

### **Suction Filters**

**AS 010 · AS 025 · AS 040  
AS 060 · AS 080 · AS 100  
AS 150**

- In Tank mounting
- Connection up to G2½
- Nominal flow rate up to 350 l/min

## Description

### Application

In the suction line of pumps of hydraulic or lubricating circuits.

### Performance features

Protection against

malfunction: By full-flow filtration in the suction line, particularly the pumps are protected from coarse dirt particles that have remained in the system after manufacture or repair, or enter the system when it is filled with oil.

### Special features

The robust construction with end caps, inner core, and mesh screen material, all out of metal, offers the following advantages:

- Maximum reliability at increased operating temperatures
- Enormous shock and vibration resistance

### Construction

Flow direction from outside to centre. The star-shaped pleating of the filter material results in:

- large filter surfaces
- low pressure drop
- long service life

### Filter maintenance

- Cleaning in ultrasonic bath for a few minutes.

As an alternative, put suction filter in cleaning agent for approx. 15 minutes and remove dirt from the outside using a brush.

- Then flush with fresh cleaning fluid from the inside to the outside.
- Blow out with compressed air from the inside to the outside.

In any case, be careful that no dirt enters the inner side (clean oil side) of the suction filter.

## Selection Chart

Part No.	Nominal flow	Pressure drop see Diagram D	Filter fineness	Filter surface	Cracking pressure of by-pass	Connection B	Diameter D	Length L <sub>1</sub>	Length L <sub>2</sub>	Dimension K	Symbol	Weight	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14
AS 010-00	15	D1/1	100 S	155	-	G½	45	82	60	27	1	0,13	-
AS 025-01	35	D1/2	100 S	420	-	G¾	69,5	91	75	36	1	0,24	-
AS 040-01	60	D1/4	100 S	650	-	G1	69,5	133	117	41	1	0,30	-
AS 040-71	60	D1/3	100 S	650	- 0,3	G1	69,5	133	117	41	2	0,30	-
AS 060-01	90	D2/1	100 S	1030	-	G1¼	69,5	205	185	50	1	0,42	-
AS 080-01	120	D2/2	100 S	1320	-	G1½	100	182	165	70	1	0,50	-
AS 080-81	120	D2/2	100 S	1400	- 0,3	G1½	100	182	165	70	2	0,50	-
AS 100-01	200	D2/4	100 S	2300	-	G2	100	213	196	70	1	0,60	-
AS 100-81	150	D2/3	100 S	1750	- 0,3	G2	100	213	196	70	2	0,60	-
AS 150-01	350	D2/5	100 S	2300	-	G2½	150	191	165	ø 82	1	1,40	-

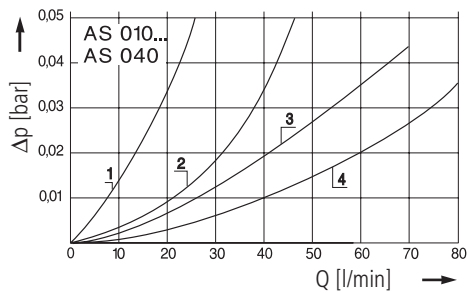
### Remarks:

The filter listed in this chart are standard filters. Other designs, e.g. other filter finenesses or magnetic system, available on request.

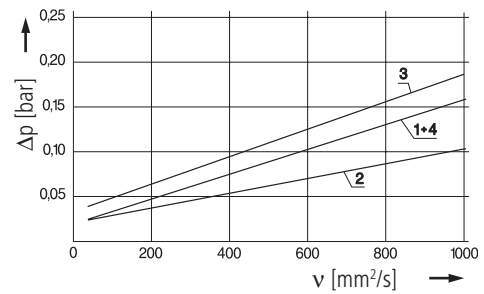
## Diagrams

### $\Delta p$ -curves for filters in Selection Chart, column 3

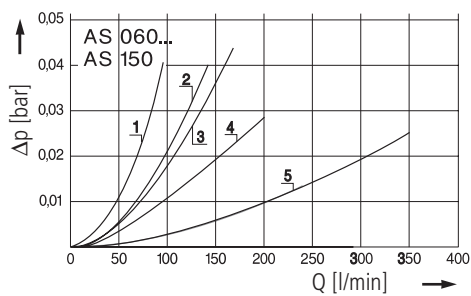
**D1** Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$



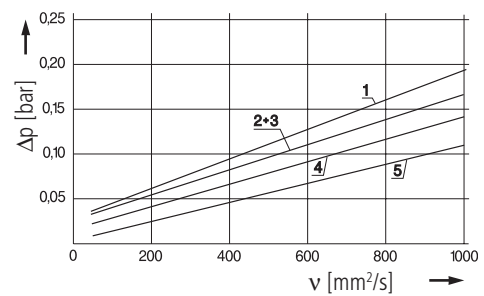
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



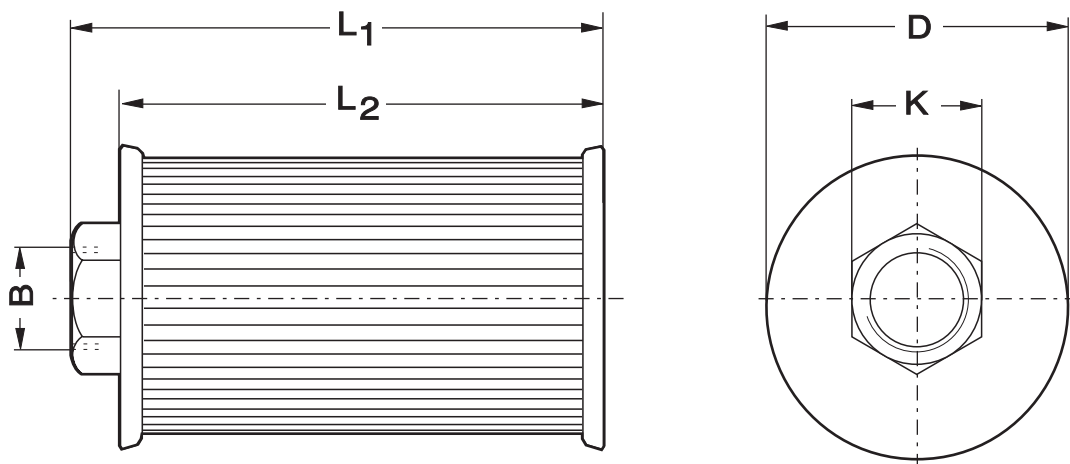
**D2** Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$



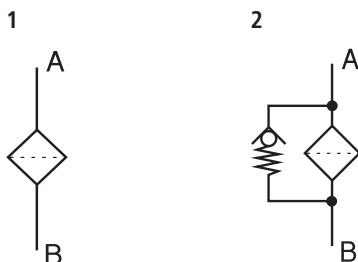
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



## Dimensions



## Symbols



## Characteristics

### Nominal flow rate

Up to 350 l/min (see Selection Chart, column 2)

The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- Pressure drop  $\Delta p < 0,035$  bar at  $v = 35$  mm<sup>2</sup>/s
- closed by-pass valve at  $v \leq 200$  mm<sup>2</sup>/s
- flow velocity in the connection lines  $\leq 1,5$  m/s

### Connection

Threaded ports according to ISO 228 or DIN 13. Sizes see Selection Chart, column 7 (other port threads on request).

### Filter fineness

100  $\mu$ m

### Hydraulic fluids

Mineral oil and biodegradable fluids (HEES or HETG, see info-sheet 00.20)

### Temperature range

- 30 °C ... + 100 °C (temporary - 40 °C ... + 120 °C)

### Materials

- AS 010-00 / AS 025-01 / AS 040-01 / AS 150-01  
End caps out of steel,  
support mesh out of steel, zinc plated,  
filter mesh out of stainless steel (1.4301)
- AS 060-01 / AS 080-01 / AS 100-01  
End cap with hexagon out of aluminum,  
bottom end cap out of steel,  
support mesh out of steel, zinc plated,  
filter mesh out of stainless steel (1.4301)

- AS 040-71  
End caps out of steel,  
filter mesh out of stainless steel (1.4301)
- AS 080-81 / AS 100-81  
End cap with hexagon out of aluminum,  
bottom end cap out of steel,  
filter mesh out of stainless steel (1.4301)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60$  mm<sup>2</sup>/s
- start-up viscosity:  $v_{\max}$  equivalent to the permitted pump inlet pressure (refer to diagram D),  $\Delta p$  to be determined as a function of the viscosity (take pressure loss in connection lines into account!)
- during initial operation of units equipped with by-pass valve:

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

Optional; versions equipped with bypass valve preferably in horizontal position. Under all operating conditions (min. oil level, max. inclination) the suction must occur under the oil level.

## 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 DIN and ISO standards:

- DIN ISO 2941** Verification of collapse/burst resistance  
**DIN ISO 2943** Verification of material compatibility with fluids  
**DIN ISO 3724** Verification of flow fatigue characteristics

**ISO 2942**  
**ISO 3968**  
**ISO 16889**

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

Various quality controls during the production process guarantee the leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

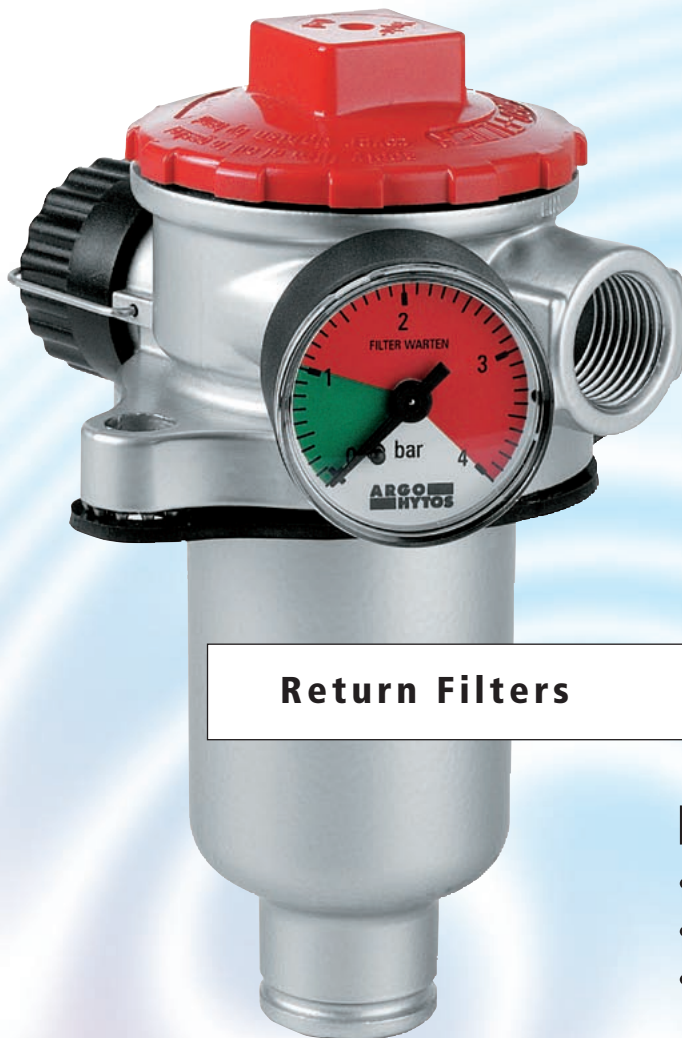
Illustrations may sometimes differ from the original. ARGO-HYTOS is not responsible for any unintentional mistake in this specification sheet.



**We produce fluid power solutions**

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## Return Filters

### D 023 • D 043

- Tank top mounting / In-line mounting
- Connection G $\frac{1}{2}$
- Nominal flow rate up to 45 l/min

## Description

### Application

In the return line circuits of hydraulic systems.

### Performance features

Protection

against wear: By means of filter elements that, in full-flow filtration, meet even the highest demands regarding cleanliness classes.

Protection against

malfunction: By means of full-flow filtration in the system return, the pumps above all are protected from dirt particles remaining in the system after assembly, repairs, or which are generated by wear or enter the system from outside.

### Special features

By-pass valve: The location close to the inlet port prevents dirt particles retained by the filter element from entering into the clean oil side.

Dirt collecting bowl: Prevents back-flushing of collected dirt particles during element replacement.

Connection: A female thread in the bowl outlet makes in-line mounting possible.

### Filter elements

Flow direction from outside to centre. The star-shaped pleating of the filter material results in:

- large filter surfaces
- low pressure drop
- high dirt-holding capacities
- long service life

In filters with a magnetic system, the ferromagnetic particles in the fluid pass first through a strong magnetic field and are separated.

### Ventilating Filter

Ventilation of the reservoir by an integral star-shape pleated filter element:

- removable (replace annually!)
- splash-proof
- fineness 2 µm

Some versions are also available with galvanized steel wool.

### Filter maintenance

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

### Materials

Screw-on cap: Polyamide, GF reinforced  
Housing: Aluminium alloy  
Seals: NBR (Viton on request)  
Filter media: EXAPOR®MAX - inorganic microfibre web  
Paper - cellulose web, impregnated with resin  
Stainless steel wire mesh (1.4301) with mesh size 40 and 60 µm, bronze screen (2.1020) is used with 100 µm

### Accessories

An optional oil separator (Part No. D 023.1702) prevents oil splashing through the ventilating filter at mobile applications. Electrical and optical clogging indicators are available. Dimensions and technical data see catalogue sheet 60.20.

## Characteristics

### Nominal flow rate

Up to 45 l/min (see Selection Chart, column 2)

The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the connection lines  $\leq 4,5 \text{ m/s}$

### Connection

Threaded ports according to ISO 228 or DIN 13. Sizes see Selection Chart, column 6 (other port threads on request)

### Filter fineness

12 µm(c) ... 100 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 or HETG, see info-sheet 00.20)

With high filling conditions we recommend an electrical conductivity  $\geq 500 \text{ pS/m}$  at 20 °C.

### Temperature range

- 30 °C ... + 100 °C (temporary - 40 °C ... + 120 °C)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$
- as starting viscosity:  $v_{\text{max}} = 1200 \text{ mm}^2/\text{s}$
- at first 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.

### Operating pressure

Max. 16 bar

### Mounting position

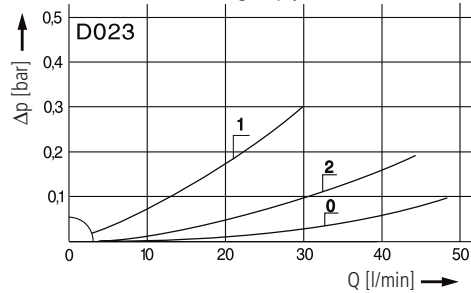
Preferably vertical, outlet downwards

## Diagrams

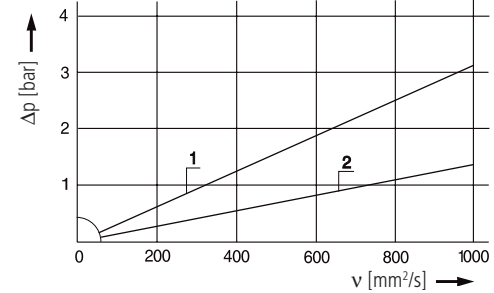
### $\Delta p$ -curves for complete filters in Selection Chart, column 3

**D1**

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

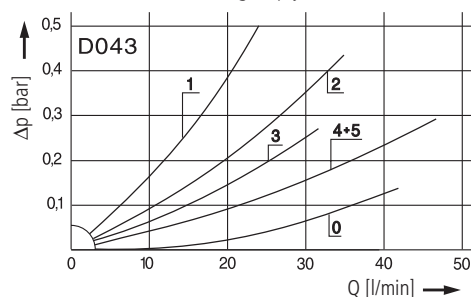


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

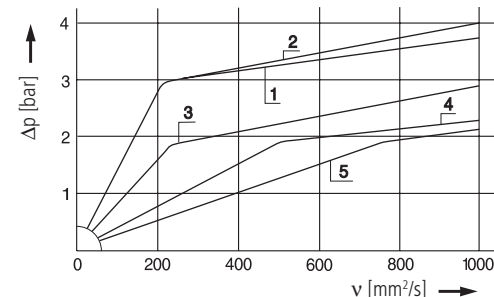


**D2**

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



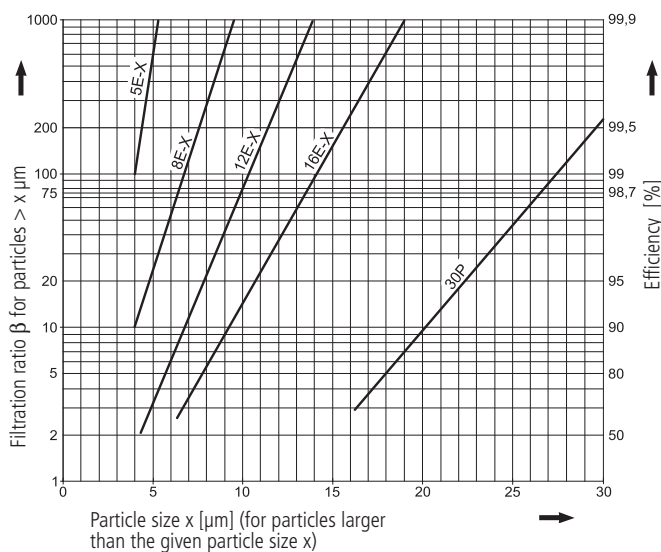
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



### 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



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

#### For EXAPOR®MAX- and Paper elements:

<b>5 E-X</b>	$\beta_{5(c)} = 200$	EXAPOR®MAX
<b>8 E-X</b>	$\beta_{8(c)} = 200$	EXAPOR®MAX
<b>12 E-X</b>	$\beta_{12(c)} = 200$	EXAPOR®MAX
<b>16 E-X</b>	$\beta_{16(c)} = 200$	EXAPOR®MAX
<b>30 P</b>	$\beta_{30(c)} = 200$	Paper

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

#### For screen elements:

<b>40 S</b>	= screen material with mesh size	40 $\mu\text{m}$
<b>60 S</b>	= screen material with mesh size	60 $\mu\text{m}$
<b>100 S</b>	= screen material with mesh size	100 $\mu\text{m}$

Tolerances for mesh size according to DIN 4189

#### For ventilating filter elements:

**2 CL** = 99,5 % filter efficiency for particles of size 2  $\mu\text{m}$

For special applications, finenesses differing from these curves are also available by using special composed filter material.

## Selection Chart

[illegible]

All filters are delivered with a plugged clogging indicator connection M12 x 1,5. As clogging indicators either manometers or electrical pressure switches can be used. Optional extension pipes adapt the filter length to various tank depths. For ordering of accessories please use the below mentioned codes.

**Order example:** The filter D 043-56 has to be supplied with an extension pipe (EV) for a mounting depth of 200 mm.

**Order description:** D 043-56 / EV 200

Part No. (Basic unit)

**Extension pipe (5 various lengths are available)**

$$EV = K + 62 / + 112 / + 212 / + 312 / + 412 \text{ (see dimensions and measurements)}$$

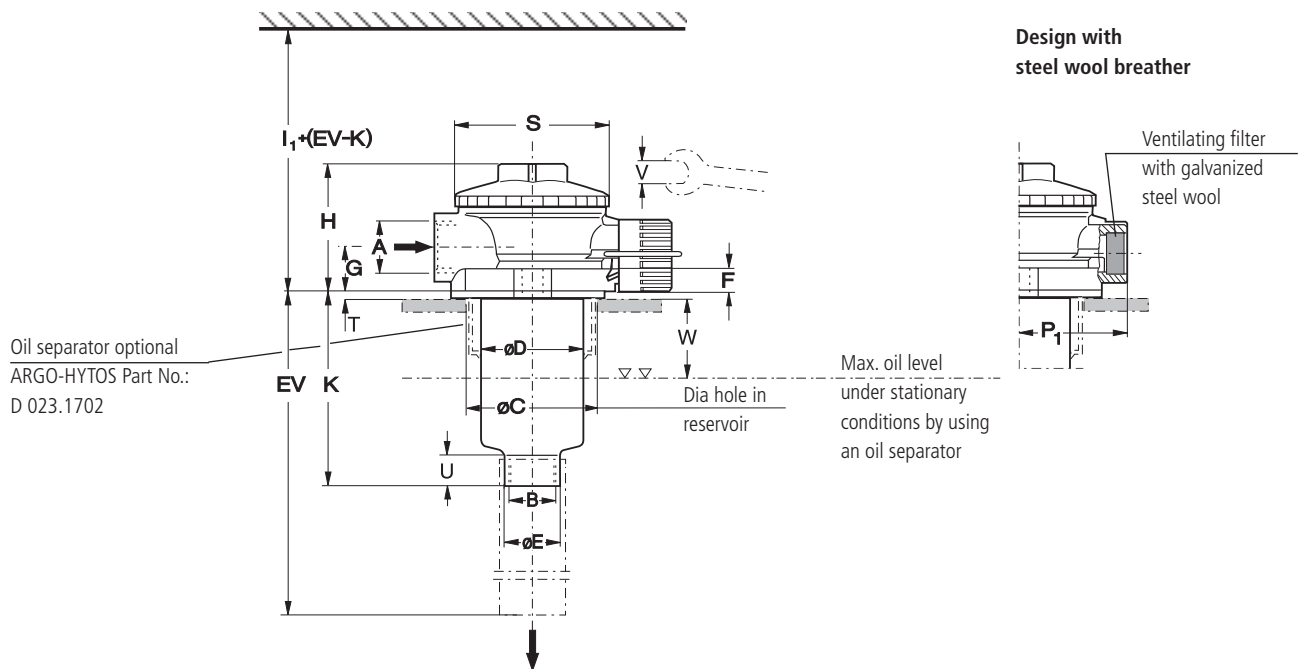
For the appropriate clogging indicator see catalogue sheet 60.20.

## Remarks:

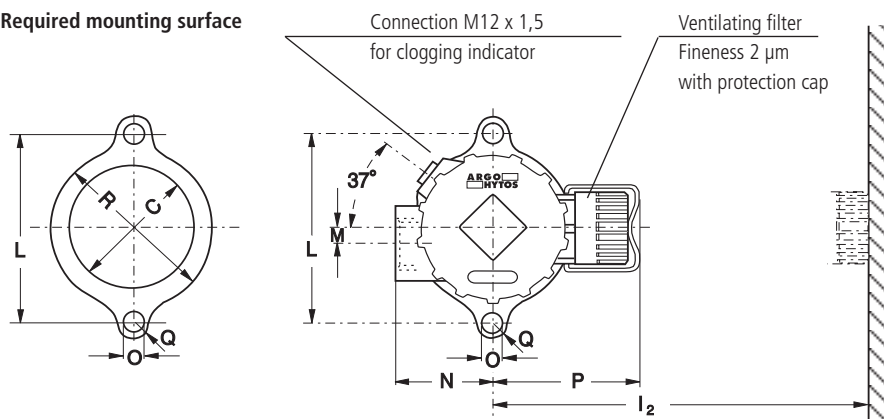
- The switching pressure of the electrical pressure switch has always to be lower than the cracking pressure of the by-pass valve (see Selection Chart, column 7).
- The clogging indicators are optionally available and will then be loosely provided.
- The filters listed in this chart are standard filters. Other designs available on request.

\* With female thread in the bowl outlet; suited for in-line mounting

## Dimensions



Required mounting surface

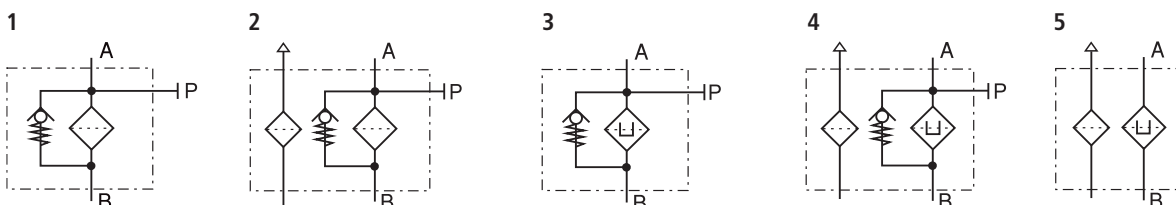


## Measurements

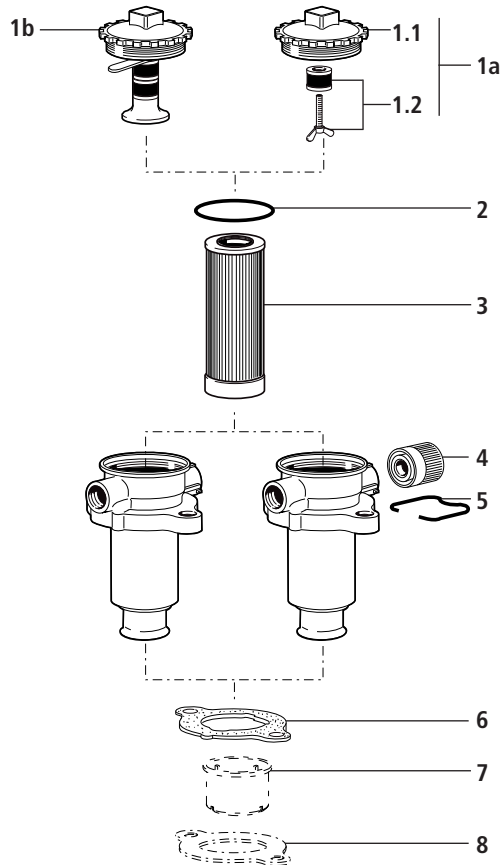
Type	A	B*	C min./max.	D	E	F	G	H	I <sub>1</sub>	I <sub>2</sub>	K	L	M	N	O	P	P <sub>1</sub>	Q	R	S
D 023	G½	G½	60/63	52	27,8	11,5	24	67	125	-	87,5	88	9	50	11	-	45	9,5	75,5	73,5
D 043	G½	G½	60/63	52	27,8	11,5	24	67	150	72	87,5	88	9	50	11	68,5	45	9,5	75,5	73,5
Type	T	U	V	W																
D 023	2	18	27	42																
D 043	2	18	27	42																

\* also see Selection Chart, column 6

## Symbols



## Spare Parts



Pos.	Designation	Part No.
<b>1a</b>	Screw-on cap with Pos. 2 for D 043 with magnetic system	D 043.1210
<b>1b</b>	Screw-on cap with Pos. 2 for D 043 with magnetic system	D 023.1210
<b>1.1</b>	Screw-on cap	D 043.2202
<b>1.2</b>	Magnetic system	M0.2501-00
<b>2</b>	Seal	N 031.0562
<b>3</b>	Filter element	see Chart / col. 9
<b>4</b>	Ventilating filter (with Pos. 5)	L1.0406-01K7
<b>5</b>	Clip	N 026.0253
<b>6</b>	Flat gasket	D 023.0704
<b>7</b>	Oil separator (with Pos. 8)	D 023.1702
<b>8</b>	Flat gasket	D 023.0718

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

<b>ISO 2942</b>	Verification of fabrication integrity (Bubble Point Test)
<b>ISO 3968</b>	Evaluation of pressure drop versus flow characteristics
<b>ISO 16889</b>	Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

Various quality controls during the production process guarantee the leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

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### We produce fluid power solutions

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## Pressure Filters

### D 042 • D 062

- In-line mounting
- Operating pressure up to 100 bar
- Nominal flow rate up to 70 l/min

## Description

### Application

In the pressure circuits of hydraulic and lubrication systems.

### Performance features

Protection

against wear: By means of filter elements that, in full-flow filtration, meet even 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  $v \leq 200 \text{ mm}^2/\text{s}$  (cold start condition).

### Filter elements

Flow direction from outside to centre. 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

Filter head: Aluminium alloy  
Filter bowl: Aluminium alloy  
Seals: NBR (Viton on request)  
Filter media: EXAPOR®MAX - inorganic multi-layer microfibre 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 catalogue sheet 60.30.

## Characteristics

### Operating pressure

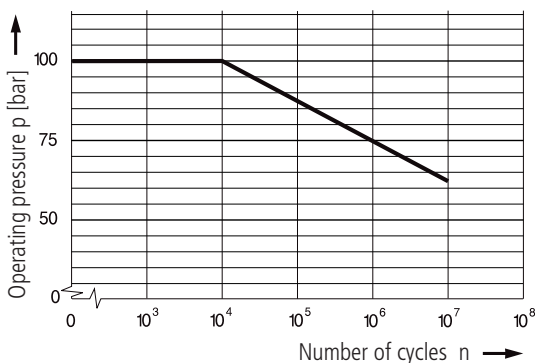
0 ... 63 bar, min.  $10^7$  pressure cycles

Nominal pressure according to DIN 24550

0 ... 100 bar, min.  $10^4$  pressure cycles

Quasi-static operating pressure

### Permissible pressures for other numbers of cycles



### Nominal flow rate

Up to 70 l/min (see Selection Chart, column 2)

The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the connection lines:
  - up to 40 bar  $\leq 4,5 \text{ m/s}$
  - up to 250 bar  $\leq 8 \text{ m/s}$

### Filter fineness

5  $\mu\text{m(c)}$  ... 30  $\mu\text{m(c)}$

$\beta$ -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 or HETG, see info-sheet 00.20)

### Temperature range

- 30 °C ... + 100 °C (temporary - 40 °C ... + 120 °C)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$
- as starting viscosity:  $v_{\text{max}} = 1200 \text{ mm}^2/\text{s}$
- 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 on top

### Connection

Threaded ports according to ISO 228 or DIN 13.

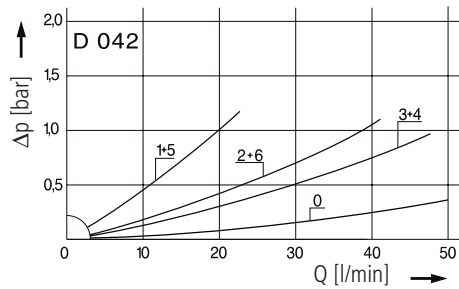
Sizes see Selection Chart, column 6 (other port threads on request).

## Diagrams

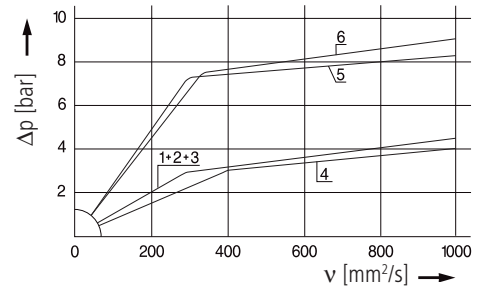
### $\Delta p$ -curves for complete filters in Selection Chart, column 3

**D1**

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

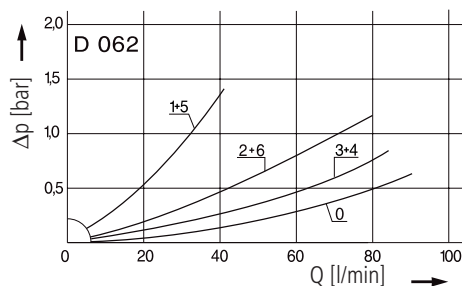


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

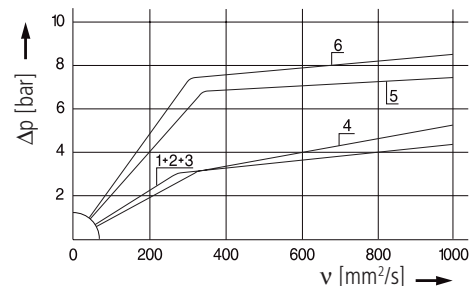


**D2**

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



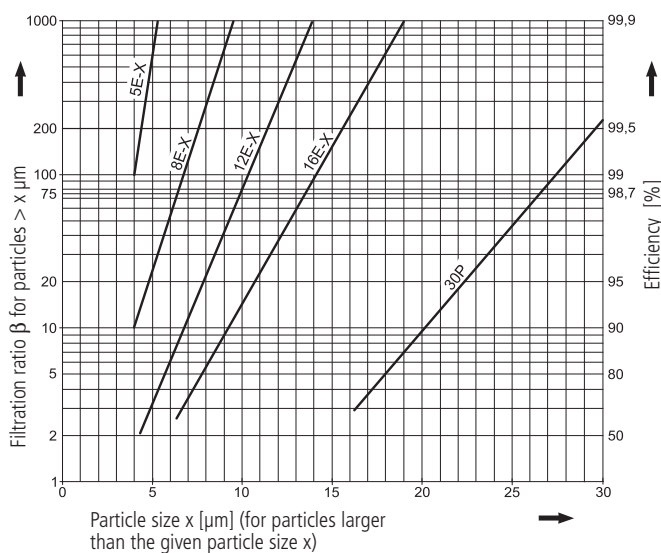
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



### 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



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

**For EXAPOR®MAX- and Paper elements:**

<b>5 E-X</b>	$\beta_{5(c)} = 200$	EXAPOR®MAX
<b>8 E-X</b>	$\beta_{8(c)} = 200$	EXAPOR®MAX
<b>12 E-X</b>	$\beta_{12(c)} = 200$	EXAPOR®MAX
<b>16 E-X</b>	$\beta_{16(c)} = 200$	EXAPOR®MAX
<b>30 P</b>	$\beta_{30(c)} = 200$	Paper

Based on the structure of the filter media of the 30 P 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 media.

## Selection Chart

[illegible]

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 acknowledgements show both items separately.

**Order example: The filter D 042-156 has to be supplied with optical clogging indicator - response pressure 2,0 bar**

Order description: D 042-156 / DG 042-01 M

Part No. (Basic unit) \_\_\_\_\_ Mounted

Clogging indicator \_\_\_\_\_

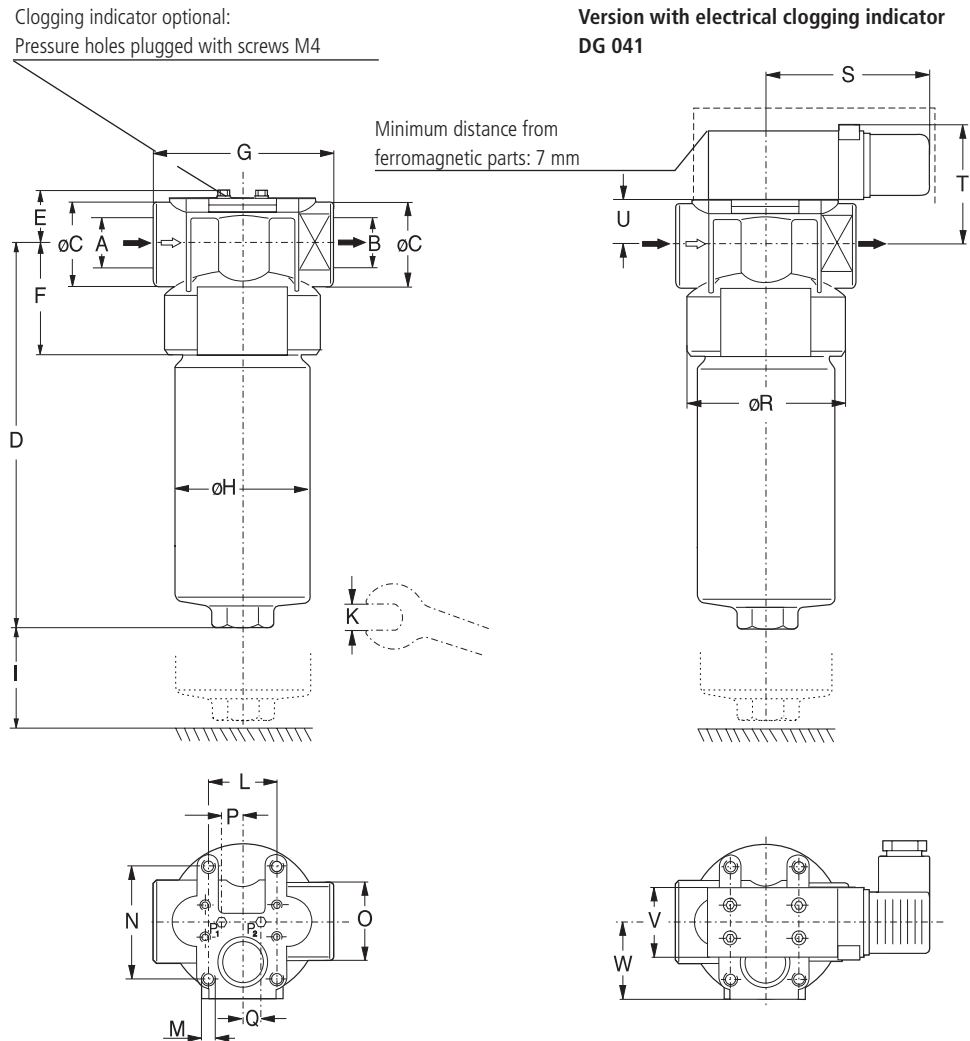
For the appropriate clogging indicators see catalogue sheet 60.30

## 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.

\* Paper media supported with metal gauze

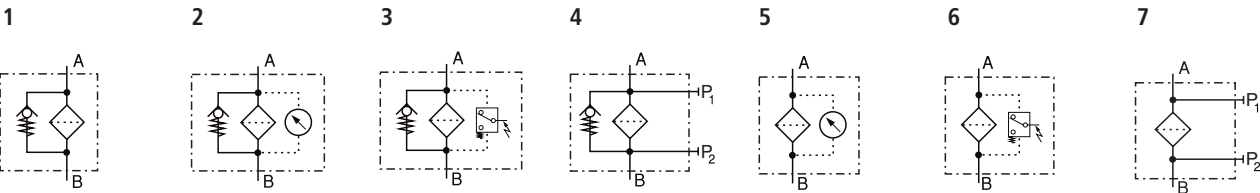
# Dimensions



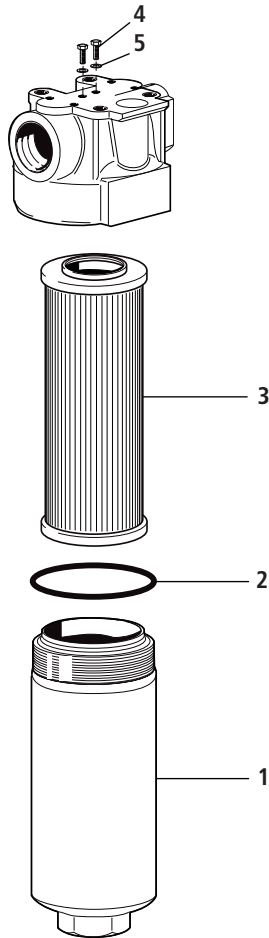
# Measurements

Type	A/B	C	D	E	F	G	H	I	K	L	M ø/depth	N	O	P	Q	R	S	T	U	V	W
D 042	G½	39	148	27	45,5	80	58,5	55	27	35	M6/8	44	36	19	15	70	81	55	23	30	35,5
D 062	G½, G¾	39	244	27	45,5	80	58,5	55	27	35	M6/8	44	36	19	15	70	81	55	23	30	35,5

# Symbols



## Spare Parts



Pos.	Designation	Part No.
1	Filter bowl D 042	D 044.0101
1	Filter bowl D 062	D 064.0101
2	O-ring 50 x 2	N 007.0501
3	Filter element (with seal)	see Chart / col. 9
4	Hexagonal head screw M4 x 8 DIN 933-8.8	3301051
5	Bonded seal 4,1 x 7,2 x 1	3404074

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

### ISO 2942 ISO 3968 ISO 16889

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

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 leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

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



### We produce fluid power solutions

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## Pressure Filters

**D 162 • D 232 • D 332**

- In-line mounting
- Operating pressure up to 63 bar
- Nominal flow rate up to 300 l/min

## Description

### Application

In the pressure circuits of hydraulic and lubrication systems.

### Performance features

Protection

against wear: By means of filter elements that, in full-flow filtration, meet even 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  $v \leq 200 \text{ mm}^2/\text{s}$  (cold start condition).

### Filter elements

Flow direction from outside to centre. 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

Filter head: Aluminium alloy  
 Filter bowl: Aluminium alloy  
 Seals: NBR (Viton on request)  
 Filter media: EXAPOR®MAX - inorganic multi-layer microfibre 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 catalogue sheet 60.30.

## Characteristics

### Operating pressure

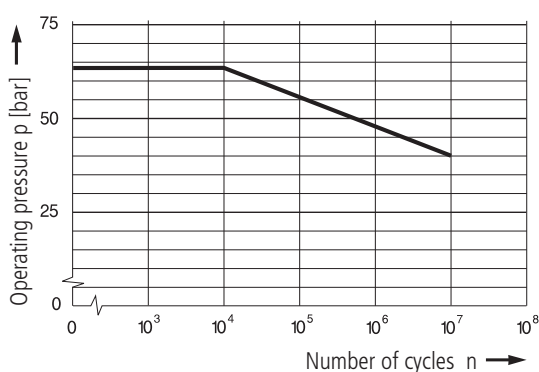
0 ... 40 bar, min.  $10^7$  pressure cycles

Nominal pressure according to DIN 24550

0 ... 63 bar, min.  $10^4$  pressure cycles

Quasi-static operating pressure

### Permissible pressures for other numbers of cycles



### Nominal flow rate

Up to 300 l/min (see Selection Chart, column 2)

The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the connection lines:
  - up to 40 bar  $\leq 4,5 \text{ m/s}$
  - up to 250 bar  $\leq 8 \text{ m/s}$

### Filter fineness

$5 \mu\text{m(c)} \dots 30 \mu\text{m(c)}$

$\beta$ -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 or HETG, see info-sheet 00.20)

### Temperature range

- 30 °C ... + 100 °C (temporary - 40 °C ... + 120 °C)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$
- as starting viscosity:  $v_{\text{max}} = 1200 \text{ mm}^2/\text{s}$
- at initial operation: 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 on top

### Connection

Threaded ports according to ISO 228 or DIN 13.

Sizes see Selection Chart, column 6 (other port threads on request).

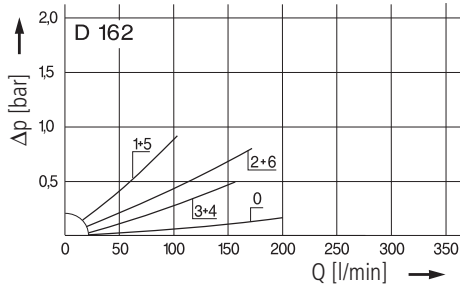
### Electrical clogging indicator

- Switching voltage: max. 120 V AC / 175 V DC
- Switching current: max. 0,17 A AC / 0,25 A DC
- Switching power: max. 3,5 VA AC / 5 W DC
- Type of contact: change-over
- Electrical protection: IP 65 (with mounted and secured socket)

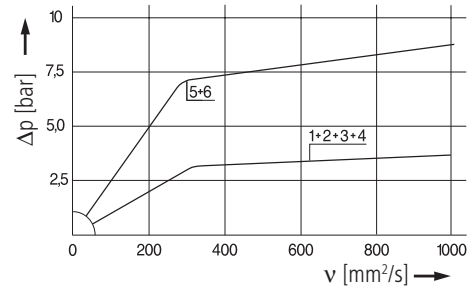
## Diagrams

### $\Delta p$ -curves for complete filters in Selection Chart, column 3

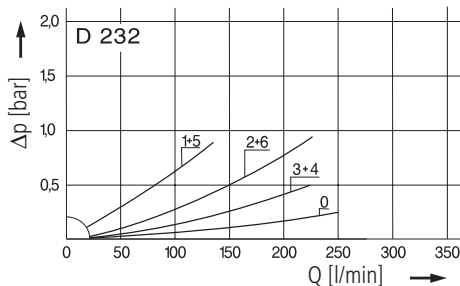
**D1** Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$  (0 = casing empty)



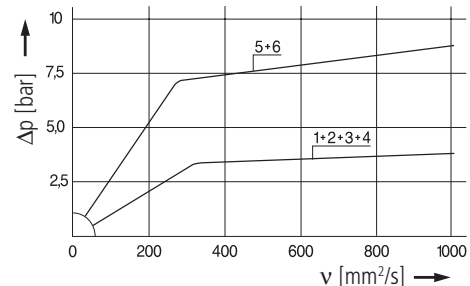
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



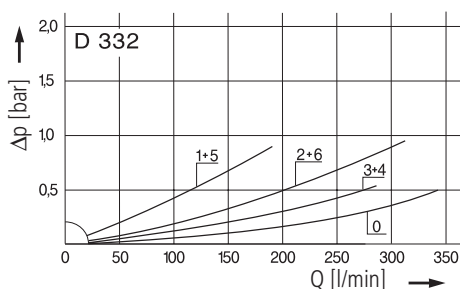
**D2** Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$  (0 = casing empty)



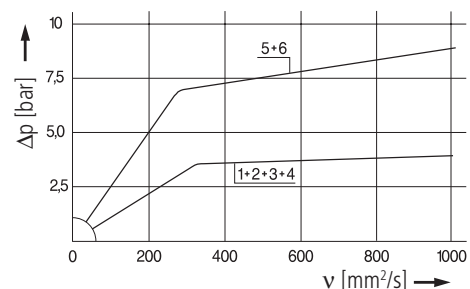
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



**D3** Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$  (0 = casing empty)

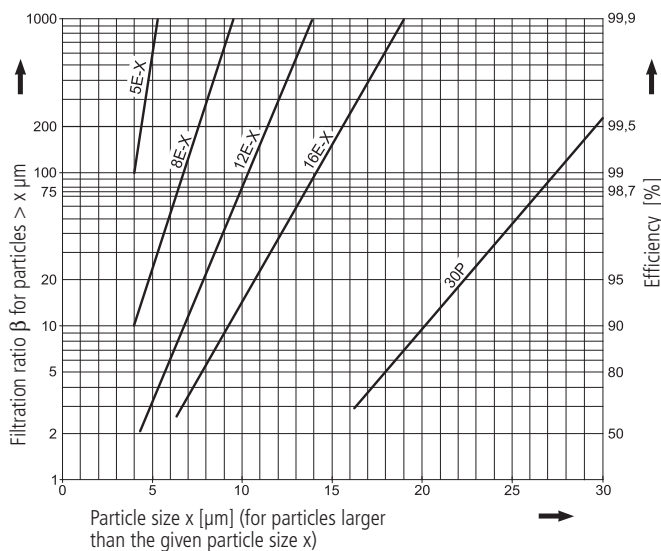


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



### 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



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

**For EXAPOR®MAX- and Paper elements:**

**5 E-X** =  $\bar{\beta}_{5(c)} = 200$  EXAPOR®MAX

**8 E-X** =  $\bar{\beta}_{8(c)} = 200$  EXAPOR®MAX

**12 E-X** =  $\bar{\beta}_{12(c)} = 200$  EXAPOR®MAX

**16 E-X** =  $\bar{\beta}_{16(c)} = 200$  EXAPOR®MAX

**30 P** =  $\bar{\beta}_{30(c)} = 200$  Paper

Based on the structure of the filter media of the 30 P 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.

## Selection Chart

<div><div>Part No.</div><div>Nominal flow</div><div>Pressure drop see diagram <b>D</b>/curve no.</div><div>Filter fineness see diagr. <b>Dx</b></div><div>Dirt-holding capacity</div><div>Connection A/B</div><div>Cracking pressure of by-pass</div><div>Symbol</div><div>Replacement filter element</div><div>Part No.</div><div>Weight</div><div>Clogging indicator</div><div>Remarks</div></div>											
	l/min			g		bar			kg		
1	2	3	4	5	6	7	8	9	10	11	12
D 162-253	40	<b>D1</b> /1	5 E-X	18	G1¼	3,5	4	V3.0817-03	3,2	optional	-
D 162-256	65	<b>D1</b> /2	12 E-X	28	G1¼	3,5	4	V3.0817-06	3,2	optional	-
D 162-258	105	<b>D1</b> /3	16 E-X	30	G1¼	3,5	4	V3.0817-08	3,2	optional	-
D 162-251	130	<b>D1</b> /4	30 P	18	G1¼	3,5	4	P3.0817-01*	3,2	optional	-
D 162-283	95	<b>D1</b> /5	5 E-X	18	G1¼	7	4	V3.0817-03	3,2	optional	-
D 162-286	150	<b>D1</b> /6	12 E-X	28	G1¼	7	4	V3.0817-06	3,2	optional	-
D 232-253	55	<b>D2</b> /1	5 E-X	26	G1¼	3,5	4	V3.0823-03	3,4	optional	-
D 232-256	90	<b>D2</b> /2	12 E-X	41	G1¼	3,5	4	V3.0823-06	3,4	optional	-
D 232-258	150	<b>D2</b> /3	16 E-X	46	G1¼	3,5	4	V3.0823-08	3,4	optional	-
D 232-251	180	<b>D2</b> /4	30 P	26	G1¼	3,5	4	P3.0823-01*	3,4	optional	-
D 232-283	130	<b>D2</b> /5	5 E-X	26	G1¼	7	4	V3.0823-03	3,4	optional	-
D 232-286	210	<b>D2</b> /6	12 E-X	41	G1½	7	4	V3.0823-06	3,4	optional	-
D 332-253	80	<b>D3</b> /1	5 E-X	36	G1¼	3,5	4	V3.0833-03	4,0	optional	-
D 332-256	130	<b>D3</b> /2	12 E-X	58	G1¼	3,5	4	V3.0833-06	4,0	optional	-
D 332-258	210	<b>D3</b> /3	16 E-X	67	G1¼	3,5	4	V3.0833-08	4,0	optional	-
D 332-251	260	<b>D3</b> /4	30 P	34	G1½	3,5	4	P3.0833-01*	4,0	optional	-
D 332-283	190	<b>D3</b> /5	5 E-X	36	G1¼	7	4	V3.0833-03	4,0	optional	-
D 332-286	300	<b>D3</b> /6	12 E-X	58	G1½	7	4	V3.0833-06	4,0	optional	-

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 acknowledgements show both items separately.

**Order example: The Filter D 232-256 has to be supplied with optical clogging indicator - response pressure 2,0 bar.**

Order description: **D 232-256 / DG 042-01 M**  
 Part No. (basic unit) \_\_\_\_\_ Mounted  
 Clogging indicator \_\_\_\_\_

**For the appropriate clogging indicator see catalogue sheet 60.30.**

Besides these mounted clogging indicators we also offer - with a certain order quantity - clogging indicators integrated in the filter head (as listed under "dimensions").

