Low-Pressure In-Line Filters

FNL 1000 · FNL 2000

In-line mounting · Operating pressure up to 40 bar / 580 psi · Nominal flow rate up to 1450 l/min / 383 gpm

Description

Application
In the pressure circuits of hydraulic and lubrication systems.

Performance features

Protection against wear:
By means of filter elements that even meet the highest demands regarding cleanliness classes.

Protection against malfunction:
Through installation near to the control valves or other expensive components. The specific determined flow rate guarantees a closed by-pass valve even at \( \nu \leq 200 \text{ mm}^2/\text{s} / 927 \text{ SUS} \) (cold start condition).

Filter elements
Flow direction from outside to center.
The star-shaped pleating of the filter material results in:
› large filter surfaces
› low pressure drop
› high dirt-holding capacities
› long service life

Filter maintenance
By using a clogging indicator the correct moment for maintenance is stated and guarantees the optimum utilization of the filter life.

Materials
Cover: Aluminum alloy
Filter housing: Aluminum alloy
Seals: NBR (FPM on request)
Filter media: EXAPOR® MAX 2 - inorganic multi-layer microfiber web
Paper - cellulose web, impregnated with resin

Accessories
Electrical and / or optical clogging indicators are available - optionally with one or two switching points resp. temperature suppression.

Dimensions and technical data see catalog sheet 60.30.
### Operating pressure
- 0 ... 16 bar / 232 psi, min. 3 x 10⁶ pressure cycles
- Nominal pressure according to DIN 24550
- 0 ... 40 bar / 580 psi, min. 10⁴ pressure cycles
- Quasi-static operating pressure

### Permissible pressures for other numbers of cycles

![Permissible pressures graph]

### Filter fineness
- 5 µm(c) ... 10 µm(c)
- β-values according to ISO 16889 (see Selection Chart, column 4 and diagram Dx).

### Dirt-holding capacity
- Values in g test dust ISO MTD according to ISO 16889 (see Selection Chart, column 5).

### Hydraulic fluids
- Mineral oil and biodegradable fluids (HEEs and HETG, see info-sheet 00.20).

### Temperature range
- -30 °C ... +100 °C (temporary -40 °C ... +120 °C)
- -22 °F ... +212 °F (temporary -40 °F ... +248 °F)

### Viscosity at nominal flow rate
- at operating temperature: \( \nu \leq 60 \text{ mm}^2/\text{s} / 280 \text{ SUS} \)
- as starting viscosity: \( \nu_{\text{max}} = 1200 \text{ mm}^2/\text{s} / 5560 \text{ SUS} \)
- at initial operation:
  - The recommended starting viscosity can be read from the diagram D (pressure drop as a function of the kinematic viscosity) as follows: Find the 70% \( \Delta p \) of the cracking pressure of the by-pass valve on the vertical axis. Draw a horizontal line so that it intersects the \( \Delta p \) curve at a point. Read this point on the horizontal axis for the viscosity.

### Mounting position
- Preferably vertical, filter head at the bottom.

### Connection
- SAE-flange (3000 psi)
- Sizes see Selection Chart, line 6 (other connections on request).
- Standard: connection ports A/B opposed.
- Optional: connection port A sidewise, connection port B at the bottom.

### Nominal flow rate
- Up to 1450 l/min / 383 gpm (see Selection Chart, column 2).
  - The nominal flow rates indicated by ARGO-HYTOS are based on the following features:
    - closed by-pass valve at \( \nu \leq 200 \text{ mm}^2/\text{s} / 927 \text{ SUS} \)
    - element service life > 1000 operating hours at an average fluid contamination of 0.07 g per l/min / 0.27 g per gpm flow volume
    - flow velocity in the connection lines:
      - up to 25 bar \( \leq 4.5 \text{ m/s} / 363 \text{ psi} \leq 14.8 \text{ ft/s} \)
**Diagrams**

Δp-curves for complete filters in Selection Chart, column 3

**D1** Pressure drop as a function of the flow volume at \( v = 35 \text{ mm}^2/\text{s} / 162 \text{ SUS} \) (0 = casing empty)

![Diagram D1](image)

**D2** Pressure drop as a function of the flow volume at \( v = 35 \text{ mm}^2/\text{s} / 162 \text{ SUS} \) (0 = casing empty)

