V FPM
- W NBR compatible with fluids HFA-HFB-HFC

### Connections
- B G1"  
- F SAE 16 - 1 5/16" - 12 UN

### Connection for indicator
- 1 Without  
- 2 With connection G1/8" for clogging indicator  
- 3 With connection G1/4" for clogging indicator  
- 4 With connection for differential indicator

### Filtration rating (filter media)
- A03 Inorganic microfiber 3 µm M25 Wire mesh 25 µm  
- A06 Inorganic microfiber 6 µm M60 Wire mesh 60 µm  
- A10 Inorganic microfiber 10 µm M90 Wire mesh 90 µm  
- A16 Inorganic microfiber 16 µm P10 Resin impregnated paper 10 µm  
- A25 Inorganic microfiber 25 µm P25 Resin impregnated paper 25 µm

### FILTER ELEMENT

<table>
<thead>
<tr>
<th>Element series and size</th>
<th>Configuration example: CU110 4 A10 A N P01</th>
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<tbody>
<tr>
<td>Element length</td>
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<tr>
<td>Hydraulic diagram config</td>
<td>Axx</td>
</tr>
</tbody>
</table>

### Seals and treatments
- A NBR
- V FPM
- W NBR compatible with fluids HFA-HFB-HFC

### Connections

### Clogging indicators
- BVA Axial pressure gauge 250  
- BVR Radial pressure gauge 250  
- BVP Visual pressure indicator with automatic reset 251  
- BVQ Visual pressure indicator with manual reset 251

### Differential indicators
- DEA Electrical differential indicator 252  
- DEM Electrical differential indicator 252-253  
- DLA Electrical / visual differential indicator 253-254  
- DLE Electrical / visual differential indicator 254

### ACCESSORIES

<table>
<thead>
<tr>
<th>Additional features</th>
<th>page</th>
</tr>
</thead>
<tbody>
<tr>
<td>T2 Plug</td>
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</tbody>
</table>

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**LMP 124 MULTIPORT**

**Designation & Ordering code**
## LMP 124 MULTIPORT SPARE PARTS

### Order number for spare parts

### LMP 124 MULTIPORT

<table>
<thead>
<tr>
<th>Item:</th>
<th>Q.ty: 1 pc.</th>
<th>Q.ty: 1 pc.</th>
<th>Q.ty: 1 pc.</th>
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<tr>
<td>Item:</td>
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### Filter series

<table>
<thead>
<tr>
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<th>Seal Kit code number</th>
<th>Indicator connection plug</th>
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<tbody>
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<td></td>
<td></td>
<td>02050479</td>
<td>T2V</td>
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</tbody>
</table>

---

Return / Suction filters
Clogging indicators

Introduction
Filter elements are efficient only if their Dirt Holding Capacity is fully exploited. This is achieved by using filter housings equipped with clogging indicators. These devices trip when the clogging of the filter element causes an increase in pressure drop across the filter element. 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.

Suitable indicator types

VACUUM INDICATORS
Vacuum indicators are used on the Suction line to check the efficacy 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.

BAROMETRIC INDICATORS
Pressure indicators are used on the Return line to check the efficacy of the filter element. They measure the pressure upstream of the filter element. Standard items are produced with R 1/8" EN 10226 connection.

DIFFERENTIAL INDICATORS
Differential indicators are used on the Pressure line to check the efficacy 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.

Quick reference guide

<table>
<thead>
<tr>
<th>Filter series</th>
<th>Visual indicator</th>
<th>Electrical indicator</th>
<th>Electrical / Visual indicator</th>
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<tbody>
<tr>
<td>Suction line</td>
<td>WB16P01</td>
<td>VEB21AA50P01</td>
<td>VLB21A51P01 BL21A52P01</td>
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<tr>
<td>MRSX 116 - 165 - 166</td>
<td>WS16P01</td>
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<td>VLB21A53P01 VLB21A71P01</td>
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<td>Return line</td>
<td>BWA25P01</td>
<td>BEA25HAS5P01</td>
<td>BL25HAS5P01 BL25HAS3P01</td>
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<td>BEM25HA41P01</td>
<td>BL25HAS3P01 BL25HAS71P01</td>
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<td>BVP20HP01</td>
<td>BET25HF10P01</td>
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<td>BV020HP01</td>
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<td></td>
<td></td>
<td>BET25HF50P01</td>
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</table>
## VE*50

**Electrical Vacuum Indicator**

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<tr>
<th>R</th>
<th>Ordering code</th>
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<tr>
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<tr>
<td></td>
<td>VE B 21 A A 50 P01</td>
</tr>
</tbody>
</table>

**Electrical symbol**

```
1
2
3
```

**Hydraulic symbol**

```
1
3
```

**Materials**
- Body: Brass
- Base: Black Nylon
- Contacts: Silver
- Seal: 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 oil, Synthetic fluids
- Degree of protection: IP65 according to EN 60529

**Electrical data**
- Electrical connection: EN 175301-803
- Resistive load: 5 A / 14 Vdc
- Max working pressure: 10 bar
- Proof pressure: 15 bar
- Working temperature: From -25 °C to +80 °C
- Available Atex product: II 1GD Ex ia IIC Tx Ex ia IIIC Tx°C X

**Dimensions**

- A/F 27
- Max tightening torque: 25 N·m

## VL*51 - VL*52 - VL*53

**Electrical/Visual Vacuum Indicator**

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<thead>
<tr>
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<tbody>
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<tr>
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<tr>
<td></td>
<td>VL B 21 A A xx P01</td>
</tr>
</tbody>
</table>