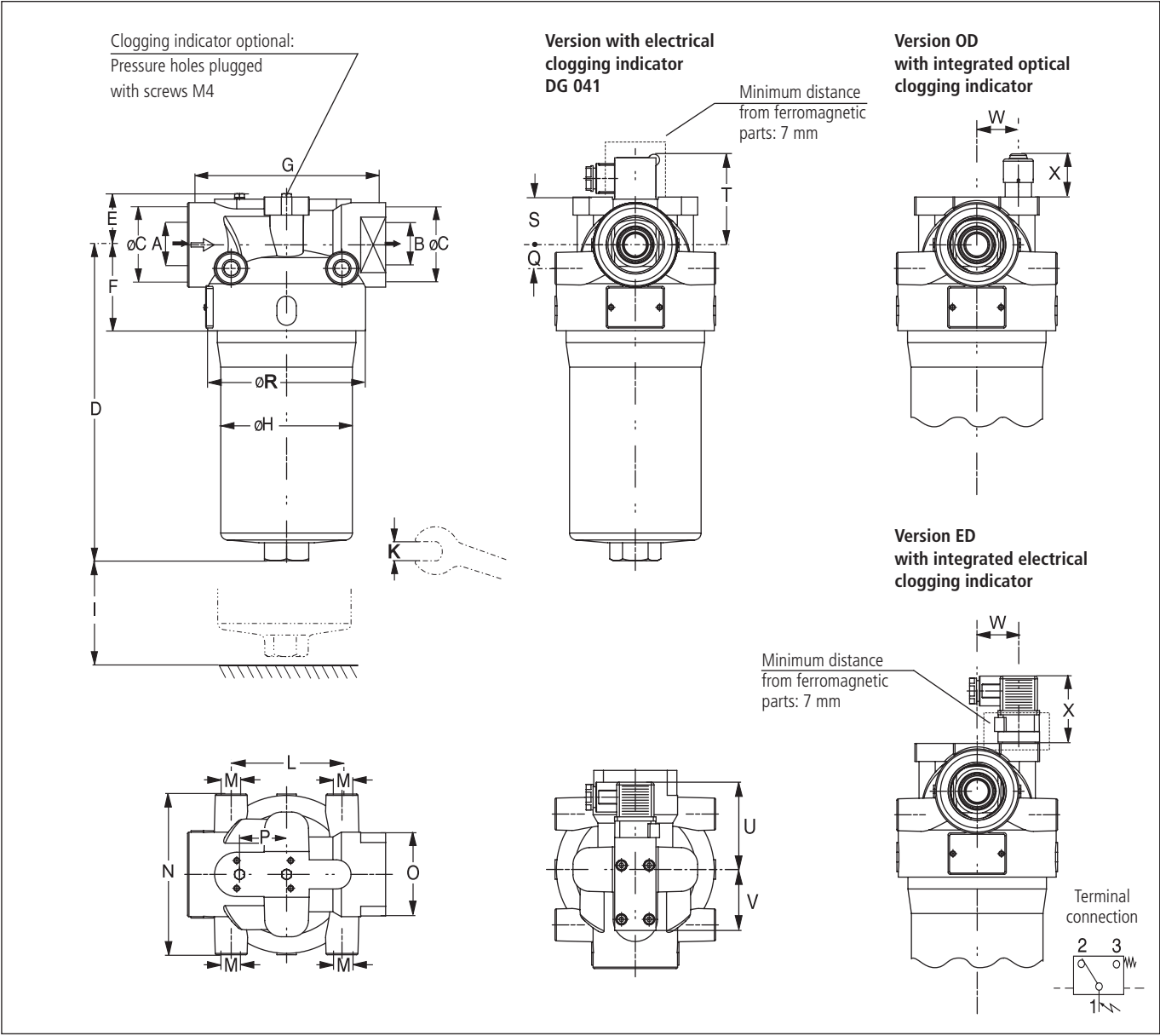
**Order examples:**  
**D 232-256 ED** (electrical differential pressure indicator)  
**D 232-256 OD** (optical differential pressure indicator) } the switching pressure matches the cracking pressure of the by-pass valve

### 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.

\* Paper media supported with metal gauze

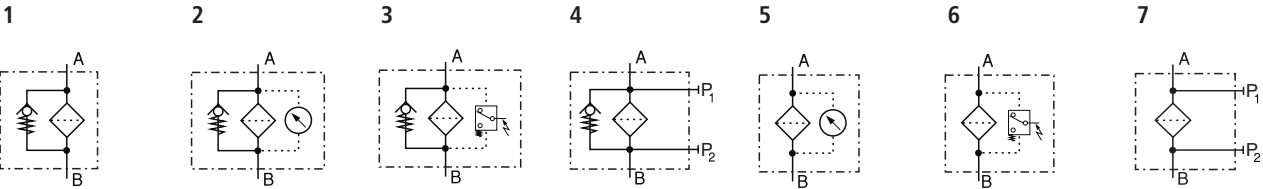
# Dimensions



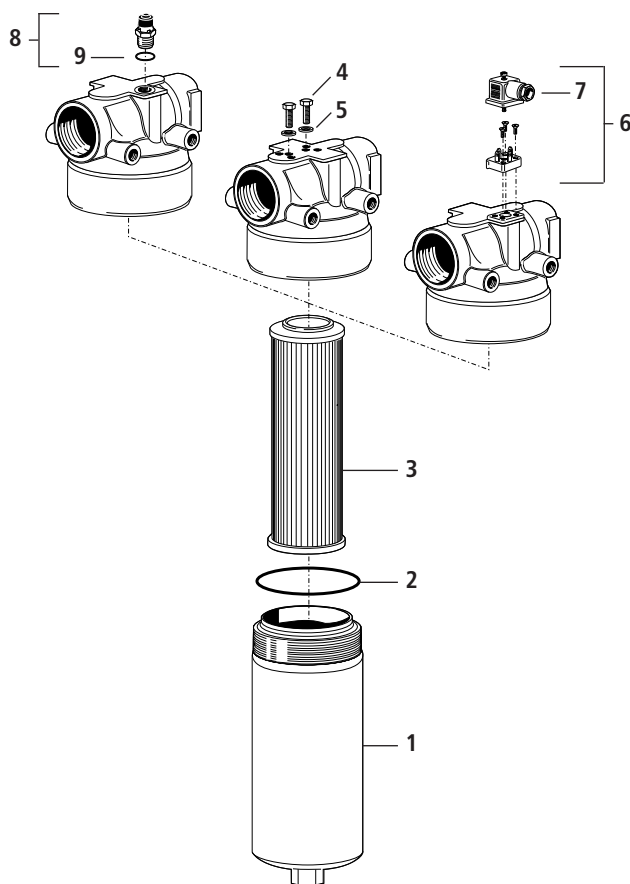
# Measurements

Type	A/B	C	D	E	F	G	H	I	K	L	M ø/depth	N	O	P	Q	R	S	T	U	V	W	ED	OD
D 162	G1¼	61	232	38	62	140	95	80	32	80	M12/18	116	SW60	34	17	115	34	66	66	44	30	49	30
D 232	G1¼, G1½	61	296	38	62	140	95	80	32	80	M12/18	116	SW60	34	17	115	34	66	66	44	30	49	30
D 332	G1¼, G1½	61	396	38	62	140	95	80	32	80	M12/18	116	SW60	34	17	115	34	66	66	44	30	49	30

# Symbols



## Spare Parts



Pos.	Designation	Part No.
1	Filter bowl D 162	D 162.0102
1	Filter bowl D 232	D 232.0102
1	Filter bowl D 332	D 332.0102
2	O-ring 88,57 x 2,62	N 007.0886
3	Filter element (with seal)	see Chart / col. 9
4	Hexagonal head screw M4 x 8 DIN 933-8.8	3301051
5	Bonded seal 4,1 x 7,2 x 1	3404074
6	Reed switch with screws and socket (Pos. 7)	HD 049.1410
7	Socket DIN 43650 - AF3	DG 041.1220
8	Optical clogging indicator (with Pos. 9)	D 232.1400
9	O-ring 12,3 x 2,4	N 007.0124

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

### ISO 2942 ISO 3968 ISO 16889

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

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 leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

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



### We produce fluid power solutions

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## Return Filters

### E 072

- Tank top mounting
- Connection G $\frac{3}{4}$
- Nominal flow rate up to 70 l/min

## Description

### Application

In the return line circuits of hydraulic systems.

### Performance features

Protection

against wear: By means of filter elements that, in full-flow filtration, meet even the highest demands regarding cleanliness classes.

Protection against

malfunction: By means of full-flow filtration in the system return, the pumps above all are protected from dirt particles remaining in the system after assembly, repairs, or which are generated by wear or enter the system from outside

### Special features

By-pass valve: The location close to the inlet port prevents dirt particles retained by the filter element from entering into the clean oil side.

Removable bowl: In case of maintenance the filter bowl is removed together with the filter element - therefore dirt particles are not flushed back into the tank.

### Filter elements

Flow direction from outside to centre. The star-shaped pleating of the filter material results in:

- large filter surfaces
- low pressure drop
- high dirt-holding capacities
- long service life

### Ventilating filter

Ventilation of the reservoir by an integral star-shape pleated filter element:

- removable (replace annually!)
- splash-proof
- fineness 2 µm

### Filter maintenance

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

### Materials

Screw-on cap:	Polyamide, GF reinforced
Filter head:	Aluminium alloy
Filter bowl:	Aluminium alloy
Seals:	NBR (Viton on request)
Filter media:	EXAPOR®MAX - inorganic multi-layer microfibre web Paper - cellulose web, impregnated with resin

### Accessories

An optional oil separator (Part No. D 023.0707) prevents oil splashing through the ventilating filter at mobile applications.

Electrical and optical clogging indicators are available. Dimensions and technical data see catalogue sheet 60.20.

## Characteristics

### Nominal flow rate

Up to 70 l/min (see Selection Chart, column 2)

The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the connection lines  $\leq 4,5 \text{ m/s}$

### Connection

Threaded ports according to ISO 228 or DIN 13.

Sizes see Selection Chart, column 6 (other port threads on request)

### Filter fineness

5 µm(c) ... 30 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 or HETG, see info-sheet 00.20)

With high filling conditions we recommend an electrical conductivity  $\geq 500 \text{ pS/m}$  at 20 °C.

### Temperature range

- 30 °C ... + 100 °C (temporary - 40 °C ... + 120 °C)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$
- as starting viscosity:  $v_{\text{max}} = 1200 \text{ mm}^2/\text{s}$
- at first 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% Δp of the cracking pressure of the by-pass valve on the vertical axis. Draw a horizontal line so that it intersects the Δp curve at a point. Read this point on the horizontal axis for the viscosity.

### Operating pressure

Max. 10 bar

### Mounting position

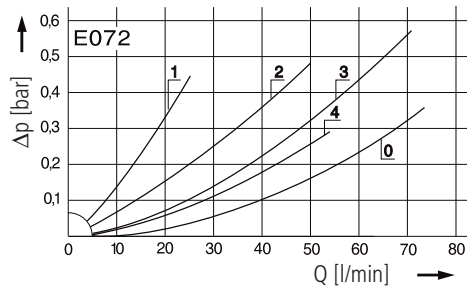
Preferably vertical, outlet downwards

## Diagrams

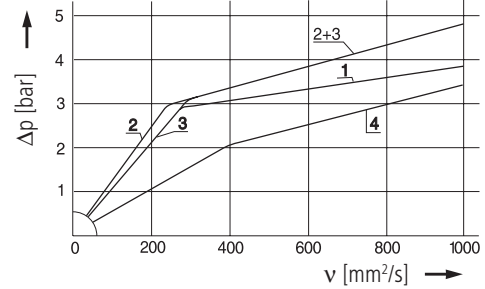
### $\Delta p$ -curves for complete filters in Selection Chart, column 3

**D1**

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



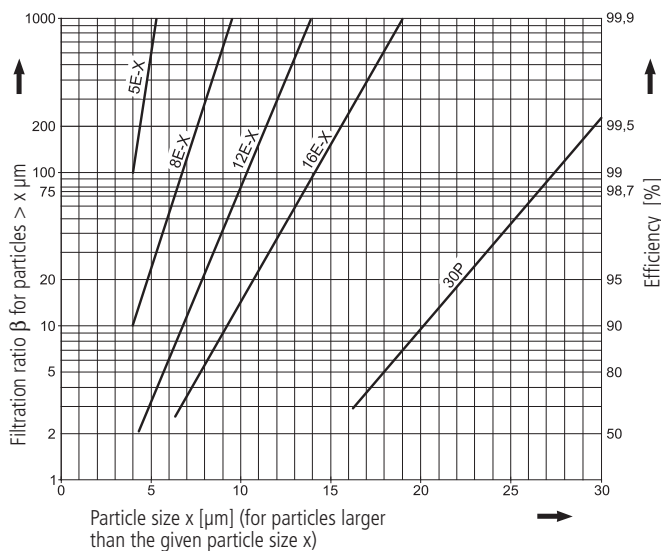
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



### 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



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

#### For EXAPOR®MAX- and Paper elements:

5 E-X	= $\beta_{5(c)}$	= 200	EXAPOR®MAX
8 E-X	= $\beta_{8(c)}$	= 200	EXAPOR®MAX
12 E-X	= $\beta_{12(c)}$	= 200	EXAPOR®MAX
16 E-X	= $\beta_{16(c)}$	= 200	EXAPOR®MAX
30 P	= $\beta_{30(c)}$	= 200	Paper

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

#### For screen elements:

40 S	= screen material with mesh size	40 μm
60 S	= screen material with mesh size	60 μm
100 S	= screen material with mesh size	100 μm

Tolerances for mesh size according to DIN 4189

#### For ventilating filter elements:

2 CL = 99,5 % efficiency for particles of size 2 μm

For special applications, finenesses differing from these curves are also available by using special composed filter material.

## Selection Chart

[illegible]

All filters are delivered with a plugged clogging indicator connection M12 x 1,5. As clogging indicators either manometers or electrical pressure switches can be used. Optional extension pipes adapt the filter length to various tank depths. For ordering of accessories please use the below mentioned codes.

**Order example: The filter E 072-58 has to be supplied with an extension pipe (EV) for a mounting depth of 300 mm.**

Order description: E 072-58 / EV 300

Part No. (basic unit)

**Extension pipe (5 various lengths are available)**

EV = K + 73 / + 123 / + 223 / + 323 / + 423 (see dimensions and measurements)

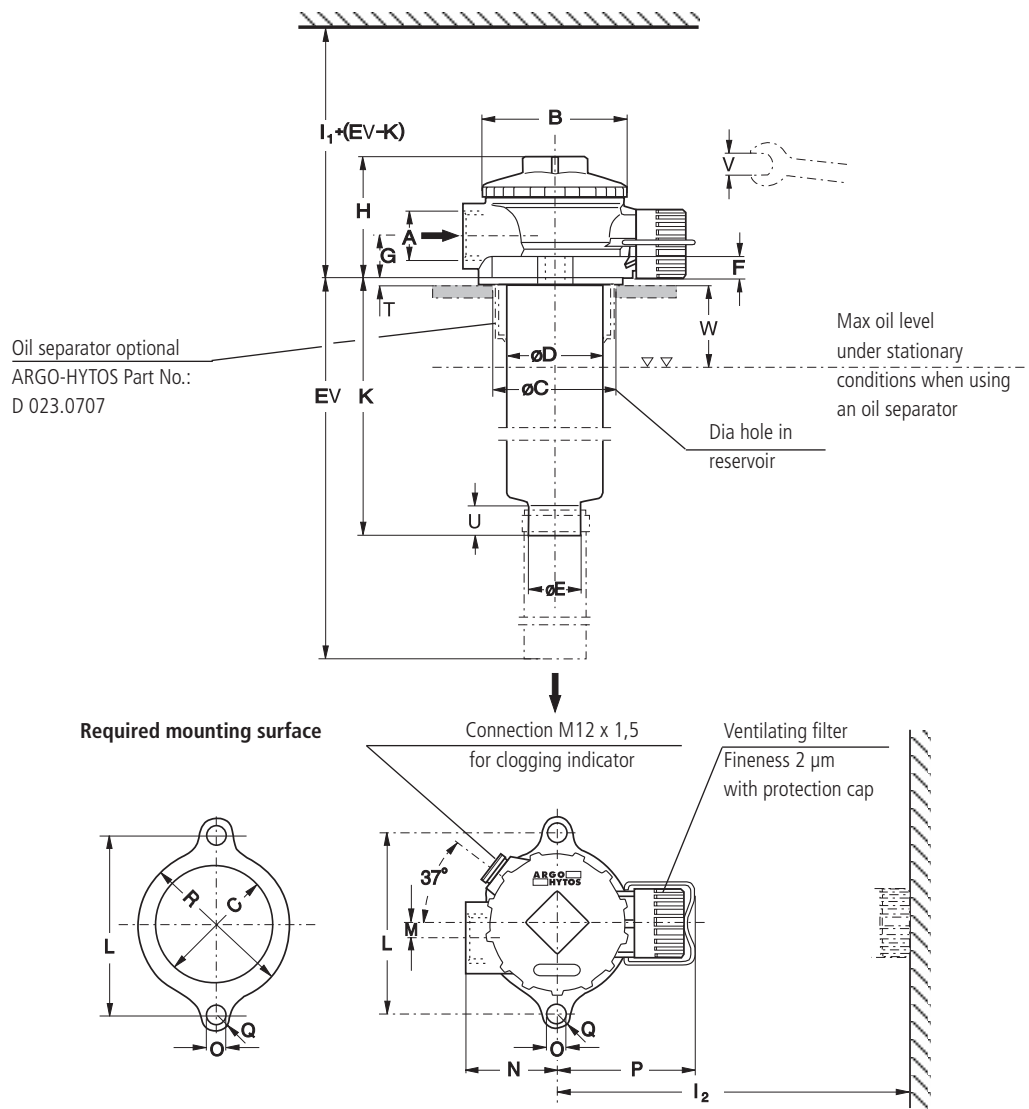
For the appropriate clogging indicators see catalogue sheet 60.20.

## Remarks:

- The switching pressure of the electrical pressure switch has always to be lower than the cracking pressure of the by-pass valve (see Selection Chart, column 7).
- The clogging indicators are optionally available and will then be loosely provided.
- The filters listed in this chart are standard filters. Other designs available on request.

\* Paper media supported with metal gauze

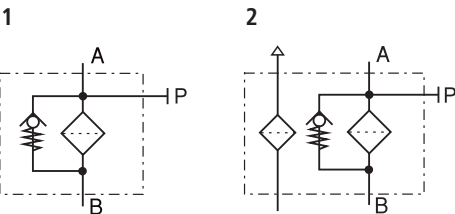
# Dimensions



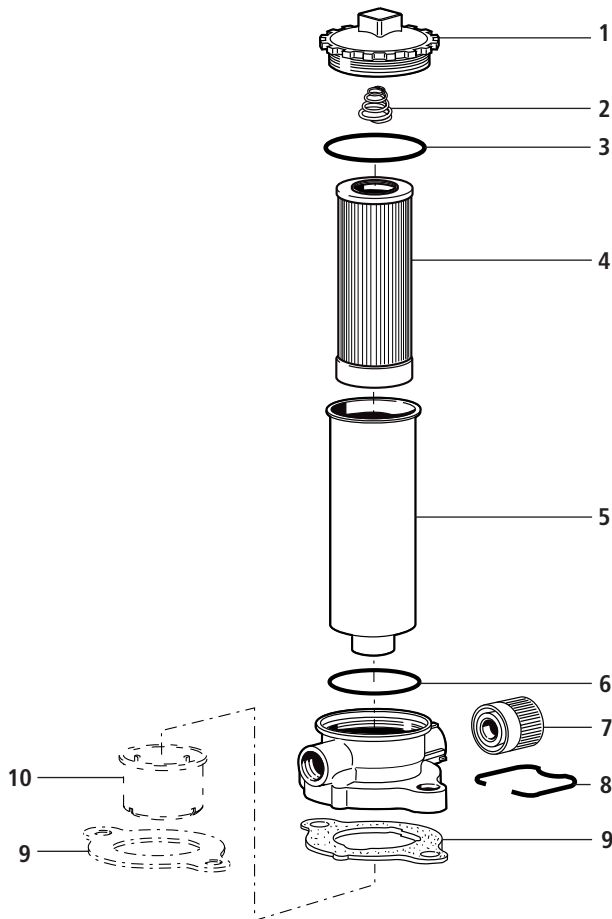
# Measurements

Type	A	B	C	D	E	F	G	H	I <sub>1</sub>	I <sub>2</sub>	K	L	M	N	O	P	Q	R	S	T
E 072	G <sup>3</sup> / <sub>4</sub>	73,5	min./max. 60/63	50,5	28	11,5	24	67	270	72	177	88	9	50	11	68,5	9,5	75,5	-	2
Type	U	V	W																	
E 072	16	27	42																	

# Symbols



## Spare Parts



Pos.	Designation	Part No.
1	Screw-on cap	D 043.2202
2	Compression spring	N 015.1606
3	Seal	N 031.0562
4	Filter element	see Chart / col. 9
5	Filter bowl *	E 072.0901
6	O-ring 47 x 2	N 007.0472
7	Ventilating filter (with Pos. 8)	L1.0406-01K7
8	Clip	N 026.0253
9	Flat gasket	D 023.0708
10	Oil separator	D 023.0707

\* Specify mounting depth in mm

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

### ISO 2942 ISO 3968 ISO 16889

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

Various quality controls during the production process guarantee the leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

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



### We produce fluid power solutions

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## Return-Suction Filters

### E 084

- Tank top mounting
- Connection up to G1
- Nominal flow rate up to 80 l/min

## Description

### Application

For operation in units with hydrostatic drives, when the return flow is under all operating conditions higher than the oil flow of the boost pump.

### Performance features

Protection

against wear: By means of filter elements that, in full-flow filtration, meet even the highest demands regarding cleanliness classes.

Suction filter function:

Because of the 100%-filtration of the suction flow, no dirt can get into the boost pump.

Return filter function:

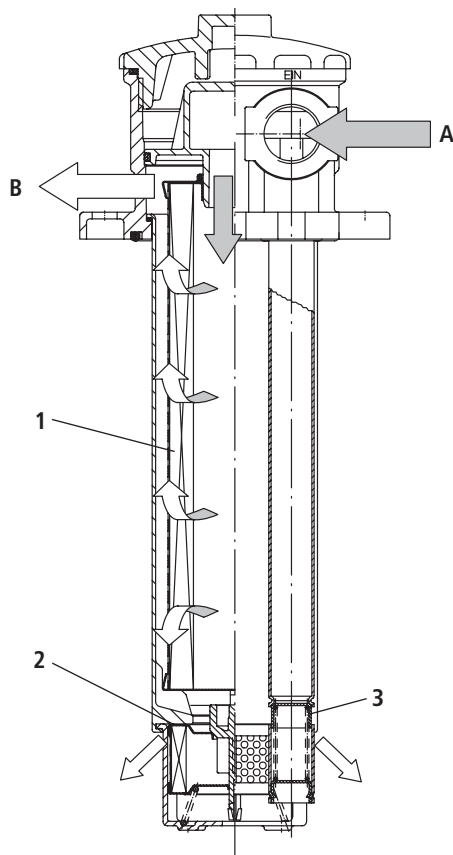
By means of full-flow filtration in the system return, the pumps above all are protected from dirt particles remaining in the system after assembly, repairs, or which are generated by wear or enter the system from outside.

### Functional characteristics

The hydraulic oil returning from the circuit (A) passes the filter element (1), is pressurized by a 0,5 bar check valve (2) and supplied to the boost pump (B). The surplus oil flows filtered over the integral check valve into the reservoir. As the boost pump is always fed with pressurized oil the risk of cavitation is minimized and full performance is available even during the critical cold start phase.

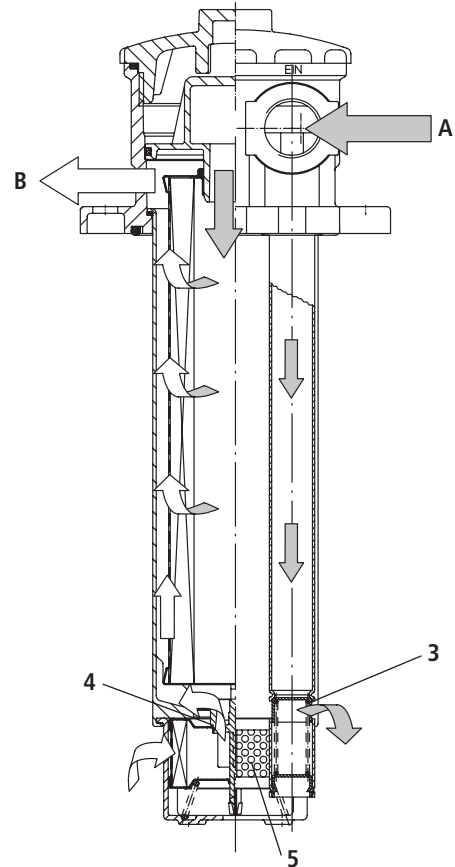
An integral pressure relief valve (3) prevents too high back pressure and protects the shaft seals against damages. As this valve leads the oil directly into the tank there is no direct connection between the return line (A) and the connection of the boost pump (B) (no bypass valve function).

Function (schematic):



The emergency-suction valve (4) with 125 µm protection strainer (5) supplies the boost pump in case of a short term of lack of oil. During normal operation, a lack of oil may definitely not occur (refer to „Design“ section).

Emergency-suction (schematic):



### Start up /Deaeration

For units with emergency-suction valve and protection strainer the start up set E 084.1710 can be used to de-aerate the hydraulic system at first start up or at start up after repair; hereby the immediate supply of the boost pump with hydraulic oil is guaranteed.

For all other types, deaerating instructions published by the manufacturers of hydraulic drives must be observed.

### Filter maintenance

By using a clogging indicator the correct moment for maintenance is indicated and guarantees therefore the optimum utilization of the filter elements.

### Filter elements

Flow direction from centre to the outside. The star-shaped pleating of the filter material results in:

- large filter surfaces
- low pressure drop
- high dirt-holding capacities
- long service life

Dirt deposits are entirely removed when the element is changed.

Dirt cannot re-enter the tank.

### Accessories

Electrical and optical clogging indicators are available.

Dimensions and technical data see catalogue sheet 60.20.

## Layout

### General

In machines with a hydrostatic drive and combined working hydraulic system, suction-return filters replace the suction or pressure filters previously required for the feed pump of the closed-loop hydrostatic drive circuit as well as the return filter for the open-loop working hydraulic circuit. While each circuit operates independently with separate filters, the combination of the two circuits via the suction-return filter causes interaction between the circuits.

If the design criteria described below are taken into account, you can take full advantage of the benefits provided by the suction-return filter concept, thus making sure that your system performs reliably even under extreme operating conditions.

### Required return flow in the system

In order to maintain a precharging pressure of approx. 0,5 bar at the intake of the feed pump, the return flow must exceed the suction flow under any operating condition:

- Versions without hole ( $\varnothing$  4 mm) in the pressurizing valve: at least 5 l/min of excess flow
- Versions with hole ( $\varnothing$  4 mm) in the pressurizing valve: at least 10 l/min of excess flow

### Permitted feed pump flow rate

- at operating temperature ( $v < 60 \text{ mm}^2/\text{s}$ ,  $\text{rpm} = \text{max}$ ): feed pump flow rate  $\leq 0,5 \times$  rated return flow according to column 2 of selection table
- at cold start-up ( $v < 1000 \text{ mm}^2/\text{s}$ ,  $\text{rpm} = 1000 \text{ min}^{-1}$ ): feed pump flow rate  $\leq 0,2 \times$  rated return flow according to column of selection table

Please contact us if your system operates with higher flow rates than stated above.

### Flow velocity in the connecting lines

- Flow velocity in the return lines  $\leq 4,5 \text{ m/s}$
- Flow velocity in the suction lines  $\leq 1,5 \text{ m/s}$

### Permitted pressure in the suction lines

At cold start up ( $v < 1000 \text{ mm}^2/\text{s}$ ,  $\text{rpm} = 1000 \text{ min}^{-1}$ ): feed pump flow rate  $\leq 0,2 \times$  rated return flow. The pressure loss in the suction lines must not exceed 0,4 bar.

### Backpressures in system return lines

If drain oil from the hydrostatic drive is routed across the filter in addition to the flow of the open-loop circuit, the following has to be observed in order to protect the shaft seals:

- permitted leakage oil pressure for a given viscosity and speed (manufacturer's specifications!)
- pressure loss caused by the leakage oil pipes
- pressure loss caused by the oil cooler used
- backpressure of the filter for a given flow rate or kinematic viscosity (refer to pressure loss diagrams)

Depending on the application, the use of a cooler bypass valve is recommended.

Generously sized drain oil pipes are also of advantage.

### Filter fineness grades

With the filter fineness grades available, the following oil cleanliness according to ISO 4406 can be achieved:

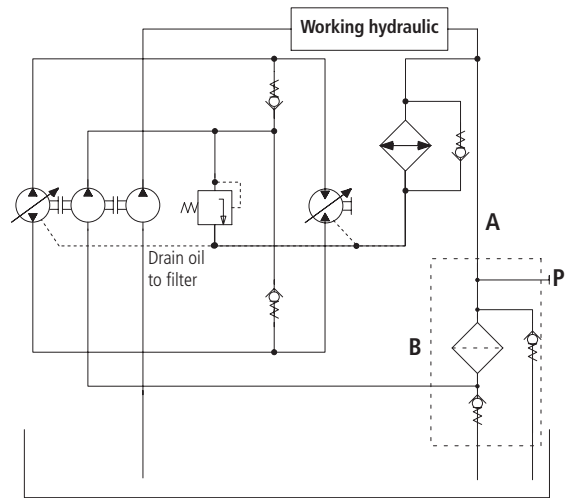
- 12 E-X: 18/15/12 ... 15/12/8
- 16 E-X: 20/17/12 ... 17/14/10

Even with the 16 E-X fineness grade, the requirements specified by manufacturers of hydrostatic drives are sometimes exceeded significantly.

If components requiring a still better oil purity are used, we recommend the 12 E-X filter fineness grade.

### Suggested circuit layouts

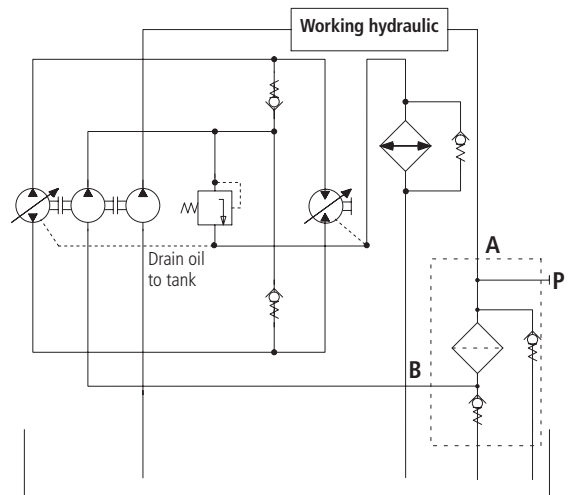
A) The leakage oil of the hydrostatic drive is routed across the filter.



The entire dirt produced in the hydrostatic drive by abrasion is filtered out immediately and is thus not taken in by the pump of the open-loop circuit.

This circuit layout is always recommended if the return flow only slightly exceeds the suction flow, i.e. if there is a risk that the 0,5 bar precharging pressure cannot be maintained.

B) The drain oil of the hydrostatic drive is not routed across the filter but is discharged directly into the tank.



This circuit layout has the advantage that drain oil pressures are comparatively low.

## Characteristics

### Nominal flow rate

Up to 80 l/min in return line (see Selection Chart, column 2)

Up to 40 l/min Feed pump flow rate (see Layout)

The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the return lines  $\leq 4,5 \text{ m/s}$
- flow velocity in the suction lines  $\leq 1,5 \text{ m/s}$

### Connection

Threaded ports according to ISO 228 or DIN 13.

Sizes see Selection Chart, column 6 and 7

(other port threads on request)

### Filter fineness

12  $\mu\text{m(c)}$  ... 16  $\mu\text{m(c)}$

$\beta$ -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-service 00.20)

### Temperature range

- 30 °C ... + 100 °C (temporary - 40 °C ... + 120 °C)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$

- as starting viscosity:  $v_{\text{max}} = 1000 \text{ mm}^2/\text{s}$

- at first 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.

### Operating pressure

Max. 10 bar

### Materials

Screw-on cap: Polyamide, GF reinforced

Filter head: Aluminium alloy

Filter bowl: Aluminium alloy

Seals: NBR (Viton on request)

Filter media: EXAPOR®MAX - inorganic multi-layer microfibre web

### Fitting position

- Standard type no restriction, preferably vertical
- Models with emergency-suction valve can vary up to 15° from the vertical
- Models with hole  $\varnothing 4 \text{ mm}$  in the check valve can vary up to 45° from the vertical

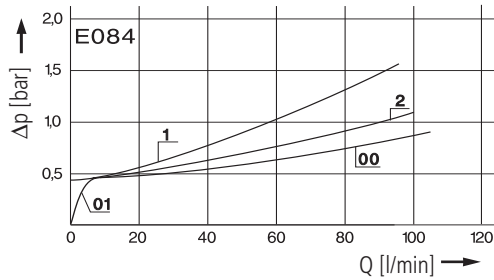
Even under unfavourable operating conditions (min. oil level, max. sloping) the oil outlet resp. emergency suction has to be below the oil level.

## Diagrams

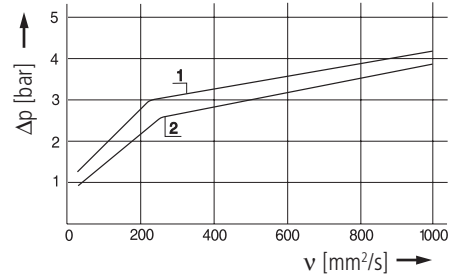
### $\Delta p$ -curves for complete filters in Selection Chart, column 3

**D1**

Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$  (00/01 = casing empty without/with hole  $\varnothing 4 \text{ mm}$ )



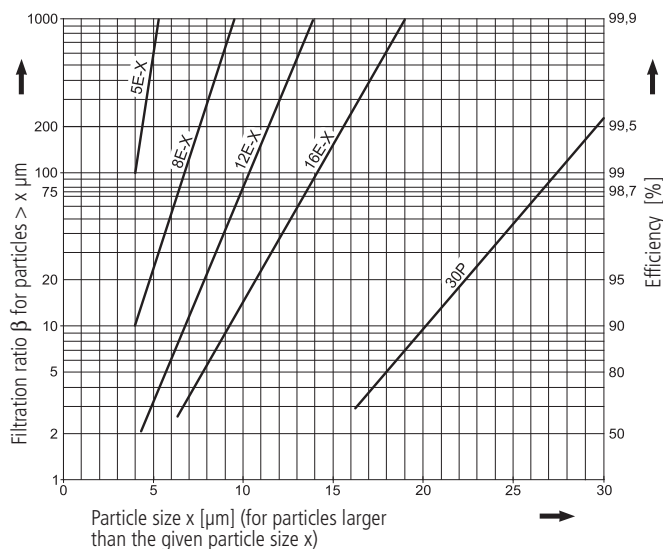
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



### 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



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

**For EXAPOR®MAX- and Paper elements:**

<b>5 E-X</b>	$= \beta_{5(c)} = 200$	EXAPOR®MAX
<b>8 E-X</b>	$= \beta_{8(c)} = 200$	EXAPOR®MAX
<b>12 E-X</b>	$= \beta_{12(c)} = 200$	EXAPOR®MAX
<b>16 E-X</b>	$= \beta_{16(c)} = 200$	EXAPOR®MAX
<b>30 P</b>	$= \beta_{30(c)} = 200$	Paper

Based on the structure of the filter media of the 30 P 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.

## Selection Chart

[illegible]

All filters are delivered with a plugged clogging indicator connection M 12 x 1,5 (at P).  
As clogging indicators either manometers or electrical pressure switches can be used.

For the appropriate clogging indicators see catalogue sheet 60.20.

## Remarks:

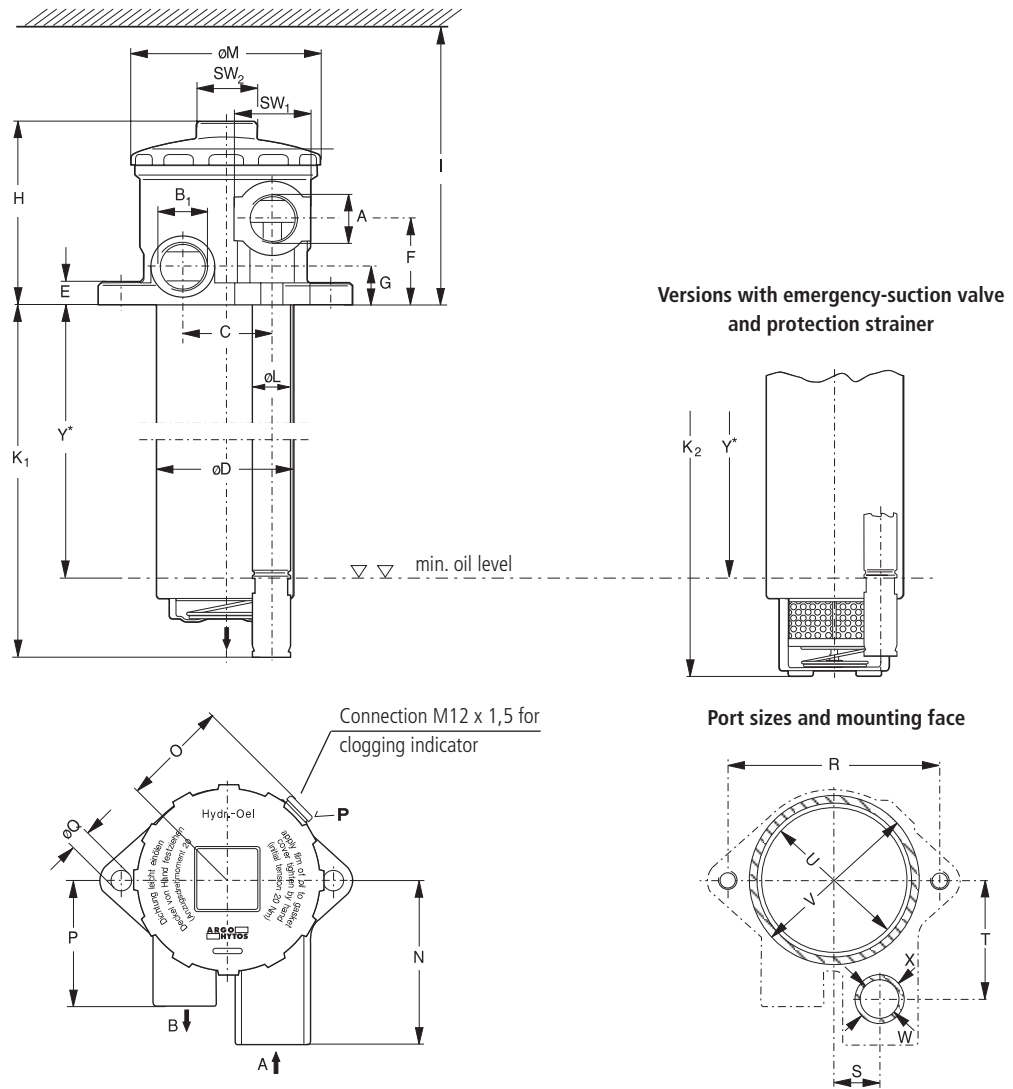
- The start of the red area respectively the switching pressure of the electrical pressure switch has always to be lower than the cracking pressure of the pressure relief valve (see Selection Chart, column 9).
- The clogging indicators are optional and always delivered detached from the filter.
- The filters listed in this chart are standard filters. If modifications are required, e.g. with integrated suction valve (integrated into the pressure relief valve see section symbols, symbol no. 5) to guarantee the emergency steering feature for vehicles with official road use, we kindly ask for your request.
- For deaeration a start-up set for units with emergency-suction valve and protection strainer is available with Part No. E084.1710, for technical details see catalogue sheet 20.870.

<sup>1</sup> Cracking pressure of check valve<sup>2</sup> Cracking pressure of pressure relief valve

<sup>3</sup> With hole Ø 4 mm in the check valve for oil drain when opening the filter cover

<sup>4</sup> With emergency-suction valve and protection strainer (125  $\mu$ m)

## Dimensions

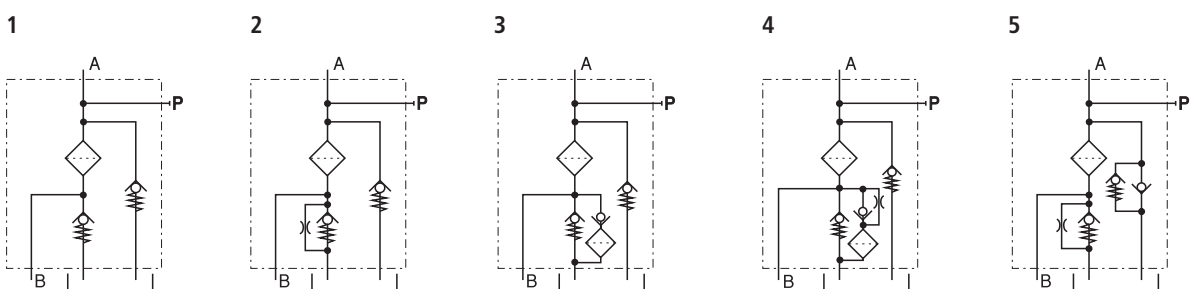


## Measurements

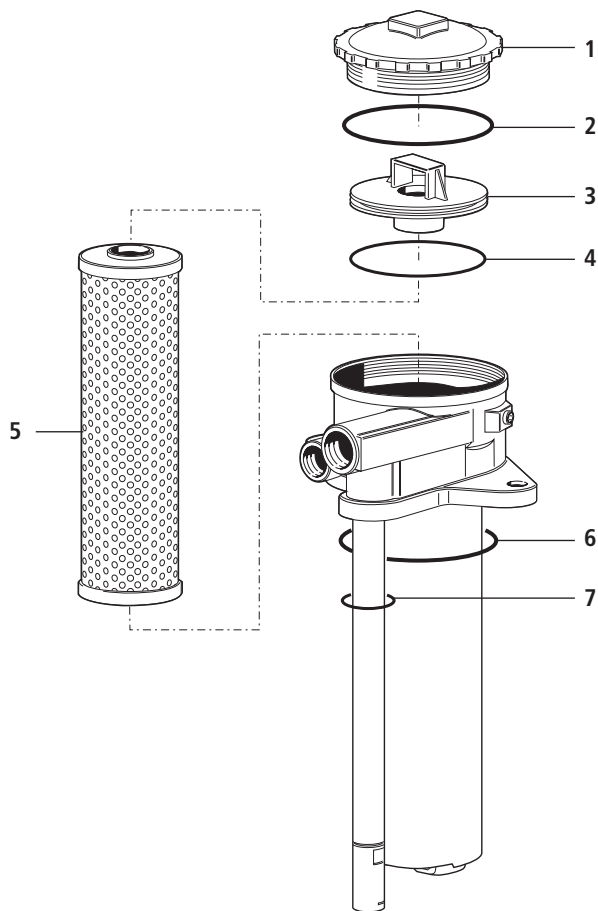
Type	A	B	C	D	E	F	G	H	I	K <sub>1</sub>	K <sub>2</sub>	L	M	N	O	P	Q	R	S
E 084	G $\frac{3}{4}$ , G1	G $\frac{3}{4}$	48	73,5	12	47	21	102	315	254	268	20,5	104,5	90	60	69	11	115	25
Type	T	U	V	W	X	Y*	SW <sub>1</sub>	SW <sub>2</sub>											
E 084	65	79	100	21	38	224	41	32											

\* Oil outlet resp. emergency suction has to be under all operating cond. below min. oil level (given by Y)

## Symbols



## Spare Parts



Pos.	Designation	Part No.
1	Screw-on cap	E 103.0201
2	Seal	N 031.0841
3	Inlet neck	E 084.0103
4	O-ring 72 x 3	N 007.0723
5	Filter element	see Chart / col. 11
6	O-ring 84 x 4	N 007.0844
7	O-ring 23 x 4	N 007.0231

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

### ISO 2942 ISO 3968 ISO 16889

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

Various quality controls during the production process guarantee the leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

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## Return Filters

**E 094 • E 103 • E 143**

- Tank top mounting
- Connection up to G1
- Nominal flow rate up to 135 l/min

## Description

### Application

In the return line circuits of hydraulic systems.

### Performance features

Protection

against wear: By means of filter elements that, in full-flow filtration meet even the highest demands regarding cleanliness classes.

Protection against

malfunction: By means of full-flow filtration in the system return, the pumps above all are protected from dirt particles remaining in the system after assembly, repairs, or which are generated by wear or enter the system from outside.

### Special features

By-pass valve: The location close to the inlet port prevents dirt particles retained by the filter element from entering into the clean oil side.

Removable bowl: In case of maintenance the filter bowl is removed together with the filter element - therefore dirt particles are not flushed back into the tank.

### Filter elements

Flow direction from outside to centre. The star-shaped pleating of the filter material results in:

- large filter surfaces
- low pressure drop
- high dirt-holding capacities
- long service life

### Ventilating Filter

Ventilation of the reservoir by an integral star-shape pleated filter element:

- removable (replace annually!)
- splash-proof
- fineness 2 µm

### Filter maintenance

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

### Materials

Screw-on cap: Polyamide, GF reinforced  
Filter head: Aluminium alloy  
Filter bowl: Polyamide, GF reinforced\*  
Seals: NBR (Viton on request)  
Filter media: EXAPOR®MAX - inorganic multi-layer microfibre web  
Paper - cellulose web, impregnated with resin

\* due to the conductable plastic material no static charge can occur

### Accessories

An optional oil separator (Part No. E 103.1702) prevents oil splashing through the ventilating filter at mobile applications.

Electrical and optical clogging indicators are available. Dimensions and technical data see catalogue sheet 60.20.

## Characteristics

### Nominal flow rate

Up to 135 l/min (see Selection Chart, column 2)

The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the connection lines  $\leq 4,5 \text{ m/s}$

### Connection

Threaded ports according to ISO 228 or DIN 13.

Sizes see Selection Chart, column 6 (other port threads on request)

### Filter fineness

5 µm(c) ... 30 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)

With high filling conditions we recommend an electrical conductivity  $\geq 500 \text{ pS/m}$  at 20 °C.

### Temperature range

- 30° C ... + 100° C (temporary - 40 °C ... + 120 °C)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$
- as starting viscosity:  $v_{\text{max}} = 1200 \text{ mm}^2/\text{s}$
- at first 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% Δp of the cracking pressure of the by-pass valve on the vertical axis. Draw a horizontal line so that it intersects the Δp curve at a point. Read this point on the horizontal axis for the viscosity.

### Operating pressure

Max. 10 bar

### Mounting position

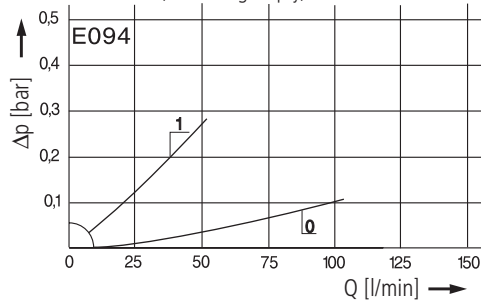
Preferably vertical, outlet downwards

## Diagrams

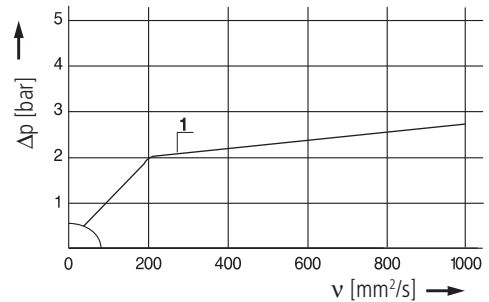
### $\Delta p$ -curves for complete filters in Selection Chart, column 3

**D1**

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

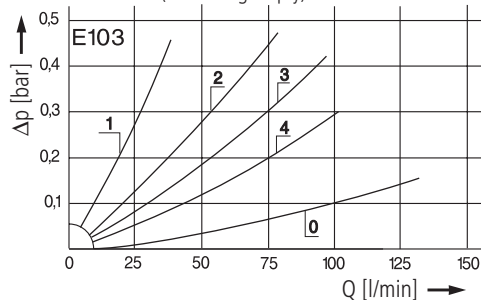


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

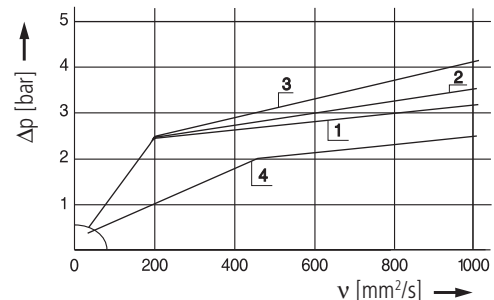


**D2**

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

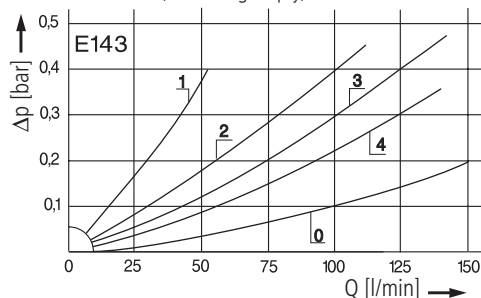


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

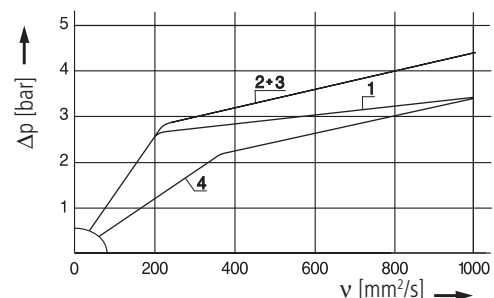


**D3**

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



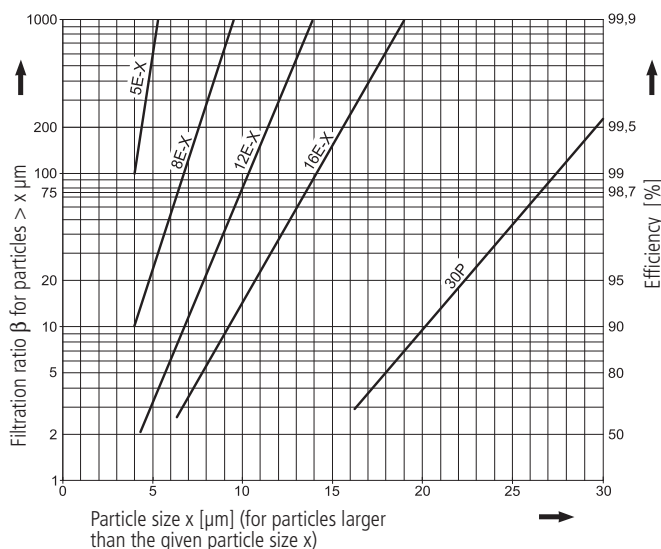
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



### 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



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

**For EXAPOR®MAX- and Paper elements:**

5 E-X =  $\beta_{5(d)} = 200$  EXAPOR®MAX  
8 E-X =  $\beta_{8(d)} = 200$  EXAPOR®MAX  
12 E-X =  $\beta_{12(d)} = 200$  EXAPOR®MAX  
16 E-X =  $\beta_{16(d)} = 200$  EXAPOR®MAX  
30 P =  $\beta_{30(d)} = 200$  Paper

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

**For screen elements:**

40 S = screen material with mesh size 40  $\mu\text{m}$   
60 S = screen material with mesh size 60  $\mu\text{m}$   
100 S = screen material with mesh size 100  $\mu\text{m}$

Tolerances for mesh size according to DIN 4189

**For ventilating filter elements:**

2 CL = 99,5 % efficiency for particles of size 2  $\mu\text{m}$

For special applications, finenesses differing from these curves are also available by using special composed filter material.

## Selection Chart

<div><div>Part No.</div><div>Nominal flow Pressure drop see Diagram <b>D</b>/curve no.</div><div>Filter fineness see Diagram <b>Dx</b></div><div>Dirt-holding capacity</div><div>Connection A</div><div>Cracking pressure of by-pass</div><div>Symbol</div><div>Replacement element Part No.</div><div>Weight</div><div>Replacement ventilating filter Part No.</div><div>Filter fineness see Diagrams</div><div>Remarks</div></div>											
	l/min			g		bar			kg		
1	2	3	4	5	6	7	8	9	10	11	12
E 094-661	50	<b>D1/1</b>	30 P	11	G <sup>3</sup> / <sub>4</sub>	1,5	2	P3.0613-51	0,8	L1.0503-03 (2 CL)	-
E 094-671	50	<b>D1/1</b>	30 P	11	G <sup>3</sup> / <sub>4</sub>	1,5	1	P3.0613-51	0,8	-	-
E 103-657	35	<b>D2/1</b>	5 E-X	13	G <sup>1</sup> / <sub>2</sub>	2,5	2	V3.0620-53	1,0	L1.0503-03 (2 CL)	-
E 103-677	35	<b>D2/1</b>	5 E-X	13	G <sup>1</sup> / <sub>2</sub>	2,5	1	V3.0620-53	1,0	-	-
E 103-676	75	<b>D2/2</b>	12 E-X	22	G <sup>3</sup> / <sub>4</sub>	2,5	2	V3.0620-56	1,0	L1.0503-03 (2 CL)	-
E 103-686	75	<b>D2/2</b>	12 E-X	22	G <sup>3</sup> / <sub>4</sub>	2,5	1	V3.0620-56	1,0	-	-
E 103-898	95	<b>D2/3</b>	16 E-X	24	G1	2,5	2	V3.0620-58	1,0	L1.0503-03 (2 CL)	-
E 103-888	95	<b>D2/3</b>	16 E-X	24	G1	2,5	1	V3.0620-58	1,0	-	-
E 103-871	70	<b>D2/4</b>	30 P	11	G <sup>3</sup> / <sub>4</sub>	1,5	2	P3.0620-51*	1,0	L1.0503-03 (2 CL)	-
E 103-861	70	<b>D2/4</b>	30 P	11	G <sup>3</sup> / <sub>4</sub>	1,5	1	P3.0620-51*	1,0	-	-
E 143-657	55	<b>D3/1</b>	5 E-X	21	G <sup>3</sup> / <sub>4</sub>	2,5	2	V3.0730-53	1,2	L1.0503-03 (2 CL)	-
E 143-667	55	<b>D3/1</b>	5 E-X	21	G <sup>3</sup> / <sub>4</sub>	2,5	1	V3.0730-53	1,2	-	-
E 143-676	115	<b>D3/2</b>	12 E-X	32	G1	2,5	2	V3.0730-56	1,2	L1.0503-03 (2 CL)	-
E 143-686	115	<b>D3/2</b>	12 E-X	32	G1	2,5	1	V3.0730-56	1,2	-	-
E 143-888	135	<b>D3/3</b>	16 E-X	36	G1	2,5	2	V3.0730-58	1,2	L1.0503-03 (2 CL)	-
E 143-688	135	<b>D3/3</b>	16 E-X	36	G1	2,5	1	V3.0730-58	1,2	-	-
E 143-851	120	<b>D3/4</b>	30 P	17	G1	1,5	2	P3.0730-51*	1,2	L1.0503-03 (2 CL)	-
E 143-861	120	<b>D3/4</b>	30 P	17	G1	1,5	1	P3.0730-51*	1,2	-	-

All filters are delivered with a plugged clogging indicator connection M 12 x 1,5. As clogging indicators either manometers or electrical pressure switches can be used. Optional extension pipes adapt the filter length to various tank depths. For ordering of accessories please use the below mentioned codes.