![Diagram D2](image)

Filter fineness curves in Selection Chart, column 4

**Dx** Filtration ratio \( \beta \) as a function of particle size \( x \) obtained by the Multi-Pass-Test according to ISO 16889

![Diagram Dx](image)

The abbreviations represent the following \( \beta \)-values resp. finenesses:

**For EXAPOR®MAX2 and Paper elements:**

- \( 5 \text{EX2} = \beta_{3.0(\text{c})} = 200 \) EXAPOR®MAX 2
- \( 7 \text{EX2} = \beta_{10(\text{c})} = 200 \) EXAPOR®MAX 2
- \( 10 \text{EX2} = \beta_{16(\text{c})} = 200 \) EXAPOR®MAX 2
- \( 16 \text{EX2} = \beta_{30(\text{c})} = 200 \) EXAPOR®MAX 2
- \( 30 \text{P} = \beta_{30(\text{c})} = 200 \) Paper

Based on the structure of the filter media of the 30P paper elements, deviations from the printed curves are quite probable.

For special applications, finenesses differing from these curves are also available by using special composed filter material.
Optical or electrical indicators are available to monitor the clogging condition of the element. If the indicator should be already mounted onto the filter head use the abbreviation "M" behind the part number of the indicator. The printed order acknowledgement shows both items separately.

Order example: The Filter FNL 1000-153 has to be supplied with electrical clogging indicator - response pressure 2.5 bar / 36 psi.

Order description: FNL 1000-153 / DG 041-32 M

Part No. (basic unit) FNL 1000-153
Clogging indicator Mounted

Remarks:
- The switching pressure of the clogging indicator has always to be lower than the cracking pressure of the by-pass valve (see Selection Chart, column 7).
- The filters listed in this chart are standard filters. Other designs available on request.

Options:
- Other filter finenesses on request.
- Check valve in filter head on request.
- Connection port A sidewise, connection port B at the bottom (standard: connection ports A/B opposed).

---

### Selection Chart

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Nominal flow rate</th>
<th>Measure diagram</th>
<th>Filter fineness</th>
<th>Dirt-holding capacity</th>
<th>Gasket pressure of bypass</th>
<th>Symbol</th>
<th>Replacement filter element</th>
<th>Part No.</th>
<th>Weight</th>
<th>Clogging indicator</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>FNL 1000-153</td>
<td>D1/1</td>
<td>5EX2</td>
<td>130</td>
<td>SAE 2</td>
<td>3.0</td>
<td>4</td>
<td>V3.1449-53</td>
<td>21</td>
<td>retrofittable</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>FNL 1000-156</td>
<td>D1/2</td>
<td>10EX2</td>
<td>190</td>
<td>SAE 2</td>
<td>3.0</td>
<td>4</td>
<td>V3.1449-56</td>
<td>21</td>
<td>retrofittable</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>FNL 2000-153</td>
<td>D2/1</td>
<td>5EX2</td>
<td>260</td>
<td>SAE 4</td>
<td>3.0</td>
<td>4</td>
<td>V3.1493-53</td>
<td>28</td>
<td>retrofittable</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>FNL 2000-156</td>
<td>D2/2</td>
<td>10EX2</td>
<td>370</td>
<td>SAE 4</td>
<td>3.0</td>
<td>4</td>
<td>V3.1493-56</td>
<td>28</td>
<td>retrofittable</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

### Selection Chart (continued)

<table>
<thead>
<tr>
<th>D</th>
<th>g</th>
<th>bar</th>
<th>kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>FNL 1000-153</td>
<td>420</td>
<td>D1/1</td>
<td>5EX2</td>
</tr>
<tr>
<td>FNL 1000-156</td>
<td>555</td>
<td>D1/2</td>
<td>10EX2</td>
</tr>
<tr>
<td>FNL 2000-153</td>
<td>820</td>
<td>D2/1</td>
<td>5EX2</td>
</tr>
<tr>
<td>FNL 2000-156</td>
<td>1450</td>
<td>D2/2</td>
<td>10EX2</td>
</tr>
</tbody>
</table>

For the appropriate clogging indicator see catalog sheet 60.30.

Remarks:
- The switching pressure of the clogging indicator has always to be lower than the cracking pressure of the by-pass valve (see Selection Chart, column 7).
- The filters listed in this chart are standard filters. Other designs available on request.