**Electrical symbol**

```
1
2
3
```

**Hydraulic symbol**

```
1
3
```

**Materials**
- Body: Brass
- Base: Transparent Nylon
- Contacts: Brass - Nylon
- Seal: 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 oil, Synthetic fluids
- 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: 0.8 A / 24 Vdc 0.2 A / 115 Vdc 4 A / 230 Vac

**Dimensions**

- A/F 27
- Max tightening torque: 25 N·m

## VL*71

**Electrical/Visual Vacuum Indicator**

<table>
<thead>
<tr>
<th>R</th>
<th>Indicator code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EN 10226 - R1/4&quot;</td>
</tr>
<tr>
<td></td>
<td>VL A 21 A A 71 P01</td>
</tr>
<tr>
<td>2</td>
<td>EN 10226 - R1/8&quot;</td>
</tr>
<tr>
<td></td>
<td>VL B 21 A A 71 P01</td>
</tr>
</tbody>
</table>

**Electrical symbol**

```
1
2
3
```

**Hydraulic symbol**

```
1
3
```

**Materials**
- Body: Brass
- Base: Black Nylon
- Contacts: Silver
- Seal: 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 oil, Synthetic fluids
- Degree of protection: IP65 according to EN 60529

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

**Dimensions**

- A/F 27
- Max tightening torque: 25 N·m
### Materials
- **Case:** Painted Steel
- **Window:** Transparent plastic
- **Dial:** Painted Steel
- **Pointer:** Painted Aluminium
- **Pressure connection:** Brass
- **Pressure element:** Bourdon tube Cu-alloy soft soldered

### Technical data
- **Max working pressure:**
  - Static: 7 bar
  - Fluctuating: 6 bar
  - Short time: 10 bar
- **Working temperature:** From -40°C to +60°C
- **Compatibility with fluids:** Mineral oil, Synthetic fluids: HFA, HFB, HFC according to ISO 2943
- **Accuracy:** Class 2.5 according to EN 13190
- **Degree of protection:** IP31 according to EN 60529

### Conversion to SI units

<table>
<thead>
<tr>
<th>[cmHg]</th>
<th>[bar]</th>
</tr>
</thead>
<tbody>
<tr>
<td>-12</td>
<td>-0.16</td>
</tr>
<tr>
<td>-18</td>
<td>-0.24</td>
</tr>
<tr>
<td>-76</td>
<td>-1.01</td>
</tr>
</tbody>
</table>

### Dimensions

#### VA - WB
**Axial Vacuum Gauge**

<table>
<thead>
<tr>
<th>R</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 10226 - R1/4&quot;</td>
<td>VA 16 P01</td>
</tr>
<tr>
<td>EN 10226 - R1/8&quot;</td>
<td>VB 16 P01</td>
</tr>
</tbody>
</table>

#### VVR - WS
**Radial Vacuum Gauge**

<table>
<thead>
<tr>
<th>R</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 10226 - R1/4&quot;</td>
<td>VR 16 P01</td>
</tr>
<tr>
<td>EN 10226 - R1/8&quot;</td>
<td>VS 16 P01</td>
</tr>
</tbody>
</table>

### DESIGNATION & ORDERING CODE

**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**
- **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**
- **16** 0.16 bar
- **21** 0.21 bar

**Seals**
- **A** NBR

**Thermostat**
- **A** Without

**Electrical connections**
- **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 Vdc
- **71** Connection IEC 61076-2-101 D (M12), black base with lamps 24 Vdc

**Option**
- **P01** MP Filtri standard
- **Pxx** Customized
### Barometric Indicators

#### BEA*50
**Electrical Pressure Indicator**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 bar ±10%</td>
<td>BE A 15 HA 50 P01</td>
</tr>
<tr>
<td>2 bar ±10%</td>
<td>BE A 20 HA 50 P01</td>
</tr>
</tbody>
</table>

**Hydraulic symbol**

```
1
2
3
```

**Electrical symbol**

```
1
2
3
```

**Materials**
- Body: Brass
- Base: Black Nylon
- Contacts: Silver
- Seal: HNBR

**Technical data**
- Max working pressure: 40 bar
- Proof pressure: 60 bar
- Working temperature: From -25 °C to +80 °C
- Compatibility with fluids: Mineral oil, Synthetic fluids
- Degree of protection: IP67 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
- Available Atex product: II 1GD Ex ia IIC Tx Ex ia III C Tx°C X
- CE certification

**Dimensions**

**Materials**

```
- Body: Brass
- Base: Black Nylon
- Contacts: Silver
- Seal: HNBR
```

**Technical data**

```
- Max working pressure: 40 bar
- Proof pressure: 60 bar
- Working temperature: From -25 °C to +80 °C
- Compatibility with fluids: Mineral oil, Synthetic fluids
- Degree of protection: IP67 according to EN 60529
```

**Electrical data**

```
- Electrical connection: Four-core cable
- Resistive load: 5 A / 14 Vdc
  - 4 A / 30 Vdc
  - 5 A / 125 Vac
  - 4 A / 250 Vac
- CE certification
  - On request this indicator can be provided with main connectors in use for wirings.
```

### BEM*41
**Electrical Pressure Indicator**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 bar ±10%</td>
<td>BE M 15 HA 41 P01</td>
</tr>
<tr>
<td>2 bar ±10%</td>
<td>BE M 20 HA 41 P01</td>
</tr>
</tbody>
</table>