**Order example: The filter E 103-676 has to be supplied with an extension pipe for 300 mm length.**

**Order description:** E 103-676 / EV 300

**Part No. (basic unit)** \_\_\_\_\_

**Extension pipe (7 various lengths are available)** \_\_\_\_\_

EV = K (Bowl length) + 19 / + 79 / + 123 / + 173 / + 223 / + 323 / + 423 mm (see dimensions and measurements)

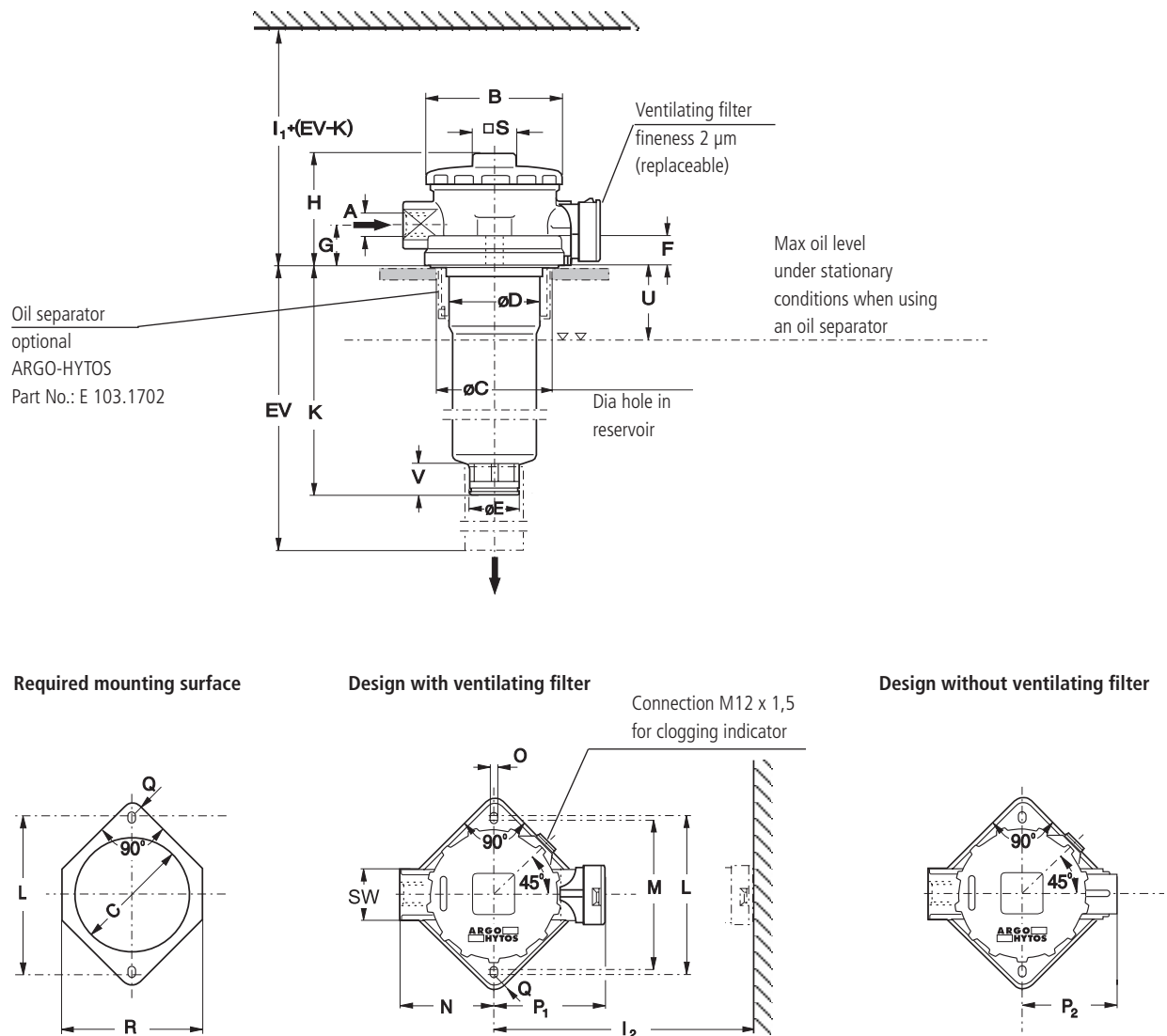
For the suitable clogging indicators please see catalogue sheet 60.20.

### Remarks:

- The switching pressure of the electrical pressure switch has always to be lower than the cracking pressure of the by-pass valve (see Selection Chart, column 7).
- The clogging indicators are always delivered detached from the filter.
- The filters listed in this chart are standard filters. Other designs available on request.

\* Paper media supported with metal gauze

## Dimensions



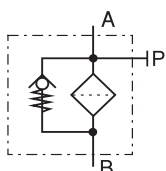
## Measurements

Type	A	B	C min./max.	D	E	F	G	H	I <sub>1</sub>	I <sub>2</sub>	K	L	M	N	O	P <sub>1</sub>	P <sub>2</sub>	Q	R	S	SW	U	V
E 094	G <sup>3</sup> / <sub>4</sub>	105	87 / 91	73,5	38	20,5	30	88,5	235	95	111	115	110	70	11	82	69	13,5	107,5	32	41	50	23
E 103	G <sup>1</sup> / <sub>2</sub> , G <sup>3</sup> / <sub>4</sub> , G1	105	87 / 91	73,5	38	20,5	30	88,5	300	95	177	115	110	70	11	82	69	13,5	107,5	32	41	50	23
E 143	G <sup>3</sup> / <sub>4</sub> , G1	105	87 / 91	73,5	38	20,5	30	88,5	400	95	278	115	110	70	11	82	69	13,5	107,5	32	41	50	23

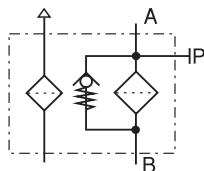
For calculation of EV use data in Selection Chart

## Symbols

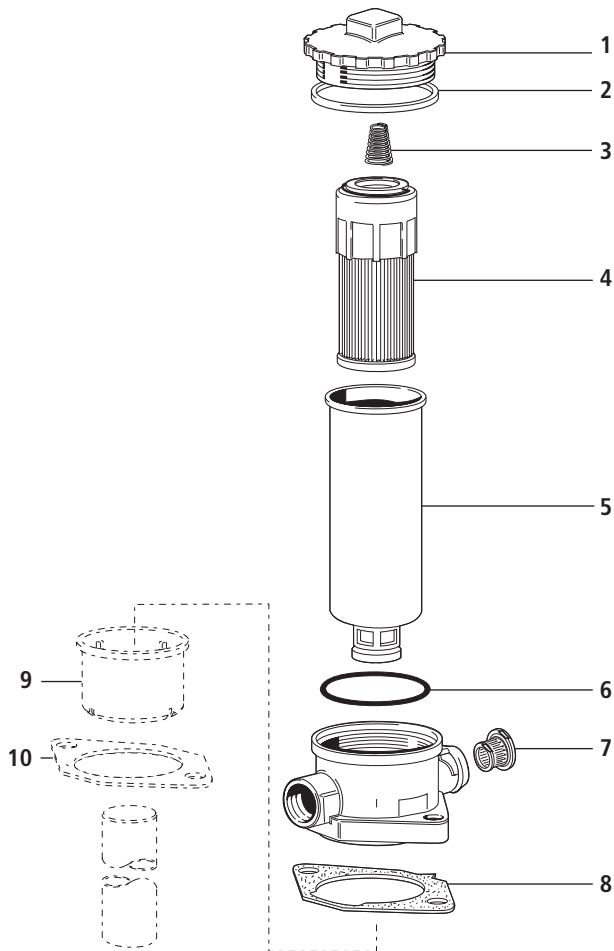
1



2



## Spare Parts



Pos.	Designation	Part No.
1	Screw-on cap	E 103.0201
2	Seal	N 031.0841
3	Compression spring	N015.3703
4	Filter element	see Chart / col. 9
5	Filter bowl E094 *	E 094.0903
5	Filter bowl E103 *	E 103.0912
5	Filter bowl E143 *	E 143.0903
6	O-ring 69,5 x 3,5	N 007.0703
7	Ventilating filter	L1.0503-03K
8	Seal (for versions without oil separator)	E 103.0147
9	Oil separator with Pos. 10	E 103.1702
10	Seal (for versions with oil separator)	E 103.0148

\* Specify mounting depth in mm

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

### ISO 2942 ISO 3968 ISO 16889

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

Various quality controls during the production process guarantee the leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

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



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## Return-Suction Filters

**E 158 • E 198 • E 248**

- Tank top mounting
- Connection up to G1 $\frac{1}{4}$
- Nominal flow rate up to 250 l/min

## Description

### Application

For operation in units with hydrostatic drives, when the return flow is under all operating conditions higher than the oil flow of the boost pump.

### Performance features

Protection

against wear: By means of filter elements that, in full-flow filtration, meet even the highest demands regarding cleanliness classes.

Suction filter

function: Because of the 100%-filtration of the suction flow, no dirt can get into the boost pump.

Return filter

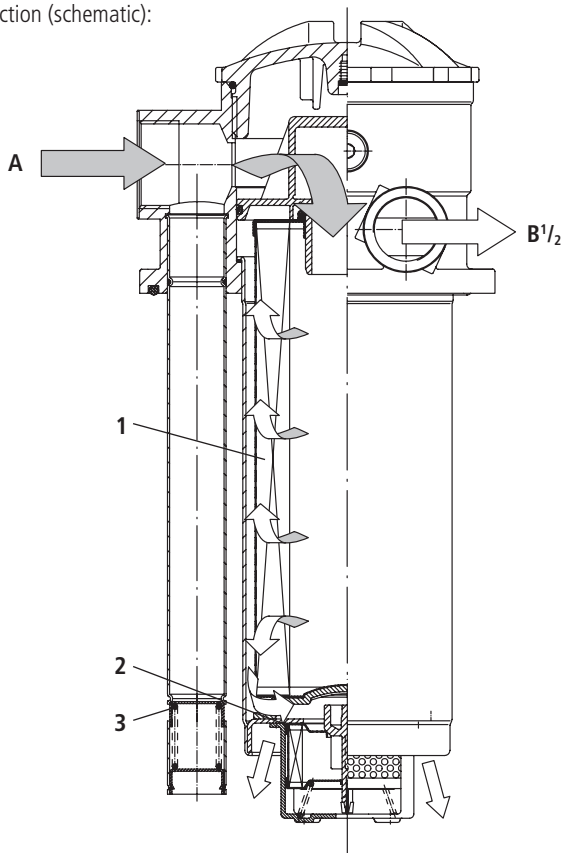
function: By means of full-flow filtration in the system return, the pumps above all are protected from dirt particles remaining in the system after assembly, repairs, or which are generated by wear or enter the system from outside.

### Functional characteristics

The hydraulic oil returning from the circuit (A) passes the filter element (1), is pressurized by a 0,5 bar check valve (2) and supplied to the boost pump (B). The surplus oil flows filtered over the integral check valve into the reservoir. As the boost pump is always feeded with pressurized oil the risk of cavitation is minimized and full performance is available even during the critical cold start phase.

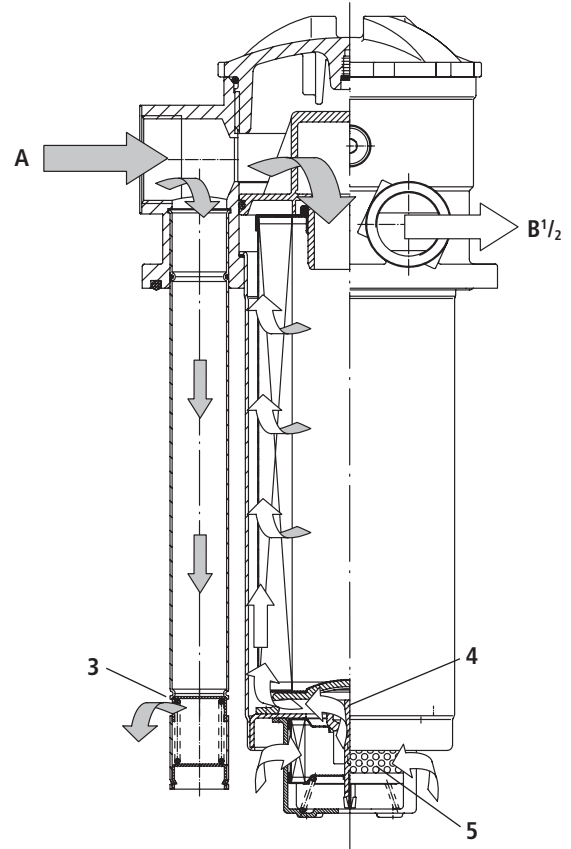
An integral pressure relief valve (3) prevents too high back pressure and protects the shaft seals against damages. As this valve leads the oil directly into the tank there is no direct connection between the return line (A) and the connection of the boost pump (B) (no bypass valve function).

Function (schematic):



The emergency-suction valve (4) with 125 µm protection strainer (5) supplies the boost pump in case of a short term of lack of oil. During normal operation, a lack of oil may definitely not occur (refer to „Design“ section).

Emergency-suction (schematic):



### Start up /Deaeration

For units with emergency-suction valve and protection strainer the start up set E 198.1710 can be used to de-aerate the hydraulic system at first start up or at start up after repair; hereby the immediate supply of the boost pump with hydraulic oil is guaranteed.

For all other types, deaerating instructions published by the manufacturers of hydraulic drives must be observed.

### Filter maintenance

By using a clogging indicator the correct moment for maintenance is indicated and guarantees therefore the optimum utilization of the filter elements.

### Filter elements

Flow direction from centre to the outside. The star-shaped pleating of the filter material results in:

- large filter surfaces
- low pressure drop
- high dirt-holding capacities
- long service life

Dirt deposits are entirely removed when the element is changed. Dirt cannot re-enter the tank.

### Accessories

Electrical and optical clogging indicators are available. Dimensions and technical data see catalogue sheet 60.20.

# Layout

## General

In machines with a hydrostatic drive and combined working hydraulic system, suction-return filters replace the suction or pressure filters previously required for the feed pump of the closed-loop hydrostatic drive circuit as well as the return filter for the open-loop working hydraulic circuit.

While each circuit operates independently with separate filters, the combination of the two circuits via the suction-return filter causes interaction between the circuits.

If the design criteria described below are taken into account, you can take full advantage of the benefits provided by the suction-return filter concept, thus making sure that your system performs reliably even under extreme operating conditions.

## Required return flow in the system

In order to maintain a precharging pressure of approx. 0,5 bar at the intake of the feed pump, the return flow must exceed the suction flow under any operating condition:

- Versions without hole (Ø 4 mm) in the pressurizing valve: at least 10 l/min of excess flow
- Versions with hole (Ø 4 mm) in the pressurizing valve: at least 20 l/min of excess flow

## Permitted feed pump flow rate

- at operating temperature ( $v < 60 \text{ mm}^2/\text{s}$ ,  $\text{rpm} = \text{max}$ ):  
feed pump flow rate  $\leq 0,5 \times$  rated return flow according to column 2 of selection table
- at cold start-up ( $v < 1000 \text{ mm}^2/\text{s}$ ,  $\text{rpm} = 1000 \text{ min}^{-1}$ ):  
feed pump flow rate  $\leq 0,2 \times$  rated return flow according to column of selection table

Please contact us if your system operates with higher flow rates than stated above.

## Flow velocity in the connecting lines

- Flow velocity in the return lines  $\leq 4,5 \text{ m/s}$
- Flow velocity in the suction lines  $\leq 1,5 \text{ m/s}$

## Permitted pressure in the suction lines

At cold start up ( $v < 1000 \text{ mm}^2/\text{s}$ ,  $\text{rpm} = 1000 \text{ min}^{-1}$ ):  
feed pump flow rate  $\leq 0,2 \times$  rated return flow. The pressure loss in the suction lines must not exceed 0,4 bar.

## Backpressures in system return lines

If drain oil from the hydrostatic drive is routed across the filter in addition to the flow of the open-loop circuit, the following has to be observed in order to protect the shaft seals:

- permitted leakage oil pressure for a given viscosity and speed (manufacturer's specifications!)
- pressure loss caused by the leakage oil pipes
- pressure loss caused by the oil cooler used
- backpressure of the filter for a given flow rate or kinematic viscosity (refer to pressure loss diagrams)

Depending on the application, the use of a cooler bypass valve is recommended.

Generously sized drain oil pipes are also of advantage.

## Filter fineness grades

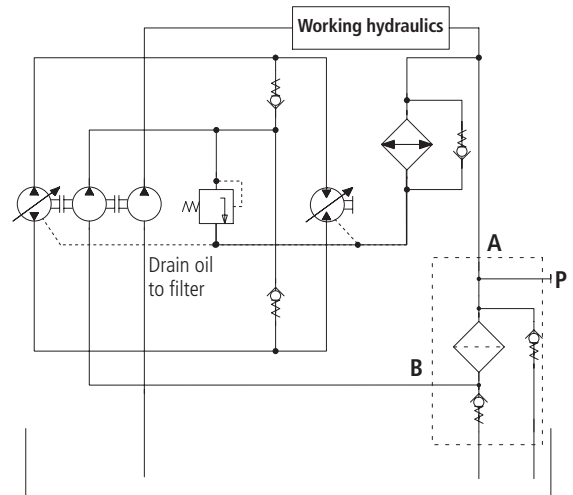
With the filter fineness grades available, the following oil cleanliness according to ISO 4406 can be achieved:

- 12 E-X: 18/15/12 ... 15/12/8
- 16 E-X: 20/17/12 ... 17/14/10

Even with the 16 E-X filter fineness grade, the requirements specified by manufacturers of hydrostatic drives are sometimes exceeded significantly. If components requiring a still better oil purity are used, we recommend the 12 E-X filter fineness grade.

## Suggested circuit layouts

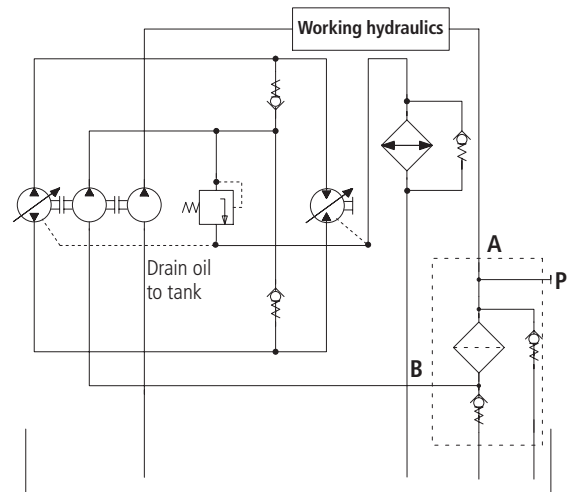
A) The leakage oil of the hydrostatic drive is routed across the filter.



The entire dirt produced in the hydrostatic drive by abrasion is filtered out immediately and is thus not taken in by the pump of the open-loop circuit.

This circuit layout is always recommended if the return flow only slightly exceeds the suction flow, i.e. if there is a risk that the 0,5 bar precharging pressure cannot be maintained.

B) The drain oil of the hydrostatic drive is not routed across the filter but is discharged directly into the tank.



This circuit layout has the advantage that drain oil pressures are comparatively low.

## Characteristics

### Nominal flow rate

Up to 250 l/min in return line (see Selection Chart, column 2)

Up to 125 l/min Feed pump flow rate (see Layout)

The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the return lines  $\leq 4,5 \text{ m/s}$
- flow velocity in the suction lines  $\leq 1,5 \text{ m/s}$

### Connection

Threaded ports according to ISO 228 or DIN 13. Sizes see Selection Chart, column 6 and 7

(other port threads on request)

### Filter fineness

12  $\mu\text{m(c)}$  ... 16  $\mu\text{m(c)}$

$\beta$ -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-service 00.20)

### Temperature range

- 30 °C ... + 100 °C (temporary - 40 °C ... + 120 °C)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$
- as starting viscosity:  $v_{\text{max}} = 1000 \text{ mm}^2/\text{s}$
- at first 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.

### Operating pressure

Max. 10 bar

### Materials

Screw-on cap: Polyester, GF reinforced

Filter head: Aluminium alloy

Filter bowl: Steel (E248), aluminium (E158, E198)

Seals: NBR (Viton on request)

Filter media: EXAPOR®MAX - inorganic multi-layer microfibre web

### Fitting position

- Standard type no restriction, preferably vertical
- Models with emergency-suction valve can vary up to 15° from the vertical
- Models with hole Ø 4 mm in the check valve can vary up to 45° from the vertical

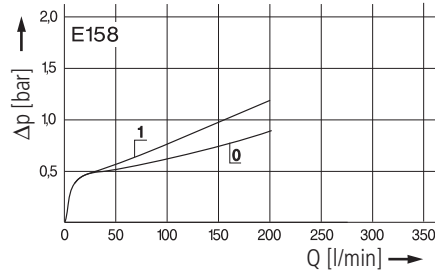
Even under unfavourable operating conditions (min. oil level, max. sloping) the oil outlet resp. emergency suction has to be below the oil level.

## Diagrams

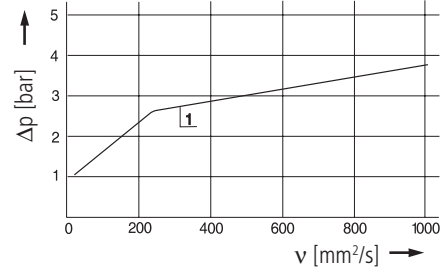
### $\Delta p$ -curves for complete filters in Selection Chart, column 3

**D1**

Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$  (0 = casing empty with hole  $\varnothing 4 \text{ mm}$ )

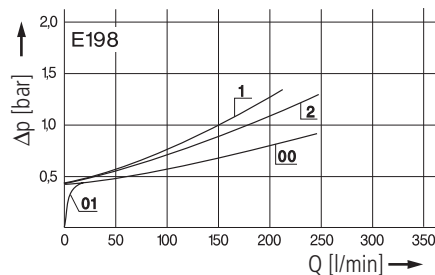


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

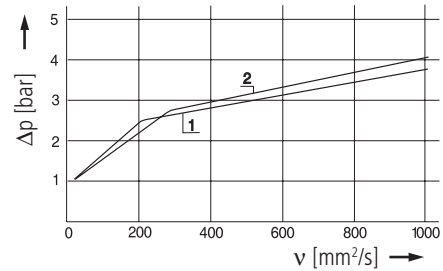


**D2**

Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$  (00/01 = casing empty without/with hole  $\varnothing 4 \text{ mm}$ )

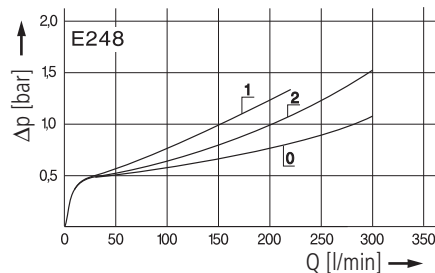


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

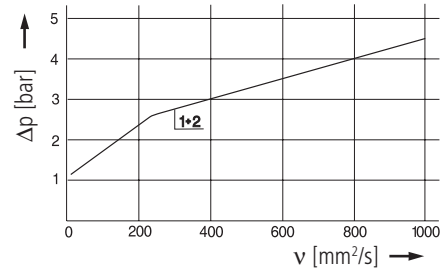


**D3**

Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$  (0 = casing empty with hole  $\varnothing 4 \text{ mm}$ )



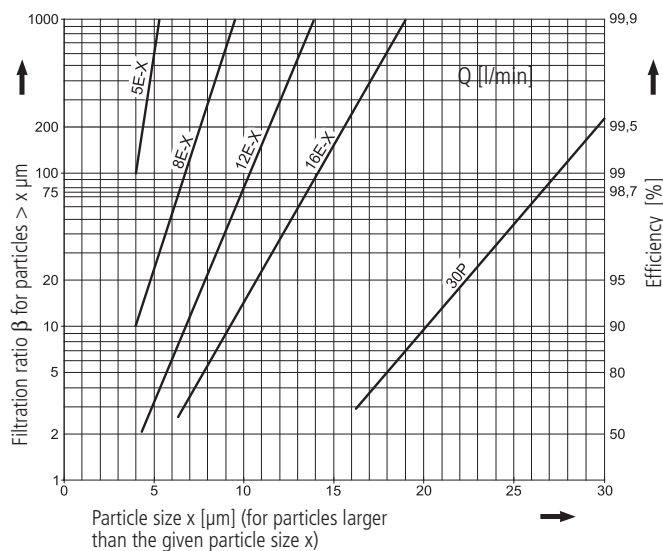
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



### 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



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

**For EXAPOR®MAX- and Paper elements:**

<b>5 E-X</b>	$= \beta_{5(c)} = 200$	EXAPOR®MAX
<b>8 E-X</b>	$= \beta_{8(c)} = 200$	EXAPOR®MAX
<b>12 E-X</b>	$= \beta_{12(c)} = 200$	EXAPOR®MAX
<b>16 E-X</b>	$= \beta_{16(c)} = 200$	EXAPOR®MAX
<b>30 P</b>	$= \beta_{30(c)} = 200$	Paper

Based on the structure of the filter media of the 30 P 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.

## Selection Chart

[illegible]

All filters are delivered with three plugged clogging indicator connections M 12 x 1,5. As clogging indicators on the return side (P<sub>1</sub>) either manometers or electrical pressure switches can be used. The monitoring of the vacuum on the suction side (P<sub>2</sub>) is additionally possible.

For the appropriate clogging indicators see catalogue sheet 60.20.

## Remarks:

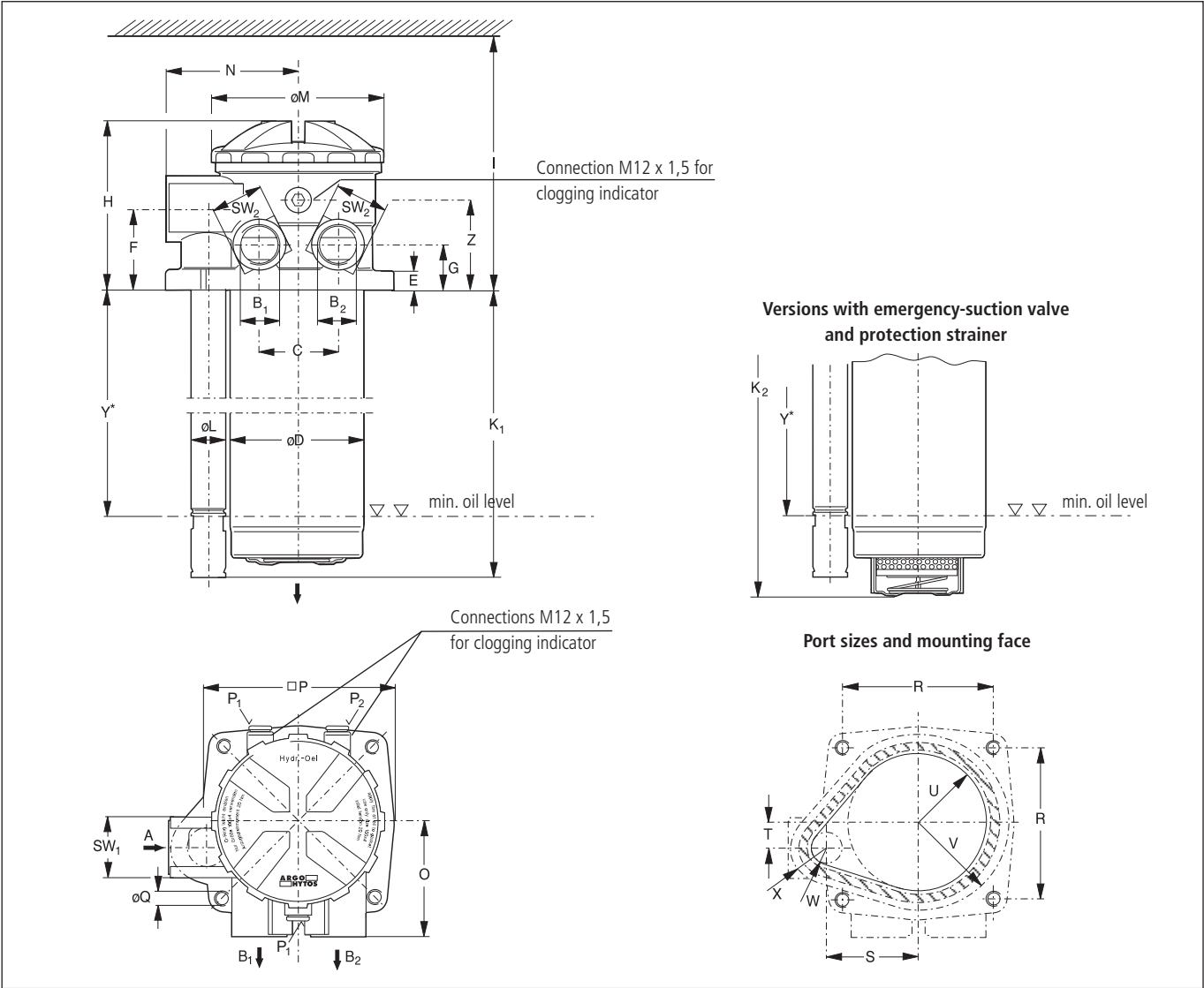
- The start of the red area respectively the switching pressure of the electrical pressure switch has always to be lower than the cracking pressure of the pressure relief valve (see Selection Chart, column 9).
- The clogging indicators are optional and always delivered detached from the filter.
- The filters listed in this chart are standard filters. If modifications are required, e.g. with integrated suction valve (integrated into the pressure relief valve) to guarantee the emergency steering feature for vehicles with official road use, we kindly ask for your request.
- For deaeration a start-up set for units with emergency-suction valve and protection strainer is available with Part No. E084.1710, for technical details see catalogue sheet 20.870.

<sup>1</sup> Cracking pressure of check valve<sup>2</sup> Cracking pressure of pressure relief valve

<sup>3</sup> With hole Ø 4 mm in the check valve for oil drain when opening the filter cover

<sup>4</sup> With emergency-suction valve and protection strainer (125 µm).

## Dimensions

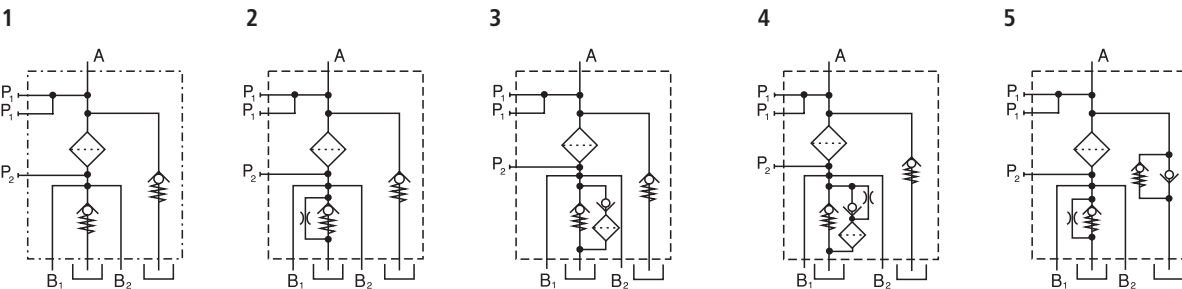


## Measurements

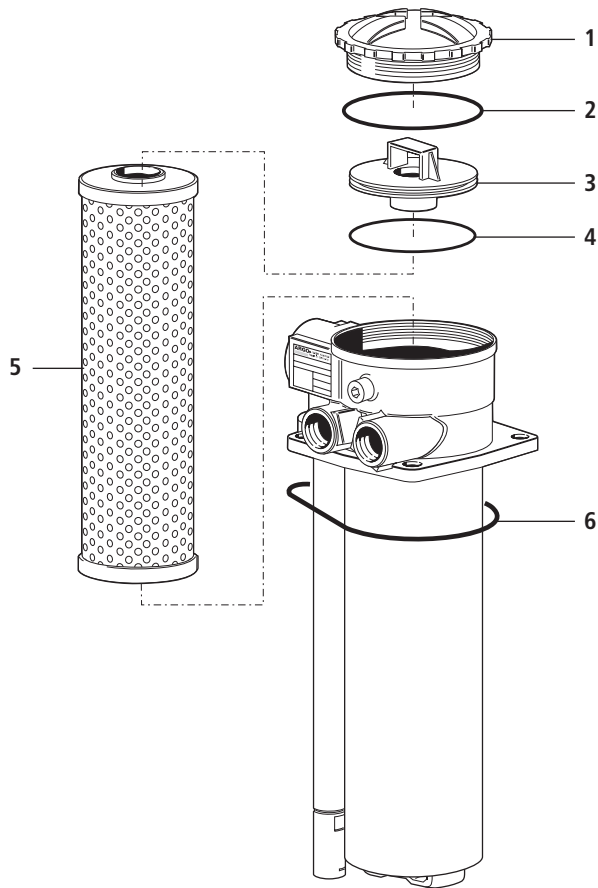
[illegible]

\* Oil outlet resp. emergency suction has to be under all operating cond. below min. oil level (given by Y)

## Symbols



## Spare Parts



Pos.	Designation	Part No.
1	Screw-on cap	ES 074.0206
2	O-ring 100 x 4	N 007.1004
3	Inlet neck	E 198.0104
4	O-ring 98 x 3	N 007.0983
5	Filter element	see Chart / col. 11
6	O-ring 124 x 4,5	N 007.1245

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

### ISO 2942 ISO 3968 ISO 16889

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

Various quality controls during the production process guarantee the leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

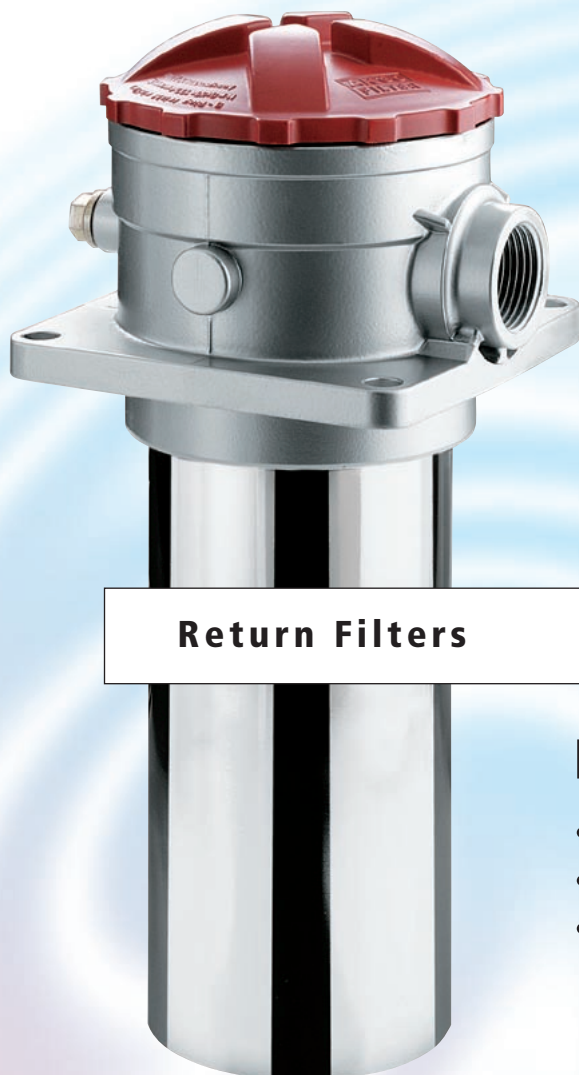
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### We produce fluid power solutions

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## Return Filters

**E 210 · E 211 · E 221**

- Tank top mounting
- Connection up to G1¼
- Nominal flow rate up to 210 l/min

## Description

### Application

In the return line circuits of hydraulic systems.

### Performance features

Protection

against wear: By means of filter elements that, in full-flow filtration, meet even the highest demands regarding cleanliness classes.

Protection against

malfunction: By means of full-flow filtration in the system return, the pumps above all are protected from dirt particles remaining in the system after assembly, repairs, or which are generated by wear or enter the system from outside.

### Special features

By-pass valve: The location close to the inlet port prevents dirt particles retained by the filter element from entering into the clear oil side.

Removable bowl: In case of maintenance the filter bowl is removed together with the filter element - therefore dirt particles are not flushed back into the tank.

### Filter elements

Flow direction from outside to centre. 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

Screw-on cap:	Polyester, GF reinforced
Filter head:	Aluminium alloy
Filter bowl:	Steel
Seals:	NBR (Viton on request)
Filter media:	EXAPOR®MAX - inorganic multi-layer microfibre web
	Paper - cellulose web, impregnated with resin

### Accessories

Electrical and optical clogging indicators are available.  
Dimensions and technical data see catalogue sheet 60.20.

## Characteristics

### Nominal flow rate

Up to 210 l/min (see Selection Chart, column 2)

The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the connection lines  $\leq 4,5 \text{ m/s}$

### Connection

Threaded ports according to ISO 228 or DIN 13. Sizes see Selection Chart, column 6 (other port threads on request)

### Filter fineness

5  $\mu\text{m(c)}$  ... 30  $\mu\text{m(c)}$

$\beta$ -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 or HETG, see info-sheet 00.20)

### Temperature range

- 30 °C ... + 100 °C (temporary - 40 °C ... + 120 °C)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$
- as starting viscosity:  $v_{\text{max}} = 1200 \text{ mm}^2/\text{s}$
- at first 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.

### Operating pressure

Max. 10 bar

### Mounting position

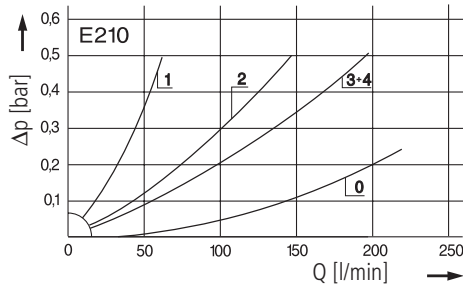
Preferably vertical, outlet downwards

## Diagrams

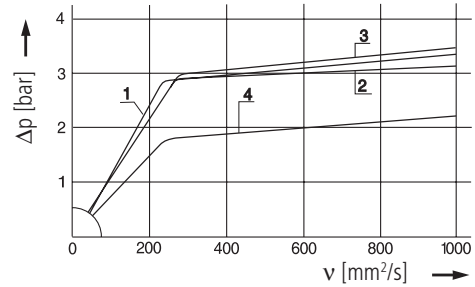
### $\Delta p$ -curves for complete filters in Selection Chart, column 3

**D1**

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

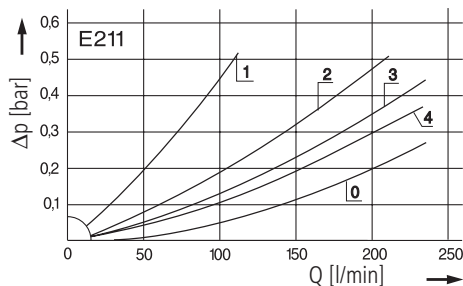


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

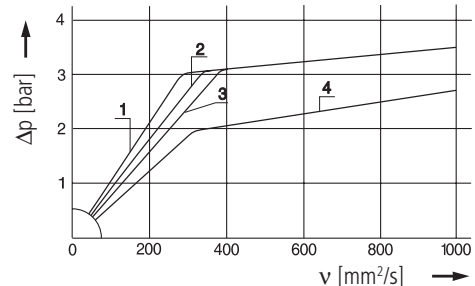


**D2**

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

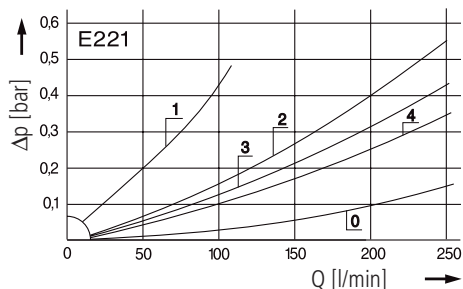


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

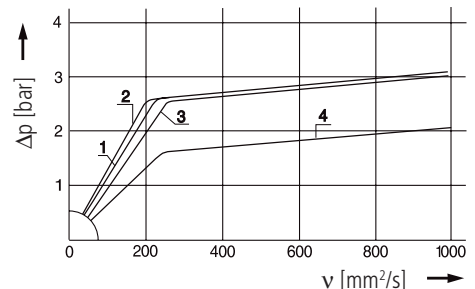


**D3**

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



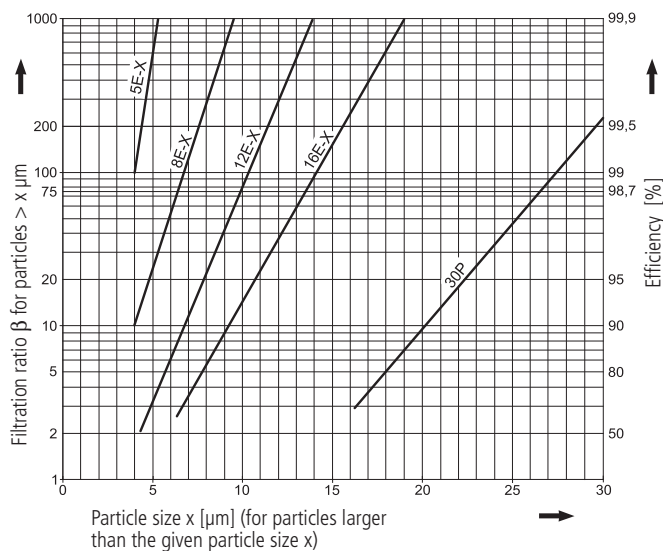
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



### 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



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

**For EXAPOR® MAX- and Paper elements:**

**5 E-X** =  $\beta_{5(c)} = 200$  EXAPOR®MAX  
**8 E-X** =  $\beta_{8(c)} = 200$  EXAPOR®MAX  
**12 E-X** =  $\beta_{12(c)} = 200$  EXAPOR®MAX  
**16 E-X** =  $\beta_{16(c)} = 200$  EXAPOR®MAX  
**30 P** =  $\beta_{30(c)} = 200$  Paper

Based on the structure of the filter media of the 30 P 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 media.

## Selection Chart

Part No.	Nominal flow	Pressure drop see Diagram D/curve no.	Filter fineness see Diagram Dx	Dirt-holding capacity	Connection A	Cracking pressure of by-pass	Symbol	Replacement filter element Part No.	Weight	Remarks
	l/min			g		bar			kg	
1	2	3	4	5	6	7	8	9	10	11
E 210-59	60	D1/1	5 E-X	25	G1	2,5	1	V2.0920-03	2,3	-
E 210-66	130	D1/2	12 E-X	40	G1	2,5	1	V2.0920-06	2,3	-
E 210-58	180	D1/3	16 E-X	47	G1¼	2,5	1	V2.0920-08	2,3	-
E 210-51	120	D1/4	30 P	22	G1¼	1,5	1	P2.0920-11*	2,3	-
E 211-59	110	D2/1	5 E-X	50	G1	2,5	1	2 x V2.0920-03	3,4	-
E 211-56	210	D2/2	12 E-X	80	G1¼	2,5	1	2 x V2.0920-06	3,4	-
E 211-58	210	D2/3	16 E-X	94	G1¼	2,5	1	2 x V2.0920-08	3,4	-
E 211-51	210	D2/4	30 P	44	G1¼	1,5	1	2 x P2.0920-11*	3,4	-
E 221-59	100	D3/1	5 E-X	36	G1	2,5	1	V2.0833-03	3,3	-
E 221-56	210	D3/2	12 E-X	58	G1¼	2,5	1	V2.0833-06	3,3	-
E 221-58	210	D3/3	16 E-X	67	G1¼	2,5	1	V2.0833-08	3,3	-
E 221-51	210	D3/4	30 P	36	G1¼	1,5	1	P2.0833-01*	3,3	-

All filters are delivered with a plugged clogging indicator connection M 12 x 1,5. As clogging indicators either manometers or electrical pressure switches can be used. Optional extension pipes adapt the filter length to various tank depths. For ordering of accessories please use the below mentioned codes.

**Order example: The filter E 210-66 has to be supplied with an extension pipe (EV) for a mounting depth of 300 mm.**

**Order description:** E 210-66 / EV 300

**Part No. (Basic unit)**

**Extension pipe (4 various lengths are available)**

E 210 / E 211: EV = K + 95 / + 195 / + 295 / + 395

E 221: EV = K + 139 / + 239 / + 339 / + 439

(see dimensions and measurements)

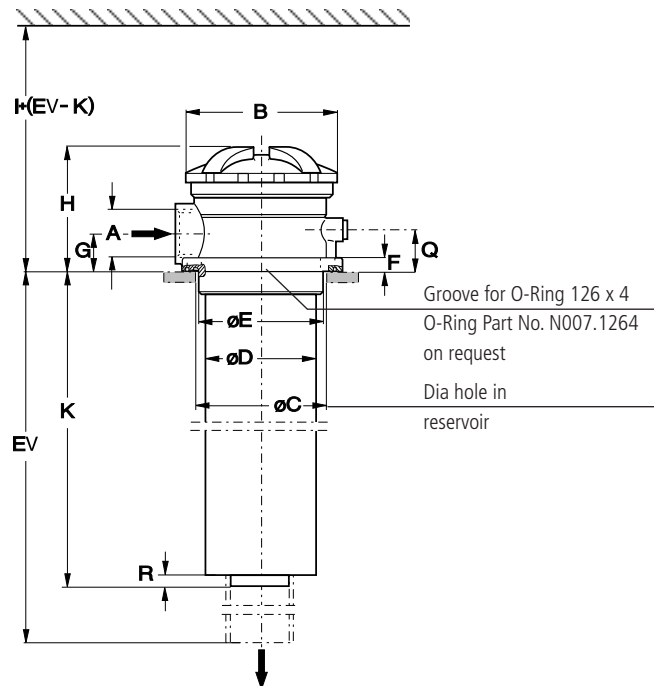
**For the appropriate clogging indicators see catalogue sheet 60.20.**

### Remarks:

- The switching pressure of the electrical pressure switch has always to be lower than the cracking pressure of the by-pass valve (see Selection Chart, column 7).
- The clogging indicators are optionally available and will then be loosely provided.
- The filters listed in this chart are standard filters. Other designs available on request.

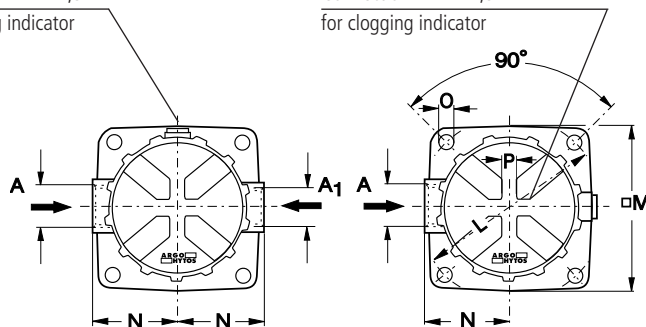
\* Paper media supported with metal gauze

## Dimensions



Design with 2 inlet ports on request

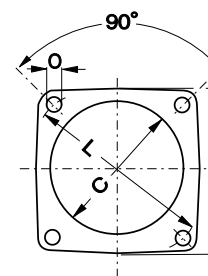
Connection M12 x 1,5  
for clogging indicator



Design with 1 inlet port

Connection M12 x 1,5  
for clogging indicator

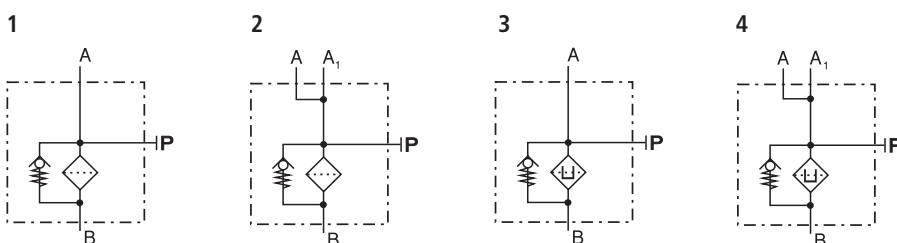
Required mounting surface



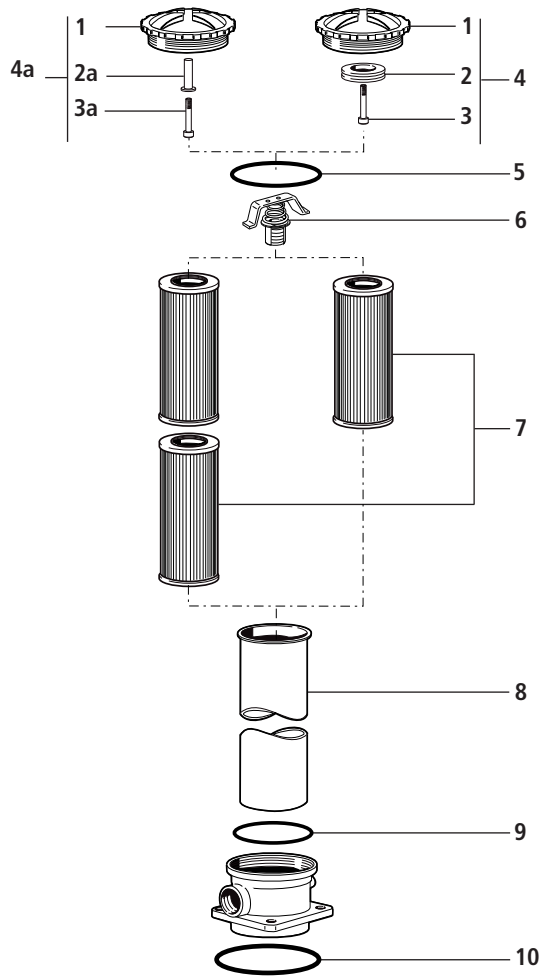
## Measurements

Type	A	B	C min./max.	D	E	F	G	H	I	K	L	M	N	O	P	Q	R
E 210	G1, G1¼	126,5	111/121	95,5	110	11,5	32	106	325	205	165	141	76	11	13	35	-
E 211	G1, G1¼	126,5	111/121	95,5	110	11,5	32	106	525	405	165	141	76	11	13	35	-
E 221	G1, G1¼	126,5	111/121	95,5	110	11,5	32	106	465	361	165	141	76	11	13	35	15

## Symbols



## Spare Parts



Pos.	Designation	Part No.
1	Screw-on cap with Pos. 5	ES 074.1212
2	Magnetic system	D 020.1401
2a	Hollow rivet A 8 x 0,75 x 25 DIN 7340-St	3309059
3	Cylinder screw assy	E 210.1201
3a	Cylinder screw M6x35 DIN 912-8.8	3302006
4	Screw-on cap assy with Pos. 5	E 210.1210
4a	Screw-on cap assy with Pos. 5	E 210.1200
5	O-ring 100 x 4	N 007.1004
6	By-pass E 210/E 211 (1,5 bar)	E 210.1903
6	By-pass E 210/E 211 (2,5 bar)	E 210.1905
6	By-pass E 221 (1,5 bar)	E 221.1903
6	By-pass E 221 (2,5 bar)	E 210.1905
7	Filter element	see Chart / col. 9
8	Filter bowl E 210 *	E 210.1901
8	Filter bowl E 211 *	E 211.1901
8	Filter bowl E 221 *	E 221.1901
9	O-ring 90 x 4	N 007.0904
10	O-ring 126 x 4 **	N 007.1264

<sup>1</sup> Specify mounting depth in mm

<sup>2</sup> Not included in basic equipment

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

### ISO 2942 ISO 3968 ISO 16889

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

Various quality controls during the production process guarantee the leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

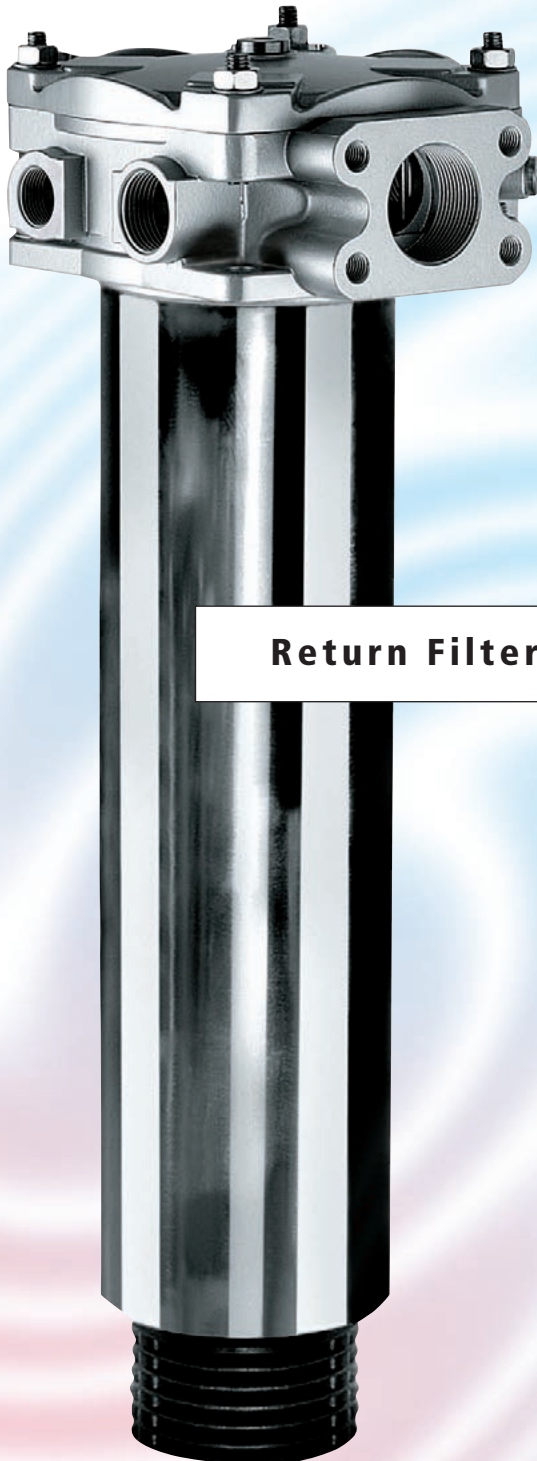
Illustrations may sometimes differ from the original. ARGO-HYTOS is not responsible for any unintentional mistake in this specification sheet.