Options:
- Other filter finenesses on request.
- Check valve in filter head on request.
- Connection port A sidewise, connection port B at the bottom (standard: connection ports A/B opposed).
Dimensions

Minimum distance for filter maintenance

Locking screw G1½ (oil outlet)
Fastening torque: 30 Nm

Clogging indicator optional:
Pressure holes plugged with screws M4
Minimum distance from ferromagnetic parts:
7 mm / 0.3 inch

View X

Measurements in mm

<table>
<thead>
<tr>
<th>Type</th>
<th>A/B</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>K</th>
<th>M</th>
<th>N</th>
<th>O</th>
<th>Q</th>
<th>R</th>
<th>S</th>
<th>T</th>
<th>U</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>FNL 1000</td>
<td>SAE 2</td>
<td>19</td>
<td>76.5</td>
<td>26.5</td>
<td>450</td>
<td>593</td>
<td>77.8</td>
<td>M12</td>
<td>Ø 50</td>
<td>42.6</td>
<td>56 - 64</td>
<td>130.2</td>
<td>77.8</td>
<td>M16</td>
<td>224</td>
</tr>
<tr>
<td>FNL 2000</td>
<td>SAE 4</td>
<td>19</td>
<td>76.5</td>
<td>26.5</td>
<td>890</td>
<td>1033</td>
<td>130.2</td>
<td>M16</td>
<td>Ø 100</td>
<td>77.8</td>
<td>110 - 118</td>
<td>130.2</td>
<td>77.8</td>
<td>M16</td>
<td>224</td>
</tr>
</tbody>
</table>

Measurements in inch

<table>
<thead>
<tr>
<th>Type</th>
<th>A/B</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>K</th>
<th>M</th>
<th>N</th>
<th>O</th>
<th>Q</th>
<th>R</th>
<th>S</th>
<th>T</th>
<th>U</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>FNL 1000</td>
<td>SAE 2</td>
<td>0.75</td>
<td>3.01</td>
<td>1.04</td>
<td>17.72</td>
<td>23.35</td>
<td>3.06</td>
<td>M12</td>
<td>Ø 1.97</td>
<td>1.68</td>
<td>2.20 - 2.52</td>
<td>5.13</td>
<td>3.06</td>
<td>M16</td>
<td>8.82</td>
</tr>
<tr>
<td>FNL 2000</td>
<td>SAE 4</td>
<td>0.75</td>
<td>3.01</td>
<td>1.04</td>
<td>35.04</td>
<td>40.67</td>
<td>5.13</td>
<td>M16</td>
<td>Ø 3.94</td>
<td>3.06</td>
<td>4.33 - 4.65</td>
<td>5.13</td>
<td>3.06</td>
<td>M16</td>
<td>8.82</td>
</tr>
</tbody>
</table>
Spare Parts

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Designation</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cover (complete)</td>
<td>FNL 1000.1200</td>
</tr>
<tr>
<td>2</td>
<td>Replacement filter element</td>
<td>see Chart / col. 9</td>
</tr>
<tr>
<td>3</td>
<td>O-ring</td>
<td>N007.1905</td>
</tr>
<tr>
<td>4</td>
<td>Locking screw</td>
<td>SV 0620.08</td>
</tr>
</tbody>
</table>

The functions of the complete filters as well as the outstanding features of the filter elements assured by ARGO-HYTOS can only be guaranteed if original ARGO-HYTOS spare parts are used.

Quality Assurance

Quality management according to DIN EN ISO 9001
To ensure constant quality in production and operation, ARGO-HYTOS filter elements undergo strict controls and tests according to the following ISO standards:

- ISO 2941 Verification of collapse / burst pressure rating
- ISO 2942 Verification of fabrication integrity (Bubble Point Test)
- ISO 2943 Verification of material compatibility with fluids
- ISO 3968 Evaluation of pressure drop versus flow characteristics
- ISO 16889 Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)
- ISO 23181 Determination of resistance to flow fatigue using high viscosity fluid

Before release into the series production the filter casing is tested for fatigue strength in our pressure pulse test rig. Various quality controls during the production process guarantee the leak-free function and solidity of our filters.

Illustrations may sometimes differ from the original. ARGO-HYTOS is not responsible for any unintentional mistake in this specification sheet.