**Hydraulic symbol**

```
1
2
3
```

**Electrical symbol**

```
1
2
3
```

**Materials**
- Body: Brass
- Base: Black Nylon
- Contacts: Silver
- Seal: HNBR

**Technical data**
- Max working pressure: 40 bar
- Proof pressure: 60 bar
- Working temperature: From -25 °C to +80 °C
- Compatibility with fluids: Mineral oil, Synthetic fluids
- Degree of protection: IP67 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
- Available Atex product: II 1GD Ex ia IIC Tx Ex ia III C Tx°C X
- CE certification

**Dimensions**

**Materials**

```
- Body: Brass
- Base: Black Nylon
- Contacts: Silver
- Seal: HNBR
```

**Technical data**

```
- Max working pressure: 40 bar
- Proof pressure: 60 bar
- Working temperature: From -25 °C to +80 °C
- Compatibility with fluids: Mineral oil, Synthetic fluids
- Degree of protection: IP67 according to EN 60529
```

**Electrical data**

```
- Electrical connection: Four-core cable
- Resistive load: 5 A / 14 Vdc
  - 4 A / 30 Vdc
  - 5 A / 125 Vac
  - 4 A / 250 Vac
- CE certification
  - On request this indicator can be provided with main connectors in use for wirings.
```

### BET*10
**Electrical Pressure Indicator**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 bar ±10%</td>
<td>BE T 20 HA 10 P01</td>
</tr>
<tr>
<td>2.5 bar ±10%</td>
<td>BE T 25 HA 10 P01</td>
</tr>
</tbody>
</table>

**Hydraulic symbol**

```
1
2
```

**Electrical symbol**

```
1
2
```

**Materials**
- Body: Brass
- Base: Black Nylon
- Contacts: Silver
- Seal: HNBR

**Technical data**
- Max working pressure: 10 bar
- Proof pressure: 15 bar
- Working temperature: From -25 °C to +100 °C
- Compatibility with fluids: Mineral oil, Synthetic fluids
- Degree of protection: IP67 according to EN 60529

**Electrical data**
- Electrical connection: AMP Superseal series 1.5
- Resistive load: 0.5 A / 48 Vdc
- Thermostat condition: Open up to 30°C
- CE certification

**Dimensions**

**Materials**

```
- Body: Brass
- Base: Black Nylon
- Contacts: Silver
- Seal: HNBR
```

**Technical data**

```
- Max working pressure: 10 bar
- Proof pressure: 15 bar
- Working temperature: From -25 °C to +100 °C
- Compatibility with fluids: Mineral oil, Synthetic fluids
- Degree of protection: IP67 according to EN 60529
```

**Electrical data**

```
- Electrical connection: AMP Superseal series 1.5
- Resistive load: 0.5 A / 48 Vdc
- Thermostat condition: Open up to 30°C
- CE certification
```
**BET*30**

**Electrical Pressure Indicator**

<table>
<thead>
<tr>
<th>Settings</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 bar ±10%</td>
<td>BE T 20 HA 30 P01</td>
</tr>
<tr>
<td>2.5 bar ±10%</td>
<td>BE T 25 HA 30 P01</td>
</tr>
</tbody>
</table>

**Hydraulic symbol**

**Electrical symbol**

**Materials**
- Body: Brass
- Base: Black Nylon
- Contacts: Silver
- Seal: HNBR

**Technical data**
- Max working pressure: 10 bar
- Proof pressure: 15 bar
- Working temperature: From -25 °C to +100 °C
- Compatibility with fluids: Mineral oil, Synthetic fluids
  - HFA, HFB, HFC according to ISO 2943
- Degree of protection: IP65 according to EN 60529

**Electrical data**
- Electrical connection: Deutsch DT-04-2-P
- Resistive load: 0.5 A / 48 Vdc
- Thermostat condition: Open up to 30 °C
- CE certification

**Dimensions**

**BET*50**

**Electrical Pressure Indicator**

<table>
<thead>
<tr>
<th>Settings</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 bar ±10%</td>
<td>BE T 20 HA 50 P01</td>
</tr>
<tr>
<td>2.5 bar ±10%</td>
<td>BE T 25 HA 50 P01</td>
</tr>
</tbody>
</table>

**Hydraulic symbol**

**Electrical symbol**

**Materials**
- Body: Brass
- Base: Black Nylon
- Contacts: Silver
- Seal: HNBR

**Technical data**
- Max working pressure: 10 bar
- Proof pressure: 15 bar
- Working temperature: From -25 °C to +100 °C
- Compatibility with fluids: Mineral oil, Synthetic fluids
  - HFA, HFB, HFC according to ISO 2943
- Degree of protection: IP65 according to EN 60529

**Electrical data**
- Electrical connection: EN 175301-803
- Resistive load: 0.5 A / 48 Vdc
- Thermostat condition: Open up to 30 °C
- CE certification

**Dimensions**

**BL*51 - BL*52 - BL*53**

**Electrical/Visual Pressure Indicator**

<table>
<thead>
<tr>
<th>Settings</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 bar ±10%</td>
<td>BL A 15 HA xx P01</td>
</tr>
<tr>
<td>2 bar ±10%</td>
<td>BL A 20 HA xx P01</td>
</tr>
</tbody>
</table>