### We produce fluid power solutions

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## Return Filters

**E 303 • E 503 • E 703**

- Tank top mounting
- Connection up to SAE 2½
- Nominal flow rate up to 780 l/min

## Description

### Application

In the return line circuits of hydraulic systems.

### Performance features

Protection

against wear: By means of filter elements that, in full-flow filtration, meet even the highest demands regarding cleanliness classes.

Protection against

malfunction: By means of full-flow filtration in the system return, the pumps above all are protected from dirt particles remaining in the system after assembly, repairs, or which are generated by wear or enter the system from outside.

### Special features

By-pass valve: The location close to the inlet port prevents dirt particles retained by the filter element from entering into the clear oil side.

Removable bowl: In case of maintenance the filter bowl is removed together with the filter element - therefore dirt particles are not flushed back into the tank.

### Filter elements

Flow direction from outside to centre. 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

Filter head cover: Steel

Filter head: Aluminium alloy

Filter bowl: Steel

Seals: NBR (Viton on request)

Filter media: EXAPOR®MAX - inorganic multi-layer microfibre web

### Accessories

Extension pipes or diffusers are available on the bowl outlet.

Extension pipe: A correct extension pipe length ensures oil outlet below minimum oil level and prevents foaming.

Diffuser: Diffusers reduce oil velocity and direct the oil to 90° outlet flow. This function prevents also oil foaming and whirling up of solid particles settled at the tank bottom. The mesh screen element filters the oil in case of an open by-pass valve.

Electrical and optical clogging indicators are available.

Dimensions and technical data see catalogue sheet 60.20.

## Characteristics

### Nominal flow

Up to 780 l/min (see Selection Chart, column 2)

The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the connection lines  $\leq 4,5 \text{ m/s}$

### Connection

SAE-flange (3000 psi). Sizes see Selection Chart, column 6 (other port threads on request)

### Filter fineness

5  $\mu\text{m(c)}$  ... 16  $\mu\text{m(c)}$

$\beta$ -values according to ISO 16889

(see Selection Chart, column 4 and Diagram Dx)

### Dirt-holding capacity

Values in g test dust ACFTD 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)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$

- as starting viscosity:  $v_{\text{max}} = 1200 \text{ mm}^2/\text{s}$

- at first 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.

### Operating pressure

Max. 10 bar

### Mounting position

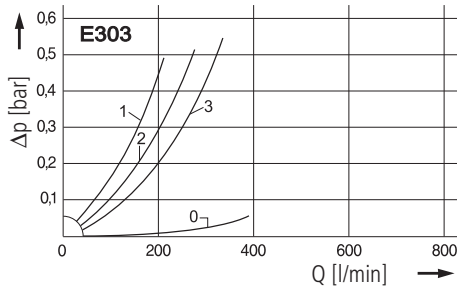
Preferably vertical, outlet downwards

## Diagrams

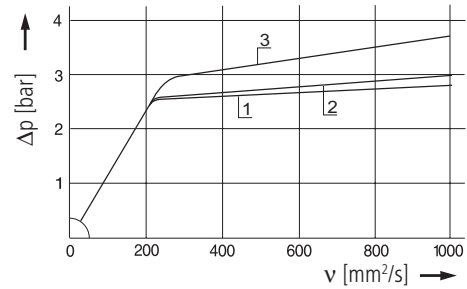
### $\Delta p$ -curves for complete filters in Selection Chart, column 3

**D1**

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

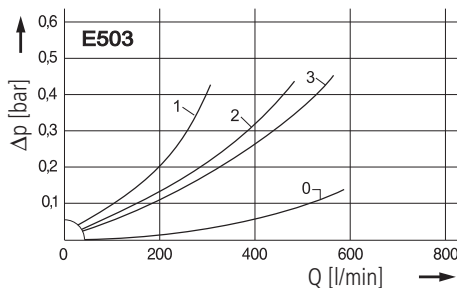


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

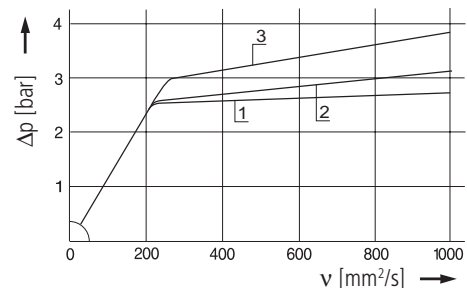


**D2**

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

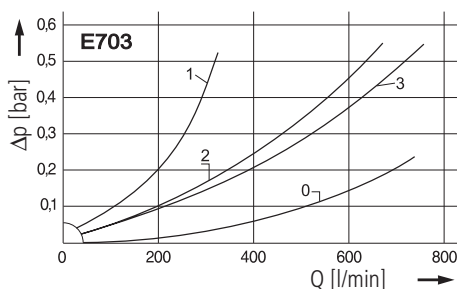


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

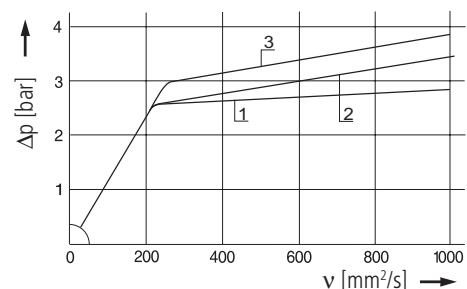


**D3**

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



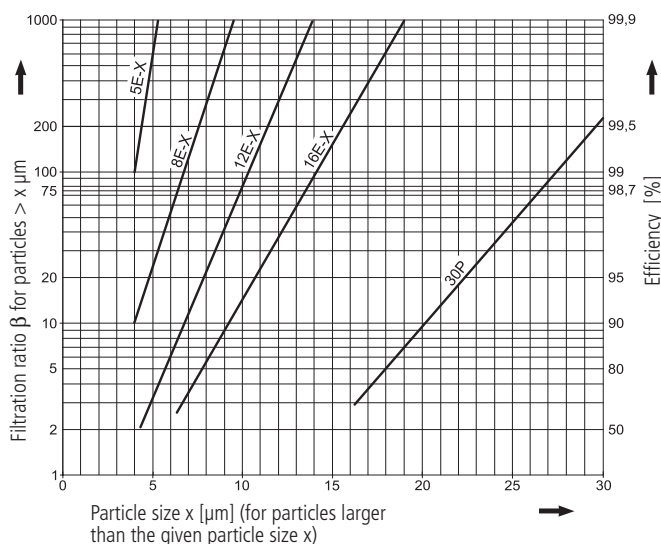
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



### 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



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

#### For EXAPOR®MAX- and Paper elements:

- 5 E-X** =  $\beta_{5(c)} = 200$  EXAPOR®MAX
- 8 E-X** =  $\beta_{8(c)} = 200$  EXAPOR®MAX
- 12 E-X** =  $\beta_{12(c)} = 200$  EXAPOR®MAX
- 16 E-X** =  $\beta_{16(c)} = 200$  EXAPOR®MAX
- 30 P** =  $\beta_{30(c)} = 200$  Paper

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

#### For screen elements:

- 40 S** = screen material with mesh size 40  $\mu\text{m}$
- 60 S** = screen material with mesh size 60  $\mu\text{m}$
- 100 S** = screen material with mesh size 100  $\mu\text{m}$

Tolerances for mesh size according to DIN 4189.

For special applications, finenesses differing from these curves are also available by using special composed filter media.

## Selection Chart

[illegible]

All filters are delivered with a plugged clogging indicator connection M 12x1,5. (Mounting holes for differential pressure switches on request). As clogging indicators either manometers or electrical pressure switches can be used. Two different head pieces with three various connecting options are available. All filters can also be supplied with an outlet diffuser. Optional extension pipes adapt the filter length to various tank depths. For ordering of accessories please use the below mentioned codes.

**Order example:** The filter E 703-256 has to be supplied with 4 connections (A1, A2, A3 and A4) and an extension pipe for 800 mm length.

### Order description:

**E 703- 456                      /                      RV                      /                      EV 800**

### Connections:

four various options are available

two connections (A und A4)<sup>1</sup> - SAE2½ and G1————— 2

four connections (A1, A2, A3 and A4) - 2 x G1¼ / SAE1½, G¾ and G1————— 4

**Bowl outlet:**

two various options are available

VD - Outlet diffuser, RV - Only extension pipe

### Extension pipe<sup>2</sup>:

four various lengths are available

EV = K (Bowl length) + 64 / + 164 / + 264 / + 454 mm (see section dimensions and measurements)

For the appropriate clogging indicators see catalogue sheet 60.20.

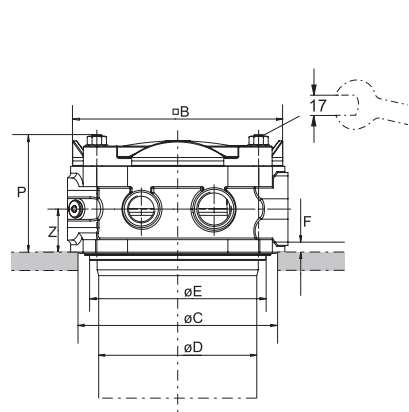
## Remarks:

- The switching pressure of the electrical pressure switch has always to be lower than the cracking pressure of the by-pass valve (see Selection Chart, column 7).
- The clogging indicators are optional and always delivered detached from the filter.
- The filters listed in this chart are standard filters. Other designs available on request.

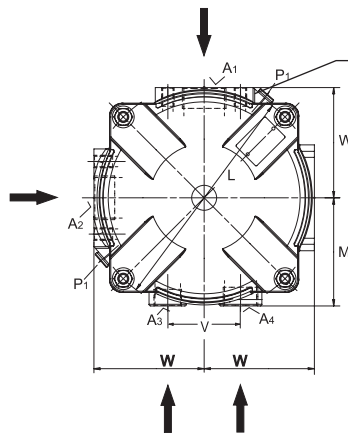
<sup>1</sup> Connection G1 (A4) with locking screw    <sup>2</sup> On request an outlet diffuser can be combined with an extension pipe

## Dimensions

Version with 4 connections

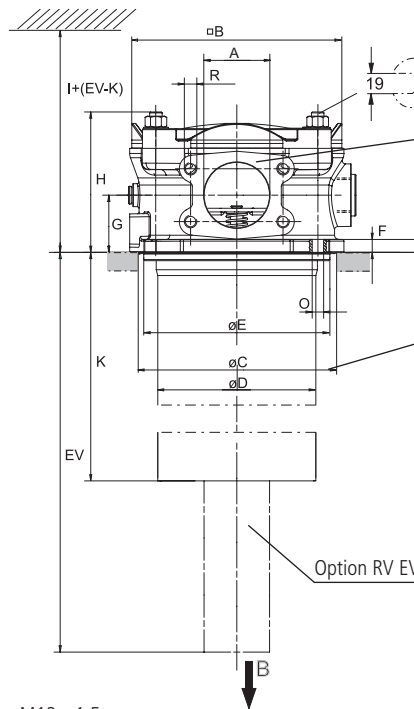


Tank surface sealing  
with O-ring N007.1806  
(included in basic equipment)



Connection M12 x 1,5  
for clogging indicator  
standard  
(mounting holes for  
differential pressure  
switches on request)

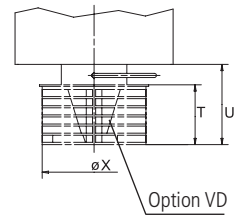
Version with 2 connections



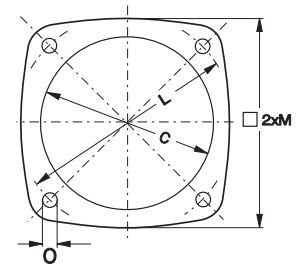
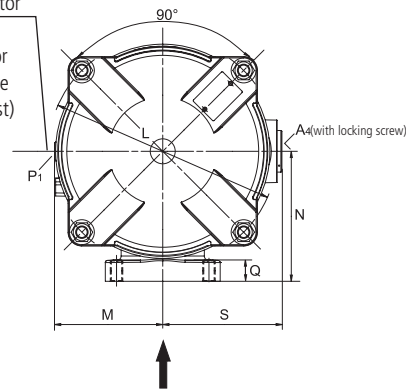
For use of SAE-flanges  
see measurement G or Z

Dia hole  
in reservoir

Option RV EV



Required mounting surface



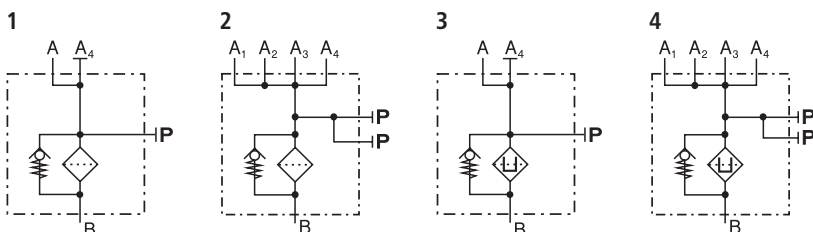
For calculation of EV see Selection Chart

## Measurements

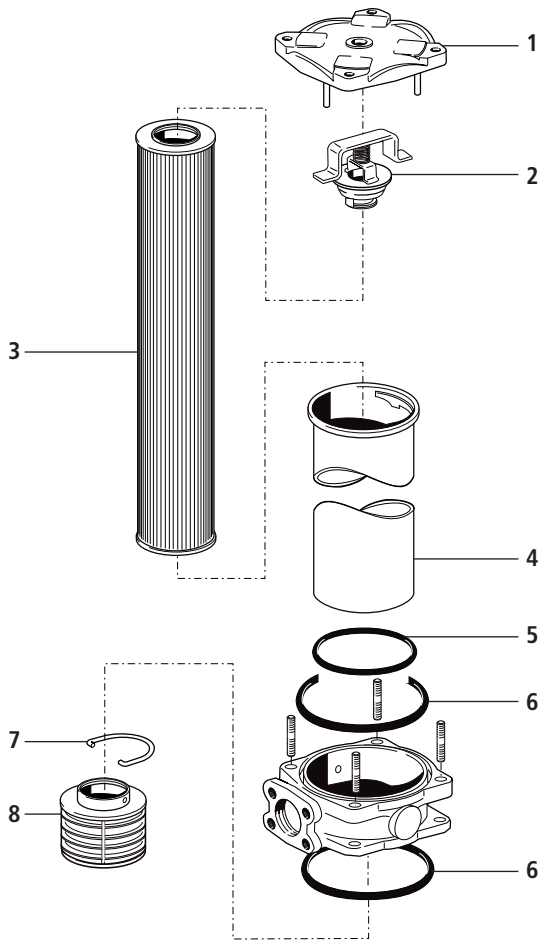
Type	A	B	C	D	E	F	G	H	I	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Z
E 303	see	182	180	152	179	12	55	133	400	276	220	104	125	11,5*	113	20	M12	115	58	79	70	106	100	41,5
E 503	Selection	182	180	152	179	12	55	133	550	430	220	104	125	11,5*	113	20	M12	115	58	79	70	106	100	41,5
E 703	Chart	182	180	152	179	12	55	133	810	636	220	104	125	11,5*	113	20	M12	115	58	79	70	106	100	41,5

\* for M10

## Symbols



## Spare Parts



Pos.	Designation	Part No.
1	Cover assy (2 connections)	E 303.1200
1	Cover (4 connections)	E 703.2202
2	By-pass assy (2,5 bar)	E 703.1510
3	Filter elements	see Chart / col. 9
4	Filter bowl E 303*	E 303.1900
4	Filter bowl E 503*	E 503.1910
4	Filter bowl E 703*	E 703.1900
5	O-ring 145,42 x 5,33	N007.1455
6	O-ring 180 x 6	N007.1806
7	Clip (only option VD)	N026.0311
8	Diffuser (only option VD)	E 703.0701

\* Please indicate options (VD, VDEV resp. RVEV)

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

**ISO 2942**  
**ISO 3968**  
**ISO 16889**

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

Various quality controls during the production process guarantee the leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

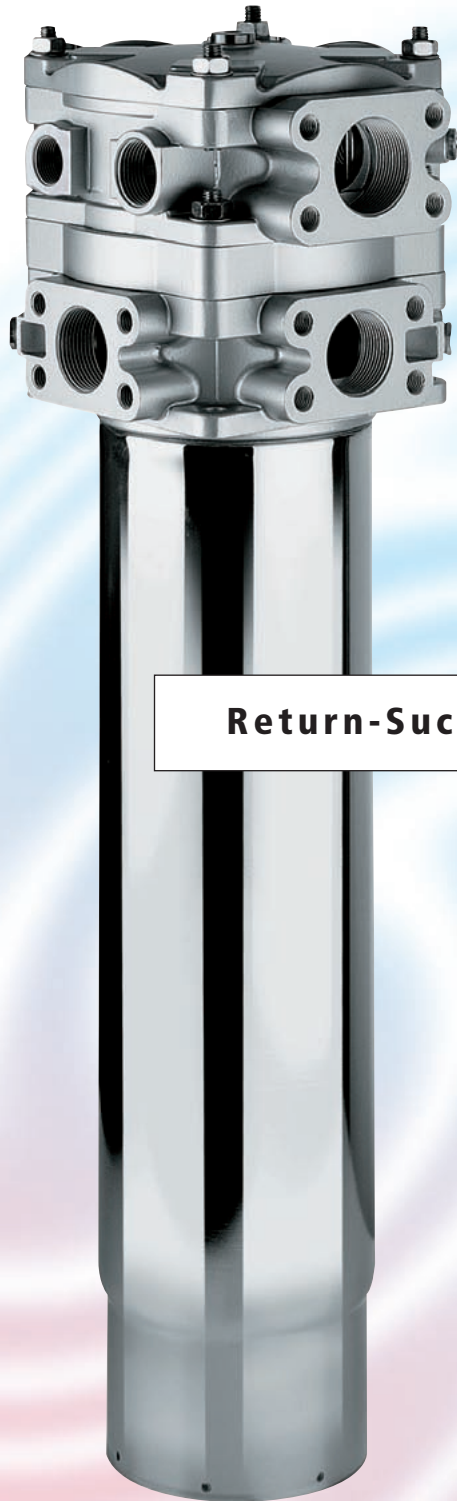
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## Return-Suction Filters

### E 328 • E 498

- Tank top mounting
- Connection up to G1½ and SAE 2
- Nominal flow rate up to 600 l/min

## Description

### Application

For operation in units with hydrostatic drives, when the return flow is under all operating conditions higher than the oil flow of the boost pump.

### Performance features

Protection against wear:	By means of filter elements that, in fullflow filtration, meet even the highest demands regarding cleanliness classes.
Suction filter function:	Because of the 100%-filtration of the suction flow, no dirt can get into the boost pump.
Return filter function:	By means of full-flow filtration in the system return, the pumps above all are protected from dirt particles remaining in the system after assembly, repairs, or which are generated by wear or enter the system from outside.

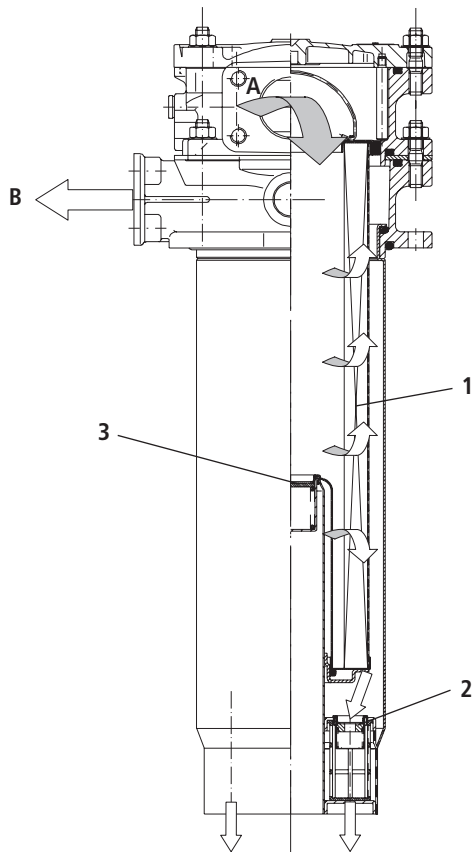
### Functional characteristics

The hydraulic oil returning from the circuit (A) passes the filter element (1), is pressurized by a 0,5 bar check valve (2) and supplied to the boost pump (B). The surplus oil flows filtered over the integral check valve into the reservoir.

As the boost pump is always feeded with pressurized oil the risk of cavitation is minimized and full performance is available even during the critical cold start phase.

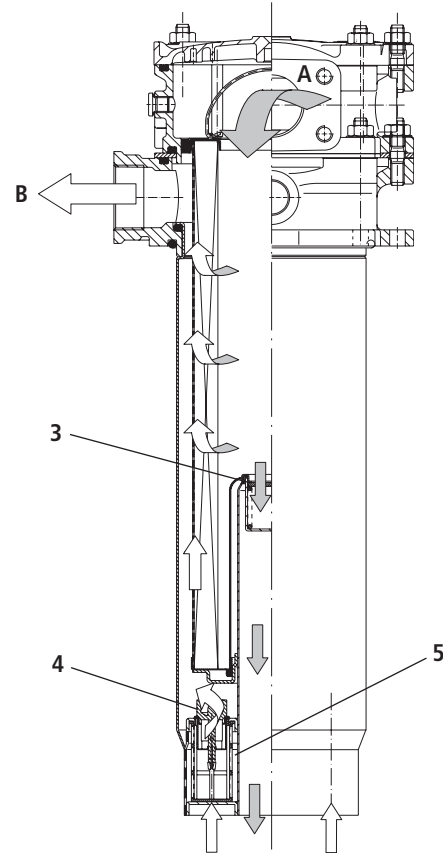
An integral pressure relief valve (3) prevents too high back pressure and protects the shaft seals against damages. As this valve leads the oil directly into the tank there is no direct connection between the return line (A) and the con-nection of the boost pump (B) (no bypass valve function).

Function (schematic):



The emergency-suction valve (4) with 300 µm protection strainer (5) supplies the boost pump in case of a short term of lack of oil. During normal operation, a lack of oil may definitely not occur (refer to „Design“ section).

Emergency-suction (schematic):



### Start up / Deaeration

For units with emergency-suction valve and protection strainer the start up set E 328.1700 can be used to de-aerate the hydraulic system at first start up or at start up after repair; hereby the immediate supply of the boost pump with hydraulic oil is guaranteed.

For all other types, deaerating instructions published by the manufacturers of hydraulic drives must be observed.

### Filter maintenance

By using a clogging indicator the correct moment for maintenance is indicated and guarantees therefore the optimum utilization of the filter elements.

### Filter elements

Flow direction from centre to the outside. The star-shaped pleating of the filter material results in:

- large filter surfaces
- low pressure drop
- high dirt-holding capacities
- long service life

Dirt deposits are entirely removed when the element is changed. Dirt cannot re-enter the tank.

### Accessories

Electrical and optical clogging indicators are available. Dimensions and technical data see catalogue sheet 60.20.

# Layout

## General

In machines with a hydrostatic drive and combined working hydraulic system, suction-return filters replace the suction or pressure filters previously required for the feed pump of the closed-loop hydrostatic drive circuit as well as the return filter for the open-loop working hydraulic circuit. While each circuit operates independently with separate filters, the combination of the two circuits via the suction-return filter causes interaction between the circuits. If the design criteria described below are taken into account, you can take full advantage of the benefits provided by the suction-return filter concept, thus making sure that your system performs reliably even under extreme operating conditions.

## Required return flow in the system

In order to maintain a precharging pressure of approx. 0,5 bar at the intake of the feed pump, the return flow must exceed the suction flow under any operating conditions:

- Versions with hole (Ø 8 mm) in the pressurizing valve: at least 30 l/min of excess flow

## Permitted feed pump flow rate

- at operating temperature ( $v < 60 \text{ mm}^2/\text{s}$ ,  $\text{rpm} = \text{max}$ ):  
feed pump flow rate  $< 0,5 \times$  rated return flow according to column 2 of selection table
- at cold start-up ( $v < 1000 \text{ mm}^2/\text{s}$ ,  $\text{rpm} = 1000 \text{ min}^{-1}$ ):  
feed pump flow rate  $< 0,2 \times$  rated return flow according to column 2 of selection table

Please contact us if your system operates with higher flow rates than stated above.

## Flow velocity in the connecting lines

- Flow velocity in the return lines  $\leq 4,5 \text{ m/s}$
- Flow velocity in the suction lines  $\leq 1,5 \text{ m/s}$

## Permitted pressure in the suction lines

At cold start up ( $v < 1000 \text{ mm}^2/\text{s}$ ,  $\text{rpm} = 1000 \text{ min}^{-1}$ ):  
feed pump flow rate  $\leq 0,2 \times$  rated return flow. The pressure loss in the suction lines must not exceed 0,4 bar.

## Backpressures in system return lines

If drain oil from the hydrostatic drive is routed across the filter in addition to the flow of the open-loop circuit, the following has to be observed in order to protect the shaft seals:

- permitted leakage oil pressure for a given viscosity and speed (manufacturer's specifications!)
- pressure loss caused by the leakage oil pipes
- pressure loss caused by the oil cooler used
- backpressure of the filter for a given flow rate or kinematic viscosity (refer to pressure loss diagrams)

Depending on the application, the use of a cooler bypass valve is recommended.

Generously sized drain oil pipes are also of advantage.

## Filter fineness grades

With the filter fineness grades available, the following oil cleanliness according to ISO 4406 can be achieved:

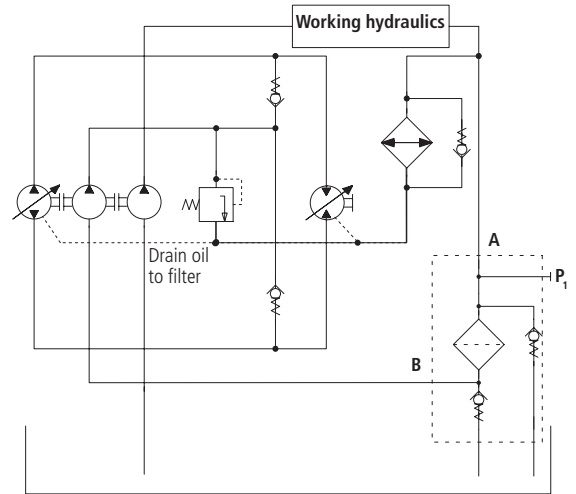
- 12 E-X: 18/15/12 ... 15/12/8
- 16 E-X: 20/17/12 ... 17/14/10

Even with the 16 E-X filter fineness grade, the requirements specified by manufacturers of hydrostatic drives are sometimes exceeded significantly.

If components requiring a still better oil purity are used, we recommend the 12 E-X filter fineness grade.

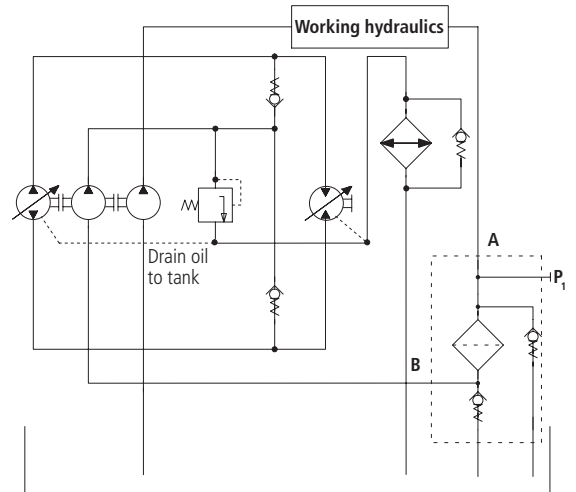
## Suggested circuit layouts

A) The leakage oil of the hydrostatic drive is routed across the filter.



The entire dirt produced in the hydrostatic drive by abrasion is filtered out immediately and is thus not taken in by the pump of the open-loop circuit. This circuit layout is always recommended if the return flow only slightly exceeds the suction flow, i.e. if there is a risk that the 0,5 bar precharging pressure cannot be maintained.

B) The drain oil of the hydrostatic drive is not routed across the filter but is discharged directly into the tank.



This circuit layout has the advantage that drain oil pressures are comparatively low.

## Characteristics

### Nominal flow rate

Up to 600 l/min in return line (see Selection Chart, column 2)

Up to 300 l/min feed pump flow rate (see Layout)

The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the return lines  $\leq 4,5 \text{ m/s}$
- flow velocity in the suction lines  $\leq 1,5 \text{ m/s}$

### Connection

Threaded ports according to ISO 228 or DIN 13 and SAE flange (3000 psi).

Sizes see Selection Chart, column 6 (other port threads on request)

### Filter fineness

12  $\mu\text{m(c)}$  ... 16  $\mu\text{m(c)}$

$\beta$ -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 or HETG, see info sheet 00.20)

### Temperature range

- 30 °C ... + 100 °C (temporary - 40 °C ... + 120 °C)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$

- as starting viscosity:  $v_{\text{max}} = 1200 \text{ mm}^2/\text{s}$

- at first 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.

### Operating pressure

Max. 10 bar

### Materials

Screw-on cap: Aluminium alloy

Filter head: Aluminium alloy

Filter bowl: Steel

Seals: NBR (Viton on request)

Filter media: EXAPOR®MAX - inorganic multi-layer microfibre web

### Fitting position

Up to 15° from the vertical, preferably vertical

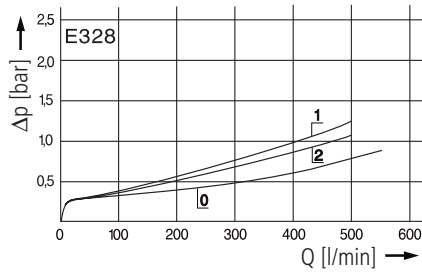
Even under unfavourable operating conditions (min. oil level, max. sloping) the oil outlet resp. emergency suction has to be below the oil level.

## Diagrams

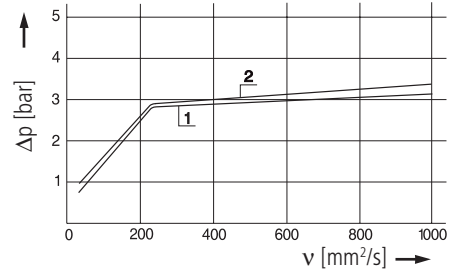
### $\Delta p$ -curves for complete filters in Selection Chart, column 3

**D1**

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

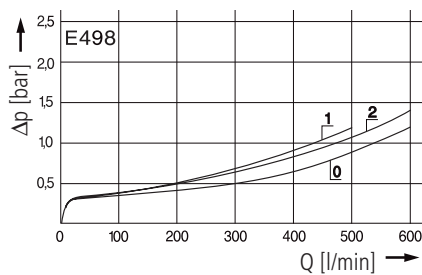


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

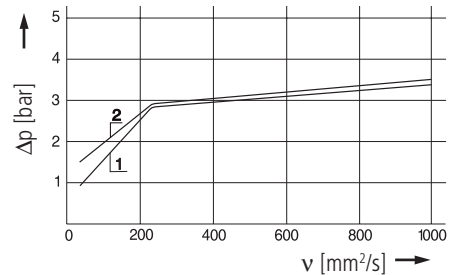


**D2**

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



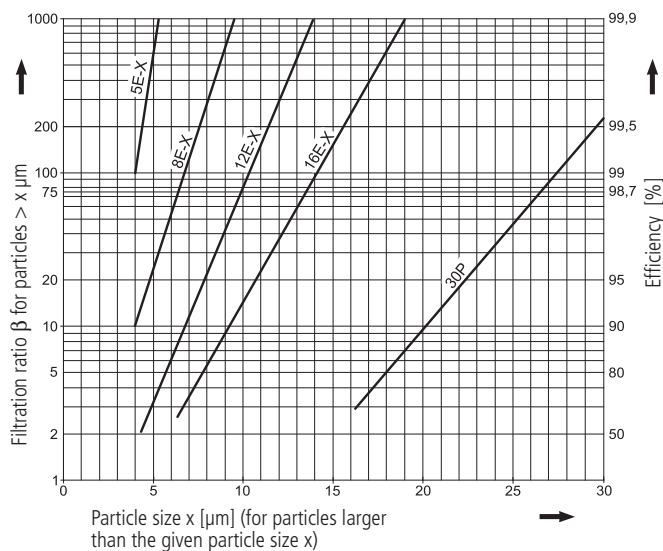
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



### 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



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

**For EXAPOR®MAX- and Paper elements:**

<b>5 E-X</b>	$= \beta_{5(c)} = 200$	EXAPOR®MAX
<b>8 E-X</b>	$= \beta_{8(c)} = 200$	EXAPOR®MAX
<b>12 E-X</b>	$= \beta_{12(c)} = 200$	EXAPOR®MAX
<b>16 E-X</b>	$= \beta_{16(c)} = 200$	EXAPOR®MAX
<b>30 P</b>	$= \beta_{30(c)} = 200$	Paper

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

For special applications, finenesses differing from these curves are also available by using special composed filter material.

## Selection Chart

[illegible]

All filters are delivered with plugged clogging indicator connections M 12 x 1,5 (Mounting holes for differential pressure switches on request). As clogging indicators on the return side (P<sub>1</sub>) either manometers or electrical pressure switches can be used. The monitoring of the vacuum on the suction side (P<sub>2</sub>) is additionally possible.

**Order example:** The filter E 328-256 has to be supplied with 2 x 4 connections ( $A_1 \dots A_4, B_1 \dots B_4$ ).

**Order description:**

E 328- 2 56

**Connections:**

2 various options are available:

2 x 2 connections (A and A<sub>1</sub>, B and B<sub>1</sub>) - G 1 1/2 / SAE 2 + G 1 (with locking screw) — 1

2 x 4 connections (A<sub>1</sub> ... A<sub>4'</sub> B<sub>1</sub> ... B<sub>4</sub>) - 2 x G 1¼ / SAE 1½, G ¾ + G 1 (SAE 2 on request)

For the appropriate clogging indicator see catalogue sheet 60.20.

## Remarks:

- The start of the red area respectively the switching pressure of the electrical pressure switch has always to be lower than the cracking pressure of the pressure relief valve (see Selection Chart, column 9).
- The clogging indicators are optional and always delivered detached from the filter.
- The filters listed in this chart are standard filters. If modifications are required, we kindly ask for your request.
- For deaeration a start up set is available with Part-No. E 328.1700, technical details see catalogue sheet 20.890.

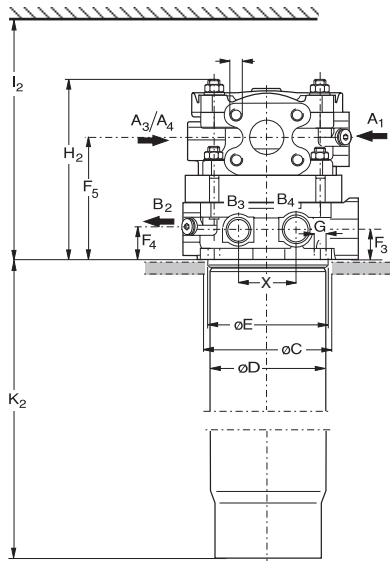
<sup>1</sup> Cracking pressure of check valve<sup>2</sup> Cracking pressure of pressure relief valve

<sup>3</sup> with hole Ø 8 mm in the check valve for oil drain when opening the filter cover

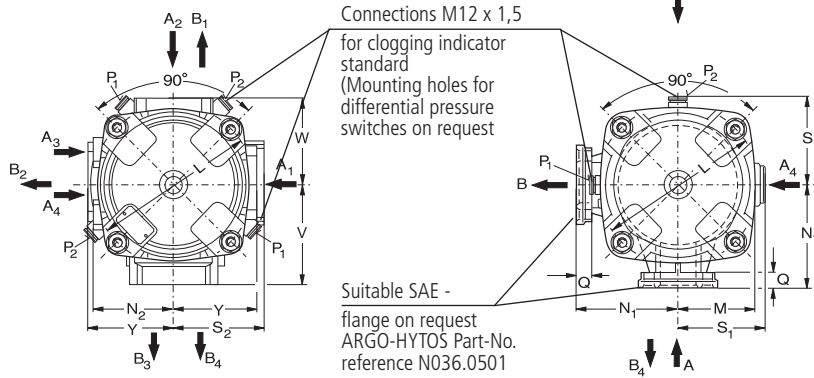
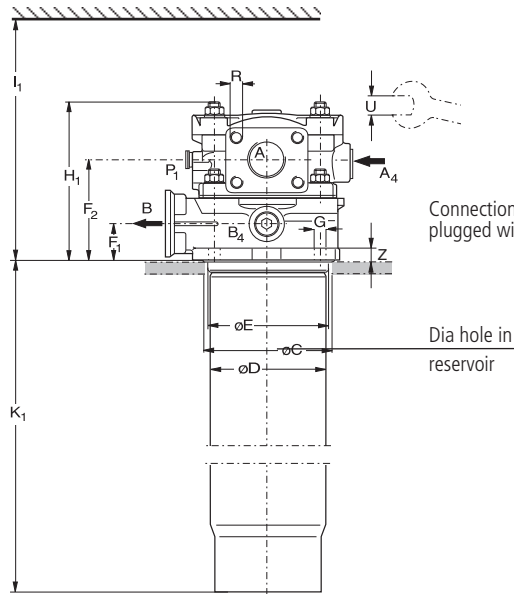
<sup>4</sup> with emergency-suction valve and protection strainer (300  $\mu\text{m}$ )

## Dimensions

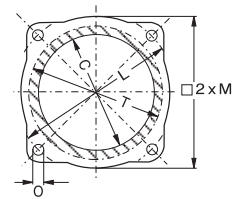
Version with 2 x 4 connections



Version with 2 x 2 connections



Port sizes and mounting face  
(O-ring area of support hatched)



Tank surface sealing with  
O-ring N007.1375  
(included in basic equipment)

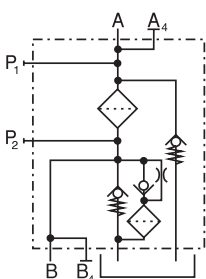
## Measurements

Type	A			B			C	D	E	F <sub>1</sub>	F <sub>2</sub> *	F <sub>3</sub> *	F <sub>4</sub>	F <sub>5</sub>	G	H <sub>1</sub>	H <sub>2</sub>	I <sub>1</sub>	I <sub>2</sub>
E 328	s. Selection Chart			s. Selection Chart			140,5	138	139,9	36	104,5	32	35	126	11,5	165	185	540	565
E 498	s. Selection Chart			s. Selection Chart			140,5	138	139,9	36	104,5	32	35	126	11,5	165	185	750	780
Type	K <sub>1</sub>	K <sub>2</sub>	L	M	N <sub>1</sub>	N <sub>2</sub>	O	Q	R	S <sub>1</sub>	S <sub>2</sub>	T	U	V	W	X	Y	Z	
E 328	425	403	185	86,5	116	89	M10	18	M12	99	109	160	17	106	102	70	98	12	
E 498	630	605	185	86,5	116	89	M10	18	M12	99	109	160	17	106	102	70	98	12	

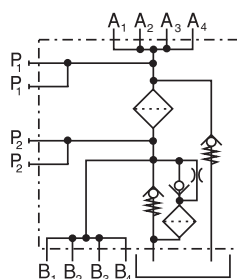
\*For use of SAE-flanges see this measurement

## Symbols

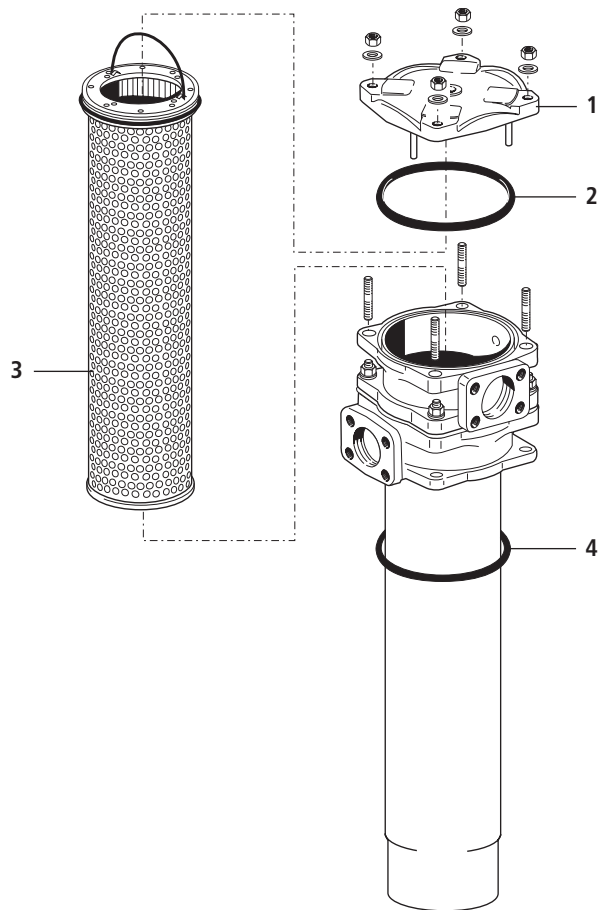
1



2



## Spare Parts



Pos.	Designation	Part No.
1	Cover assy	E 443.1225
2	O-ring 151,76 x 5,33	N 007.1525
3	Filter elements	see Chart / col. 10
4	O-ring 136,5 x 5,34	N 007.1375

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

<b>ISO 2942</b>	Verification of fabrication integrity (Bubble Point Test)
<b>ISO 3968</b>	Evaluation of pressure drop versus flow characteristics
<b>ISO 16889</b>	Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

Various quality controls during the production process guarantee the leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

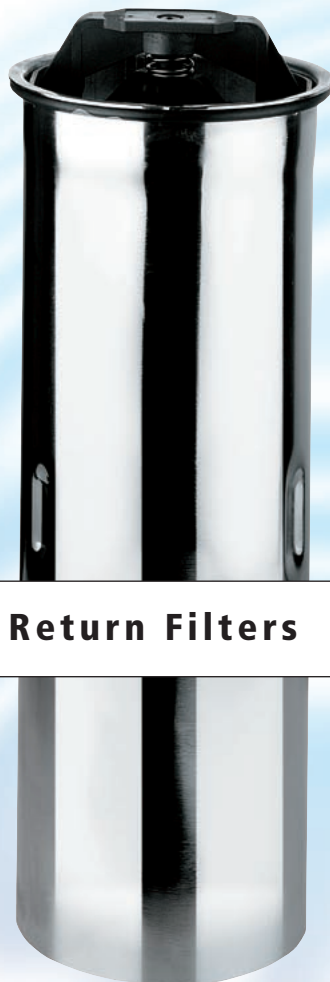
Illustrations may sometimes differ from the original. ARGO-HYTOS is not responsible for any unintentional mistake in this specification sheet.



### We produce fluid power solutions

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**Return Filters**

**E 440 • E 450 • E 460  
E 640 • E 700**

- Tank mounting
- Nominal flow rate up to 680 l/min

## Description

### Application

In the return line circuits of hydraulic systems.

### Performance features

Protection

against wear: By means of filter elements that, in full-flow filtration meet even the highest demands regarding cleanliness classes.

Protection against

malfunction: By means of full-flow filtration in the system return, the pumps above all are protected from dirt particles remaining in the system after assembly, repairs, or which are generated by wear or enter the system from outside.

### Special features

Installation: Installation directly into a separate tank section for the return oil. This solution allows a number of return line connections and does not show any restriction by a filter head.

By-pass valve: The location close to the inlet port prevents dirt particles retained by the filter element from entering into the clear oil side.

Removable bowl: In case of maintenance the filter bowl is removed together with the filter element - therefore dirt particles are not flushed back into the tank.

### Filter elements

Flow direction from outside to centre. The star-shaped pleating of the filter material results in:

- large filter surfaces
- high dirt-holding capacities
- low pressure drop
- 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

Filter bowl: Steel

Seals: NBR (Viton on request)

Filter media: EXAPOR®MAX - inorganic multi-layer microfibre web  
Paper - cellulose web, impregnated with resin

### Accessories

Extension pipes and diffusers are available on the bowl outlet.

Extension pipe: A correct extension pipe length ensures oil outlet below minimum oil level and prevents foaming.

Diffusers: Diffusers reduce oil velocity and direct the oil to 90° outlet flow. This function prevents also oil foaming and whirling up of solid particles settled at the tank bottom. The mesh screen element filters the oil in case of an open by-pass valve.

Electrical and optical clogging indicators are available.  
Dimensions and technical data see catalogue sheet 60.20.

## Characteristics

### Nominal flow rate

Up to 680 l/min (see Selection Chart, column 2)

The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the connection lines  $\leq 4,5 \text{ m/s}$

### Installation

Tank immersed installation in a separate return oil chamber of the reservoir.

### Filter fineness

12  $\mu\text{m(c)}$  ... 30  $\mu\text{m(c)}$

$\beta$ -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)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$

- as starting viscosity:  $v_{\text{max}} = 1200 \text{ mm}^2/\text{s}$

- at first 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.

### Operating pressure

Max. 10 bar

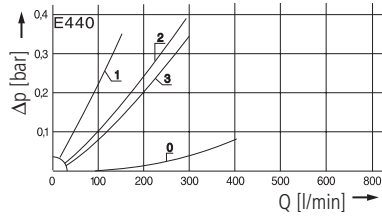
### Mounting position

Preferably vertical, outlet downwards

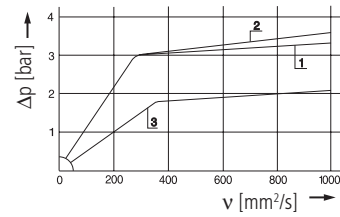
## Diagrams

### $\Delta p$ -curves for complete filters in Selection Chart, column 3

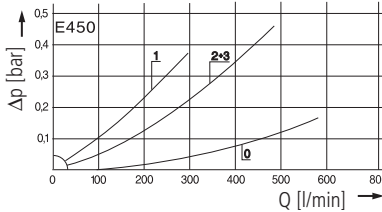
**D1** Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$  (0=casing empty)



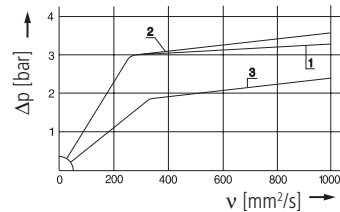
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



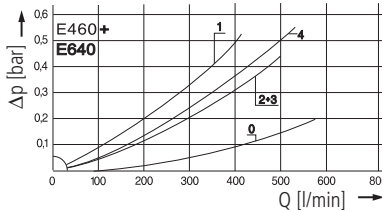
**D2** Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$  (0=casing empty)



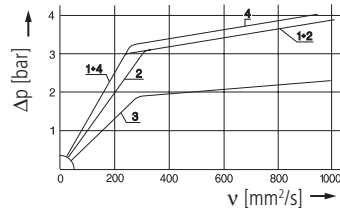
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



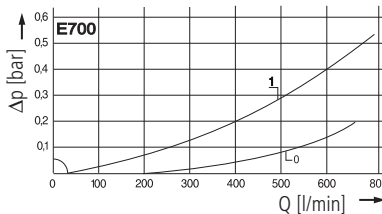
**D3** Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$  (0=casing empty)



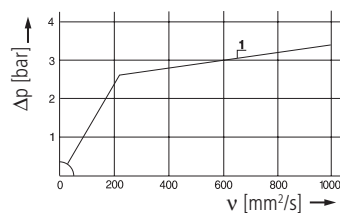
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



**D4** Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$  (0=casing empty)

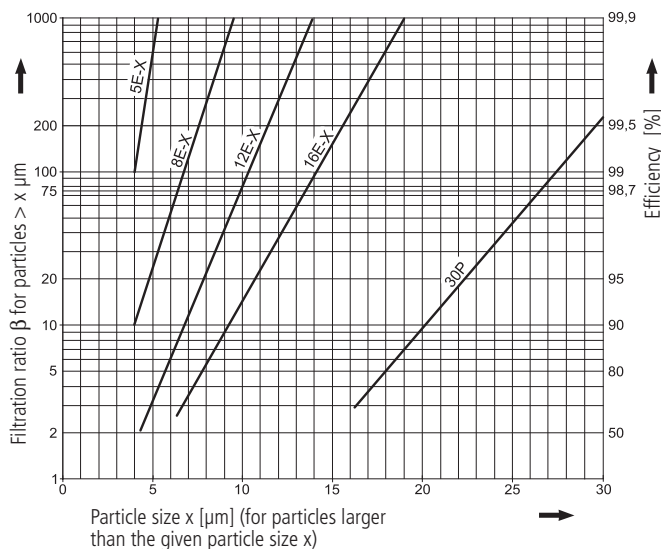


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



### 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



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

#### For EXAPOR®MAX- and Paper elements:

- 5 E-X** =  $\beta_{5(c)} = 200$  EXAPOR®MAX
- 8 E-X** =  $\beta_{8(c)} = 200$  EXAPOR®MAX
- 12 E-X** =  $\beta_{12(c)} = 200$  EXAPOR®MAX
- 16 E-X** =  $\beta_{16(c)} = 200$  EXAPOR®MAX
- 30 P** =  $\beta_{30(c)} = 200$  Paper

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

#### For screen elements:

- 40 S** = screen material with mesh size 40  $\mu\text{m}$
- 60 S** = screen material with mesh size 60  $\mu\text{m}$
- 100 S** = screen material with mesh size 100  $\mu\text{m}$

Tolerances for mesh size according to DIN 4189.

For special applications, finenesses differing from these curves are also available by using special composed filter material.

## Selection Charts

Part No.	Nominal flow	Pressure drop see Diagram D/curve no.	Filter fineness see Diagram D <sub>x</sub>	Dirt-holding capacity	connection A	Cracking pressure of by-pass	Symbol	Replacement filter element Part No.	Weight	Remarks
1	l/min	3	4	g	6	7	8	9	10	11
E 440-156	130	D1/1	12 E-X	53	-	2,5	1	V2.1217-36	2,4	-
E 440-168	210	D1/2	16 E-X	57	-	2,5	1	V2.1217-08	2,4	-
E 440-153	175	D1/3	30 P	29	-	1,5	1	P2.1217-21*	2,4	-
E 450-156	260	D2/1	12 E-X	106	-	2,5	1	2 x V2.1217-36	4,1	-
E 450-168	410	D2/2	16 E-X	114	-	2,5	1	2 x V2.1217-08	4,1	-
E 450-153	350	D2/3	30 P	58	-	1,5	1	2 x P2.1217-21*	4,1	-
E 460-156	390	D3/1	12 E-X	159	-	2,5	1	3 x V2.1217-36	5,8	-
E 460-168	500	D3/2	16 E-X	171	-	2,5	1	3 x V2.1217-08	5,8	-
E 460-153	480	D3/3	30 P	87	-	1,5	1	3 x P2.1217-21*	5,8	-
E 640-76	550	D3/4	12 E-X	210	-	3,0	1	V2.1260-26	7,5	-
E 700-156	680	D4/1	12 E-X	270	-	2,5	1	V2.1460-26	12,4	-

As clogging indicators either manometers or electrical pressure switches can be used. Filters can also be supplied with an outlet diffuser. Optional extension pipes adapt the filter length to various tank depths. For ordering of accessories please use the below mentioned codes.

**Order example: The filter E 450-156 has to be supplied with an outlet diffuser and an extension pipe for 580 mm length.**

**Order description:** E 450-156 / VD / EV 580

**Part No. (Basic unit)**

### Options

**Two various options are available**

VD: Outlet diffuser, RV: Extension pipe

### Extension pipes:

7 various lengths are available

E 440 / E 450 / E 460 / E 640

EV = K + 81 / + 136 / + 196 / + 231 / + 356 / + 446 / + 626 mm (see section dimensions and measurements)

E 700

EV on request.

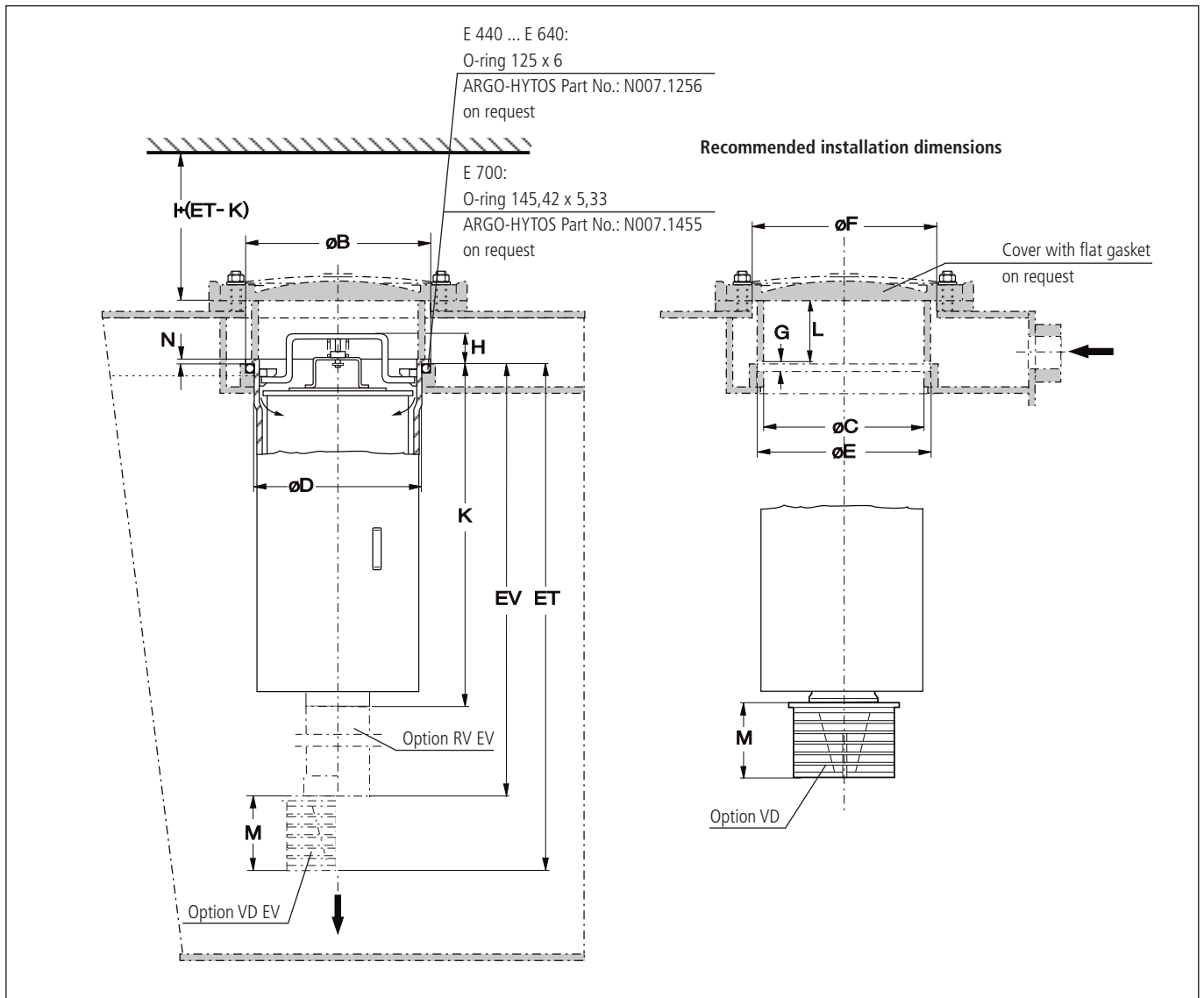
**For the appropriate clogging indicators see catalogue sheet 60.20.**

### Remarks:

- The switching pressure of the electrical pressure switch has always to be lower than the cracking pressure of the by-pass valve (see Selection Chart, column 7).
- The clogging indicators are optional and always delivered detached from the filter.
- The filters listed in this chart are standard filters. Other designs e.g. with screen elements (mesh size 450 µm) at the bowl outlet, are available on request.

\* Paper media supported with metal gauze

## Dimensions



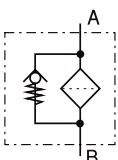
## Measurements

Type	A	B	C	D	E	F	G	H	I	K	L	M	N
E 440	-	142 <sup>+2</sup>	132	130,5	145	>145	6,5	26	250	217	48	58	1,5
E 450	-	142 <sup>+2</sup>	132	130,5	145	>145	6,5	26	410	384	48	58	1,5
E 460	-	142 <sup>+2</sup>	132	130,5	145	>145	6,5	26	580	552	48	58	1,5
E 640	-	142 <sup>+2</sup>	132	130,5	145	>145	6,5	26	680	650	48	58	1,5
E 700	-	167 <sup>+2</sup>	156,5	155	170	>170	6,5	27	700	651	82	58	1,5

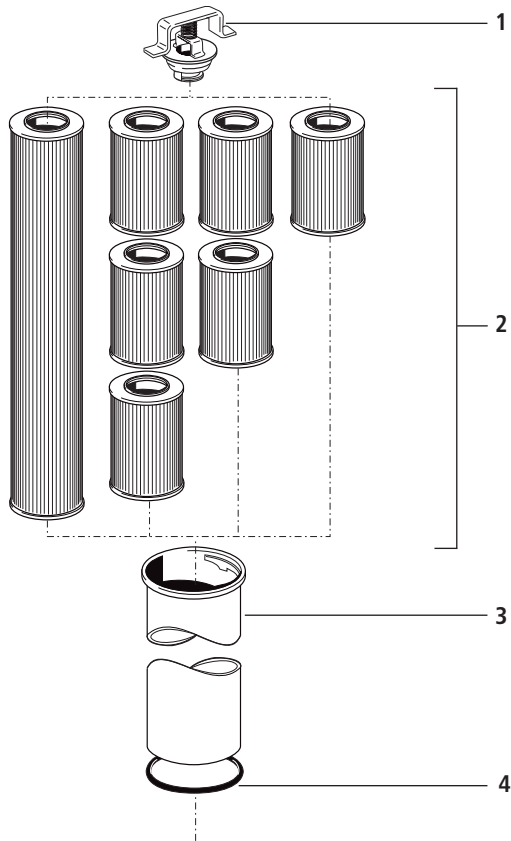
For calculation of EV use data in Selection Chart

## Symbols

1



## Spare Parts



Pos.	Designation	Part No.
1	By-pass assy (1,5 bar)	E 440.1500
1	By-pass assy (2,5 bar)	E 460.1520
1	By-pass assy (3,0 bar)	E 640.1510
1	By-pass assy (2,5 bar) for E 700	E 703.1510
2	Filter elements	see Chart. / col. 9
3	Filter bowl E 440 <sup>1</sup>	E 440.1960
3	Filter bowl E 450 <sup>1</sup>	E 450.1906
3	Filter bowl E 460 <sup>1</sup>	E 460.1915
3	Filter bowl E 640 <sup>1</sup>	E 640.1910
3	Filter bowl E 700	E 700.1900
4.1	O-ring 125 x 6 <sup>2</sup>	N 007.1256
4.2	O-ring 145,42 x 5,33 <sup>2</sup> for E 700	N 007.1455

<sup>1</sup> Please indicate options (VD, VDEV resp. RVEV)

<sup>2</sup> Not included in basic equipment

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

### ISO 2942 ISO 3968 ISO 16889

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

Various quality controls during the production process guarantee the leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

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



### We produce fluid power solutions

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## **Return Filters**

**E 443 • E 453 • E 463  
E 643**

- Tank top mounting
- Connection up to SAE 2
- Nominal flow rate up to 550 l/min

## Description

### Application

In the return line circuits of hydraulic systems.

### Performance features

Protection against wear:	By means of filter elements that, in full-flow filtration, meet even the highest demands regarding cleanliness classes.
Protection against malfunction:	By means of full-flow filtration in the system return, the pumps above all are protected from dirt particles remaining in the system after assembly, repairs, or which are generated by wear or enter the system from outside.

### Special features

By-pass valve:	The location close to the inlet port prevents dirt particles retained by the filter element from entering into the clear oil side.
Removable bowl:	In case of maintenance the filter bowl is removed together with the filter element - therefore dirt particles are not flushed back into the tank.

### Filter elements

Flow direction from outside to centre. The star-shaped pleating of the filter material results in:

- large filter surfaces
- low pressure drop
- high dirt-holding capacities
- long service life

In filters with a magnetic system, the ferromagnetic particles in the fluid pass first through a strong magnetic field and are separated.

### Filter maintenance

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

### Materials

Filter head cover:	Aluminium alloy
Filter head:	Aluminium alloy
Filter bowl:	Steel
Seals:	NBR (Viton on request)
Filter media:	EXAPOR®MAX - inorganic multi-layer microfibre web Paper - cellulose web, impregnated with resin Stainless steel wire mesh (1.4301)

### Accessories

Extension pipes and diffusers are available on the bowl outlet.	
Extension pipe:	A correct extension pipe length ensures oil outlet below minimum oil level and prevents foaming.
Diffuser:	Diffusers reduce oil velocity and direct the oil to 90° outlet flow. This function prevents also oil foaming and whirling up of solid particles settled at the tank bottom. The mesh screen element filters the oil in case of an open by-pass valve. Electrical and optical clogging indicators are available. Dimensions and technical data see catalogue sheet 60.20.

## Characteristics

### Nominal flow rate

Up to 550 l/min (see Selection Chart, column 2)

The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the connection lines  $\leq 4,5 \text{ m/s}$

### Connection

Threaded ports according to ISO 228 or DIN 13 and SAE-flange (3000 psi). Sizes see Selection Chart, column 6 (other port threads on request)

### Filter fineness

5  $\mu\text{m(c)}$  ... 60  $\mu\text{m(c)}$

$\beta$ -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)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$
- as starting viscosity:  $v_{\text{max}} = 1200 \text{ mm}^2/\text{s}$
- at first 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.

### Operating pressure

Max. 10 bar

### Mounting position

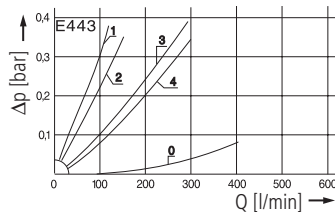
Preferably vertical, outlet downwards

## Diagrams

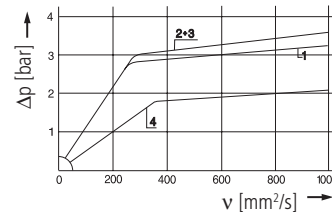
### $\Delta p$ -Kennlinien für die Kompletfilter in der Auswahltabelle, Spalte 3

**D1**

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

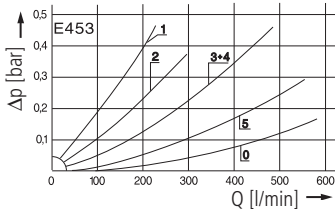


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

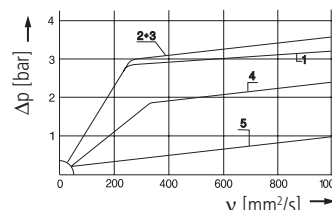


**D2**

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

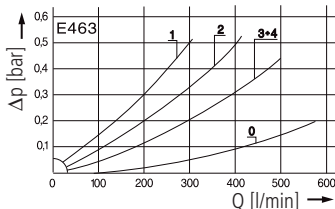


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

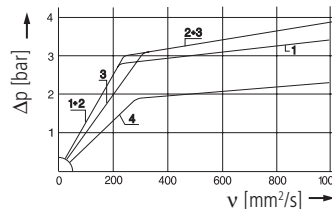


**D3**

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

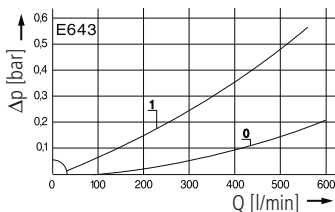


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

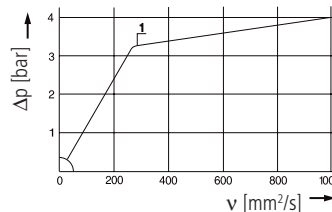


**D4**

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



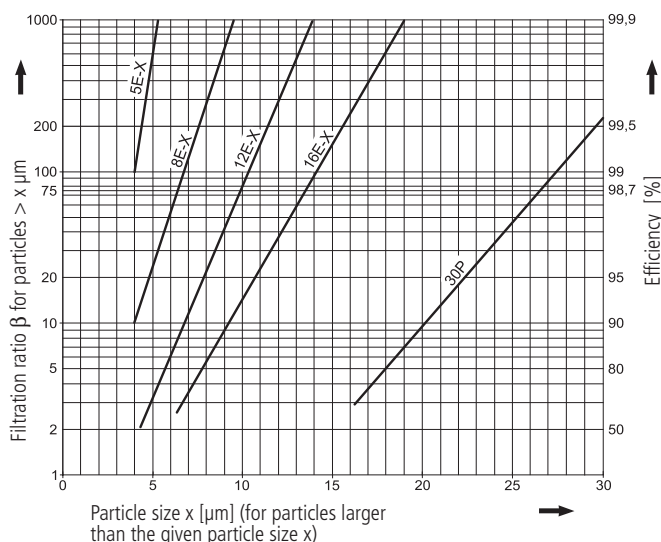
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



### 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



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

**For EXAPOR®MAX- and Paper elements:**

- 5 E-X** =  $\beta_{5(c)} = 200$  EXAPOR®MAX
- 8 E-X** =  $\beta_{8(c)} = 200$  EXAPOR®MAX
- 12 E-X** =  $\beta_{12(c)} = 200$  EXAPOR®MAX
- 16 E-X** =  $\beta_{16(c)} = 200$  EXAPOR®MAX
- 30 P** =  $\beta_{30(c)} = 200$  Paper

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

**screen elements:**

- 40 S** = screen material with mesh size 40  $\mu\text{m}$
- 60 S** = screen material with mesh size 60  $\mu\text{m}$
- 100 S** = screen material with mesh size 100  $\mu\text{m}$

Tolerances for mesh size according to DIN 4189

For special applications, finenesses differing from these curves are also available by using special composed filter media.

## Selection Chart

Part No.	Nominal flow	Pressure drop see Diagram D	Filter fineness see Diagram D	Dirt-holding capacity	Filter surface in ( )	Connection A	Cracking pressure of by-pass	Replacement filter element	Weight	Remarks
	l/min			g		bar			kg	
1	2	3	4	5	6	7	8	9	10	11
E 443-159	85	D1/1	5 E-X	34	G1½ / SAE2	2,5	1	V2.1217-03	4,4	-
E 443-156	130	D1/2	12 E-X	53	G1½ / SAE2	2,5	1	V2.1217-36	4,4	-
E 443-168	210	D1/3	16 E-X	57	G1½ / SAE2	2,5	1	V2.1217-08	4,4	-
E 443-181	175	D1/4	30 P	29	G1½ / SAE2	1,5	1	P2.1217-21*	4,4	-
E 453-159	170	D2/1	5 E-X	68	G1½ / SAE2	2,5	1	2 x V2.1217-03	6,1	-
E 453-156	260	D2/2	12 E-X	106	G1½ / SAE2	2,5	1	2 x V2.1217-36	6,1	-
E 453-168	410	D2/3	16 E-X	114	G1½ / SAE2	2,5	1	2 x V2.1217-08	6,1	-
E 453-153	350	D2/4	30 P	58	G1½ / SAE2	1,5	1	2 x P2.1217-21*	6,1	-
E 453-100	525	D2/5	60 S	(3600 cm²)	G1½ / SAE2	1,5	4	2 x S2.1217-00	6,4	with magnetic system
E 463-159	250	D3/1	5 E-X	102	G1½ / SAE2	2,5	1	3 x V2.1217-03	7,8	-
E 463-156	390	D3/2	12 E-X	159	G1½ / SAE2	2,5	1	3 x V2.1217-36	7,8	-
E 463-168	500	D3/3	16 E-X	171	G1½ / SAE2	2,5	1	3 x V2.1217-08	7,8	-
E 463-153	480	D3/4	30 P	87	G1½ / SAE2	1,5	1	3 x P2.1217-21*	7,8	-
E 643-176	550	D4/1	12 E-X	210	G1½ / SAE2	3,0	1	V2.1260-26	9,5	-

All filters are delivered with a plugged clogging indicator connection M12 x 1,5. (Mounting holes for differential pressure switches on request). As clogging indicators either manometers or electrical pressure switches can be used. Two different head pieces with three various connecting options are available. All filters can also be supplied with an outlet diffuser. Optional extension pipes adapt the filter length to various tank depths. For ordering of accessories please use the below mentioned codes.

**Order example:** The filter E 453-156 has to be supplied with 2 connections (A and A3), an outlet diffuser and an extension pipe for 564 mm length.

### Order description:

E 453-2 56 / VD / EV 564

### Connections:

3 various options are available

one connection (A)

- G1½ / SAE 2 ————— 1

two connections (A and A3)

- G1½ / SAE 2 and G¾ ————— 2

four connections (A1, A2, A3 and A4)

- 2 x G1¼ / SAE 1½, G¾ and G1 ————— 4

### Options:

2 various options are available

**VD:** Outlet diffuser, **RV:** Extension pipe

### Extension pipe:

7 various lengths are available

EV = K (Bowl length) + 81 / + 136 / + 196 / + 231 / + 356 / + 446 / + 626 mm (see section dimensions and measurements)

**For the appropriate clogging indicators see catalogue sheet 60.20.**

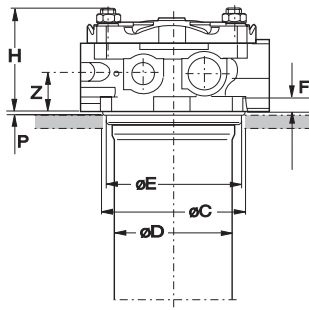
### Remarks:

- The switching pressure of the electrical pressure switch has always to be lower than the cracking pressure of the by-pass valve (see Selection Chart, column 7).
- The clogging indicators are optional and always delivered detached from the filter.
- The filters listed in this chart are standard filters. Other designs, e.g. with screen elements (mesh size 450 µm) at the bowl outlet, are available on request.

\* Paper media supported with metal gauze

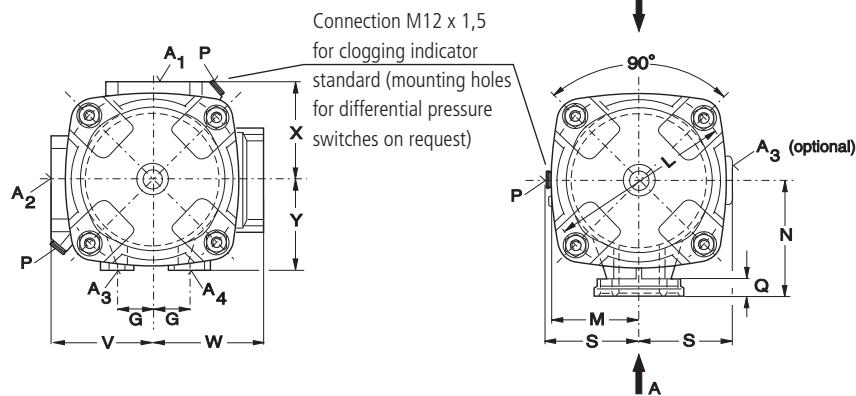
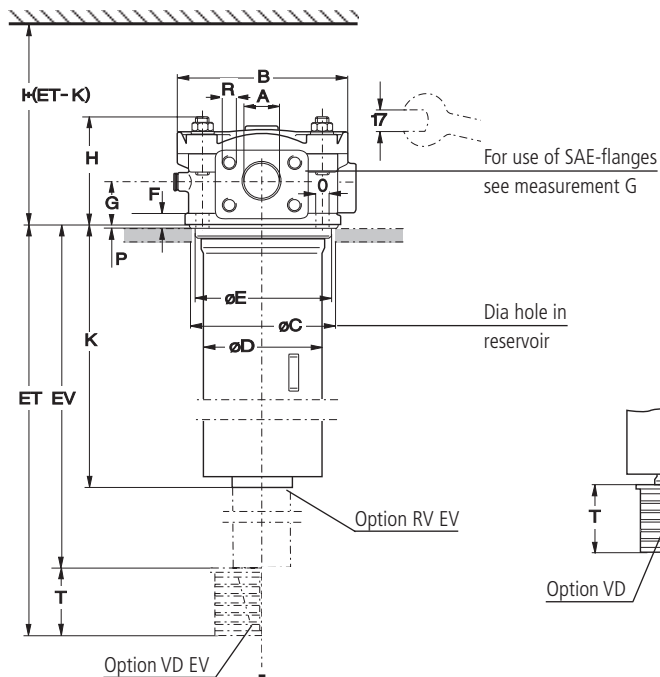
## Dimensions

Version with 4 connections

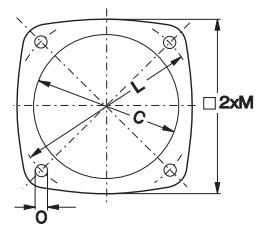


Tank surface sealing either with flat gasket E442.0103 or O-ring N007.1375 (both items included in basic equipment)

Versions with 1 or 2 connections



Required mounting surface



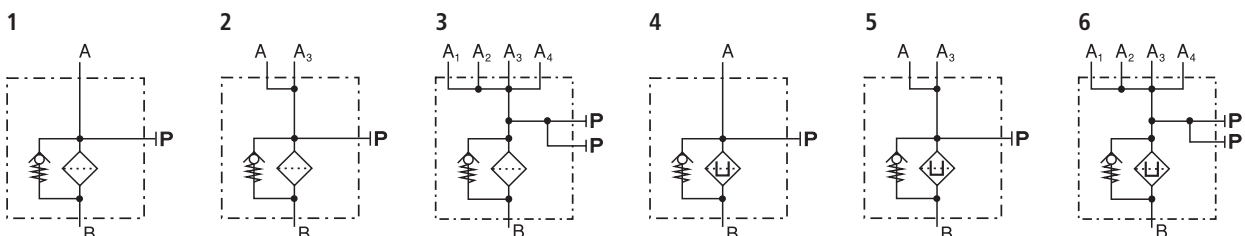
For calculation of EV see Selection Chart

## Measurements

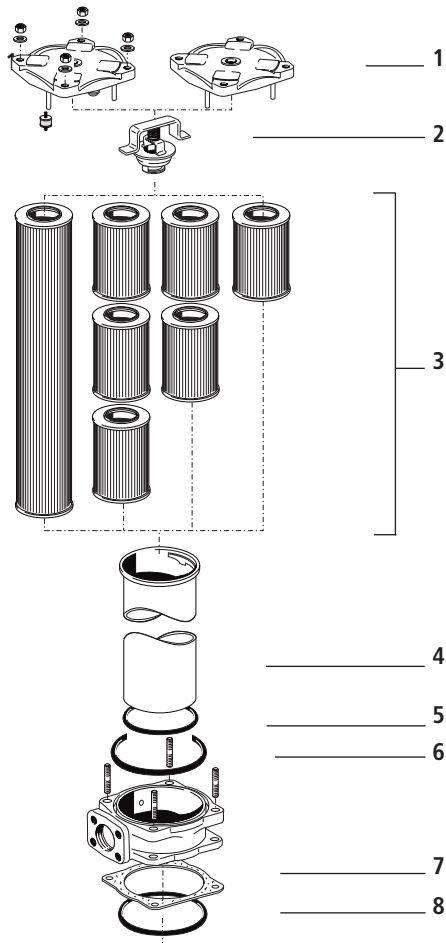
Type	A	B	C	D	E	F	G	H	I	K	L	M	N	O	P	Q	R	S	T	V	W	X	Y	Z
E 443	G1½ / SAE 2	174	141	131	139,9	12	36/35*	97	370	201	185	86,5	116	11,5	2	18	M12	92	58	96	106	96	89	32,5
E 453	G1½ / SAE 2	174	141	131	139,9	12	36/35*	97	540	368	185	86,5	116	11,5	2	18	M12	92	58	96	106	96	89	32,5
E 463	G1½ / SAE 2	174	141	131	139,9	12	36/35*	97	710	536	185	86,5	116	11,5	2	18	M12	92	58	96	106	96	89	32,5
E 643	G1½ / SAE 2	174	141	131	139,9	12	36/35*	97	840	634	185	86,5	116	11,5	2	18	M12	92	58	96	106	96	89	32,5

\* for design with 4 connections

## Symbols



## Spare Parts



Pos.	Designation	Part No.
1	Cover assy	E 443.1200
1a	cover with magnetic system	E 443.1210
2	By-pass assy (1,5 bar)	E 440.1500
2	By-pass assy (2,5 bar)	E 460.1520
2	By-pass assy (3,0 bar)	E 640.1510
3	Filter elements	see Chart / col. 9
4	Filter bowl E 443 *	E 440.1960
4	Filter bowl E 453 *	E 450.1906
4	Filter bowl E 463 *	E 460.1915
4	Filter bowl E 643 *	E 640.1910
5	O-ring 125 x 6	N 007.1256
6	O-ring 151,76 x 5,33	N 007.1525
7	Flat gasket	E 442.0103
8	O-ring 136,5 x 5,34	N 007.1375

\* Please indicate options (VD, VDEV, resp. RVEV)

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

### ISO 2942 ISO 3968 ISO 16889

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

Various quality controls during the production process guarantee the leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

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



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### **Suction Filters**

#### **ES 074 · ES 094**

- Tank top mounting
- Connection up to G1¼
- Nominal flow rate up to 80 l/min

## Description

### Application

To be installed in the suction line of the pumps of hydraulic systems resp. upstream of the charge pumps of hydrostatic drives.

### Performance features

Protection against wear: By means of filter elements that, in full-flow filtration, meet even the highest demands regarding cleanliness classes.

Protection against malfunction: By means of full-flow filtration in the system return, the pumps above all are protected from dirt particles remaining in the system after assembly, repairs, or which are generated by wear or enter the system from outside.

### Special features

By-pass valve: The location close to the suction inlet prevents dirt particles retained by the filter element from entering into the clear oil side.

Filter element locking valve: Ensures that dirt accumulated in the filter element is removed together with the element and cannot return to the tank.

Foot valve: When the screw-on cap is removed for maintenance, the foot valve closes automatically. This makes it possible to service the filter even if it is submerged below the oil level in a full tank.

### Filter elements

Flow direction from centre to outside. The star-shaped pleating of the filter material results in:

- large filter surfaces
- low pressure drop
- high dirt-holding capacities
- long service life

In filters with a magnetic system, the ferromagnetic particles in the fluid pass first through a strong magnetic field and are separated.

### Filter maintenance

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

### Materials

Screw-on cap:	Polyester, GF reinforced
Filter head:	Aluminium alloy
Filter bowl:	Steel
Seals:	NBR (Viton on request)
	EXAPOR®-inorganic microfibre web
Filter media:	Paper-cellulose web, impregnated with resin
	Stainless steel wire mesh (1.4301)

### Accessories

Electrical and optical clogging indicators are available.  
Dimensions and technical data see catalogue sheet 60.20.

## Characteristics

### Nominal flow rate

Up to 80 l/min (see Selection Chart, column 2)

The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the connection lines  $\leq 1,5 \text{ m/s}$   
If units not equipped with a bypass valve are used in hydrostatic drives, the recommendations regarding their technical application given on catalogue sheet 10.310 should be observed.

### Connection

Threaded ports according to ISO 228 or DIN 13. Sizes see Selection Chart, column 6 (other port threads on request)

### Filter fineness

16  $\mu\text{m(c)}$  ... 60  $\mu\text{m(c)}$

$\beta$ -values according 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 or HETG, see info-sheet 00.20)

### Temperature range

- 30 °C ... + 100 °C (temporary - 40 °C ... + 120 °C)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$
- start-up viscosity: determine  $v_{\text{max}}$ , observing the permissible pressure at the pump inlet according to diagram D; determine  $\Delta p$  as a function of the viscosity (take into account the pressure loss in the connecting lines!)

- on initial operation of units equipped with a bypass valve:

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

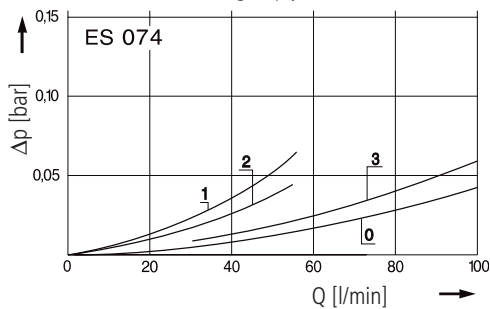
Vertical mounting to be preferred, suction opening pointing downwards, versions equipped with foot valve for horizontal mounting also.

## Diagrams

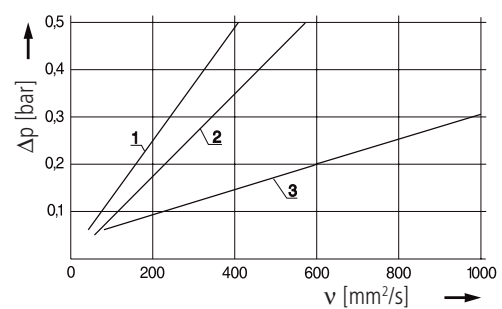
### $\Delta p$ -curves for complete filters in Selection Chart, column 3

**D1**

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

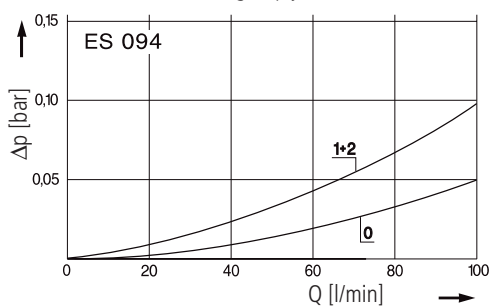


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

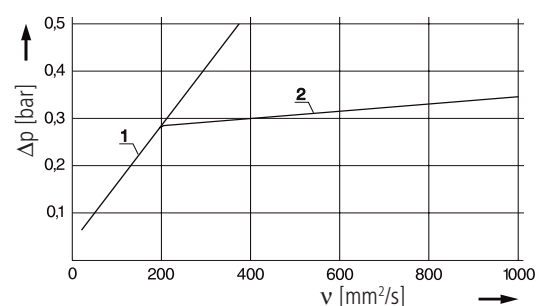


**D2**

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



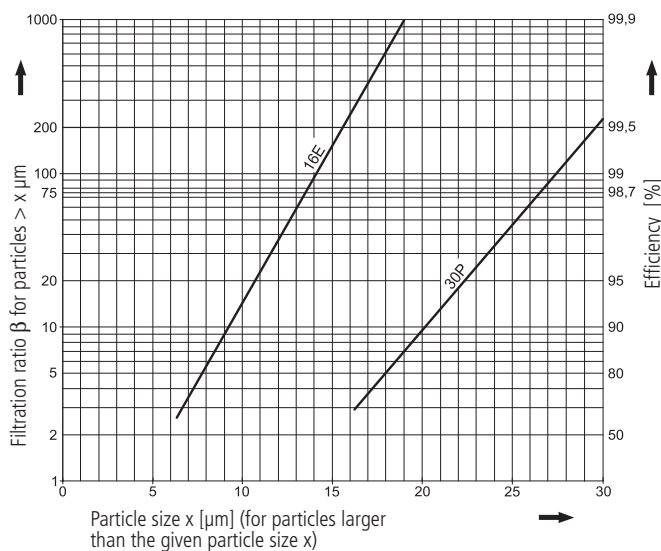
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



### 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



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

**For EXAPOR®- and Paper elements:**

**16 E** =  $\beta_{16(d)} = 200$  EXAPOR®

**30 P** =  $\beta_{30(d)} = 200$  Paper

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

**For screen elements:**

**40 S** = screen material with mesh size 40  $\mu\text{m}$

**60 S** = screen material with mesh size 60  $\mu\text{m}$

**100 S** = screen material with mesh size 100  $\mu\text{m}$

Tolerances for mesh size according to DIN 4189.

For special applications, finenesses differing from these curves are also available by using special composed filter material.

## Selection Chart

Part No.		Nominal flow	Pressure drop see	Diagram <b>D</b> /curve no.	Filter fineness see Diagram <b>Dx</b>	Dirt-holding capacity	Filter surface in ( )	Connection B	Cracking pressure of by-pass	Foot valve	Symbol	Replacement filter element	Part No.	Weight	Remarks
	l/min				g			bar						kg	
1	2	3	4	5	6	7	8	9	10	11	12				
ES 074-6801	35*	D1/1	16 E	18	G1¼	-	•	2	V2.0923-07	2,4	-				
ES 074-6110	45*	D1/1	30 P	23	G1	-	-	1	P2.0923-01	2,2	-				
ES 074-6120	45*	D1/2	30 P	23	G1¼	-	-	1	P2.0923-01	2,2	-				
ES 074-6121	45*	D1/1	30 P	23	G1	-	•	2	P2.0923-01	2,4	-				
ES 074-6141	45*	D1/2	30 P	23	G1¼	-	•	2	P2.0923-01	2,4	-				
ES 074-0001	80	D1/3	60 S	(1540 cm²)	G1¼	-0,25	•	6	S2.0920-10	2,4	with magnetic system				
ES 094-6801	55*	D2/1	16 E	26	G1¼	-	•	2	V2.0933-08	3,2	-				
ES 094-6110	70*	D2/1	30 P	34	G1¼	-	-	1	P2.0933-01	3,0	-				
ES 094-6111	70*	D2/1	30 P	34	G1¼	-	•	2	P2.0933-01	3,2	-				
ES 094-6121	70	D2/2	30 P	34	G1¼	-0,25	•	4	P2.0933-01	3,2	-				

All filters are delivered with a plugged clogging indicator connection G¼. As clogging indicators either manometers or vacuum switches can be used. Optional extension pipes adapt the filter length to various tank depths. For ordering of accessories please use the below mentioned codes.

**Order example: The filter ES 074-6110 has to be supplied with an extension pipe (EV) for a mounting depth of 400 mm.**

**Order description:** ES 074-6110 / EV 400

**Part No. (Basic unit)** \_\_\_\_\_

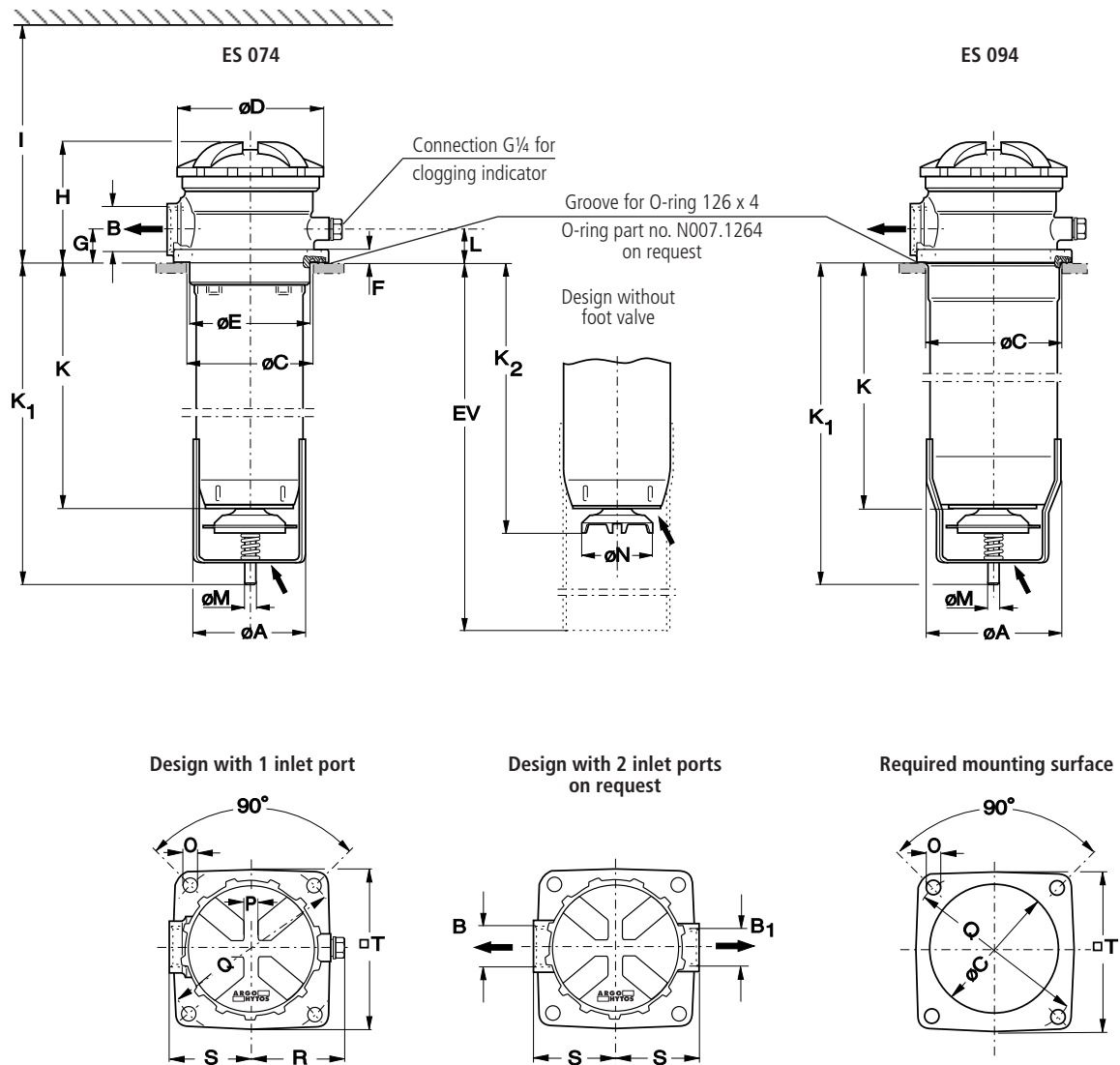
**Extension pipe (2 various lengths are available)** \_\_\_\_\_  
 EV = 400 / 500 mm (see dimensions and measurements)

**For the appropriate clogging indicator see catalogue sheet 60.20.**

- Remarks:**
- The start of the red area respectively the actuating pressure of the vacuum switch has always to be higher than the cracking pressure of the by-pass valve (see Selection Chart, column 7).
  - The clogging indicators are optionally available and will then be loosely provided.
  - The filters listed in this chart are standard filters. Other designs available on request.

\* Those values apply when used in hydrostatic drives and instructions in catalogue sheet 10.310 have to be observed

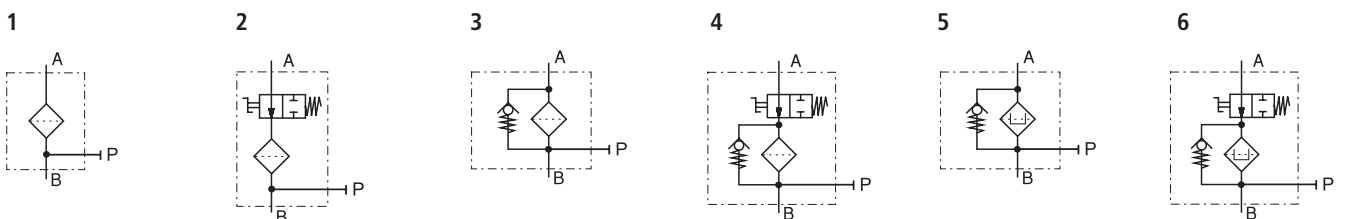
## Dimensions



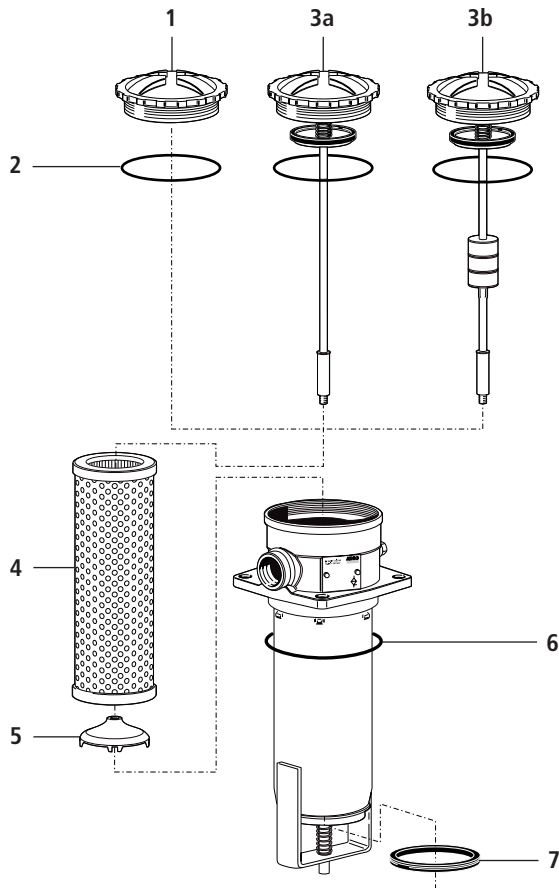
## Measurements

Type	A	B	C min./max.	D	E	F	G	H	I	K	K <sub>1</sub>	K <sub>2</sub>	L	M	N	O	P
ES 074	100	G1, G1 $\frac{1}{4}$	111/121	126,5	110	11,5	32	106	400	198	256	218	35	10	62,5	11	13
ES 094	115	G1 $\frac{1}{4}$	119/121	126,5	-	11,5	32	106	525	305	364	325	35	10	62,5	11	13
Type	Q	R	S	T													
ES 074	165	82,5	76	141													
ES 094	165	76,5	76	141													

## Symbols



## Spare Parts



Pos.	Designation	Part No.
1	Screw-on cap with Pos. 2	ES 074.1212
2	O-ring 100 x 4	N 007.1004
3a	Screw-on cap with Pos. 2 ES 074 (without by-pass) ES 094 (without by-pass) ES 094 (with by-pass)	ES 074.1213 ES 094.1212 ES 094.1213
3b	Screw-on cap with Pos. 2 including magnetic system ES 074 (with by-pass)	ES 074.1205
4	Filter element	see Chart / col. 10
5	Valve cone	ES 074.0202
6	O-ring 126 x 4 *	N 007.1264
7	Rubber ring	N 042.7401

\* not included in basic equipment

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

### ISO 2942 ISO 3968 ISO 16889

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

Various quality controls during the production process guarantee the leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

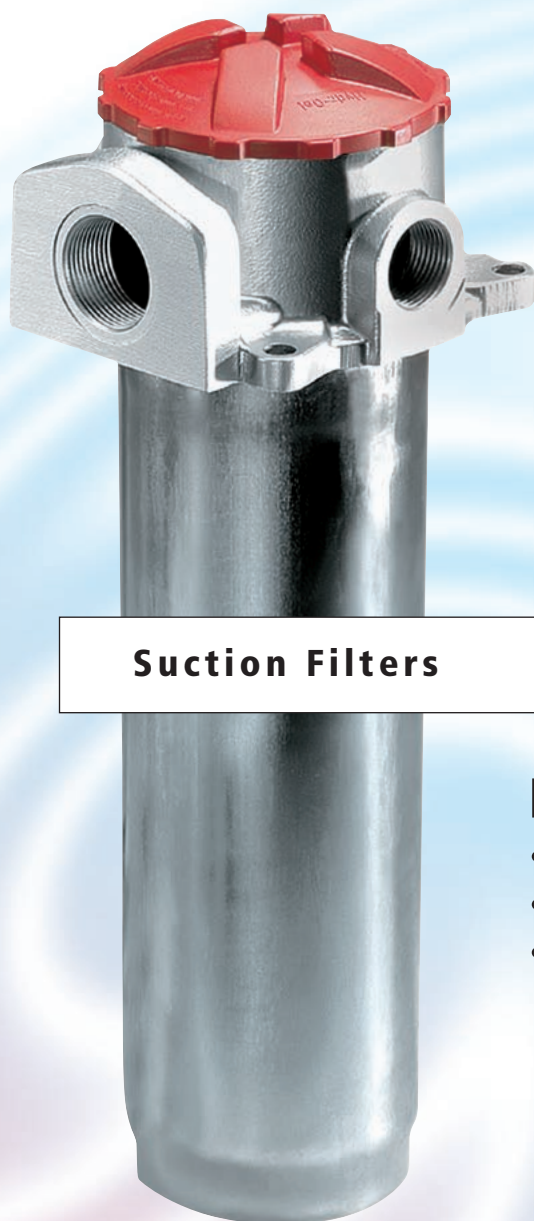
Illustrations may sometimes differ from the original. ARGO-HYTOS is not responsible for any unintentional mistake in this specification sheet.



### We produce fluid power solutions

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## Suction Filters

### ES 134 • ES 144

- Tank top mounting
- Connection up to SAE 1½
- Nominal flow rate up to 130 l/min

## Description

### Application

To be installed in the suction line of the pumps of hydraulic systems resp. upstream of the charge pumps of hydrostatic drives.

### Performance features

Protection

against wear: By means of filter elements that, in full-flow filtration, meet even the highest demands regarding cleanliness classes.

Protection against

malfunction: By means of full-flow filtration in the system return, the pumps above all are protected from dirt particles remaining in the system after assembly, repairs, or which are generated by wear or enter the system from outside.

### Special features

By-pass valve: The location close to the suction inlet prevents dirt particles retained by the filter element from entering into the clear oil side.

Filter element

locking valve: Ensures that dirt accumulated in the filter element is removed together with the element and cannot return to the tank.

Foot valve: When the screw-on cap is removed for maintenance, the foot valve closes automatically. This makes it possible to service the filter even if it is submerged below the oil level in a full tank.

### Filter elements

Flow direction from centre to outside. The star-shaped pleating of the filter material results in:

- large filter surfaces
- low pressure drop
- high dirt-holding capacities
- long service life

In filters with a magnetic system, the ferromagnetic particles in the fluid pass first through a strong magnetic field and are separated.

### Filter maintenance

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

### Materials

Screw-on cap: Polyester, GF reinforced

Filter head: Aluminium alloy

Filter bowl: Steel

Seals: NBR (Viton on request)

Filter media: Paper - cellulose web, impregnated with resin  
Stainless steel wire mesh (1.4301)

### Accessories

Electrical and optical clogging indicators are available. Dimensions and technical data see catalogue sheet 60.20.

## Characteristics

### Nominal flow rate

Up to 130 l/min (see Selection Chart, column 2)

The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the connection lines  $\leq 1,5 \text{ m/s}$   
If units not equipped with a bypass valve are used in hydrostatic drives, the recommendations regarding their technical application given on catalogue sheet 10.310 should be observed.

### Connection

Threaded ports according to ISO 228 or DIN 13 or SAE-flanges (3000 psi)

Sizes see Selection Chart, column 6 (other port threads on request)

### Filter fineness

30  $\mu\text{m(c)}$  ... 60  $\mu\text{m(c)}$

$\beta$ -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 or HETG, see info-sheet 00.20)

### Temperature range

- 30 °C ... + 100 °C (temporary - 40 °C ... + 120 °C)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$
- start-up viscosity: determine  $v_{\text{max}}$ , observing the permissible pressure at the pump inlet according to diagram D; determine  $\Delta p$  as a function of the viscosity (take into account the pressure loss in the connecting lines!)

- on initial operation of units equipped with a bypass valve:

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

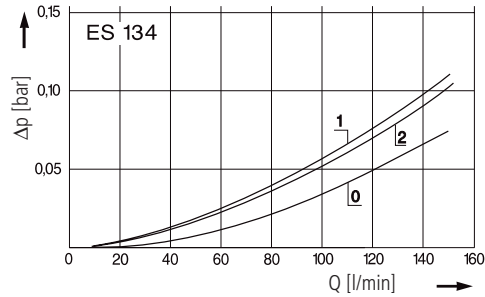
Vertical mounting to be preferred, suction opening pointing downwards, versions equipped with foot valve for horizontal mounting also.

## Diagrams

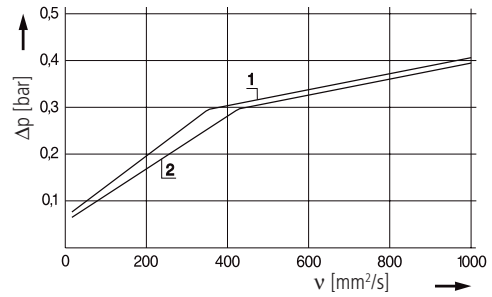
### $\Delta p$ -curves for complete filters in Selection Chart, column 3

**D1**

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

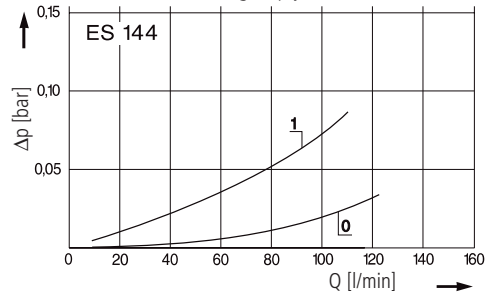


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

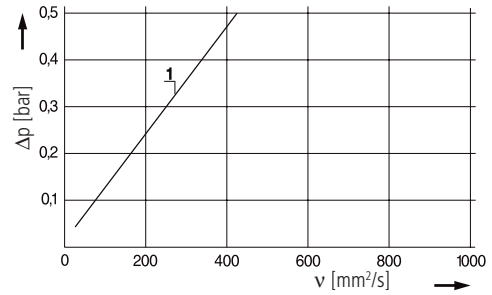


**D2**

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



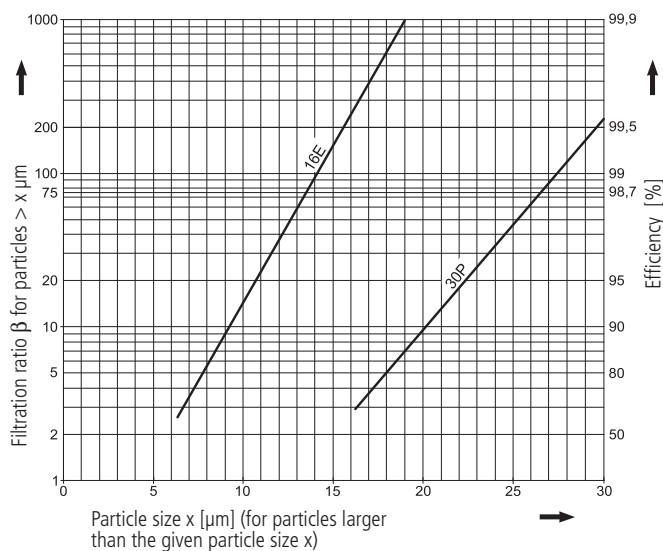
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



### 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



The abbreviations represent the following -values resp. finenesses:

**For EXAPOR®- and Paper elements:**

**16 E** =  $\beta_{16(c)} = 200$  EXAPOR®  
**30 P** =  $\beta_{30(c)} = 200$  Papier

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

**For screen elements:**

**40 S** = screen material with mesh size 40  $\mu\text{m}$   
**60 S** = screen material with mesh size 60  $\mu\text{m}$   
**100 S** = screen material with mesh size 100  $\mu\text{m}$

Tolerances for mesh size according to DIN 4189.