**Hydraulic symbol**

**Electrical symbol**

**Materials**
- Body: Brass
- Base: Transparent Nylon
- Contacts: Silver
- Seal: HNBR

**Technical data**
- Max working pressure: 40 bar
- Proof pressure: 60 bar
- Working temperature: From -25 °C to +80 °C
- Compatibility with fluids: Mineral oil, Synthetic fluids
  - HFA, HFB, 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: 0.8 A / 24 Vdc 0.2 A / 110 Vdc 4 A / 230 Vac
- CE certification

**Dimensions**
### BAROMETRIC INDICATORS

#### Materials
- **Case:** Painted Steel
- **Window:** Transparent plastic
- **Dial:** Painted Steel
- **Pointer:** Painted Aluminium
- **Pressure connection:** Brass
- **Pressure element:** Bourdon tube Cu-alloy soft soldered

#### Technical data
- **Max working pressure:**
  - Static: 7 bar
  - Fluctuating: 6 bar
  - Short time: 10 bar
- **Working temperature:**
  - From -40 °C to +60 °C
- **Compatibility with fluids:**
  - Mineral oil, Synthetic fluids
- **Accuracy:**
  - Class 2.5 according to EN 13190
- **Degree of protection:**
  - IP31 according to EN 60529

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

---

### BVA

#### Axial Pressure Gauge

<table>
<thead>
<tr>
<th>Settings</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4 bar ±10%</td>
<td>BV A 14 P01</td>
</tr>
<tr>
<td>2.5 bar ±10%</td>
<td>BV A 25 P01</td>
</tr>
</tbody>
</table>

#### Materials
- **Case:** Painted Steel
- **Window:** Transparent plastic
- **Dial:** Painted Steel
- **Pointer:** Painted Aluminium
- **Pressure connection:** Brass
- **Pressure element:** Bourdon tube Cu-alloy soft soldered

#### Technical data
- **Max working pressure:**
  - Static: 7 bar
  - Fluctuating: 6 bar
  - Short time: 10 bar
- **Working temperature:**
  - From -40 °C to +60 °C
- **Compatibility with fluids:**
  - Mineral oil, Synthetic fluids
- **Accuracy:**
  - Class 2.5 according to EN 13190
- **Degree of protection:**
  - IP31 according to EN 60529

---

### BVR

#### Radial Pressure Gauge

<table>
<thead>
<tr>
<th>Settings</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4 bar ±10%</td>
<td>BV R 14 P01</td>
</tr>
<tr>
<td>2.5 bar ±10%</td>
<td>BV R 25 P01</td>
</tr>
</tbody>
</table>

#### Materials
- **Case:** Painted Steel
- **Window:** Transparent plastic
- **Dial:** Painted Steel
- **Pointer:** Painted Aluminium
- **Pressure connection:** Brass
- **Pressure element:** Bourdon tube Cu-alloy soft soldered

#### Technical data
- **Max working pressure:**
  - Static: 7 bar
  - Fluctuating: 6 bar
  - Short time: 10 bar
- **Working temperature:**
  - From -40 °C to +60 °C
- **Compatibility with fluids:**
  - Mineral oil, Synthetic fluids
- **Accuracy:**
  - Class 2.5 according to EN 13190
- **Degree of protection:**
  - IP31 according to EN 60529
## Barometric Indicators

### Series
- **BE**: Electrical pressure indicator
- **BL**: Electrical/Visual pressure indicator
- **BV**: Visual pressure indicator

### Hydraulic Symbol
![Hydraulic symbol]

### Dimensions

**BE**
- **P01**
  - **MP Filtri standard**
  - **Customized**

**BL**
- **P01**
  - **MP Filtri standard**
  - **Customized**

**BV**
- **P01**
  - **MP Filtri standard**
  - **Customized**

### Configuration Examples
1. **BE HM 41 A15 P01**
2. **BL HA 71 A20 P01**
3. **BV R 14 P01**
4. **BV H P 20 P01**

### Designation & Ordering Code

#### Series
- BE: Electrical pressure indicator
- BL: Electrical/Visual pressure indicator
- BV: Visual pressure indicator

#### Configuration Examples
1. **BE M 15 H A 41 P01**
2. **BL A 20 H A 71 P01**
3. **BV R 14 41 P01**
4. **BV P 20 H 41 P01**

#### Type
- **A**: Standard type
- **M**: With wired electrical connection
- **T**: With thermal switch

#### Pressure Setting
- **BEA-BEM**: 14 1.4 bar
- **BE**: 15 1.5 bar, 20 2 bar, 25 2.5 bar

#### Seals
- **BE**: HNBR

#### Thermostat
- **BE**: Without

#### Electrical Connections
- **BEA-BEM**: 10 Connection AMP Superseal series 1.5
- **BE**: 50 Connection EN 175301-803
- **BL**: 51 Connection EN 175301-803, transparent base with lamps 24 Vdc
- **BV**: 52 Connection EN 175301-803, transparent base with lamps 110 Vdc
- **BV**: 53 Connection EN 175301-803, transparent base with lamps 230 Vdc
- **BV**: 71 Connection IEC 61076-2-101 D (M12), black base with lamps 24 Vdc

### Technical Data
- **Reset**: BVP - Automatic reset
  - BVQ - Manual reset
- **Max working pressure**: 10 bar
- **Proof pressure**: 15 bar
- **Working temperature**: From -25 °C to +80 °C
- **Compatibility with fluids**: Mineral oil, Synthetic fluids HFA, HFB, HFC according to ISO 2943
- **Degree of protection**: IP45 according to EN 60529

### Materials
- **Body**: Brass
- **Cover / Internal parts**: Nylon
- **Caps**: VMQ
- **Seal**: HNBR

### Signals
- **Absence of pressure**: (no indicator)
- **Presence of pressure**: (green button rises gradually)
- **Clogged filter element**: (red button risen)

### Electical Pressure Indicator
- **BVP - BVQ**
  - **EN 10226 - R1/8”
  - **10 14 55**
  - **77 1000**

### Return / Suction filters
- **251**
DIFFERENTIAL INDICATORS

Dimensions

### DEA*50

**Electrical Differential Indicator**

- **Ordering code:** DE A 20 x A 50 P01

![Hydraulic symbol](image)

**Electrical symbol**

- **Ordering code:** DEM20xx20P01

![electrical connection](image)

**Materials**

- **Body:** Brass
- **Base:** Black Nylon
- **Contacts:** Silver
- **Seal:** HNBR - FPM

**Technical data**

- **Max working pressure:** 2 bar ±10%
- **Burst pressure:** 1260 bar
- **Working temperature:** From -25 °C to +110 °C
- **Compatibility with fluids:** Mineral oil, Synthetic fluids
- **Degree protection:** IP66 according to EN 60529

**Electrical data**

- **Electrical connection:** AMP Superseal series 1.5
- **Resistive load:** 0.2 A / 115 Vdc
- **Switching type:** Normally open contacts (NC on request)
- **Thermal lockout:** Normally open up to 30 °C (option “F”)

---

### DEM*10

**Electrical Differential Indicator**

- **Ordering code:** DE M 20 xx 10 P01

![Hydraulic symbol](image)

**Electrical symbol**

- **Ordering code:** DEM20xx10P01

![Electrical connection](image)

**Materials**

- **Body:** Brass
- **Base:** Black Nylon
- **Contacts:** Silver
- **Seal:** HNBR - FPM

**Technical data**

- **Max working pressure:** 2 bar ±10%
- **Burst pressure:** 1260 bar
- **Working temperature:** From -25 °C to +110 °C
- **Compatibility with fluids:** Mineral oil, Synthetic fluids
- **Degree protection:** IP66 according to EN 60529

**Electrical data**

- **Electrical connection:** AMP Superseal series 1.5
- **Resistive load:** 0.2 A / 115 Vdc
- **Switching type:** Normally open contacts (NC on request)
- **Thermal lockout:** Normally open up to 30 °C (option “F”)

---

### DEM*20

**Electrical Differential Indicator**

- **Ordering code:** DEM20xx20P01

![Hydraulic symbol](image)

**Electrical symbol**

- **Ordering code:** DEM20xx20P01

![Electrical connection](image)

**Materials**

- **Body:** Brass
- **Base:** Black Nylon
- **Contacts:** Silver
- **Seal:** HNBR - FPM

**Technical data**

- **Max working pressure:** 2 bar ±10%
- **Burst pressure:** 1260 bar
- **Working temperature:** From -25 °C to +110 °C
- **Compatibility with fluids:** Mineral oil, Synthetic fluids
- **Degree protection:** IP66 according to EN 60529

**Electrical data**

- **Electrical connection:** AMP Superseal series 1.5
- **Resistive load:** 0.2 A / 115 Vdc
- **Switching type:** Normally open contacts (NC on request)
- **Thermal lockout:** Normally open up to 30 °C (option “F”)

---

**Return / Suction filters**

252
### DEM*30
**Electrical Differential Indicator**

<table>
<thead>
<tr>
<th>Settings</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 bar ±10%</td>
<td>DE M 20 xx 30 P01</td>
</tr>
</tbody>
</table>

**Technical data**
- Max working pressure: 420 bar
- Proof pressure: 630 bar
- Burst pressure: 1260 bar
- Working temperature: From -25 °C to +110 °C
- Compatibility with fluids: Mineral oil, Synthetic fluids
- Degree protection: IP66 according to EN 60529

**Electrical data**
- Electrical connection: Deutsch DT-04-2-P
- Resistive load: 0.2 A / 115 Vdc
- Switching type: Normally open contacts (NC on request)
- Thermal lockout: Normally open up to 30 °C (option “F”)

**Materials**
- Body: Brass
- Base: Black Nylon
- Contacts: Silver
- Seal: HNBR - FPM

**Dimensions**
- Hydraulic symbol:

**Electrical symbol**
- Thermal lockout

---

### DEM*35
**Electrical Differential Indicator**

<table>
<thead>
<tr>
<th>Settings</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 bar ±10%</td>
<td>DE M 20 xx 35 P01</td>
</tr>
</tbody>
</table>

**Technical data**
- Max working pressure: 420 bar
- Proof pressure: 630 bar
- Burst pressure: 1260 bar
- Working temperature: From -25 °C to +110 °C
- Compatibility with fluids: Mineral oil, Synthetic fluids
- Degree protection: IP66 according to EN 60529

**Electrical data**
- Electrical connection: Deutsch DT-04-3-P
- Resistive load: 0.2 A / 115 Vdc
- Switching type: SPDT contact
- Thermal lockout: Normally open up to 30 °C (option “F”)

**Materials**
- Body: Brass
- Base: Black Nylon
- Contacts: Silver
- Seal: HNBR - FPM

**Dimensions**
- Hydraulic symbol:

**Electrical symbol**
- Thermal lockout

---

### DLA*51 - DLA*52
**Electrical/Visual Differential Indicator**

<table>
<thead>
<tr>
<th>Settings</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 bar ±10%</td>
<td>DL A 20 x A xx P01</td>
</tr>
</tbody>
</table>