For special applications, finenesses differing from these curves are also available by using special composed filter material.

## Selection Chart

[illegible]

All filters are delivered with a plugged clogging indicator connection G¼. As clogging indicators either manometers or vacuum switches can be used. Optional extension pipes adapt the filter length to various tank depths. For ordering of accessories please use the below mentioned codes.

**Order example:** The filter ES 134-0501 has to be supplied with an extension pipe (EV) for a mounting depth of 400 mm.

**Order description:** ES 134-0501 / EV 400

Part No. (Basic unit)

**Extension pipe (2 various lengths are available)**

EV = 400 / 500 mm (see section dimensions and measurements)

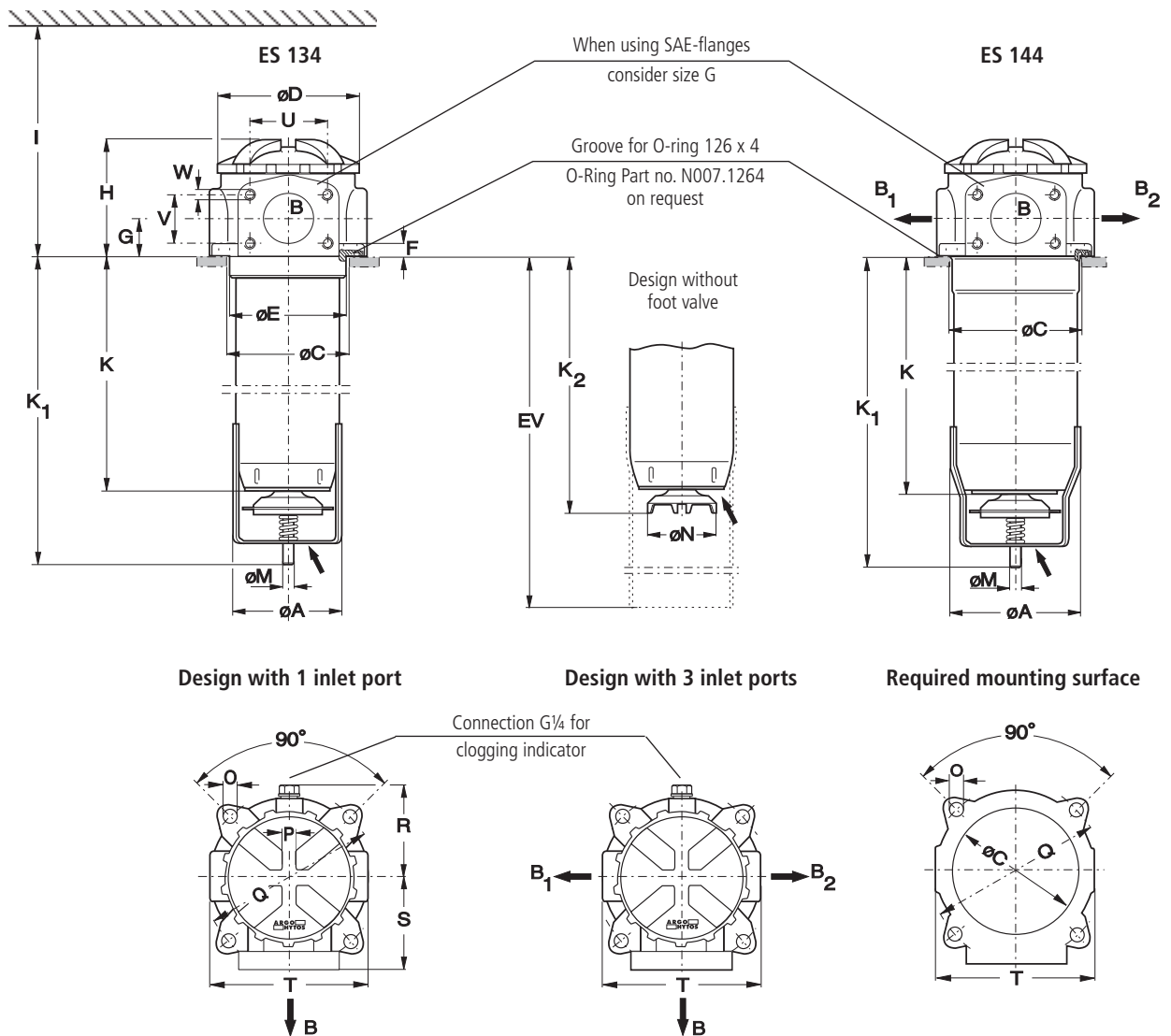
For the appropriate clogging indicator see catalogue sheet 60.20.

## Remarks:

- The start of the red area respectively the actuating pressure of the vacuum switch has always to be higher than the cracking pressure of the by-pass valve (see Selection Chart, column 7).
- The clogging indicators are optionally available and will then be loosely provided.
- The filters listed in this chart are standard filters. Other designs available on request.

\* Those values apply when used in hydrostatic drives and instructions in catalogue sheet 10.310 have to be observed.

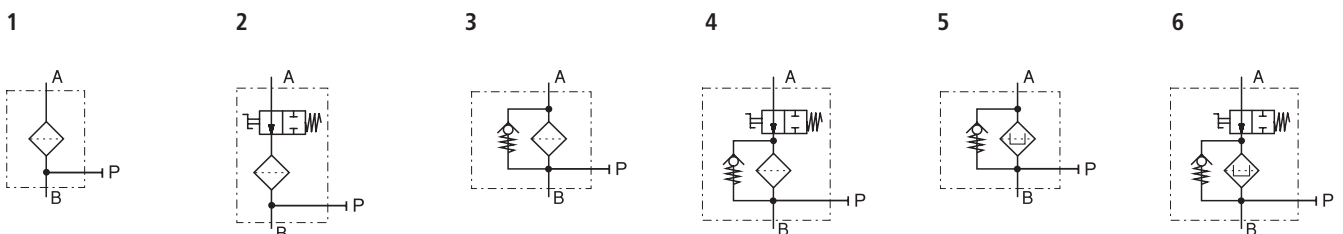
## Dimensions



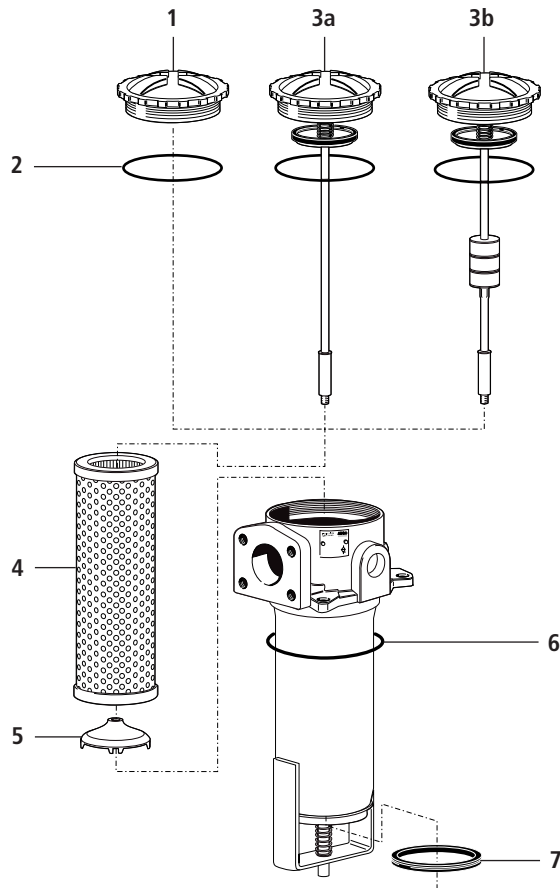
## Measurements

Type	A	B	B1	B2	C min./max.	D	E	F	G	H	I	K	K1	K2	L	M	N
ES 134	100	SAE 1½	-	-	111/121	126,5	110	12	32	106	400	198	256	218	-	10	62,5
ES 144	115	G1¼	G1	G1	119/121	126,5	-	12	32	106	525	305	364	325	-	10	62,5
Type	O	P	Q	R	S	T	U	V	W								
ES 134	11,5	13	165	81	82	144	69,8	35,7	M 12								
ES 144	11,5	13	165	81	82	144	69,8	35,7	M 12								

## Symbols



## Spare Parts



Pos.	Designation	Part No.
1	Screw-on cap with Pos. 2	ES 074.1212
2	O-ring 100 x 4	N 007.1004
3a	Screw-on cap assy with Pos. 2 ES 134 (without by-pass) ES 144 (without by-pass)	ES 074.1213 ES 094.1212
3b	Screw-on cap wiht Pos. 2 magnetic system ES 134 (with by-pass)	ES 074.1205
4	Filter element	see Chart / col. 10
5	Valve cone	ES 074.0202
6	O-ring 126 x 4 *	N 007.1264
7	Rubber ring	N 042.7401

\* not included in basic equipment

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

### ISO 2942 ISO 3968 ISO 16889

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

Various quality controls during the production process guarantee the leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

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



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## Return Filters - lightline

### FR 043 • FR 072

- Tank top mounting / In-line mounting
- Hose connection up to ID 19 mm
- Nominal flow rate up to 70 l/min

## Description

### Application

In the return line circuits of hydraulic systems.

### Performance features

Protection

against wear: By means of filter elements that, in full-flow filtration, meet even the highest demands regarding cleanliness classes.

Protection against malfunction: By means of full-flow filtration in the system return, the pumps above all are protected from dirt particles remaining in the system after assembly, repairs, or which are generated by wear or enter the system from outside.

### Special features

Connection: Hose nipple

By-pass valve: The location close to the inlet port prevents dirt particles retained by the filter element from entering into the clean oil side.

Removable bowl: In case of maintenance the filter bowl is removed together with the filter element - therefore dirt particles are not flushed back into the tank.

Oil separator: Prevents oil splashing through the breather on mobile application.

Extension pipe: Easy and fast adaption to various lengths.

### Filter elements

Flow direction from outside to centre. The star-shaped pleating of the filter material results in:

- large filter surfaces
- low pressure drop
- high dirt-holding capacities
- long service life

### Ventilating Filter

Ventilation of the reservoir by an integral star-shape pleated filter element:

- removable (replace annually!)
- splash-proof
- fineness 2 µm

### Filter maintenance

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

### Materials

Screw-on cap: Polyester, GF reinforced

Housing: Polyamide, GF reinforced\*

Seals: NBR (Viton on request)

Filter media: EXAPOR®MAX - inorganic multi-layer microfibre web  
Paper - cellulose web, impregnated with resin

\* due to the conductable plastic material no static charge can occur

### Accessories

Electrical and optical clogging indicators are available.

Dimensions and technical data see catalogue sheet 60.20.

Recommended hose clamps according to DIN 3017 Part 2 or equivalent for hose OD 23 mm or 26 mm. For orders use ARGO-HYTOS Part No. 332 70 03 or 332 70 04.

For mounting of extension pipes following parts are needed:

Aluminium pipe (Length xxx in mm)	Part No. FR 043.Lxxx
O-ring	Part No. N 007.0203
Crimping tool	Part No. FR 043.1770

## Characteristics

### Nominal flow rate

Up to 70 l/min (see Selection Chart, column 2)

The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the connection lines  $\leq 4,5 \text{ m/s}$

### Connection

Hose nipple for hose up to ID 19 mm. Sizes see Selection Chart, column 6 (other connections on request)

### Filter fineness

12 µm(c) ... 30 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 or HETG, see info-sheet 00.20)

With high filling conditions we recommend an electrical conductivity  $\geq 500 \text{ pS/m}$  at 20 °C.

### Temperature range

- 30 °C ... + 80 °C (short intervals to + 100 °C)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$
- as starting viscosity:  $v_{\text{max}} = 1200 \text{ mm}^2/\text{s}$
- at first 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.

### Operating pressure

Max. 6 bar

### Mounting position

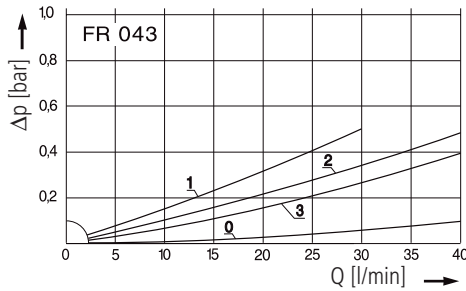
Preferably vertical, outlet downwards

## Diagrams

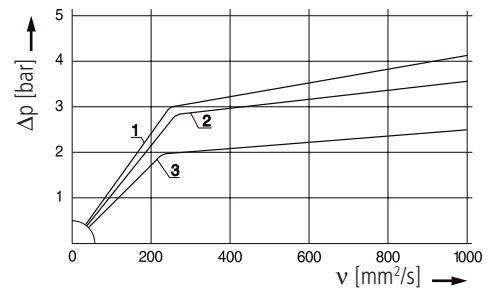
### $\Delta p$ -curves for complete filters in Selection Chart, column 3

**D1**

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

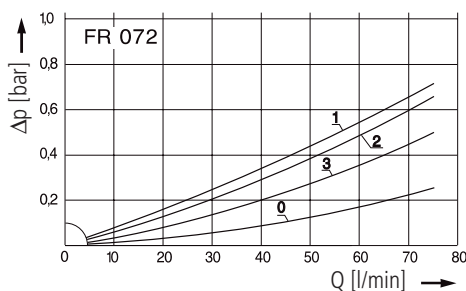


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

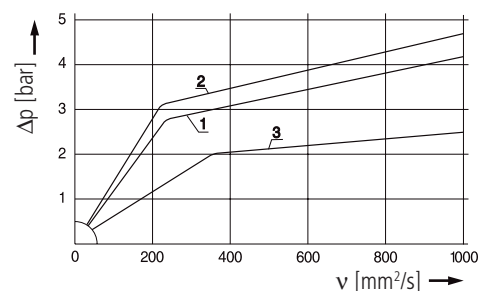


**D2**

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



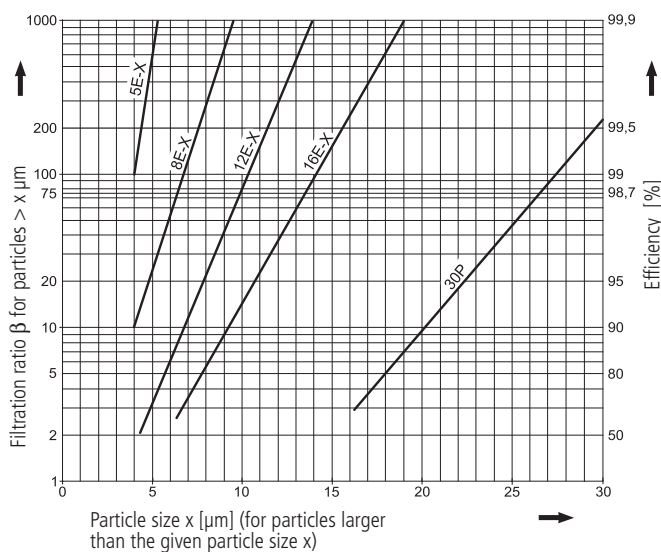
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



### 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



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

#### For EXAPOR®MAX- and Paper elements:

<b>5 E-X</b>	= $\beta_{5(c)}$	= 200	EXAPOR®MAX
<b>8 E-X</b>	= $\beta_{8(c)}$	= 200	EXAPOR®MAX
<b>12 E-X</b>	= $\beta_{12(c)}$	= 200	EXAPOR®MAX
<b>16 E-X</b>	= $\beta_{16(c)}$	= 200	EXAPOR®MAX
<b>30 P</b>	= $\beta_{30(c)}$	= 200	Paper

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

#### For screen elements:

<b>40 S</b>	= screen material with mesh size	40 $\mu\text{m}$
<b>60 S</b>	= screen material with mesh size	60 $\mu\text{m}$
<b>100 S</b>	= screen material with mesh size	100 $\mu\text{m}$

Tolerances for mesh size according to DIN 4189

#### For ventilating filter elements:

**2 CL** = 99,5 % filter efficiency for particles of size 2  $\mu\text{m}$

For special applications, finenesses differing from these curves are also available by using special composed filter material.

## Selection Chart

Part No.	Nominal flow l/min	Pressure drop see Diagram D/curve no.	Filter fineness see Diagram Dx	Dirt-holding capacity g	Connection A	Cracking pressure of by-pass bar	Symbol	Replacement filter element Part No.	Weight kg	Replacement ventilating filter Part No.	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
FR 043-156	25	D1/1	12 E-X	5,3	17,5	2,5	1	V3.0510-56	0,42	L1.0403-51 (2 CL)	-
FR 043-166	25	D1/1	12 E-X	5,3	17,5	2,5	2	V3.0510-56	0,42	L1.0403-51 (2 CL)	M12 x 1,5 for indicator
FR 043-158	35	D1/2	16 E-X	5,7	17,5	2,5	1	V3.0510-58	0,42	L1.0403-51 (2 CL)	-
FR 043-178	35	D1/2	16 E-X	5,7	17,5	2,5	2	V3.0510-58	0,42	L1.0403-51 (2 CL)	M12 x 1,5 for indicator
FR 043-151	30	D1/3	30 P	4,0	17,5	1,5	1	P3.0510-51	0,42	L1.0403-51 (2 CL)	-
FR 043-161	30	D1/3	30 P	4,0	17,5	1,5	2	P3.0510-51	0,42	L1.0403-51 (2 CL)	M12 x 1,5 for indicator
FR 072-156	50	D2/1	12 E-X	11	20,5	2,5	1	V3.0520-56	0,58	L1.0403-51 (2 CL)	-
FR 072-166	50	D2/1	12 E-X	11	20,5	2,5	2	V3.0520-56	0,58	L1.0403-51 (2 CL)	M12 x 1,5 for indicator
FR 072-158	70	D2/2	16 E-X	12	20,5	2,5	1	V3.0520-58	0,58	L1.0403-51 (2 CL)	-
FR 072-168	70	D2/2	16 E-X	12	20,5	2,5	2	V3.0520-58	0,58	L1.0403-51 (2 CL)	M12 x 1,5 for indicator
FR 072-151	50	D2/3	30 P	6,6	20,5	1,5	1	P3.0520-51*	0,58	L1.0403-51 (2 CL)	-
FR 072-171	50	D2/3	30 P	6,6	20,5	1,5	2	P3.0520-51*	0,58	L1.0403-51 (2 CL)	M12 x 1,5 for indicator

As clogging indicators either manometers or electrical pressure switches can be used. Optional extension pipes adapt the filter length to various tank depths. For ordering of accessories please use the below mentioned codes.

**Order example: The filter FR 043-166 has to be supplied with an extension pipe (EV) for a mounting depth of 300 mm.**

**Order description:**

FR 043-166 / EV 300

**Part No. (Basic unit)**

**Extension pipe (5 various lengths are available)**

EV = K + 65 / + 115 / + 215 / + 315 / + 415 (see dimensions and measurements)

**For the appropriate clogging indicator see data sheet 60.20.**

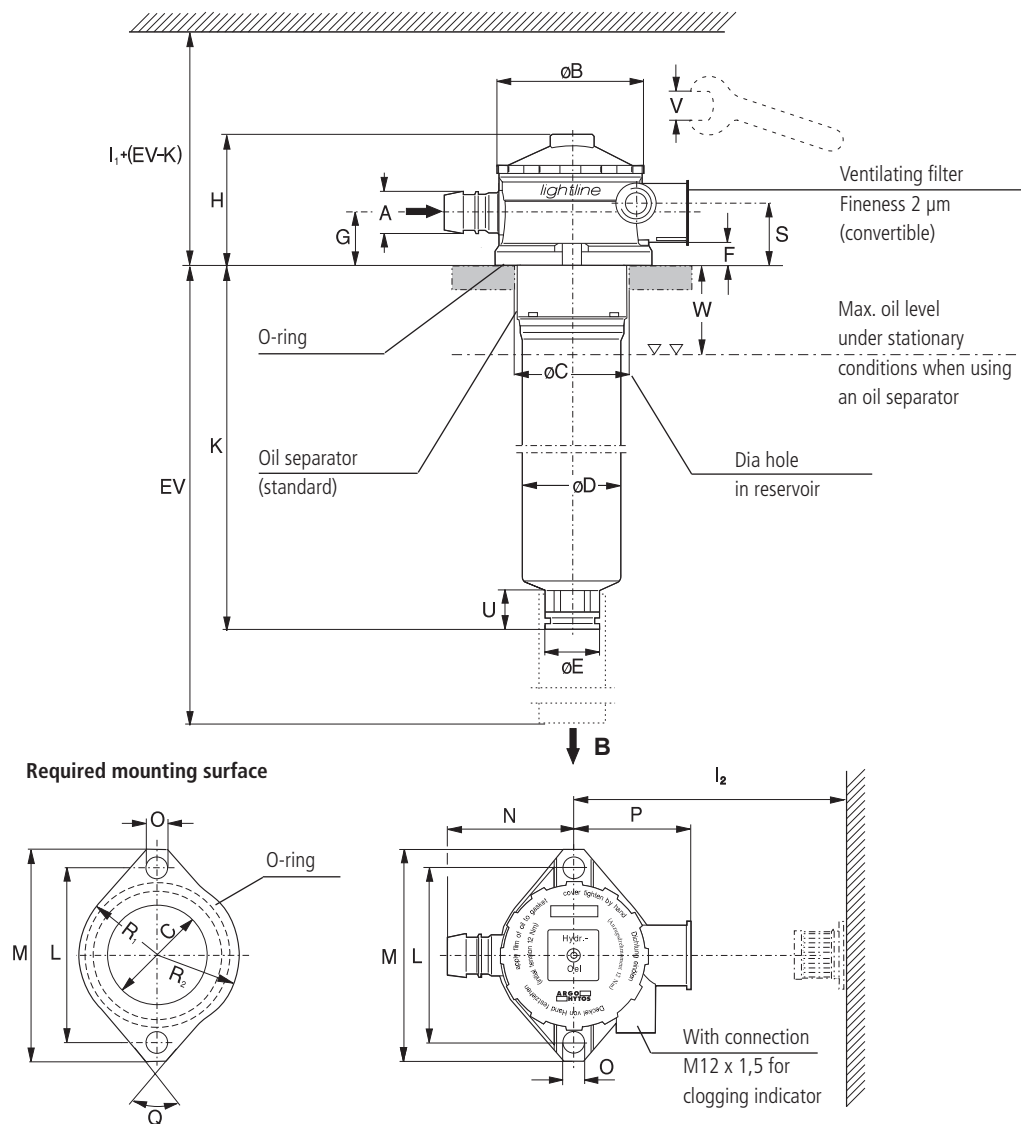
When using pressure switches of series DG 813 sealing by means of an O-ring (order no. N 007.0103, to be ordered separately) has to be guaranteed (torque 4 Nm). When using manometers of series DG 200 variants with preformed sealing ring are to be used.

### Remarks:

- The switching pressure of the electrical pressure switch has always to be lower than the cracking pressure of the by-pass valve (see Selection Chart, column 7).
- The clogging indicators are optionally available and will then be loosely provided.
- For fastening the filter the enclosed spring washers have to be used. Mounting force 15<sup>+5</sup> Nm.
- The filters listed in this chart are standard filters. Other designs available on request.

\* Paper media supported with metal gauze

## Dimensions



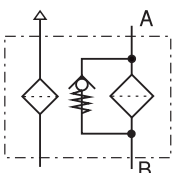
## Measurements

Type	A	B	C min./max.	D	E	F*	G	H	I <sub>1</sub>	I <sub>2</sub>	K	L	M	N	O	P	Q	R <sub>1</sub>	R <sub>2</sub>	S
FR 043	17,5	75	60/61	51	27,8	11	22	65	175	30	85	88	108	65	11	59	80°	39	42	27
FR 072	20,5	75	60/61	51	27,8	11	22	65	270	30	182	88	108	65	11	59	80°	39	42	27
Type	U	V	W																	
FR 043	20	27	40																	
FR 072	20	27	40																	

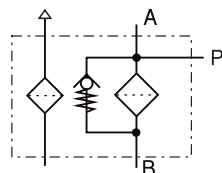
\* including the enclosed spring washers Ø10, DIN 137 shape B, corrugated

## Symbols

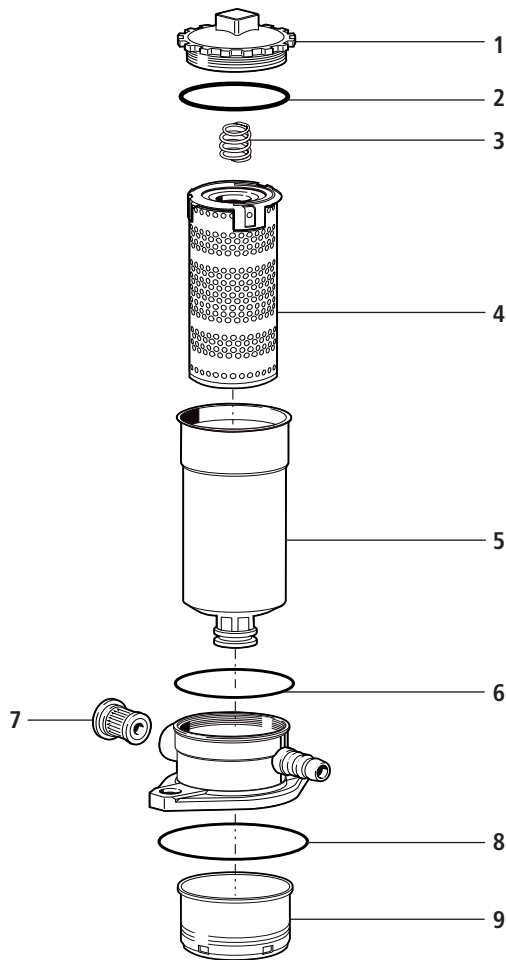
1



2



## Spare Parts



Pos.	Designation	Part No.
1	Screw-on cap	FR 043.0201
2	O-ring 57 x 3	N 007.0573
3	Compression spring	N 015.1606
4	Filter element	s. Chart / col. 9
5	Filter bowl FR 043 *	FR 043.0107
5	Filter bowl FR 072 *	FR 072.0104
6	O-ring 50 x 2	N 007.0501
7	Ventilating filter	L1.0403-51
8	O-ring 69 x 4	N 007.0704
9	Oil separator	FR 043.0701

\* Specify mounting depth in mm

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

### ISO 2942 ISO 3968 ISO 16889

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

Various quality controls during the production process guarantee the leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

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



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**High-Pressure Safety Filters**

**HD 040 • HD 081  
HD 150**

- In-line mounting
- Operating pressure up to 315 bar
- Nominal flow rate up to 100 l/min

Description	
-------------	--

**Application**  
In the high-pressure circuits of hydraulic systems.

## Performance features

Functional protection:	The high-pressure safety filter retains residues remaining in the system due to installation or after repairs, and intake chips from pumps (especially gear pumps). This prevents functional failures or faults on downstream components, particularly control/regulation or throttle valves.
Protection against wear:	For wear protection, a fine filter should be installed elsewhere in the system.

### Filter elements

Flow direction from outside to centre. The star-shaped pleating of the filter material provides:

- large filter surfaces
- low pressure drop
- high dirt-holding capacities
- long service life

**Materials**

Housing:	steel, zinc plated
Seals:	NBR (Viton on request)
Filter media:	stainless steel wire mesh (1.4301)

## Selection Chart

[illegible]

**Remark:**  
The filters listed in this chart are standard filters. If modifications are required, e.g. different filter finenesses, we kindly ask for your request.

---

<sup>1</sup> Filter element differential pressure stable up to 160 bar      <sup>2</sup> Connection according to DIN 3861

The filters listed in this chart are standard filters. If modifications are required, e.g. different filter finenesses, we kindly ask for your request.

---

<sup>1</sup> Filter element differential pressure stable up to 160 bar      <sup>2</sup> Connection according to DIN 3861

<sup>1</sup> Filter element differential pressure stable up to 160 bar    <sup>2</sup> Connection according to DIN 3861

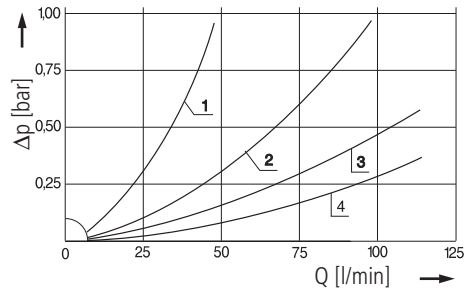
<sup>2</sup> Connection according to DIN 3861

## Diagrams

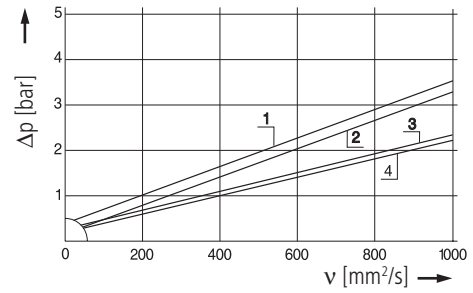
$\Delta p$ -curves for the filters in Selection Chart, column 3

**D1**

Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$

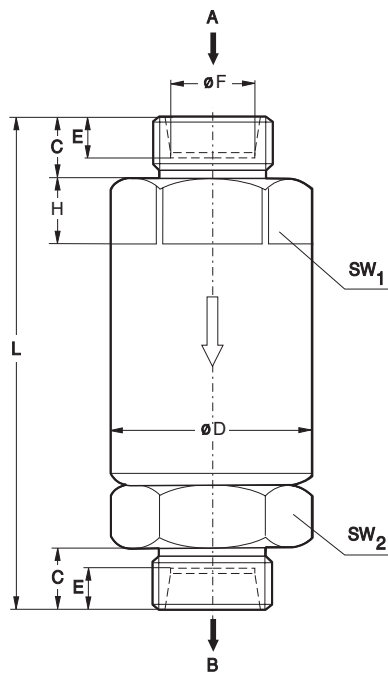


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

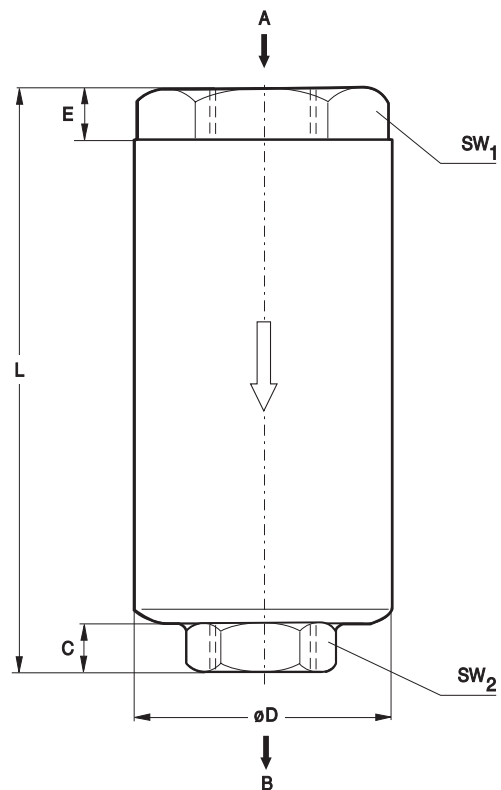


## Dimensions

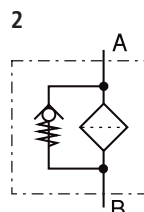
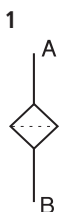
HD 040 / HD 081



HD 150



## Symbols



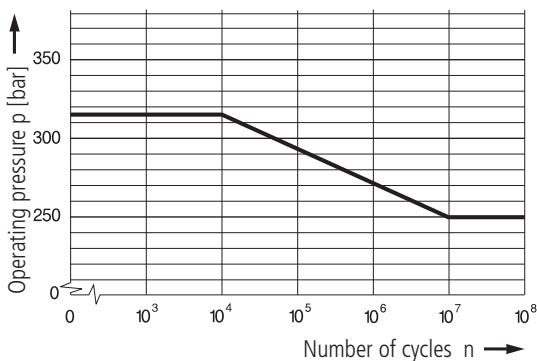
## Characteristics

### Operating pressure

0 ... 250 bar, min.  $10^7$  pressure cycles  
Nominal pressure according to DIN 24550

0 ... 315 bar, min.  $10^4$  pressure cycles  
Quasi-static operating pressure

### Permissible pressure for other numbers of cycles



### Nominal flow rate

Up to 100 l/min (see Selection Chart, column 2)  
The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- flow velocity in the connection lines:  
up to 250 bar  $\leq 8 \text{ m/s}$   
up to 450 bar  $\leq 12 \text{ m/s}$

### Filter fineness

60  $\mu\text{m}$ , 100  $\mu\text{m}$   
(see Selection Chart, column 4)

### 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)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$
- as starting viscosity:  $v_{\text{max}} = 1200 \text{ mm}^2/\text{s}$
- 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

As desired

### Connection

Threaded ports according to ISO 228, DIN 13 and/or DIN 3861. Sizes see Selection Chart, column 7 (other port threads on request).

## 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 DIN and ISO standards:

- |                     |  |
|---------------------|--|
| <b>DIN ISO 2941</b> | Verification of collapse/burst resistance          |
| <b>DIN ISO 2943</b> | Verification of material compatibility with fluids |
| <b>DIN ISO 3724</b> | Verification of flow fatigue characteristics       |

**ISO 2942**  
**ISO 3968**  
**ISO 16889**

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

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 leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

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



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## High Pressure Filters

### HD 044 • HD 064

- Flange mounting
- Operating pressure up to 350 bar
- Nominal flow rate up to 80 l/min

## Description

### Application

In the high pressure circuits of hydraulic systems.

### Performance features

Protection

against wear: By means of filter elements that, in full-flow filtration, meet even 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  $v \leq 200 \text{ mm}^2/\text{s}$  (cold start condition).

### Filter elements

Flow direction from outside to centre. 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

Filter head: Spheroidal graphite cast iron (SGI)  
Filter bowl: Cold extruded steel  
Coating: Powder paint  
Seals: NBR (Viton on request)  
Filter media: EXAPOR®MAX - inorganic multi-layer microfibre web

### Accessories

Electrical and/or optical clogging indicators are available - optionally with one or two switching points resp. temperature suppression.  
Dimensions and technical data see catalogue sheet 60.30.

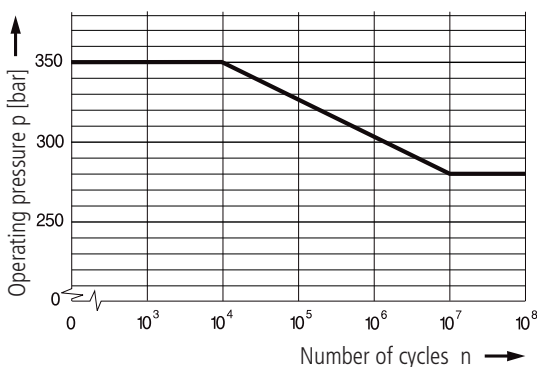
## Characteristics

### Operating pressure

0 ... 280 bar, min.  $10^7$  pressure cycles  
Nominal pressure according to DIN 24550

0 ... 350 bar, min.  $10^4$  pressure cycles  
Quasi-static operating pressure

### Permissible pressures for other numbers of cycles



### Nominal flow rate

Up to 80 l/min (see Selection Chart, column 2)  
The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the connection lines:
  - up to 250 bar  $\leq 8 \text{ m/s}$
  - up to 450 bar  $\leq 12 \text{ m/s}$

### Filter fineness

$5 \mu\text{m(c)}$  ...  $16 \mu\text{m(c)}$   
 $\beta$ -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 ISO16889  
(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)

### Viscosity at nominal flow rate

- at operating temperature:  $< 60 \text{ mm}^2/\text{s}$
- as starting viscosity:  $v_{\text{max}} = 1200 \text{ mm}^2/\text{s}$
- 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 on top

### Connection

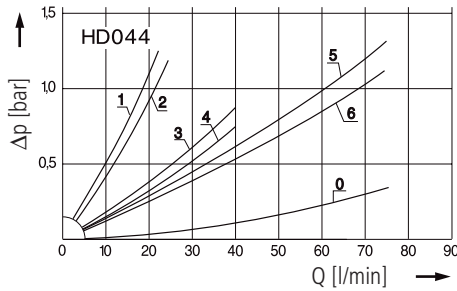
2 x Ø 15 mm on plain flange

## Diagrams

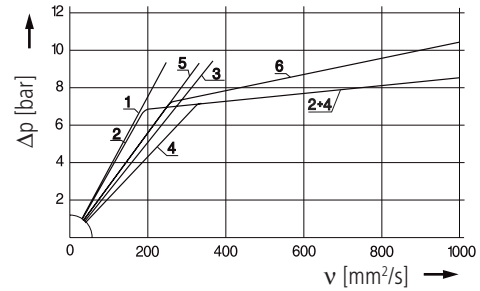
### $\Delta p$ -curves for complete filters in Selection Chart, column 3

**D1**

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

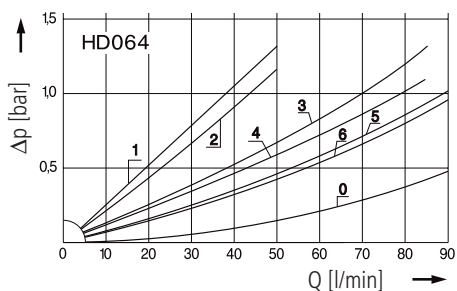


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

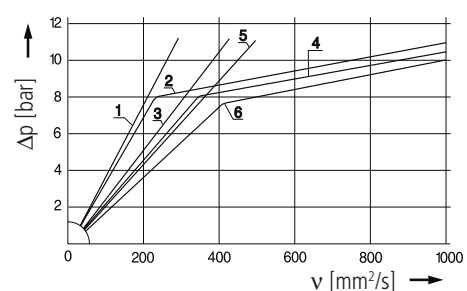


**D2**

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



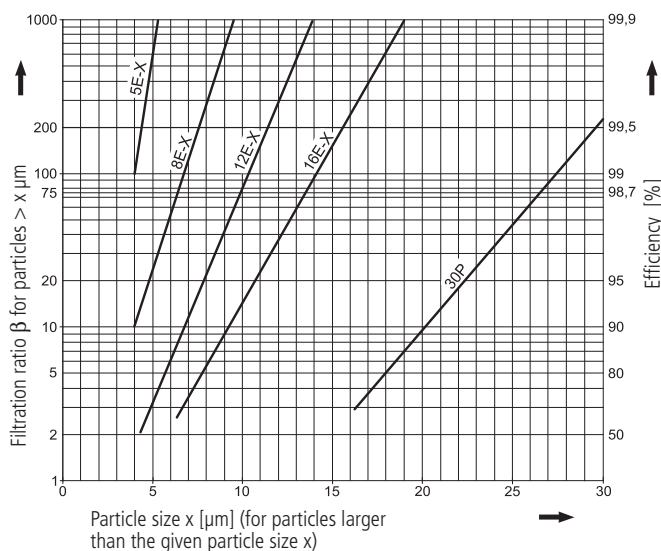
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



### 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



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

#### For EXAPOR®MAX- and Paper elements:

<b>5 E-X</b>	$= \beta_{5(c)} = 200$	EXAPOR®MAX
<b>8 E-X</b>	$= \beta_{8(c)} = 200$	EXAPOR®MAX
<b>12 E-X</b>	$= \beta_{12(c)} = 200$	EXAPOR®MAX
<b>16 E-X</b>	$= \beta_{16(c)} = 200$	EXAPOR®MAX
<b>30 P</b>	$= \beta_{30(c)} = 200$	Paper

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

#### For screen elements:

<b>40 S</b>	= screen material with mesh size	40 $\mu\text{m}$
<b>60 S</b>	= screen material with mesh size	60 $\mu\text{m}$
<b>100 S</b>	= screen material with mesh size	100 $\mu\text{m}$

Tolerances for mesh size according to DIN 4189

For special applications, finenesses differing from these curves are also available by using special composed filter media.

## Selection Chart

[illegible]

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 acknowledgements show both items separately.

**Order example:** The filter HD 064-156 has to be supplied with optical clogging indicator - response pressure 5,0 bar

**Order description:**

**HD 064-156**

/

**DG 042-02**

M

Part No. (Basic unit)

### Clogging indicator

mounted

For the appropriate clogging indicators see catalogue sheet 60.30.

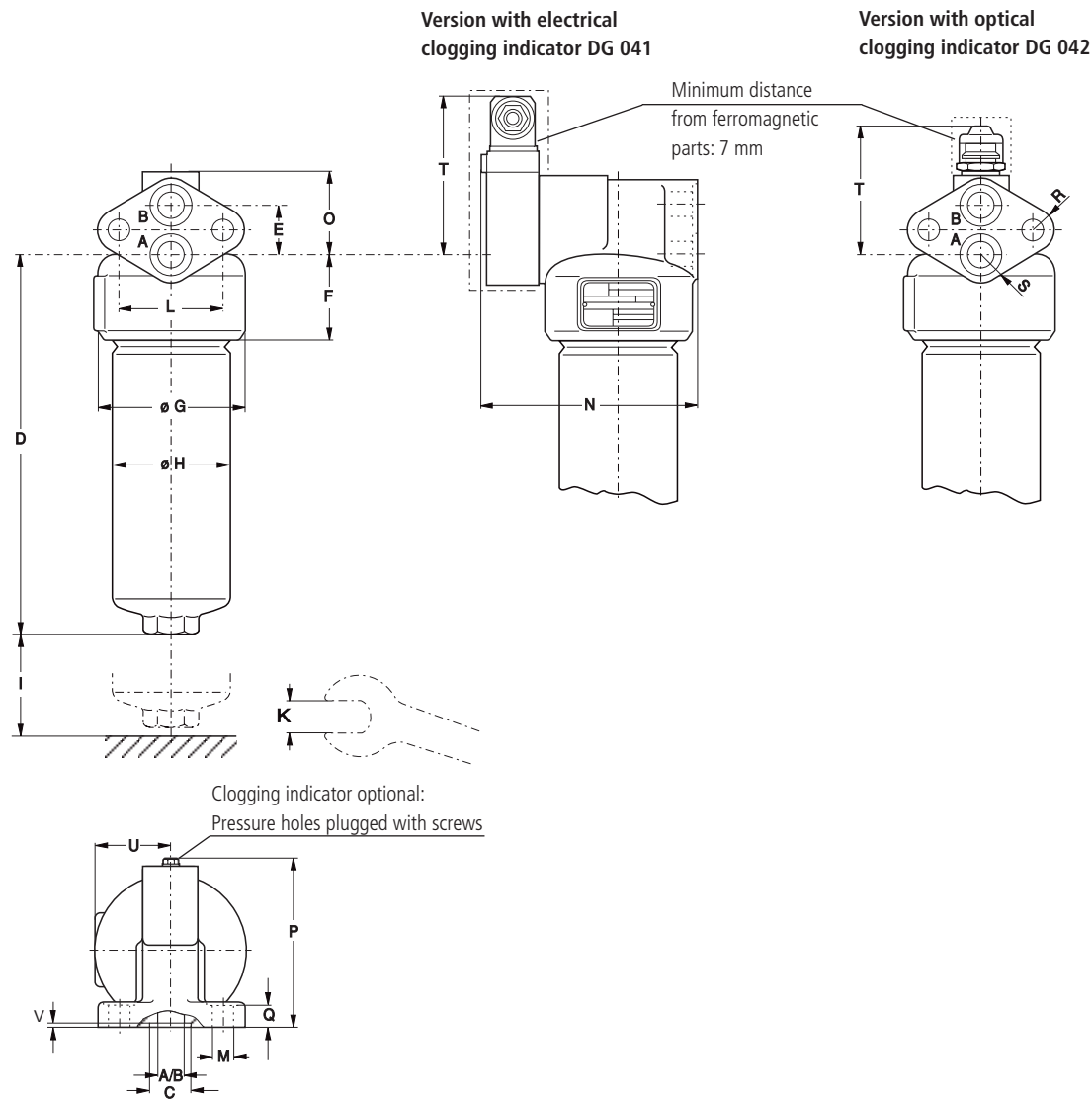
## Remarks:

- Filter versions without by-pass valves must always be equipped with a clogging indicator.
- The filters listed in this chart are standard filters. If modifications are required, e.g. filter fineness 30 µ, we kindly ask for your request.

<sup>1</sup> Element differential pressure stable up to 160 bar

<sup>2</sup> Clogging indicator is obligatory

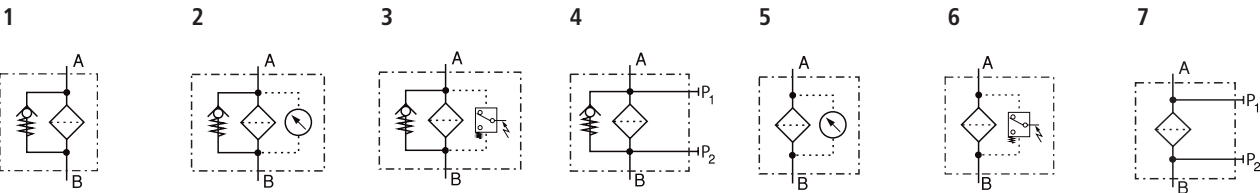
# Dimensions



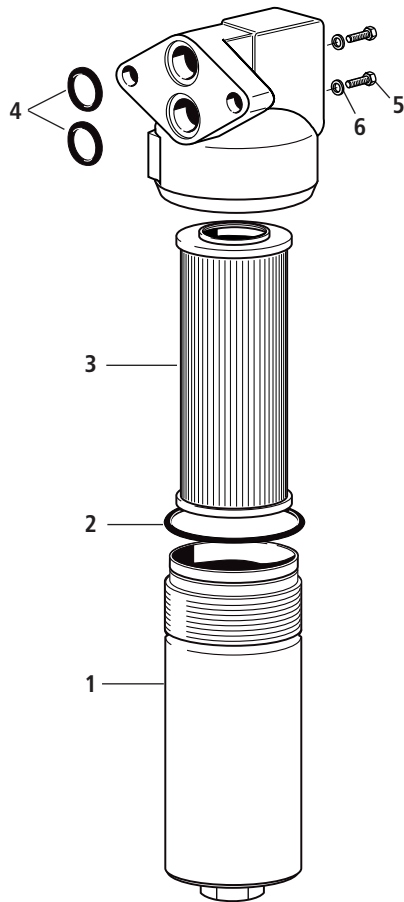
# Measurements

Type	A/B	C	D	E	F	G	H	I	K	L	M	N	O	P	Q	R	S	T	U	V
HD 044	Ø 15	23,5	145	26	49	83	66	70	36	58	12,5	118,5	48	90	17	13	16	electr. / opt.	45	2
HD 064	Ø 15	23,5	241	26	49	83	66	70	36	58	12,5	118,5	48	90	17	13	16	106 / 79	45	2

# Symbols



## Spare Parts



Pos.	Designation	Part No.
1	Filter bowl HD 044	HD 052.0101
1	Filter bowl HD 064	HD 072.0101
2	O-ring 53,57 x 3,53	N 007.0543/1
3	Filter element (with seal)	s. Chart / col. 9
4	O-ring 18,72 x 2,62 *	N 007.0193
5	Hexagonal head screw M4x8 DIN 933-8.8	3301051
6	Bonded Seal 4,1 x 7,2 x 1	3404074

\*Not supplied with filter - has to be ordered separately

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

### ISO 2942 ISO 3968 ISO 16889

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

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 leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

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



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**High Pressure Filters – Worldline 100**

**HD 049 • HD 069**

- In-line mounting
- Operating pressure up to 450 bar
- Nominal flow rate up to 80 l/min

## Description

### Application

In the high pressure circuits of hydraulic systems.

### Performance features

#### Protection

against wear: By means of filter elements that, in full-flow filtration, meet even 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  $\leq 200 \text{ mm}^2/\text{s}$  (cold start condition).

### Filter elements

Flow direction from outside to centre. 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

Filter head:	Spheroidal graphite cast iron (SGI)
Filter bowl:	Cold extruded steel
Coating:	Powder paint resp. phosphate coating
Seals:	NBR (Viton on request)
Filter media:	EXAPOR®MAX - inorganic multi-layer microfibre web Paper - cellulose web, impregnated with resin

### Accessories

If an electrical indicator is used a transparent socket with LED for optical indication is also available with Part No. DG 041.1200.

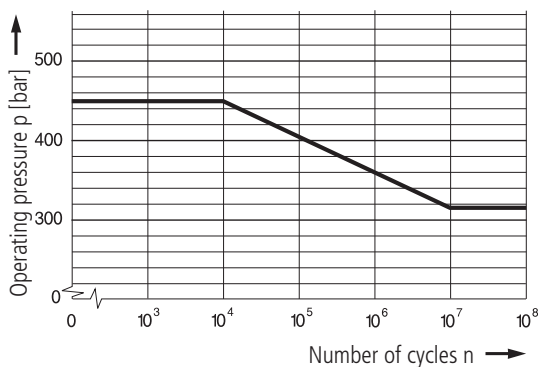
## Characteristics

### Operating pressure

0 ... 315 bar, min.  $10^7$  pressure cycles  
Nominal pressure according to DIN 24550

0 ... 450 bar, min.  $10^4$  pressure cycles  
Quasi-static operating pressure

### Permissible pressures for other numbers of cycles



### Nominal flow rate

Up to 80 l/min (see Selection Chart, column 2)  
The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the connection lines:
  - up to 250 bar  $\leq 8 \text{ m/s}$
  - up to 450 bar  $\leq 12 \text{ m/s}$

### Filter fineness

$5 \mu\text{m(c)}$  ...  $30 \mu\text{m(c)}$   
 $\beta$ -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)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$
- as starting viscosity:  $v_{\text{max}} = 1200 \text{ mm}^2/\text{s}$
- 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 on top

### Connection

Threaded ports according to ISO 228 or DIN 13. Sizes see Selection Chart, column 6 (other port threads on request)

### Electrical clogging indicator

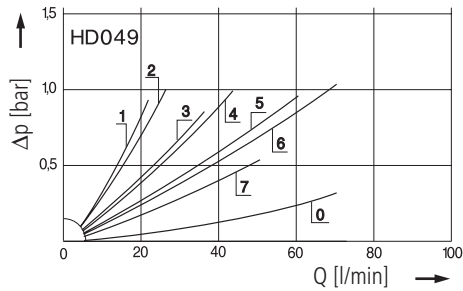
- Switching voltage: max. 120 V AC / 175 V DC
- Switching current: max. 0,17 A AC / 0,25 A DC
- Switching power: max. 3,5 VA AC / 5 W DC
- Type of contact: Change-over
- Electrical protection: IP 65 (with mounted and secured socket)

## Diagrams

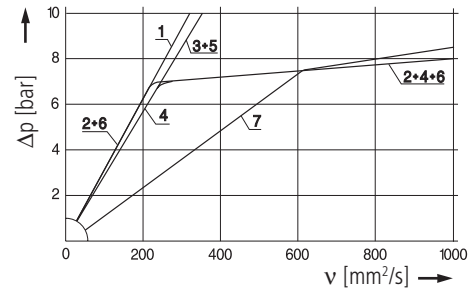
### $\Delta p$ -curves for complete filters in Selection Chart, column 3

**D1**

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

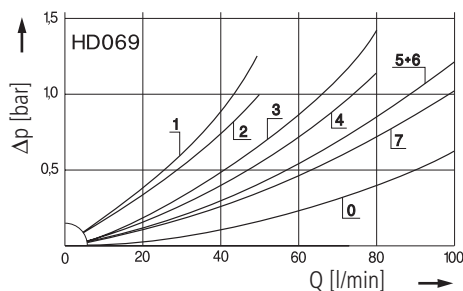


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

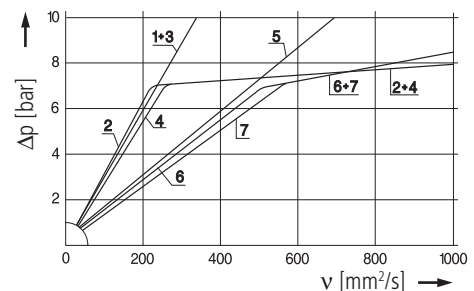


**D2**

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



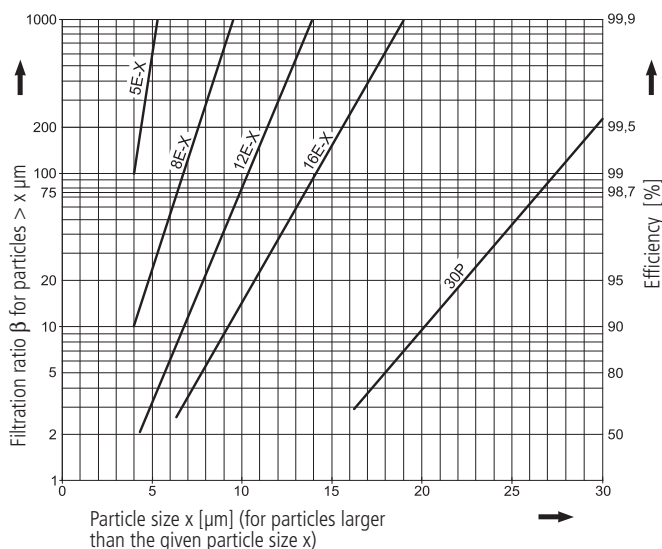
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



### 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



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

**For EXAPOR®MAX- and Paper elements:**

5 E-X	$\beta_{5(c)}$	= 200	EXAPOR®MAX
8 E-X	$\beta_{8(c)}$	= 200	EXAPOR®MAX
12 E-X	$\beta_{12(c)}$	= 200	EXAPOR®MAX
16 E-X	$\beta_{16(c)}$	= 200	EXAPOR®MAX
30 P	$\beta_{30(c)}$	= 200	Paper

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

**For screen elements:**

40 S	= screen material with mesh size	40 $\mu\text{m}$
60 S	= screen material with mesh size	60 $\mu\text{m}$
100 S	= screen material with mesh size	100 $\mu\text{m}$

Tolerances for mesh size according to DIN 4189

For special applications, finenesses differing from these curves are also available by using special composed filter media.