**Technical data**
- Max working pressure: 420 bar
- Proof pressure: 630 bar
- Burst pressure: 1260 bar
- Working temperature: From -25 °C to +110 °C
- Compatibility with fluids: Mineral oil, Synthetic fluids
- Degree protection: IP66 according to EN 60529
- Degree protection: IP69K according to ISO 20653

**Electrical data**
- Electrical connection: EN 175301-803
- Type: 51, 52
- Lamps: 24 Vdc, 110 Vdc
- Resistive load: 0.8 A / 24 Vdc, 0.2 A / 110 Vdc

**Materials**
- Body: Brass
- Base: Transparent Nylon
- Contacts: Silver
- Seal: HNBR - FPM

**Dimensions**
- Hydraulic symbol:

**Electrical symbol**
- Thermal lockout
- Green lamp
- Red lamp

---

**Note:**
- A/F 28 Max tightening torque: 65 N·m
- A/F 30 Max tightening torque: 65 N·m
- Flexible cable: 240 to "A"
## Differential Indicators

### DLA*71

**Electrical/Visual Differential Indicator**

<table>
<thead>
<tr>
<th>Settings</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 bar ±10%</td>
<td>DL A 20 x A 71 P01</td>
</tr>
</tbody>
</table>

**Materials**
- Body: Brass
- Base: Black Nylon
- Contacts: Silver
- Seal: HNBR - FPM

**Technical data**
- Max working pressure: 420 bar
- Proof pressure: 630 bar
- Burst pressure: 1260 bar
- Working temperature: From -25 °C to +110 °C
- Compatibility with fluids: Mineral oil, Synthetic fluids, HFA, HFB, HFC according to ISO 2943
- Degree protection: IP65 according to EN 60529

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

### DLE*A50

**Electrical/Visual Differential Indicator**

<table>
<thead>
<tr>
<th>Settings</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 bar ±10%</td>
<td>DL E 20 x A 50 P01</td>
</tr>
</tbody>
</table>

**Materials**
- Body: Brass
- Base: Black Nylon
- Contacts: Silver
- Seal: HNBR - FPM

**Technical data**
- Max working pressure: 420 bar
- Proof pressure: 630 bar
- Burst pressure: 1260 bar
- Working temperature: From -25 °C to +110 °C
- Compatibility with fluids: Mineral oil, Synthetic fluids, HFA, HFB, HFC according to ISO 2943
- Degree protection: IP65 according to EN 60529

**Electrical data**
- Electrical connection: EN 175301-803
- Resistive load: 5 A / 250 Vac
- Available the connector with lamps

### DLE*F50

**Electrical/Visual Differential Indicator**

<table>
<thead>
<tr>
<th>Settings</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 bar ±10%</td>
<td>DL E 20 x F 50 P01</td>
</tr>
</tbody>
</table>

**Materials**
- Body: Brass
- Base: Black Nylon
- Contacts: Silver
- Seal: HNBR - FPM

**Technical data**
- Max working pressure: 420 bar
- Proof pressure: 630 bar
- Burst pressure: 1260 bar
- Working temperature: From -25 °C to +110 °C
- Compatibility with fluids: Mineral oil, Synthetic fluids, HFA, HFB, HFC according to ISO 2943
- Degree protection: IP65 according to EN 60529

**Electrical data**
- Electrical connection: EN 175301-803
- Resistive load: 5 A / 250 Vac
- Thermal lockout setting: +30 °C
### Differential Indicators

#### DTA*70

**Electronic Differential Indicator**

<table>
<thead>
<tr>
<th>Settings</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 bar ±10%</td>
<td>DT A 20 x 70 P01</td>
</tr>
</tbody>
</table>

- **Hydraulic symbol**
- **Electrical symbol**
- **Materials**
  - Body: Brass
  - Internal parts: Brass - Nylon
  - Contacts: Silver
  - Seal: HNBR - FPM
- **Technical data**
  - Max working pressure: 420 bar
  - Proof pressure: 630 bar
  - Burst pressure: 1260 bar
  - Compatibility with fluids: Mineral oil, Synthetic fluids
  - Degree protection: IP67 according to EN 60529
- **Electrical data**
  - Electrical connection: IEC 61076-2-101 D (M12)
  - Power supply: 24 Vdc
  - Analogue output: From 4 to 20 mA
  - Thermal lockout: 30°C (all output signals stalled up to 30°C)

#### DVA

**Visual Differential Indicator**

<table>
<thead>
<tr>
<th>Settings</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 bar ±10%</td>
<td>DV A 20 x P01</td>
</tr>
</tbody>
</table>

- **Hydraulic symbol**
- **Materials**
  - Body: Brass
  - Internal parts: Brass - Nylon
  - Contacts: Silver
  - Seal: HNBR - FPM
- **Technical data**
  - Reset: Automatic reset
  - Max working pressure: 420 bar
  - Proof pressure: 630 bar
  - Burst pressure: 1260 bar
  - Working temperature: From -25 °C to +110°C
  - Compatibility with fluids: Mineral oil, Synthetic fluids
  - Degree protection: IP65 according to EN 60529
- **Electrical data**
  - Electrical connection: IEC 61076-2-101 D (M12)
  - Power supply: 24 Vdc
  - Analogue output: From 4 to 20 mA
  - Thermal lockout: 30°C (all output signals stalled up to 30°C)

#### DVM

**Visual Differential Indicator**

<table>
<thead>
<tr>
<th>Settings</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 bar ±10%</td>
<td>DV M 20 x P01</td>
</tr>
</tbody>
</table>

- **Hydraulic symbol**
- **Materials**
  - Body: Brass
  - Internal parts: Brass - Nylon
  - Contacts: Silver
  - Seal: HNBR - FPM
- **Technical data**
  - Reset: Manual reset
  - Max working pressure: 420 bar
  - Proof pressure: 630 bar
  - Burst pressure: 1260 bar
  - Working temperature: From -25 °C to +110°C
  - Compatibility with fluids: Mineral oil, Synthetic fluids
  - Degree protection: IP65 according to EN 60529
DIFFERENTIAL INDICATORS

Dimensions

**T2**
Indicator plug

<table>
<thead>
<tr>
<th>Seal</th>
<th>Ordering code</th>
</tr>
</thead>
<tbody>
<tr>
<td>HNBR</td>
<td>T2 H</td>
</tr>
<tr>
<td>FPM</td>
<td>T2 V</td>
</tr>
</tbody>
</table>

A/F 30
Max tightening torque: 50 N·m

Materials
- Body: Phosphatized steel
- Seal: HNBR / FPM

**DESIGNATION & ORDERING CODE - DIFFERENTIAL INDICATORS**

<table>
<thead>
<tr>
<th>Series</th>
<th>Configuration example 1:</th>
</tr>
</thead>
<tbody>
<tr>
<td>DE</td>
<td>DE M 20 H F 50 P01</td>
</tr>
<tr>
<td>DL</td>
<td>DL E 20 V A 71 P01</td>
</tr>
<tr>
<td>DT</td>
<td>DT A 20 H F 70 P01</td>
</tr>
<tr>
<td>DV</td>
<td>DV M 20 V  P01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>DE</th>
<th>DL</th>
<th>DT</th>
<th>DV</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Standard type</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>A</td>
</tr>
<tr>
<td>M With wired electrical connection</td>
<td>●</td>
<td>●</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td>E For high power supply</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Pressure setting</th>
<th>20 2 bar</th>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Seals</th>
<th>H HNBR</th>
<th>V FPM</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Thermostat</th>
<th>DEA</th>
<th>DEM</th>
<th>DLA</th>
<th>DLE</th>
<th>DT</th>
<th>DV</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Without</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>F With thermostat</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Electrical connections</th>
<th>DEA</th>
<th>DEM</th>
<th>DLA</th>
<th>DLE</th>
<th>DT</th>
<th>DV</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Connection AMP Superseal series 1.5</td>
<td>●</td>
<td></td>
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</tr>
<tr>
<td>20 Connection AMP Timer Junior</td>
<td>●</td>
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</tr>
<tr>
<td>30 Connection Deutsch DT-04-2-P</td>
<td>●</td>
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<tr>
<td>35 Connection Deutsch DT-04-3-P</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>50 Connection EN 175301-803</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>51 Connection EN 175301-803, transparent base with lamps 24 Vdc</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>52 Connection EN 175301-803, transparent base with lamps 110 Vdc</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70 Connection IEC 61076-2-T01 D (M12), black base with lamps 24 Vdc</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>71 Connection IEC 61076-2-T01 D (M12), black base with lamps 24 Vdc</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DESIGNATION & ORDERING CODE - DIFFERENTIAL INDICATOR PLUG**

<table>
<thead>
<tr>
<th>Series</th>
<th>Configuration example</th>
</tr>
</thead>
<tbody>
<tr>
<td>T2 Indicator plug</td>
<td>T2 H</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seals</th>
<th>H HNBR</th>
<th>V FPM</th>
</tr>
</thead>
</table>

Option
- P01 MP Filtri standard
- Pxx Customized

Return / Suction filters
Filter elements are efficient only if their Dirt Holding Capacity is fully exploited. This is achieved by using filter housings equipped with clogging indicators.

These devices trip when the clogging of the filter element causes an increase in pressure drop across the filter element.

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.
Clogging Indicators
Clogging indicators
VACUUM 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.

BAROMETRIC 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.