## Selection Chart

Part No.	Nominal flow	Pressure drop see diagram D	Filter curve no.	Dirt-holding capacity	Connection A/B	Cracking pressure of by-pass	Symbol	Replacement element Part No.	Weight	Clogging indicator Cracking pressure in ( )	Remarks
1	l/min	3	4	g	6	7	8	9	10	11	12
HD 049-189	20	D1/1	5 E-X	3,4	G½	-	6	V3.0510-13 <sup>1</sup>	3,9	electrical (5)	change-over
HD 049-169	25	D1/2	5 E-X	3,8	G½	7	1	V3.0510-03	3,8	-	-
HD 049-179	25	D1/2	5 E-X	3,8	G½	7	2	V3.0510-03	3,9	optical (5)	-
HD 049-159	25	D1/2	5 E-X	3,8	G½	7	3	V3.0510-03	3,9	electrical (5)	change-over
HD 049-186	30	D1/3	12 E-X	5	G½	-	6	V3.0510-16 <sup>1</sup>	3,9	electrical (5)	change-over
HD 049-166	35	D1/4	12 E-X	6,1	G½	7	1	V3.0510-06	3,8	-	-
HD 049-176	35	D1/4	12 E-X	6,1	G½	7	2	V3.0510-06	3,9	optical (5)	-
HD 049-156	35	D1/4	12 E-X	6,1	G½	7	3	V3.0510-06	3,9	electrical (5)	change-over
HD 049-188	55	D1/5	16 E-X	5,5	G½	-	6	V3.0510-18 <sup>1</sup>	3,9	electrical (5)	change-over
HD 049-268	63	D1/6	16 E-X	6,6	M18 x 1,5	7	1	V3.0510-08	3,8	-	casing phosphated
HD 049-168	63	D1/6	16 E-X	6,6	G½	7	1	V3.0510-08	3,8	-	-
HD 049-178	63	D1/6	16 E-X	6,6	G½	7	2	V3.0510-08	3,9	optical (5)	-
HD 049-158	63	D1/6	16 E-X	6,6	G½	7	3	V3.0510-08	3,9	electrical (5)	change-over
HD 049-151	55	D1/7	30 P	3,6	G½	7	1	P3.0510-11 <sup>2</sup>	3,8	-	-
HD 049-161	55	D1/7	30 P	3,6	G½	7	2	P3.0510-11 <sup>2</sup>	3,9	optical (5)	-
HD 049-171	55	D1/7	30 P	3,6	G½	7	3	P3.0510-11 <sup>2</sup>	3,9	electrical (5)	change-over
HD 069-189	43	D2/1	5 E-X	6,9	G½	-	6	V3.0520-13 <sup>1</sup>	5,1	electrical (5)	change-over
HD 069-169	50	D2/2	5 E-X	7,6	G½	7	1	V3.0520-03	4,9	-	-
HD 069-179	50	D2/2	5 E-X	7,6	G½	7	2	V3.0520-03	5,0	optical (5)	-
HD 069-159	50	D2/2	5 E-X	7,6	G½	7	3	V3.0520-03	5,0	electrical (5)	change-over
HD 069-186	63	D2/3	12 E-X	11	G¾	-	6	V3.0520-16 <sup>1</sup>	5,1	electrical (5)	change-over
HD 069-166	70	D2/4	12 E-X	13	G¾	7	1	V3.0520-06	4,9	-	-
HD 069-176	70	D2/4	12 E-X	13	G¾	7	2	V3.0520-06	5,0	optical (5)	-
HD 069-156	70	D2/4	12 E-X	13	G¾	7	3	V3.0520-06	5,0	electrical (5)	change-over
HD 069-188	80	D2/5	16 E-X	12	G¾	-	6	V3.0520-18 <sup>1</sup>	5,1	electrical (5)	change-over
HD 069-268	80	D2/6	16 E-X	14	G¾	7	1	V3.0520-08	4,9	-	casing phosphated
HD 069-168	80	D2/6	16 E-X	14	G¾	7	1	V3.0520-08	4,9	-	-
HD 069-178	80	D2/6	16 E-X	14	G¾	7	2	V3.0520-08	5,0	optical (5)	-
HD 069-158	80	D2/6	16 E-X	14	G¾	7	3	V3.0520-08	5,0	electrical (5)	change-over
HD 069-151	80	D2/7	30 P	7,1	G¾	7	1	P3.0520-01 <sup>2</sup>	4,9	-	-
HD 069-161	80	D2/7	30 P	7,1	G¾	7	2	P3.0520-01 <sup>2</sup>	5,0	optical (5)	-
HD 069-171	80	D2/7	30 P	7,1	G¾	7	3	P3.0520-01 <sup>2</sup>	5,0	electrical (5)	change-over

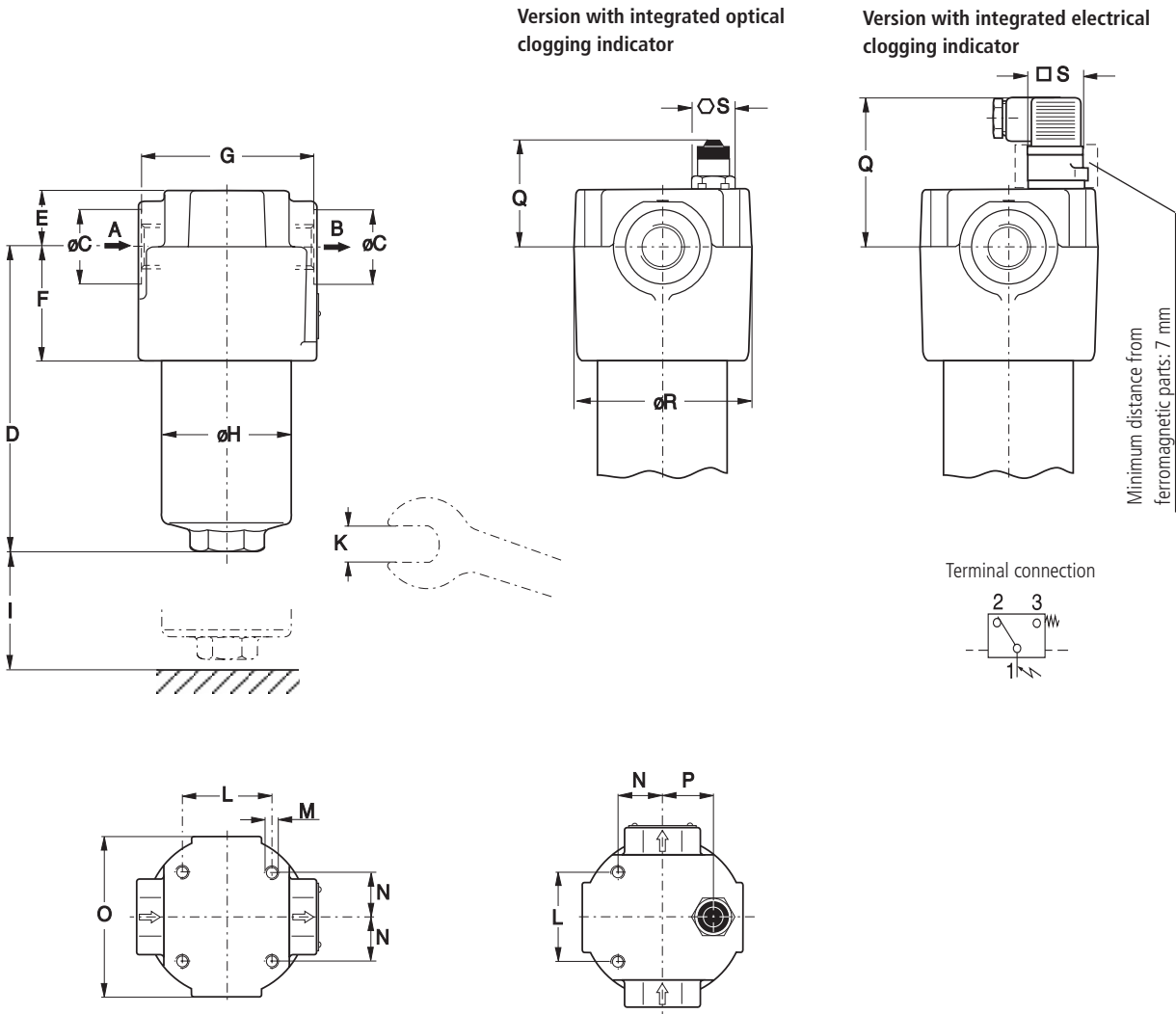
### Remarks:

- The filters listed in this chart are standard filters. If modifications are required, e.g. bolt mounted indicators according to catalogue sheet 60.30, we kindly ask for your request.
- If an electrical indicator is used a transparent socket with LED for optical indication is also available with Part No. DG 041.1200.

<sup>1</sup> Element differential pressure up to 160 bar

<sup>2</sup> Paper media supported with metal gauze

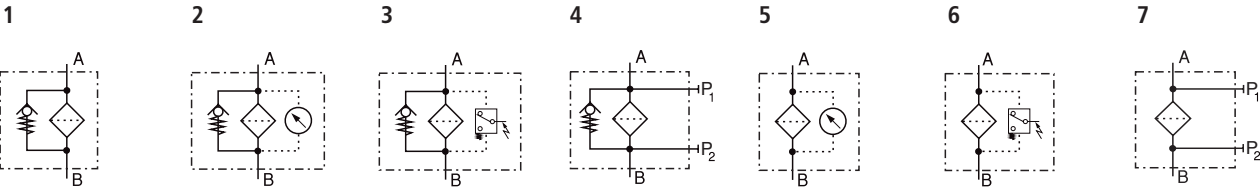
# Dimensions



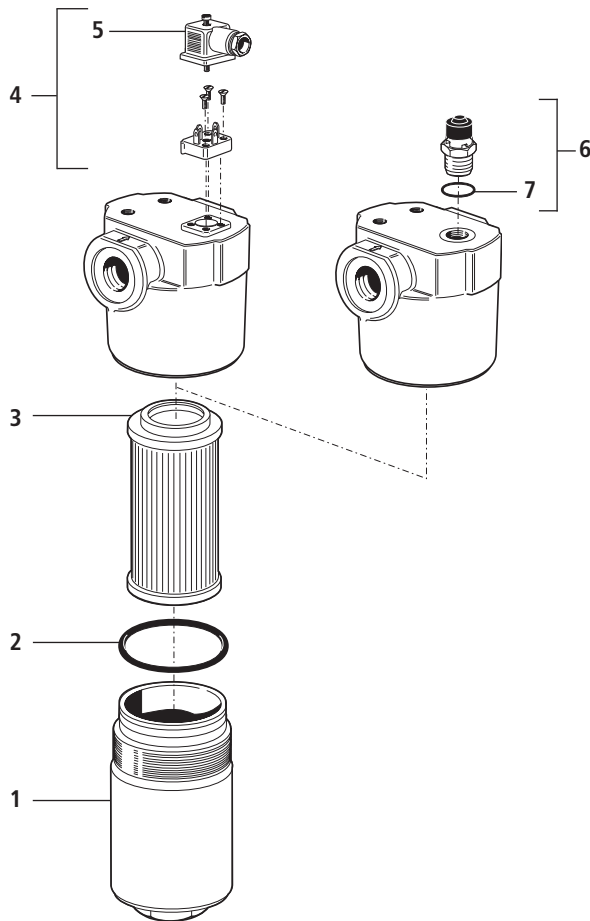
# Measurements

Type	A/B	C	D	E	F	G	H	I	K	L	M ø/depth	N	O	P	Q opt./electr.	R	S opt./electr.
HD 049	M18 x 1,5 , G½	24, 33	158	24,5	61	84	65	55	36	40	M8/12	25	89	27,5	55/72	85	24/30
HD 069	G½, G¾	33, 36	254	24,5	61	84	65	55	36	40	M8/12	25	89	27,5	55/72	85	24/30

# Symbols



## Spare Parts



Pos.	Designation	Part No.
1	Filter bowl HD 049	HD 052.0101
1	Filter bowl HD 069	HD 072.0101
2	O-ring 53,57 x 3,53	N 007.0543/1
3	Filter element (with seal)	s. Chart / col. 9
4	Reed switch with screws and socket (Pos. 5)	HD 049.1410
5	Socket DIN 43650 - AF3	DG 041.1220
6	Optical indicator (with Pos. 7)	HD 049.1400
7	O-ring 17 x 2	N 007.0172

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

### ISO 2942 ISO 3968 ISO 16889

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

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 leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

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



### We produce fluid power solutions

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**High Pressure Filters – Worldline 200**

**HD 152 • HD 172**

- In-line mounting
- Operating pressure up to 450 bar
- Nominal flow rate up to 150 l/min

## Description

### Application

In the high pressure circuits of hydraulic systems.

### Performance features

Protection

against wear: By means of filter elements that, in full-flow filtration, meet even 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  $v \leq 200 \text{ mm}^2/\text{s}$  (cold start condition).

### Filter elements

Flow direction from outside to centre. 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

Filter head: Spheroidal graphite cast iron (SGI)  
Filter bowl: Cold extruded steel  
Coating: Powder paint  
Seals: NBR (Viton on request)  
Filter media: EXAPOR®MAX - inorganic multi-layer microfibre web  
Paper - cellulose web, impregnated with resin

### Accessories

If an electrical indicator is used a transparent socket with LED for optical indication is also available with Part No. DG 041.1200.

## Characteristics

### Operating pressure

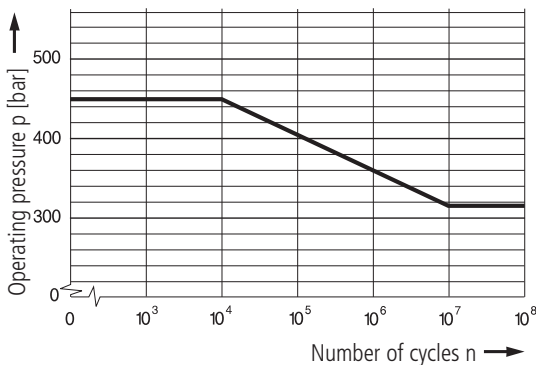
0 ... 315 bar, min.  $10^7$  pressure cycles

Nominal pressure according to DIN 24550

0 ... 450 bar, min.  $10^4$  pressure cycles

Quasi-static operating pressure

### Permissible pressures for other numbers of cycles



### Nominal flow rate

Up to 150 l/min (see Selection Chart, column 2)

The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the connection lines:
  - up to 250 bar  $\leq 8 \text{ m/s}$
  - up to 450 bar  $\leq 12 \text{ m/s}$

### Filter fineness

5  $\mu\text{m(c)}$  ... 30  $\mu\text{m(c)}$

$\beta$ -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)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$
- as starting viscosity:  $v_{\text{max}} = 1200 \text{ mm}^2/\text{s}$
- 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 on top

### Connection

Threaded ports according to ISO 228 or DIN 13. Sizes see Selection Chart, column 6 (other port threads on request)

### Electrical clogging indicator

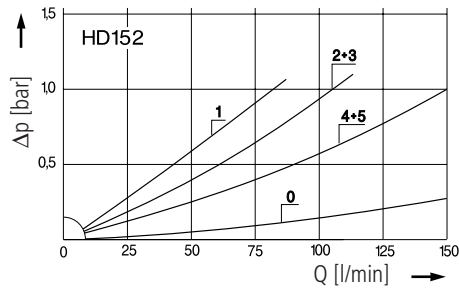
- Switching voltage: max. 120 V AC / 175 V DC
- Switching current: max. 0,17 A AC / 0,25 A DC
- Switching power: max. 3,5 VA AC / 5 W DC
- Type of contact: Change-over
- Electrical protection: IP 65 (with mounted and secured socket)

## Diagrams

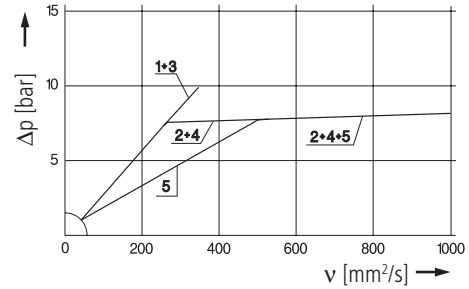
### $\Delta p$ -curves for complete filters in Selection Chart, column 3

**D1**

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

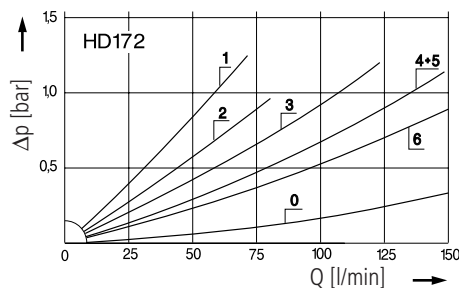


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

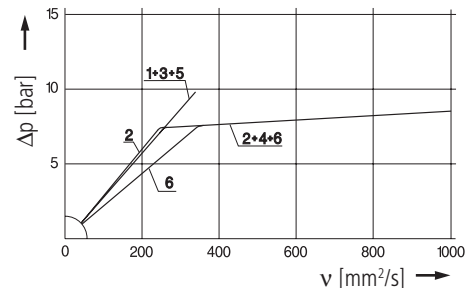


**D2**

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



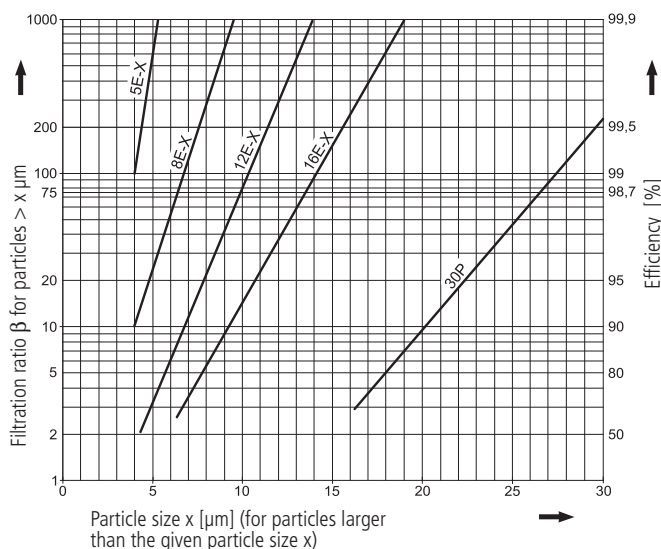
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



### 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



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

#### For EXAPOR®MAX- and Paper elements:

<b>5 E-X</b>	$= \beta_{5(c)} = 200$	EXAPOR®MAX
<b>8 E-X</b>	$= \beta_{8(c)} = 200$	EXAPOR®MAX
<b>12 E-X</b>	$= \beta_{12(c)} = 200$	EXAPOR®MAX
<b>16 E-X</b>	$= \beta_{16(c)} = 200$	EXAPOR®MAX
<b>30 P</b>	$= \beta_{30(c)} = 200$	Paper

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

#### For screen elements:

<b>40 S</b>	= screen material with mesh size	40 $\mu\text{m}$
<b>60 S</b>	= screen material with mesh size	60 $\mu\text{m}$
<b>100 S</b>	= screen material with mesh size	100 $\mu\text{m}$

Tolerances for mesh size according to DIN 4189

For special applications, finenesses differing from these curves are also available by using special composed filter media.

## Selection Charts

Table 1. Technical specifications of the filter elements											
Part No.	Nominal flow	Pressure drop see diagram <b>D</b> /curve no.	Filter fineness see diagr. <b>Dx</b>	Dirt-holding capacity	Connection A/B	Cracking pressure of by-pass	Symbol	Replacement filter element Part No.	Weight	Clogging indicator	Remarks
	l/min			g	bar				kg	bar	
1	2	3	4	5	6	7	8	9	10	11	12
HD 152-186	60	<b>D1</b> /1	12 E-X	12	G¾	-	6	V3.0617-26 <sup>1</sup>	7,1	electrical (5)	change-over
HD 152-166	95	<b>D1</b> /2	12 E-X	14	G¾	7	1	V3.0617-06	6,9	-	-
HD 152-276	95	<b>D1</b> /2	12 E-X	14	G¾	7	2	V3.0617-06	7,0	optical (5)	-
HD 152-156	95	<b>D1</b> /2	12 E-X	14	G¾	7	3	V3.0617-06	7,0	electrical (5)	change-over
HD 152-188	90	<b>D1</b> /3	16 E-X	13	G1	-	6	V3.0617-18 <sup>1</sup>	7,1	electrical (5)	change-over
HD 152-168	150	<b>D1</b> /4	16 E-X	15	G1	7	1	V3.0617-08	6,9	-	-
HD 152-278	150	<b>D1</b> /4	16 E-X	15	G1	7	2	V3.0617-08	7,0	optical (5)	-
HD 152-158	150	<b>D1</b> /4	16 E-X	15	G1	7	3	V3.0617-08	7,0	electrical (5)	change-over
HD 152-151	130	<b>D1</b> /5	30 P	8,7	G1	7	1	P3.0617-01 <sup>2</sup>	6,9	-	-
HD 152-261	130	<b>D1</b> /5	30 P	8,7	G1	7	2	P3.0617-01 <sup>2</sup>	7,0	optical (5)	-
HD 172-189	55	<b>D2</b> /1	5 E-X	11	G1	-	6	V3.0623-13 <sup>1</sup>	8,4	electrical (5)	change-over
HD 172-163	80	<b>D2</b> /2	5 E-X	14	G1	7	1	V3.0623-03	8,0	-	-
HD 172-273	80	<b>D2</b> /2	5 E-X	14	G1	7	2	V3.0623-03	8,1	optical (5)	-
HD 172-153	80	<b>D2</b> /2	5 E-X	14	G1	7	3	V3.0623-03	8,1	electrical (5)	change-over
HD 172-186	100	<b>D2</b> /3	12 E-X	17	G1	-	6	V3.0623-26 <sup>1</sup>	8,4	electrical (5)	change-over
HD 172-166	150	<b>D2</b> /4	12 E-X	22	G1	7	1	V3.0623-06	8,0	-	-
HD 172-276	150	<b>D2</b> /4	12 E-X	22	G1	7	2	V3.0623-06	8,1	optical (5)	-
HD 172-156	150	<b>D2</b> /4	12 E-X	22	G1	7	3	V3.0623-06	8,1	electrical (5)	change-over
HD 172-188	150	<b>D2</b> /5	16 E-X	18	G1	-	6	V3.0623-18 <sup>1</sup>	8,4	electrical (5)	change-over
HD 172-168	150	<b>D2</b> /6	16 E-X	24	G1	7	1	V3.0623-08	8,0	-	-
HD 172-278	150	<b>D2</b> /6	16 E-X	24	G1	7	2	V3.0623-08	8,1	optical (5)	-
HD 172-158	150	<b>D2</b> /6	16 E-X	24	G1	7	3	V3.0623-08	8,1	electrical (5)	change-over
HD 172-151	150	<b>D2</b> /6	30 P	14	G1	7	1	P3.0623-11 <sup>2</sup>	8,0	-	-
HD 172-261	150	<b>D2</b> /6	30 P	14	G1	7	2	P3.0623-11 <sup>2</sup>	8,1	optical (5)	-

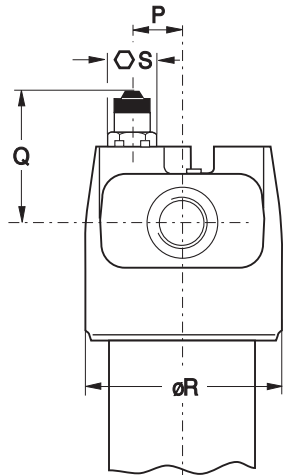
## Remarks:

- The filters listed in this chart are standard filters. If modifications are required, e.g. connections SAE 3/4 resp. SAE 1 (6000 psi), we kindly ask for your request.
- If an electrical indicator is used a transparent socket with LED for optical indication is also available with Part No. DG 041.1200.

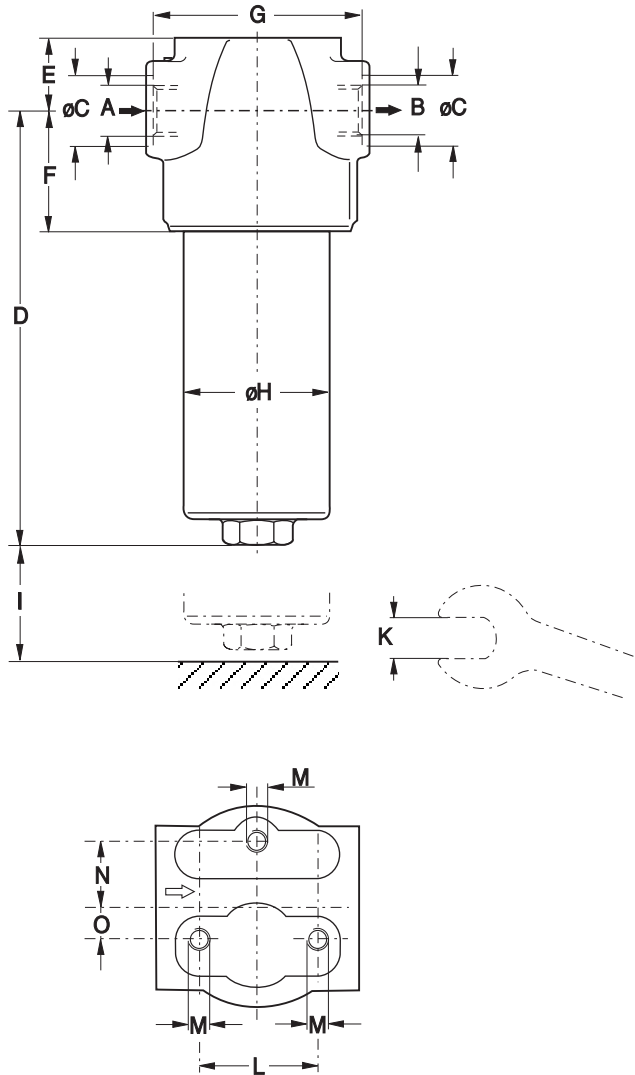
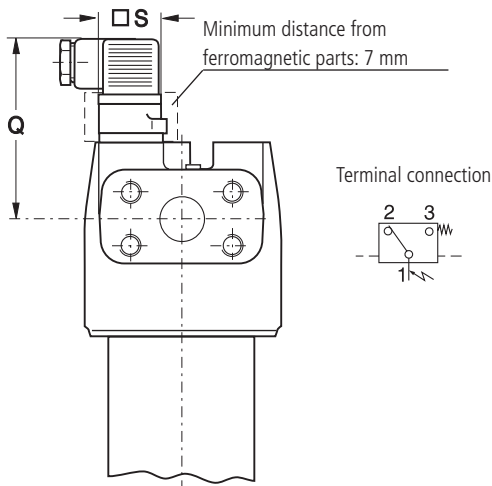
<sup>1</sup> Filter element differential pressure stable up to 160 bar<sup>2</sup> Paper media supported with metal gauze

# Dimensions

Version with integrated optical clogging indicator



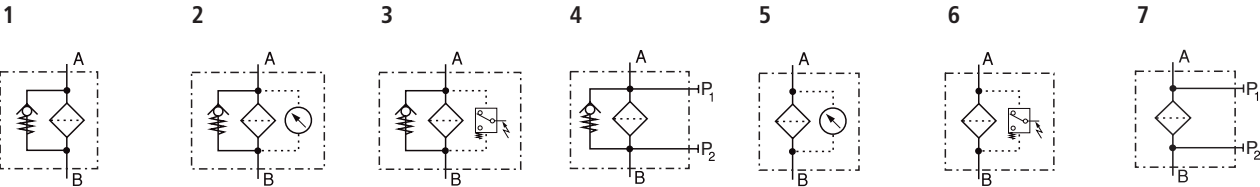
Version with integrated electrical clogging indicator and SAE-flange (6000 psi)



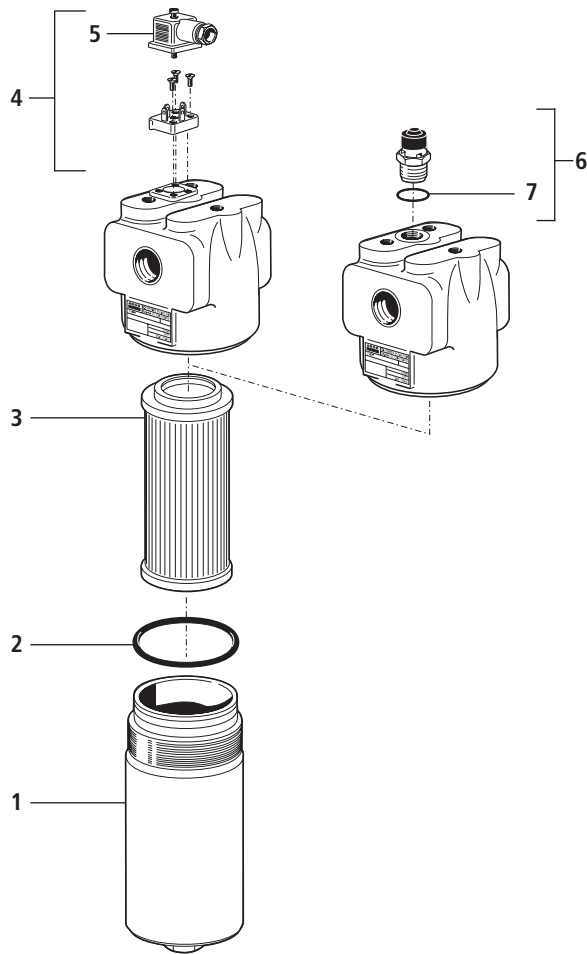
# Measurements

Type	A/B	C	D	E	F	G	H	I	K	L	M ø/depth	N	O	P	Q opt./electr.	R	S opt./electr.
HD 152	G¾, G1	36, 45	224	39	66	104	75	70	27	60	M10/12	35	17,5	30	69/86	102	24/30
HD 172	G1	45	285	39	66	104	75	70	27	60	M10/12	35	17,5	30	69/86	102	24/30

# Symbols



## Spare Parts



Pos.	Designation	Part No.
1	Filter bowl HD 152	HD 152.0102
1	Filter bowl HD 172	HD 171.0101
2	O-ring 63 x 3,5	N 007.0634
3	Filter element (with seal)	see Chart/col. 9
4	Reed switch with screws and socket (Pos. 5)	HD 049.1410
5	Socket DIN 43650 - AF3	DG 041.1220
6	Optical indicator (with Pos. 7)	HD 049.1400
7	O-ring 17 x 2	N 007.0172

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

### ISO 2942 ISO 3968 ISO 16889

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

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 leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

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



### We produce fluid power solutions

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## High Pressure Filters

### HD 314 • HD 414 HD 614

- Flange mounting
- Operating pressure up to 350 bar
- Nominal flow rate up to 400 l/min

## Description

### Application

In the high pressure circuits of hydraulic systems.

### Performance features

Protection

against wear: By means of filter elements that, in full-flow filtration, meet even 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  $\leq 200 \text{ mm}^2/\text{s}$  (cold start condition).

### Filter elements

Flow direction from outside to centre. 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

Filter head:	Spheroidal graphite cast iron (SGI)
Filter bowl:	Cold extruded steel
Coating:	Powder paint
Seals:	NBR (Viton on request)
Filter media:	EXAPOR®MAX - inorganic multi-layer microfibre 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 catalogue sheet 60.30.

## Characteristics

### Operating pressure

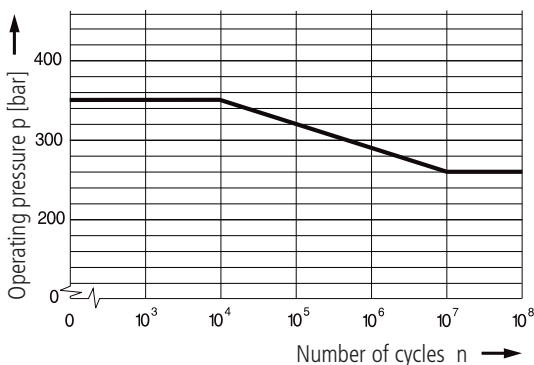
0 ... 260 bar, min.  $10^7$  pressure cycles

Nominal pressure according to DIN 24550

0 ... 350 bar, min.  $10^4$  pressure cycles

Quasi-static operating pressure

### Permissible pressures for other numbers of cycles



### Nominal flow rate

Up to 400 l/min (see Selection Chart, column 2)

The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the connection lines:
  - up to 250 bar  $\leq 8 \text{ m/s}$
  - up to 450 bar  $\leq 12 \text{ m/s}$

### Filter fineness

$5 \mu\text{m(c)}$  ...  $16 \mu\text{m(c)}$

$\beta$ -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)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$
- as starting viscosity:  $v_{\text{max}} = 1200 \text{ mm}^2/\text{s}$
- 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 on top

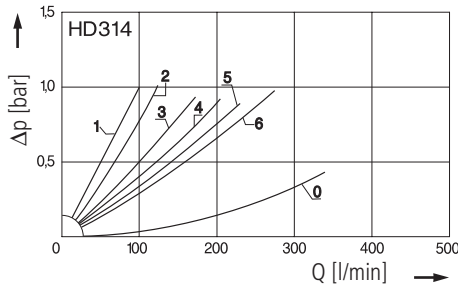
### Connection

2 x  $\varnothing 31 \text{ mm}$  on plain flange

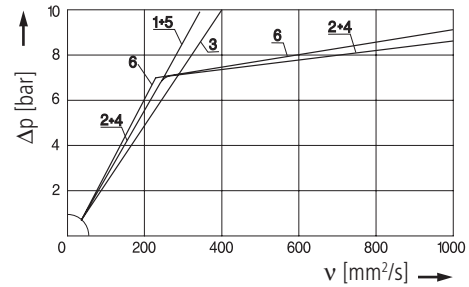
## Diagrams

### $\Delta p$ -curves for complete filters in Selection Chart, column 3

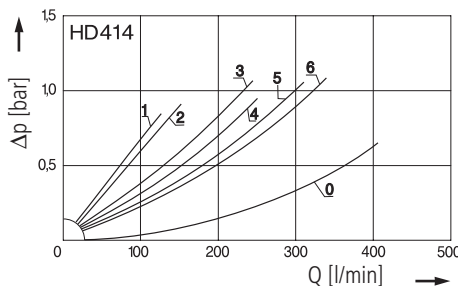
**D1** Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$  (0 = casing empty)



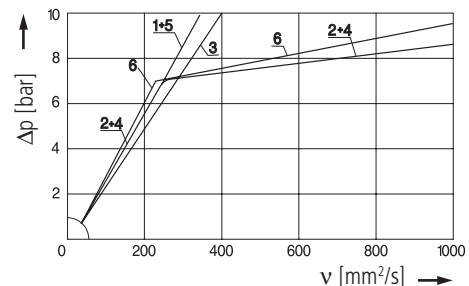
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



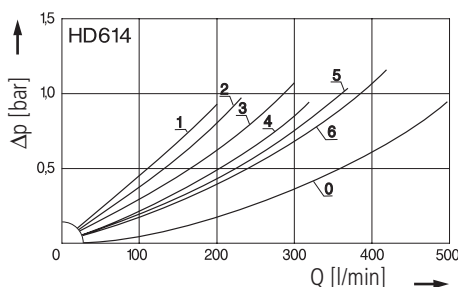
**D2** Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$  (0 = casing empty)



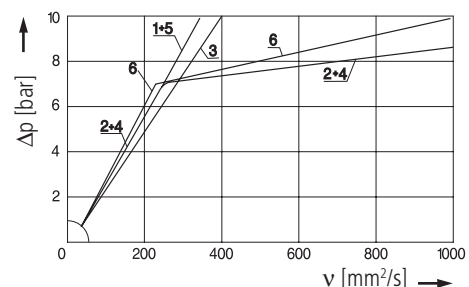
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



**D3** Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$  (0 = casing empty)

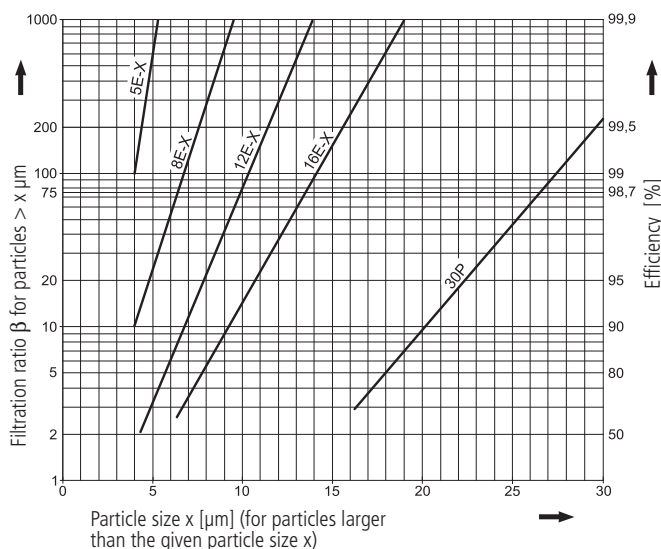


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



### 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



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

**For EXAPOR®MAX- and Paper elements:**

<b>5 E-X</b>	$= \beta_{5(c)} = 200$	EXAPOR®MAX
<b>8 E-X</b>	$= \beta_{8(c)} = 200$	EXAPOR®MAX
<b>12 E-X</b>	$= \beta_{12(c)} = 200$	EXAPOR®MAX
<b>16 E-X</b>	$= \beta_{16(c)} = 200$	EXAPOR®MAX
<b>30 P</b>	$= \beta_{30(c)} = 200$	Paper

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

**For screen elements:**

<b>40 S</b>	= screen material with mesh size	40 $\mu\text{m}$
<b>60 S</b>	= screen material with mesh size	60 $\mu\text{m}$
<b>100 S</b>	= screen material with mesh size	100 $\mu\text{m}$

Tolerances for mesh size according to DIN 4189

For special applications, finenesses differing from these curves are also available by using special composed filter media.

## Selection Chart

Part No.	Nominal flow	Pressure drop see diagram <b>D</b> /curve no.	Filter fineness see diagr. <b>Dx</b>	Dirt-holding capacity	Connection A/B	Cracking pressure of by-pass	Replacement filter element	Part No.	Weight	Clogging indicator	Remarks
	l/min			g	bar				kg		
1	2	3	4	5	6	7	8	9	10	11	12
HD 314-279	85	<b>D1/1</b>	5 E-X	14	Ø 31	-	7	V3.0817-13*	14,2	optional	-
HD 314-259	95	<b>D1/2</b>	5 E-X	18	Ø 31	7	4	V3.0817-03	13,8	optional	-
HD 314-246	135	<b>D1/3</b>	12 E-X	22	Ø 31	-	7	V3.0817-16*	14,2	optional	-
HD 314-256	160	<b>D1/4</b>	12 E-X	28	Ø 31	7	4	V3.0817-06	13,8	optional	-
HD 314-248	240	<b>D1/5</b>	16 E-X	24	Ø 31	-	7	V3.0817-18*	14,2	optional	-
HD 314-258	270	<b>D1/6</b>	16 E-X	30	Ø 31	7	4	V3.0817-08	13,8	optional	-
HD 414-279	115	<b>D2/1</b>	5 E-X	20	Ø 31	-	7	V3.0823-13*	15,7	optional	-
HD 414-259	130	<b>D2/2</b>	5 E-X	26	Ø 31	7	4	V3.0823-03	15,1	optional	-
HD 414-296	180	<b>D2/3</b>	12 E-X	32	Ø 31	-	7	V3.0823-16*	15,7	optional	-
HD 414-256	210	<b>D2/4</b>	12 E-X	41	Ø 31	7	4	V3.0823-06	15,1	optional	-
HD 414-298	300	<b>D2/5</b>	16 E-X	34	Ø 31	-	7	V3.0823-18*	15,7	optional	-
HD 414-258	340	<b>D2/6</b>	16 E-X	46	Ø 31	7	4	V3.0823-08	15,1	optional	-
HD 614-279	170	<b>D3/1</b>	5 E-X	29	Ø 31	-	7	V3.0833-13*	18,5	optional	-
HD 614-259	190	<b>D3/2</b>	5 E-X	36	Ø 31	7	4	V3.0833-03	17,8	optional	-
HD 614-246	270	<b>D3/3</b>	12 E-X	46	Ø 31	-	7	V3.0833-16*	18,5	optional	-
HD 614-256	300	<b>D3/4</b>	12 E-X	58	Ø 31	7	4	V3.0833-06	17,8	optional	-
HD 614-288	400	<b>D3/5</b>	16 E-X	50	Ø 31	-	7	V3.0833-18*	18,5	optional	-
HD 614-258	400	<b>D3/6</b>	16 E-X	67	Ø 31	7	4	V3.0833-08	17,8	optional	-

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 acknowledgements show both items separately.

**Order example: The filter HD 314-279 has to be supplied with optical clogging indicator - response pressure 5,0 bar**

**Order description:** HD 314-279 / DG 042-02 M

**Part No. (Basic unit)** \_\_\_\_\_ **mounted**

**Clogging indicator** \_\_\_\_\_

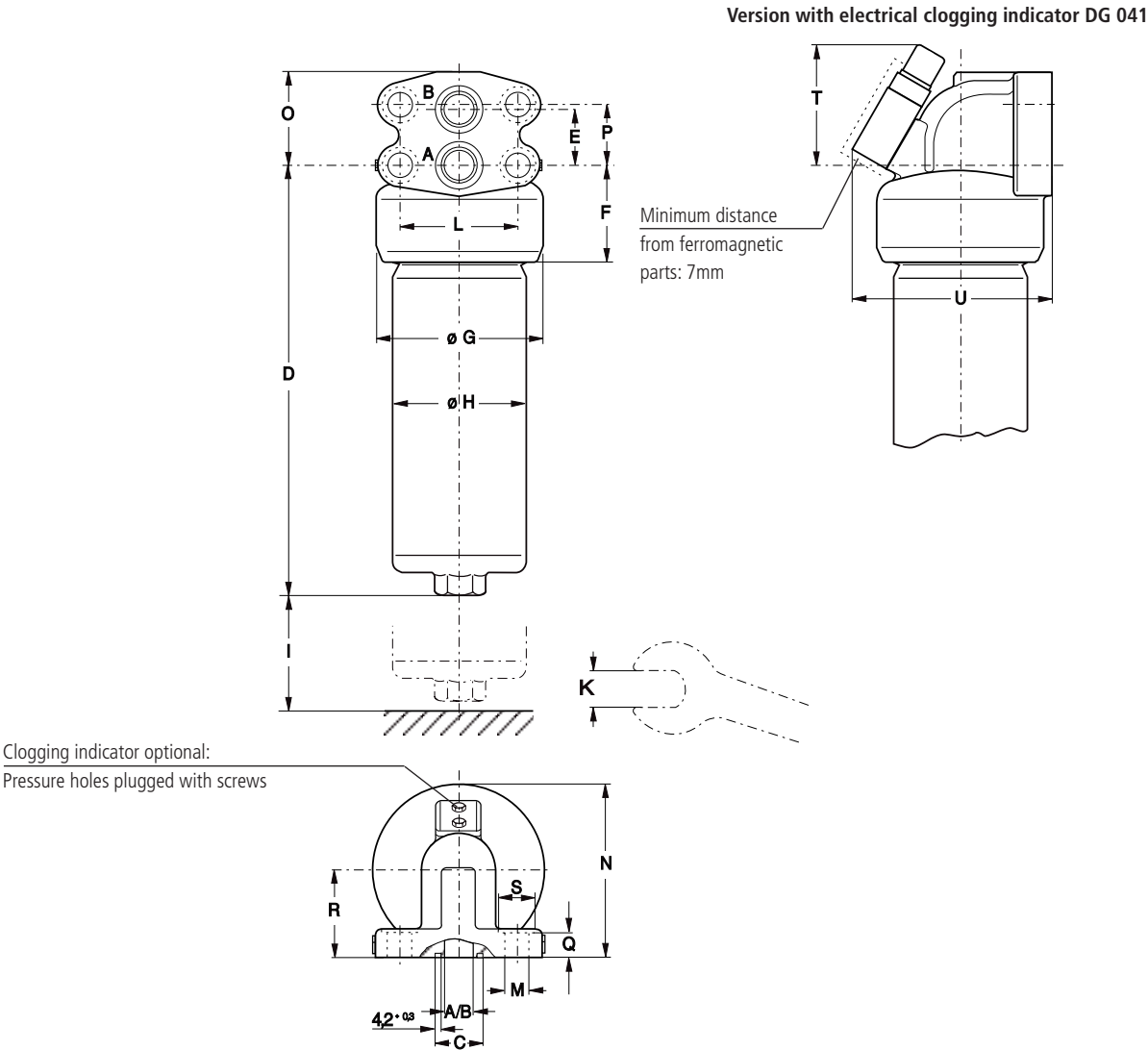
**For the appropriate clogging indicators see catalogue sheet 60.30.**

### Remarks:

- Filter versions without by-pass valves must always be equipped with a clogging indicator.
- The filters listed in this chart are standard filters. If modifications are required, e.g. filter fineness 30 P, we kindly ask for your request.

\* Element differential pressure stable up to 160 bar, clogging indicator is obligatory

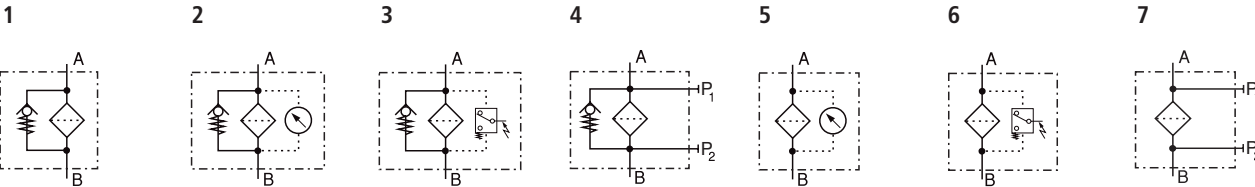
# Dimensions



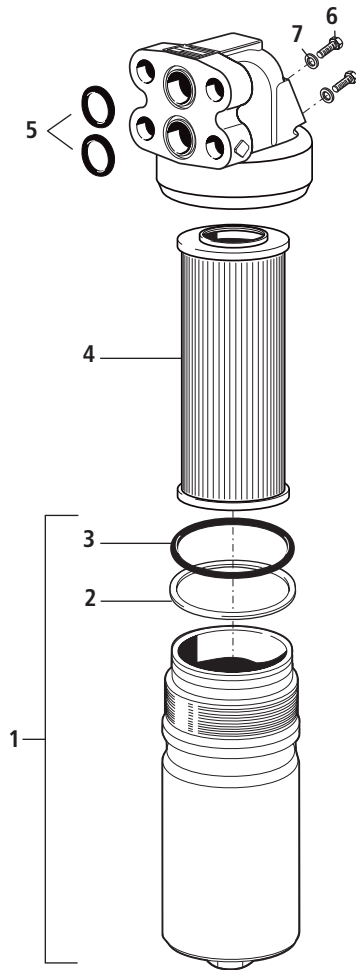
# Measurements

Type	A/B	C	D	E	F	G	H	I	K	L	M	N	O	P	Q	R	S	T	U
HD 314	Ø 31	44,4	263	52	82	138	109	80	32	95	21,5	150	83	58	25	80	34	93	165
HD 414	Ø 31	44,4	325	52	82	138	109	80	32	95	21,5	150	83	58	25	80	34	93	165
HD 614	Ø 31	44,4	426	52	82	138	109	80	32	95	21,5	150	83	58	25	80	34	93	165

# Symbols



## Spare Parts



Pos.	Designation	Part No.
1	Filter bowl HD 314 (with Pos. 2 and 3)	HD 250.0701
1	Filter bowl HD 414 (with Pos. 2 and 3)	HD 451.0702
1	Filter bowl HD 614 (with Pos. 2 and 3)	HD 619.0701
2	Back-ring	HD 255.0102
3	O-ring 94,84 x 3,53	N 007.0953
4	Filter element (with seal)	s. Chart / col. 9
5	O-ring 37,69 x 3,53 *	N 007.0384
6	Hexagonal head screw M4 x 8 DIN 933-8.8	3301051
7	Bonded Seal 4,1 x 7,2 x 1	3404074

\* Not supplied with filter - has to be ordered separately

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

### ISO 2942 ISO 3968 ISO 16889

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

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 leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

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



### We produce fluid power solutions

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**High Pressure Filters - Worldline 300**

**HD 319 • HD 419  
HD 619**

- In-line mounting/Flange mounting
- Operating pressure up to 600 bar
- Nominal flow rate up to 450 l/min

## Description

### Application

In the high pressure circuits of hydraulic systems.

### Performance features

#### Protection

against wear: By means of filter elements that, in full-flow filtration, meet even 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  $v \leq 200 \text{ mm}^2/\text{s}$  (cold start condition).

### Filter elements

Flow direction from outside to centre. 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

Filter head:	Spheroidal graphite cast iron (SGI)
Filter bowl:	Cold extruded steel
Coating:	Powder paint
Seals:	NBR (Viton on request)
Filter media:	EXAPOR®MAX - inorganic multi-layer microfibre web

### Accessories

If an electrical indicator is used, a transparent socket with LED for optical indication is also available with Part No. DG 041.1200.

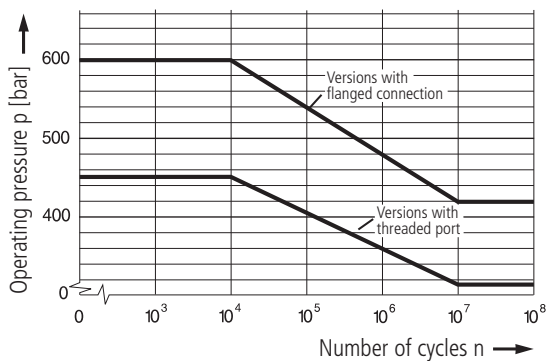
## Characteristics

### Operating pressure

0 ... 315 bar, min.  $10^7$  pressure cycles (threaded port)  
0 ... 420 bar, min.  $10^7$  pressure cycles (flanged connection)  
Nominal pressure according to DIN 24550

0 ... 450 bar, min.  $10^4$  pressure cycles (threaded port)  
0 ... 600 bar, min.  $10^4$  pressure cycles (flanged connection)  
Quasi-static operating pressure

### Permissible pressures for other numbers of cycles



### Nominal flow rate

Up to 450 l/min (see Selection Chart, column 2)  
The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the connection lines:
  - up to 250 bar  $\leq 8 \text{ m/s}$
  - up to 450 bar  $\leq 12 \text{ m/s}$

### Filter fineness

5  $\mu\text{m(c)}$  ... 16  $\mu\text{m(c)}$   
 $\beta$ -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)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$
- as starting viscosity:  $v_{\text{max}} = 1200 \text{ mm}^2/\text{s}$
- 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 on top

### Connection

- Threaded ports according to ISO 228 or DIN 13.
  - SAE-flange (6000 psi)
- Sizes see Selection Chart, column 6 and ordering example (other connections on request).