DIFFERENTIAL INDICATORS
Differential 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.
<table>
<thead>
<tr>
<th>Filter family</th>
<th>Filter series</th>
<th>Visual indicator</th>
<th>Electrical indicator</th>
<th>Electrical / Visual indicator</th>
<th>Electronic indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Suction Filters</strong></td>
<td>SF 250 - 350</td>
<td>VA16P01</td>
<td>VEA21AA50P01</td>
<td>VL21AA51P01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SF 500 - 501 - 503 - 504 - 505</td>
<td>VR16P01</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SF 510 - 535 - 540</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><strong>Return Filters</strong></td>
<td>MPX-MPTX-MPF-MPT with bypass 1.75 bar</td>
<td>BVA14P01</td>
<td>BVR14P01</td>
<td>BVP20HP01</td>
<td>BVQ20HP01</td>
</tr>
<tr>
<td></td>
<td>MPH with bypass 1.75 bar</td>
<td>BFQ14P01</td>
<td>BFR14P01</td>
<td>BFP20HP01</td>
<td>BFP20HP01</td>
</tr>
<tr>
<td></td>
<td>MPX-MPTX-MPF-MPT with bypass 3 bar</td>
<td>BVA25P01</td>
<td>BVR25P01</td>
<td>BVP20HP01</td>
<td>BFP20HP01</td>
</tr>
<tr>
<td></td>
<td>MPH with bypass 2.5 bar</td>
<td>BFQ25P01</td>
<td>BFR25P01</td>
<td>BFP20HP01</td>
<td>BFP20HP01</td>
</tr>
<tr>
<td></td>
<td>FRI 255</td>
<td>BFQ25P01</td>
<td>BFR25P01</td>
<td>BFP20HP01</td>
<td>BFP20HP01</td>
</tr>
<tr>
<td><strong>Return / Suction Filters</strong></td>
<td>Suction line</td>
<td>MRSX 116 - 165 - 166</td>
<td>VBA16P01</td>
<td>VEA21AA50P01</td>
<td>VL21AA51P01</td>
</tr>
<tr>
<td></td>
<td>Return line</td>
<td>LMP 124</td>
<td>BVA25P01</td>
<td>BVE15AA50P01</td>
<td>BLA15AA51P01</td>
</tr>
<tr>
<td></td>
<td>In-line</td>
<td>MPS 050 - 070 - 100 - 150</td>
<td>DVA12P01</td>
<td>DEA20wA50P01</td>
<td>DLA20wA51P01</td>
</tr>
<tr>
<td><strong>Spin-On Filters</strong></td>
<td>Suction line</td>
<td>MPS 200 - 250 - 300 - 350</td>
<td>VBA16P01</td>
<td>VEA21AA50P01</td>
<td>VL21AA51P01</td>
</tr>
<tr>
<td></td>
<td>Return line</td>
<td>MIST 050 - 070 - 100 - 150</td>
<td>BVA14P01</td>
<td>BVE15AA50P01</td>
<td>BLA15AA51P01</td>
</tr>
<tr>
<td></td>
<td>In-line</td>
<td>MPS 051 - 071 - 101 - 151</td>
<td>DVA12P01</td>
<td>DEA20wA50P01</td>
<td>DLA20wA51P01</td>
</tr>
<tr>
<td><strong>Low &amp; Medium Pressure Filters</strong></td>
<td>LMP 110 - 112 - 116 - 118 - 119</td>
<td>DVA20P01</td>
<td>DEA20wA50P01</td>
<td>DLA20wA51P01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LMP 120 - 122 - 123</td>
<td>DVM20xP01</td>
<td>DVM20xP01</td>
<td>DLE20wA50P01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LMP 210 - 211 - LDP</td>
<td>DVM50xP01</td>
<td>DVM50xP01</td>
<td>DLE50wA50P01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LMP 400 - 401 - 430 - 431</td>
<td>DVM50xP01</td>
<td>DVM50xP01</td>
<td>DLE50wA50P01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LMP 902 - 903 - 952 - 953 - 954</td>
<td>DVM50xP01</td>
<td>DVM50xP01</td>
<td>DLE50wA50P01</td>
<td></td>
</tr>
<tr>
<td><strong>High Pressure Filters</strong></td>
<td>FMP 039 - 065 - 135 - 320</td>
<td>DVA50xP01</td>
<td>DEA50wA50P01</td>
<td>DLA50wA51P01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FHP 010 - 011 - 065 - 135 - 320 - 500</td>
<td>DVA50xP01</td>
<td>DEA50wA50P01</td>
<td>DLA50wA51P01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FMM 050 - FHA 051</td>
<td>DVA50xP01</td>
<td>DEA50wA50P01</td>
<td>DLA50wA51P01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FHB 050 - 051 - 320</td>
<td>DVA50xP01</td>
<td>DEA50wA50P01</td>
<td>DLA50wA51P01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FHB 050 - 051 - 320</td>
<td>DVA50xP01</td>
<td>DEA50wA50P01</td>
<td>DLA50wA51P01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FHB 050 - 051 - 320</td>
<td>DVA50xP01</td>
<td>DEA50wA50P01</td>
<td>DLA50wA51P01</td>
<td></td>
</tr>
<tr>
<td><strong>Stainless Steel High Pressure Filters</strong></td>
<td>With bypass valve</td>
<td>FZH 010 - 011 - 039</td>
<td>DWX50P01</td>
<td>DEX50wA50P01</td>
<td>DLX50wA51P01</td>
</tr>
<tr>
<td></td>
<td>With bypass valve</td>
<td>FZH 010 - 011 - 039</td>
<td>DWX50P01</td>
<td>DEX50wA50P01</td>
<td>DLX50wA51P01</td>
</tr>
</tbody>
</table>
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HEADQUARTERS

MP Filtri S.p.A.
Via 1° Maggio, 3
20060 Pessano con Bornago
Milano - Italy

BRANCH OFFICES

MP Filtri U.K. Ltd.
Bourton Industrial Park
Bourton on the Water
GL54-2HQ Gloucestershire

MP Filtri Canada Inc.
8831 Keele Street
Concord, Ontario
L4K 2N1 - Canada

MP Filtri Germany GmbH
Hans-Wilhelmi-Straße
DE-66386 St. Ingbert

ITALFILTRI LLC
Russian Federation
Yuriyevsky Pereulok 13 a, Building 1
111020 Moscow - Russia

MP Filtri France SAS
Parc d’activités des Chanteraines
8 rue du Commandant d’Estienne d’Orves
Immeuble D3
92390 Villeneuve la Garenne

MP Filtri (Shanghai) Co., Ltd.
1280 Lianxi Road, Bld 8 - 2nd Floor
Shanghai - Pudong
201204 China

MP Filtri U.S.A. Inc.
2055 Quaker Pointe
PA 18951 Drive Quakertown

MP Filtri India Pvt. Ltd.
Plot-7F, Raj Pinnacle,
Beside RMZ Centennial
Brookfield Road, Whitefield
560048 Bangalore