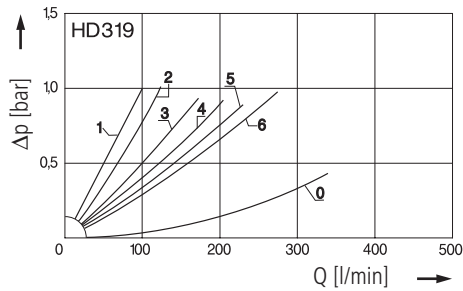
### Electrical clogging indicator

- Switching voltage: max. 120 V AC / 175 V DC
- Switching current: max. 0,17 A AC / 0,25 A DC
- Switching power: max. 3,5 VA AC / 5 W DC
- Type of contact: Change-over
- Electrical protection: IP 65 (with mounted and secured socket)

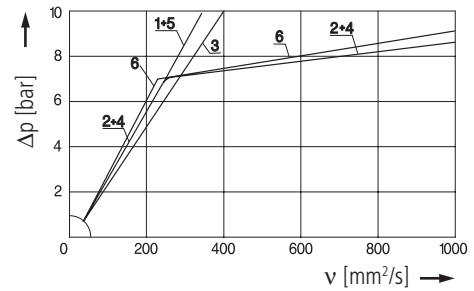
## Diagrams

### $\Delta p$ -curves for complete filters in Selection Chart, column 3

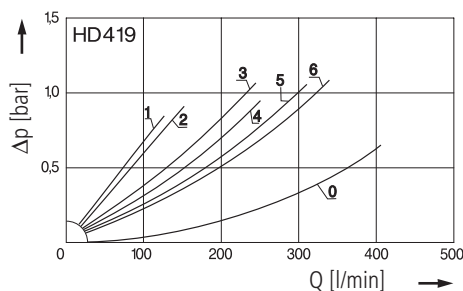
**D1** Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$  (0 = casing empty)



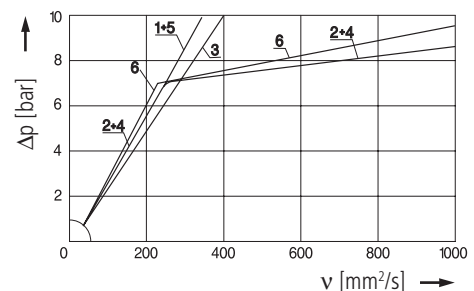
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



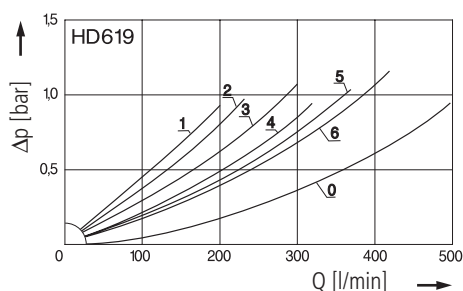
**D2** Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$  (0 = casing empty)



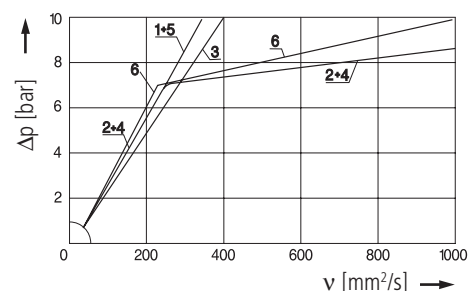
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



**D3** Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$  (0 = casing empty)

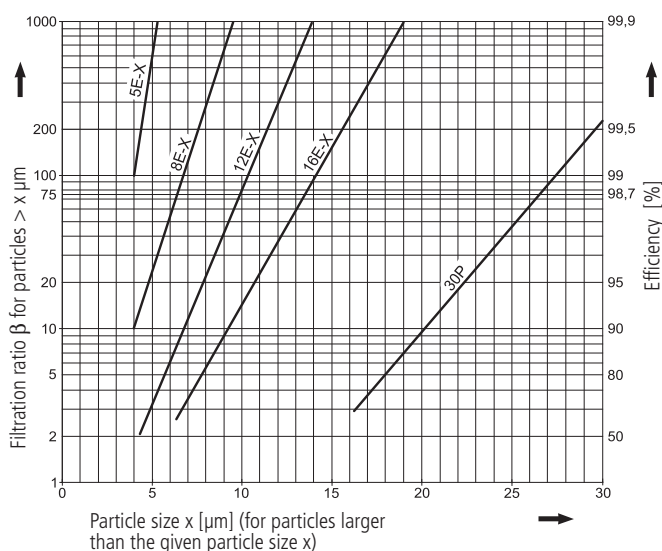


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



### 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



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

**For EXAPOR®MAX- and Paper elements:**

5 E-X	$\beta_{5(c)}$	= 200	EXAPOR®MAX
8 E-X	$\beta_{8(c)}$	= 200	EXAPOR®MAX
12 E-X	$\beta_{12(c)}$	= 200	EXAPOR®MAX
16 E-X	$\beta_{16(c)}$	= 200	EXAPOR®MAX
30 P	$\beta_{30(c)}$	= 200	Paper

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

**For screen elements:**

40 S	= screen material with mesh size	40 $\mu\text{m}$
60 S	= screen material with mesh size	60 $\mu\text{m}$
100 S	= screen material with mesh size	100 $\mu\text{m}$

Tolerances for mesh size according to DIN 4189

For special applications, finenesses differing from these curves are also available by using special composed filter media.

## Selection Chart

Part No.	Nominal flow	Pressure drop see diagram <b>D</b> /curve no.	Filter fineness see diagr. <b>Dx</b>	Dirt-holding capacity	Connection A/B	Cracking pressure of by-pass	Symbol	Replacement filter element	Part No.	Weight	Clogging indicator	Cracking pressure in ( )	Remarks
	l/min			g		bar				kg		bar	
1	2	3	4	5	6	7	8	9	10	11		12	
HD 319-289	85	<b>D1</b> /1	5 E-X	14	G1¼	-	6	V3.0817-13 <sup>1</sup>	16,3	electrical	(5)		change-over
HD 319-279	95	<b>D1</b> /2	5 E-X	18	G1¼	7	2	V3.0817-03	15,9	optical	(5)		-
HD 319-259	95	<b>D1</b> /2	5 E-X	18	G1¼	7	3	V3.0817-03	15,9	electrical	(5)		change-over
HD 319-286	135	<b>D1</b> /3	12 E-X	22	G1¼	-	6	V3.0817-16 <sup>1</sup>	16,3	electrical	(5)		change-over
HD 319-276	160	<b>D1</b> /4	12 E-X	28	G1¼	7	2	V3.0817-06	15,9	optical	(5)		-
HD 319-256	160	<b>D1</b> /4	12 E-X	28	G1¼	7	3	V3.0817-06	15,9	electrical	(5)		change-over
HD 319-288	240	<b>D1</b> /5	16 E-X	24	G1¼	-	6	V3.0817-18 <sup>1</sup>	16,3	electrical	(5)		change-over
HD 319-278	270	<b>D1</b> /6	16 E-X	30	G1¼	7	2	V3.0817-08	15,9	optical	(5)		-
HD 319-258	270	<b>D1</b> /6	16 E-X	30	G1¼	7	3	V3.0817-08	15,9	electrical	(5)		change-over
HD 419-289	115	<b>D2</b> /1	5 E-X	20	G1¼	-	6	V3.0823-13 <sup>1</sup>	17,8	electrical	(5)		change-over
HD 419-279	130	<b>D2</b> /2	5 E-X	26	G1¼	7	2	V3.0823-03	17,2	optical	(5)		-
HD 419-259	130	<b>D2</b> /2	5 E-X	26	G1¼	7	3	V3.0823-03	17,2	electrical	(5)		change-over
HD 419-286	180	<b>D2</b> /3	12 E-X	32	G1¼	-	6	V3.0823-16 <sup>1</sup>	17,8	electrical	(5)		change-over
HD 419-276	210	<b>D2</b> /4	12 E-X	41	G1¼	7	2	V3.0823-06	17,2	optical	(5)		-
HD 419-256	210	<b>D2</b> /4	12 E-X	41	G1¼	7	3	V3.0823-06	17,2	electrical	(5)		change-over
HD 419-288	300	<b>D2</b> /5	16 E-X	34	G1¼	-	6	V3.0823-18 <sup>1</sup>	17,8	electrical	(5)		change-over
HD 419-278	340	<b>D2</b> /6	16 E-X	46	G1¼	7	2	V3.0823-08	17,2	optical	(5)		-
HD 419-258	340	<b>D2</b> /6	16 E-X	46	G1¼	7	3	V3.0823-08	17,2	electrical	(5)		change-over
HD 619-289	170	<b>D3</b> /1	5 E-X	29	G1½	-	6	V3.0833-13 <sup>1</sup>	20,6	electrical	(5)		change-over
HD 619-279	190	<b>D3</b> /2	5 E-X	36	G1½	7	2	V3.0833-03	19,9	optical	(5)		-
HD 619-259	190	<b>D3</b> /2	5 E-X	36	G1½	7	3	V3.0833-03	19,9	electrical	(5)		change-over
HD 619-286	270	<b>D3</b> /3	12 E-X	46	G1½	-	6	V3.0833-16 <sup>1</sup>	20,6	electrical	(5)		change-over
HD 619-276	300	<b>D3</b> /4	12 E-X	58	G1½	7	2	V3.0833-06	19,9	optical	(5)		-
HD 619-256	300	<b>D3</b> /4	12 E-X	58	G1½	7	3	V3.0833-06	19,9	electrical	(5)		change-over
HD 619-288	450	<b>D3</b> /5	16 E-X	50	G1½	-	6	V3.0833-18 <sup>1</sup>	20,6	electrical	(5)		change-over
HD 619-278	450	<b>D3</b> /6	16 E-X	67	G1½	7	2	V3.0833-08	19,9	optical	(5)		-
HD 619-258	450	<b>D3</b> /6	16 E-X	67	G1½	7	3	V3.0833-08	19,9	electrical	(5)		change-over

Two different head pieces with two various connecting options are available.

**Order example: The Filter HD 319-289 has to be supplied with SAE1¼ flanged connection.**

**Order description:**

**HD 319-189**

**Connections:**

2 various options are available

Flanged connection (A/B) SAE1¼ (6000 psi) ————— 1

Threaded port (A/B) G1¼ or G1½<sup>2</sup> ————— 2

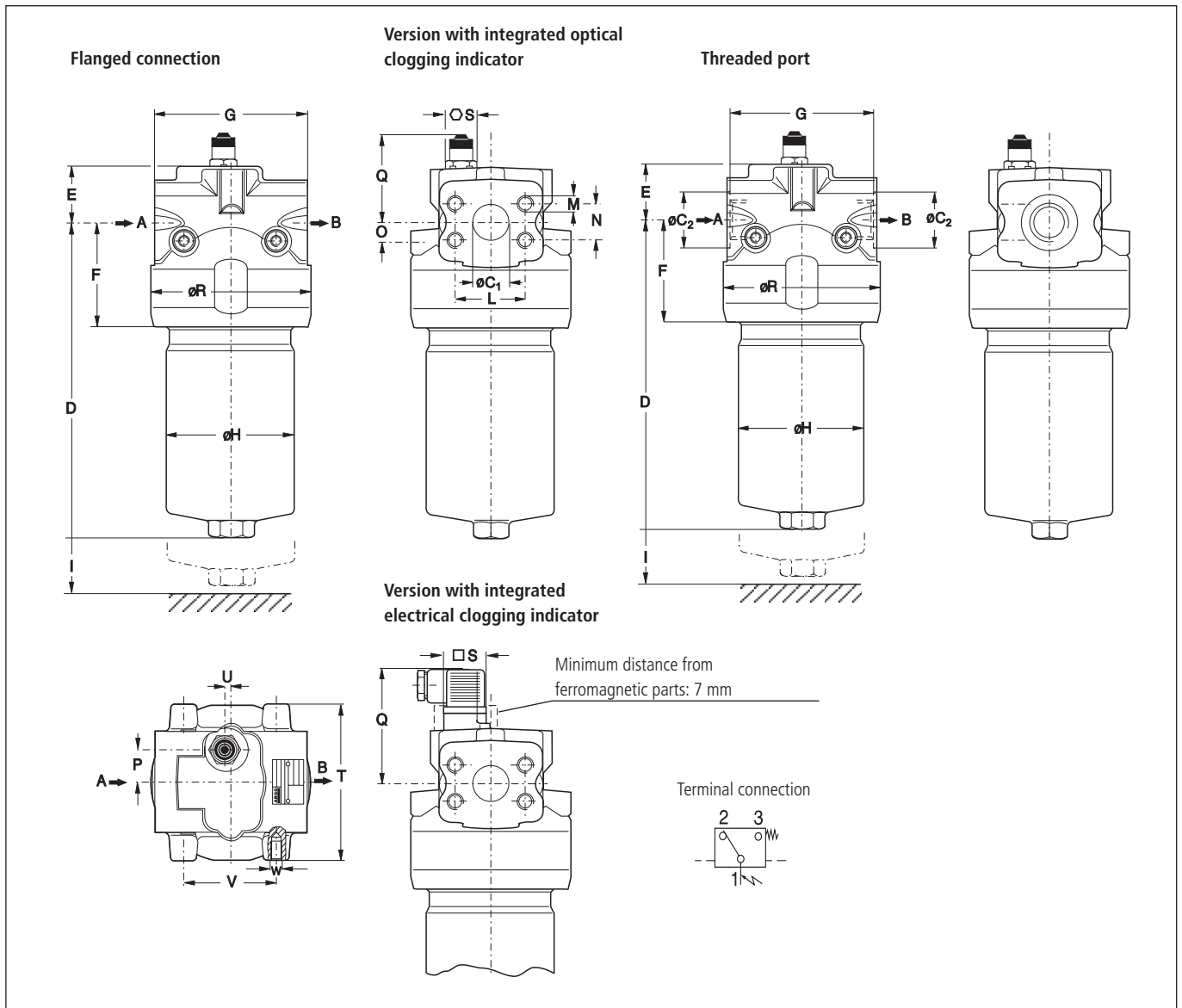
**Remarks:**

- The filters listed in this chart are standard filters. If modifications are required, e.g. bolt mounted indicators according to catalogue sheet 60.30, we kindly ask for your request.
- If an electrical indicator is used, a transparent socket with LED for optical indication is also available with Part No. DG 041.1200.

<sup>1</sup> Element differential pressure stable up to 160 bar

<sup>2</sup> G1½ from series HD 619

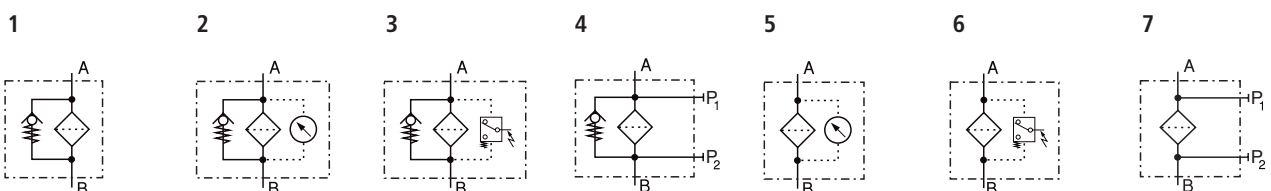
## Dimensions



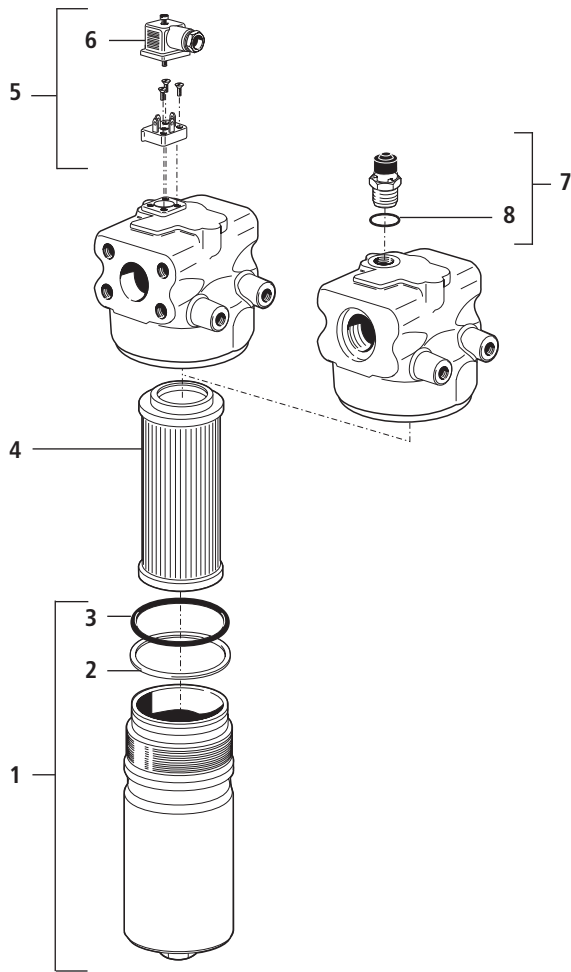
## Measurements

Type	A/B	C <sub>1</sub>	C <sub>2</sub>	D	E	F	G	H	I	K	L	M Ø/depth	N	O	P	Q opt./electr.	R	S opt./electr.	T	U	V	W Ø/depth
HD 319	see	31	65	255	45	86	145	109	80	32	66,7	M14/22	31,8	18,5	33	75/92	152	24/30	148	8	80	M12/18
HD 419	Selection	31	65	319	45	86	145	109	80	32	66,7	M14/22	31,8	18,5	33	75/92	152	24/30	148	8	80	M12/18
HD 619	Chart	31	65	420	45	86	145	109	80	32	66,7	M14/22	31,8	18,5	33	75/92	152	24/30	148	8	80	M12/18

## Symbols



## Spare Parts



Pos.	Designation	Part No.
1	Filter bowl HD 319 (with Pos. 2 and 3)	HD 250.0701
1	Filter bowl HD 419 (with Pos. 2 and 3)	HD 451.0702
1	Filter bowl HD 619 (with Pos. 2 and 3)	HD 619.0701
2	Back-ring	HD 255.0102
3	O-ring 94,84 x 3,53	N 007.0953
4	Filter element (with seal)	see Chart / col. 9
5	Reed switch with screws and socket (Pos. 6)	HD 049.1410
6	Reed switch with screws DIN 43650 - AF3	DG 041.1220
7	Optical indicator (with Pos. 8)	HD 049.1400
8	O-ring 17 x 2	N 007.0172

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

### ISO 2942 ISO 3968 ISO 16889

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

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 leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

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



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## High Pressure Filters

### HD 417 • HD 617

- Bi-directional flow
- In-line mounting
- Operating pressure up to 450 bar
- Nominal flow rate up to 300 l/min

## Description

### Application

In the high pressure circuits of hydraulic systems with changing flow direction.

### Performance features

Protection

against wear: By means of filter elements that, in full-flow filtration, meet even 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  $v \leq 200 \text{ mm}^2/\text{s}$  (cold start condition).

### Special features

Reverse flow

valves: The "Graetz" system (see Symbols) integrated into the head piece ensures the filtration of the hydraulic fluid in both flow directions.

### Filter elements

Flow direction from outside to centre. 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

Filter head:	Spheroidal graphite cast iron (SGI)
Filter bowl:	Cold extruded steel
Coating:	Powder paint
Seals:	NBR (Viton on request)
Filter media:	EXAPOR®MAX - inorganic multi-layer microfibre 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 catalogue sheet 60.30.

## Characteristics

### Operating pressure

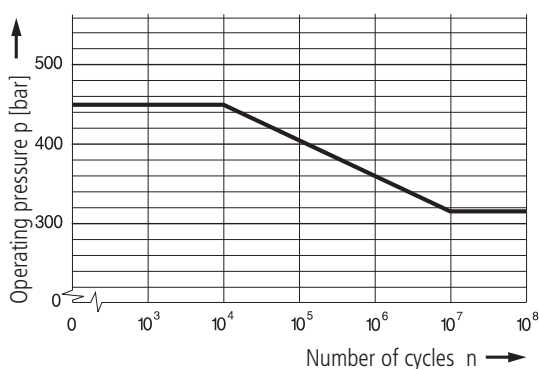
0 ... 315 bar, min.  $10^7$  pressure cycles

Nominal pressure according to DIN 24550

0 ... 450 bar, min.  $10^4$  pressure cycles

Quasi-static operating pressure

### Permissible pressures for other numbers of cycles



### Nominal flow rate

Up to 300 l/min (see Selection Chart, column 2)

The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the connection lines:
  - up to 250 bar  $\leq 8 \text{ m/s}$
  - up to 450 bar  $\leq 12 \text{ m/s}$

### Filter fineness

5  $\mu\text{m(c)}$  ... 30  $\mu\text{m(c)}$

$\beta$ -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)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$
- as starting viscosity:  $v_{\text{max}} = 1200 \text{ mm}^2/\text{s}$
- 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 on top

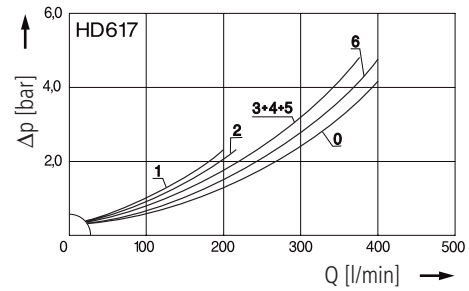
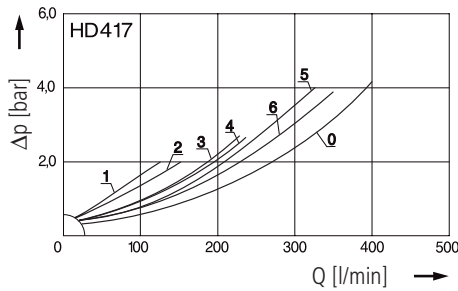
### Connection

SAE-flange (6000 psi). Sizes see Selection Chart, column 6

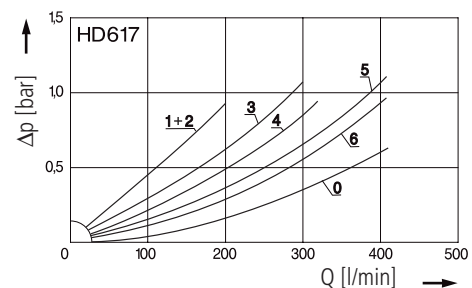
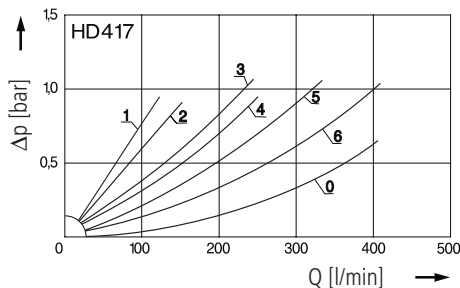
## Diagrams

### $\Delta p$ -curves for complete filters in Selection Chart, column 3

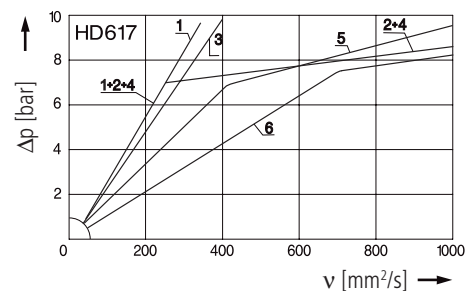
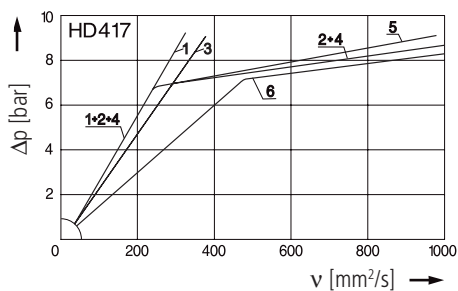
**D1** Pressure drop as a function of the **flow volume** at  $v = 35 \text{ mm}^2/\text{s}$ , measurement **with** reverse flow valves, (0 = casing empty)



**D2** Pressure drop as a function of the **flow volume** at  $v = 35 \text{ mm}^2/\text{s}$ , measurement **without** reverse flow valves, (0 = casing empty)

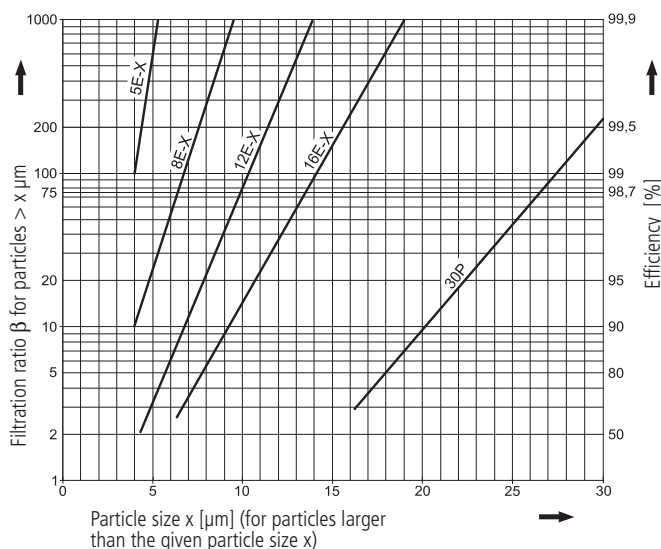


**D3** Pressure drop as a function of the **kinematic viscosity** at nominal flow, measurement **without** reverse flow valves



### 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



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

#### For EXAPOR®MAX- and Paper elements:

<b>5 E-X</b>	$= \beta_{5(c)} = 200$	EXAPOR®MAX
<b>8 E-X</b>	$= \beta_{8(c)} = 200$	EXAPOR®MAX
<b>12 E-X</b>	$= \beta_{12(c)} = 200$	EXAPOR®MAX
<b>16 E-X</b>	$= \beta_{16(c)} = 200$	EXAPOR®MAX
<b>30 P</b>	$= \beta_{30(c)} = 200$	Paper

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

#### For screen elements:

<b>40 S</b>	= screen material with mesh size	40 $\mu\text{m}$
<b>60 S</b>	= screen material with mesh size	60 $\mu\text{m}$
<b>100 S</b>	= screen material with mesh size	100 $\mu\text{m}$

Tolerances for mesh size according to DIN 4189

For special applications, finenesses differing from these curves are also available by using special composed filter media.

## Selection Chart

Part No.	Nominal flow	Pressure drop see diagram D/curve no.	Filter fineness see diagr. Dx	Dirt-holding capacity	Connection A/B	Cracking pressure of by-pass	Replacement filter element	Weight	Clogging indicator	Remarks	
	l/min			g	bar			kg			
1	2	3	4	5	6	7	8	9	10	11	12
HD 417-149	115	D1,2,3/1	5 E-X	20	SAE 1¼	-	3	V3.0823-13 <sup>1</sup>	20,3	optional	<sup>2</sup>
HD 417-179	130	D1,2,3/2	5 E-X	26	SAE 1¼	7	1	V3.0823-03	19,7	optional	-
HD 417-146	180	D1,2,3/3	12 E-X	32	SAE 1¼	-	3	V3.0823-16 <sup>1</sup>	20,3	optional	<sup>2</sup>
HD 417-176	210	D1,2,3/4	12 E-X	41	SAE 1¼	7	1	V3.0823-06	19,7	optional	-
HD 417-168	300	D1,2,3/5	16 E-X	46	SAE 1¼	7	1	V3.0823-08	19,7	optional	-
HD 417-161	300	D1,2,3/6	30 P	26	SAE 1¼	7	1	P3.0823-01 <sup>3</sup>	19,7	optional	-
HD 617-149	170	D1,2,3/1	5 E-X	29	SAE 1½	-	3	V3.0833-13 <sup>1</sup>	23,1	optional	<sup>2</sup>
HD 617-179	190	D1,2,3/2	5 E-X	36	SAE 1½	7	1	V3.0833-03	22,4	optional	-
HD 617-146	270	D1,2,3/3	12 E-X	46	SAE 1½	-	3	V3.0833-16 <sup>1</sup>	23,1	optional	<sup>2</sup>
HD 617-176	300	D1,2,3/4	12 E-X	58	SAE 1½	7	1	V3.0833-06	22,4	optional	-
HD 617-178	300	D1,2,3/5	16 E-X	67	SAE 1½	7	1	V3.0833-08	22,4	optional	-
HD 617-161	300	D1,2,3/6	30 P	34	SAE 1½	7	1	P3.0833-01 <sup>3</sup>	22,4	optional	-
	</										

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 acknowledgements show both items separately.

**Order example: The filter HD 417-149 has to be supplied with electrical clogging indicator - cracking pressure 5,0 bar**

**Order description:** HD 417-149 / DG 041-33 M  
**Part No. (Basic unit)** \_\_\_\_\_ **mounted**  
**Clogging indicator** \_\_\_\_\_

**For the appropriate clogging indicators see catalogue sheet 60.30.**

### Remarks:

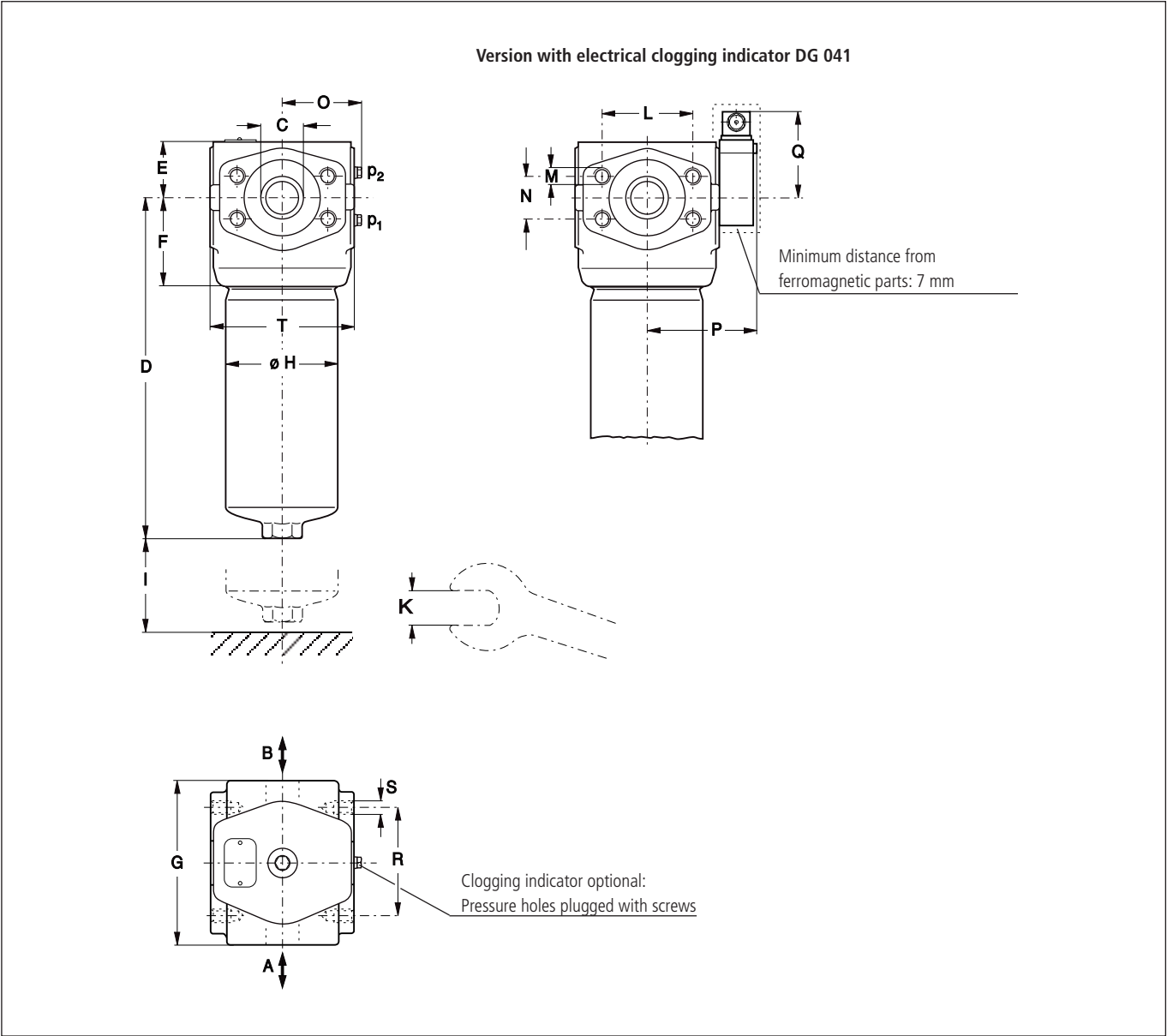
- Filter versions without by-pass valves must always be equipped with a clogging indicator.
- The filters listed in this chart are standard filters. Other designs available on request.

<sup>1</sup> Element differential pressure up to 160 bar

<sup>2</sup> Clogging indicator is obligatory

<sup>3</sup> Paper media supported with metal gauze

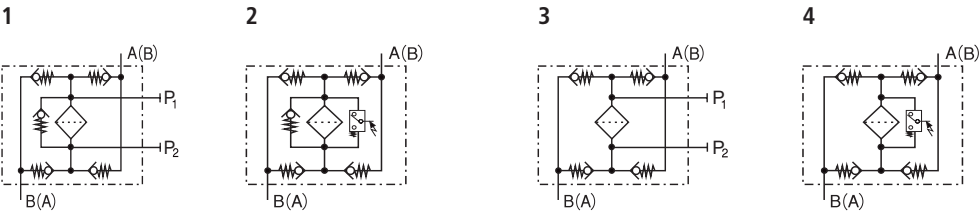
# Dimensions



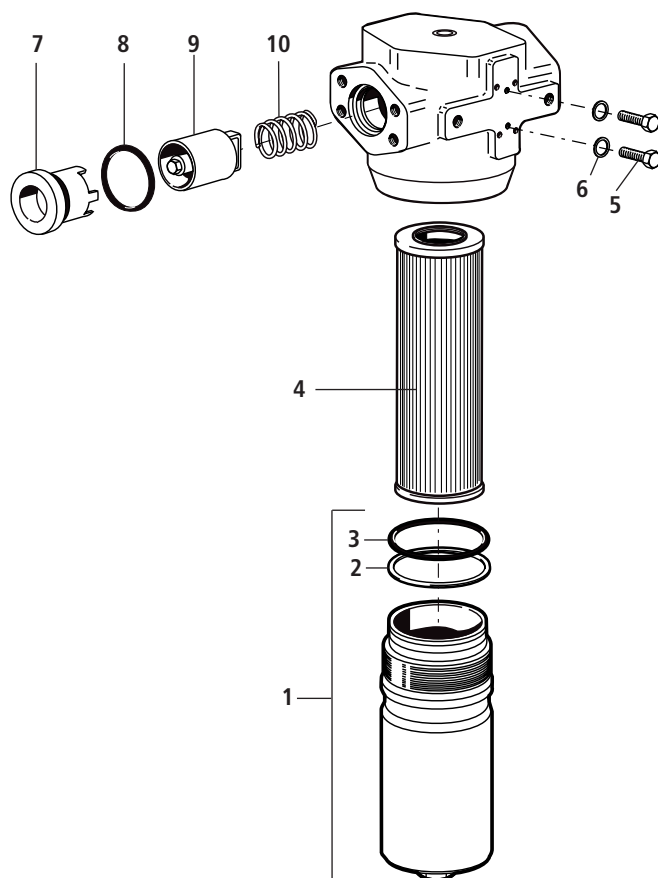
# Measurements

Type	A/B	C	D	E	F	G	H	I	K	L	M ø/depth	N	O	P	Q	R	S ø/depth	T
HD 417	SAE 1¼	31,5	328	58	87,5	156	108	80	32	66,7	M14/22	31,8	73	102	87	100	M12/18	138
HD 617	SAE 1½	31,5	428	58	87,5	156	108	80	32	79,4	M16/24	36,5	73	102	87	100	M12/18	138

# Symbols



## Spare Parts



Pos.	Designation	Part No.
1	Filter bowl HD 417 (with Pos. 2 and 3)	HD 451.0702
1	Filter bowl HD 617 (with Pos. 2 and 3)	HD 619.0701
2	Back-ring	HD 255.0102
3	O-ring 94,84 x 3,53	N 007.0953
4	Filter element (with seal)	see Chart / col. 9
5	Hexagonal head screw M4 x 8 DIN 933-8.8	3301051
6	Bonded seal 4,1 x 7,2 x 1	3404074
7	Sleeve	HD 417.0505
8	O-ring 42,52 x 2,62	N 007.0433
9	Reverse flow valve	HD 417.1520
10	Spring DM 38	N 015.3801

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

### ISO 2942 ISO 3968 ISO 16889

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

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 leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

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### High Pressure Filter Kits

**HD 049 • HD 069**

**HD 172 • HD 319**

**HD 419 • HD 619**

- Operating pressure up to 600 bar
- Nominal flow rate up to 450 l/min

## Description

### Application

In the high pressure circuits of hydraulic systems.

### Performance features

Protection

against wear: By means of filter elements that, in full-flow filtration, meet even 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  $v \leq 200 \text{ mm}^2/\text{s}$  (cold start condition).

### Filter elements

Flow direction from outside to centre. 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

Filter bowl: Cold extruded steel  
Coating: Powder paint  
Seals: NBR (Viton on request)  
Filter media: EXAPOR®MAX - inorganic multi-layer microfibre web

### Accessories

To monitor the clogging, screw-in (see section Dimensions) or flange-mounted differential pressure switches are available.

Flange-mounted clogging indicators optionally with one or two switching points resp. temperature suppression – Dimensions and technical data see catalogue sheet 60.30.

## Characteristics

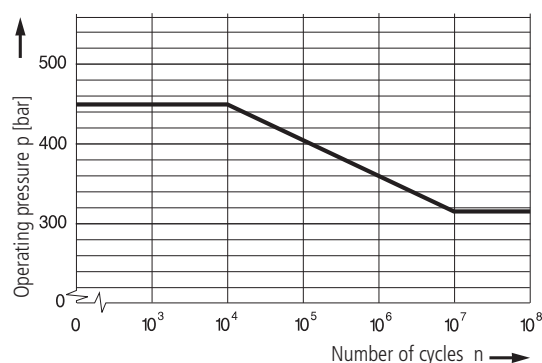
### Operating pressure

HD 049 / 069 / 172: 0 ... 315 bar, min.  $10^7$  pressure cycles  
Nominal pressure according to DIN 24550  
0 ... 450 bar, min.  $10^4$  pressure cycles  
Quasi-static operating pressure

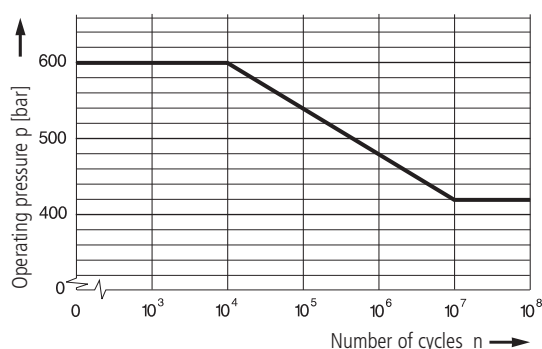
HD 319 / 419 / 619: 0 ... 420 bar, min.  $10^7$  pressure cycles  
Nominal pressure according to DIN 24550  
0 ... 600 bar, min.  $10^4$  pressure cycles  
Quasi-static operating pressure

### Permissible pressures for other numbers of cycles

HD 049 / 069 / 172



HD 319 / 419 / 619



### Nominal flow rate

Up to 450 l/min (see Selection Chart, column 2)  
The nominal flow rates indicated by ARGO-HYTOS are based on the following features:

- closed by-pass valve at  $v \leq 200 \text{ mm}^2/\text{s}$
- element service life > 1000 operating hours at an average fluid contamination of 0,07 g per l/min flow volume
- flow velocity in the connection lines:  
up to 250 bar  $\leq 8 \text{ m/s}$   
up to 450 bar  $\leq 12 \text{ m/s}$

### Filter fineness

5  $\mu\text{m(c)}$  ... 16  $\mu\text{m(c)}$   
 $\beta$ -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)

### Viscosity at nominal flow rate

- at operating temperature:  $v < 60 \text{ mm}^2/\text{s}$
- as starting viscosity  $v_{\text{max}} = 1200 \text{ mm}^2/\text{s}$
- 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

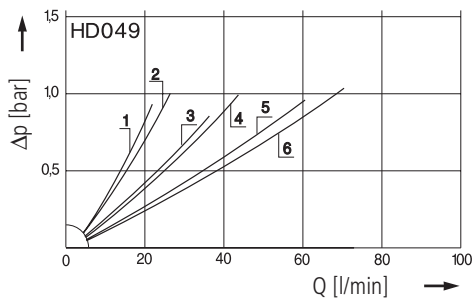
Preferably vertical

## Diagrams

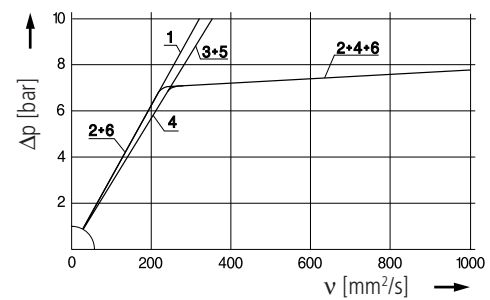
### $\Delta p$ -curves for complete filters in Selection Chart, column 3

**D1**

Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$

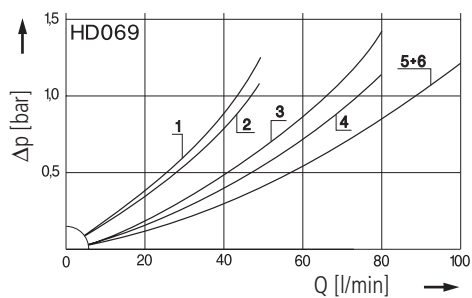


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

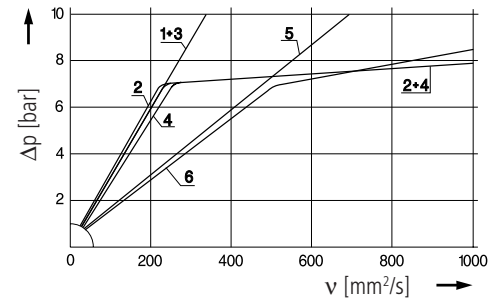


**D2**

Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$

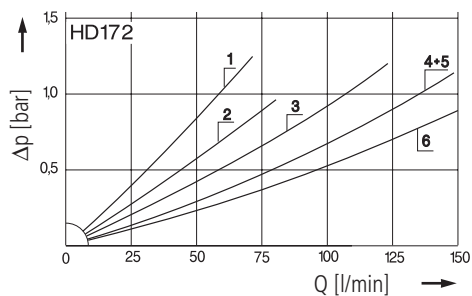


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

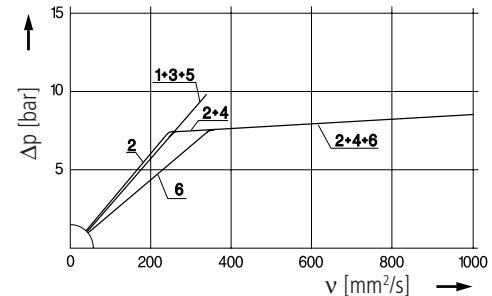


**D3**

Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$

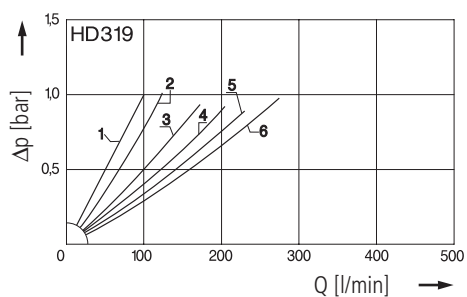


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

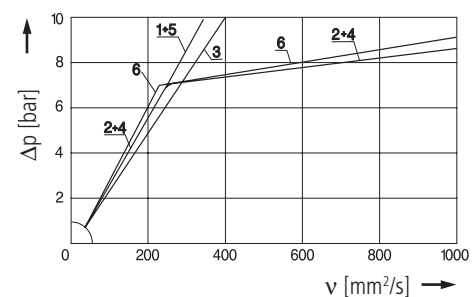


**D4**

Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$



Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

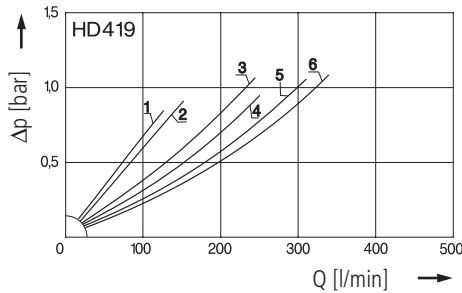


## Diagrams

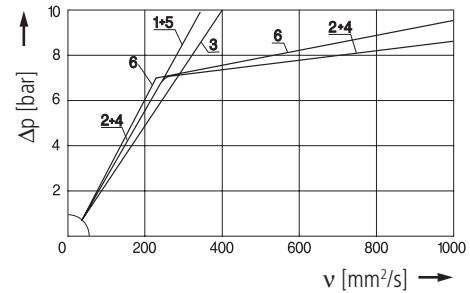
### $\Delta p$ -curves for complete filters in Selection Chart, column 3

**D5**

Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$

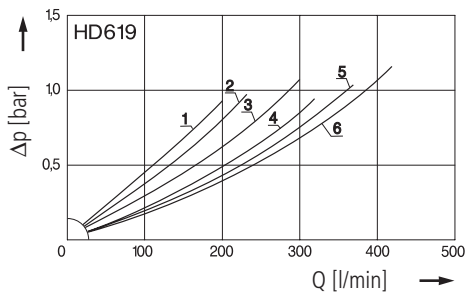


Pressure drop as a function of the **kinematic viscosity**  
at nominal flow

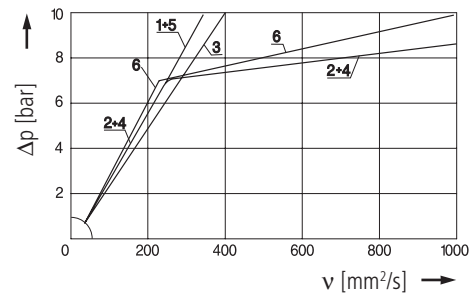


**D6**

Pressure drop as a function of the **flow volume**  
at  $v = 35 \text{ mm}^2/\text{s}$



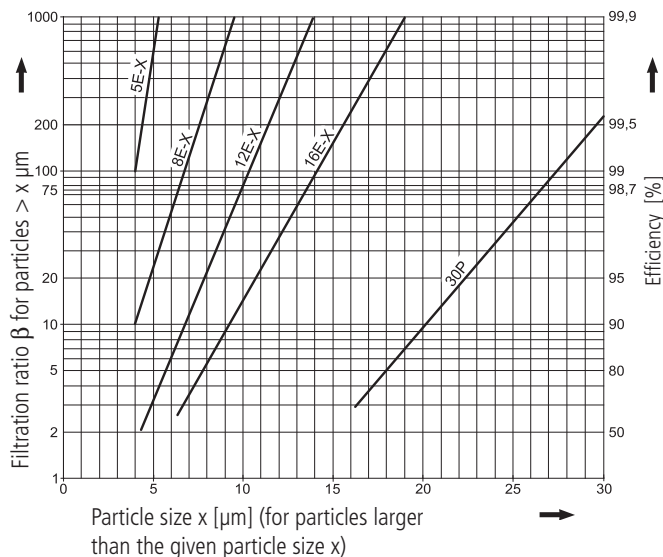
Pressure drop as a function of the **kinematic viscosity**  
at nominal flow



### 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



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

#### For EXAPOR®MAX and paper elements:

<b>5 E-X</b>	$\beta_{5(c)} = 200$	EXAPOR®MAX
<b>8 E-X</b>	$\beta_{8(c)} = 200$	EXAPOR®MAX
<b>12 E-X</b>	$\beta_{12(c)} = 200$	EXAPOR®MAX
<b>16 E-X</b>	$\beta_{16(c)} = 200$	EXAPOR®MAX
<b>30 P</b>	$\beta_{30(c)} = 200$	Paper

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

#### For screen elements:

<b>40 S</b>	= screen material with mesh size	40 $\mu\text{m}$
<b>60 S</b>	= screen material with mesh size	60 $\mu\text{m}$
<b>100 S</b>	= screen material with mesh size	100 $\mu\text{m}$

Tolerances for mesh size according to DIN 4189

For special applications, finenesses differing from these curves are also available by using special composed filter media.

## Selection Chart

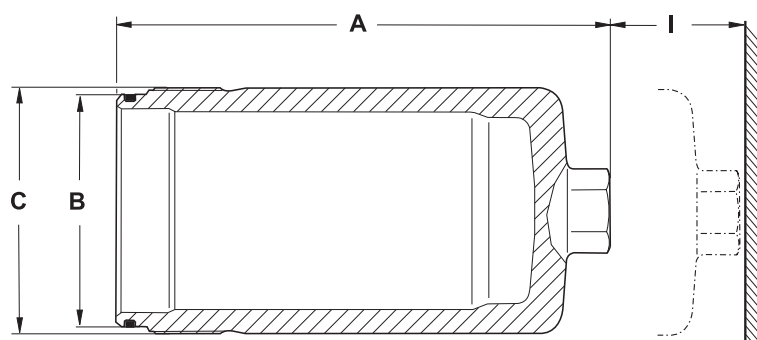
Part No.	Nominal flow	Pressure drop see diagram <b>D</b> /curve no.	Filter fineness see diagram <b>Dx</b>	Dirt-holding capacity	Cracking pressure of by-pass	Symbol	Replacement filter element Part No.	Weight	Remarks
	l/min			g	bar			kg	
1	2	3	4	5	6	7	8	9	10
HD 049-0213	20	<b>D1/1</b>	5 E-X	3,4	-	5	V3.0510-13*	1,6	with screw-in bushing
HD 049-1503	25	<b>D1/2</b>	5 E-X	3,8	7	1	V3.0510-03	1,5	-
HD 049-0216	30	<b>D1/3</b>	12 E-X	5	-	5	V3.0510-16*	1,6	with screw-in bushing
HD 049-1506	35	<b>D1/4</b>	12 E-X	6,1	7	1	V3.0510-06	1,5	-
HD 049-0218	55	<b>D1/5</b>	16 E-X	5,5	-	5	V3.0510-18*	1,6	with screw-in bushing
HD 049-1508	63	<b>D1/6</b>	16 E-X	6,6	7	1	V3.0510-08	1,5	-
HD 069-0213	43	<b>D2/1</b>	5 E-X	6,9	-	5	V3.0520-13*	2,7	with screw-in bushing
HD 069-1503	50	<b>D2/2</b>	5 E-X	7,6	7	1	V3.0520-03	2,6	-
HD 069-0216	63	<b>D2/3</b>	12 E-X	11	-	5	V3.0520-16*	2,7	with screw-in bushing
HD 069-1506	70	<b>D2/4</b>	12 E-X	13	7	1	V3.0520-06	2,6	-
HD 069-0218	80	<b>D2/5</b>	16 E-X	12	-	5	V3.0520-18*	2,7	with screw-in bushing
HD 069-1508	80	<b>D2/6</b>	16 E-X	14	7	1	V3.0520-08	2,6	-
HD 172-0213	55	<b>D3/1</b>	5 E-X	11	-	5	V3.0623-13*	4,2	with screw-in bushing
HD 172-1503	80	<b>D3/2</b>	5 E-X	14	7	1	V3.0623-03	3,9	-
HD 172-0226	100	<b>D3/3</b>	12 E-X	17	-	5	V3.0623-26*	4,2	with screw-in bushing
HD 172-1506	150	<b>D3/4</b>	12 E-X	22	7	1	V3.0623-06	3,9	-
HD 172-0218	150	<b>D3/5</b>	16 E-X	18	-	5	V3.0623-18*	4,2	with screw-in bushing
HD 172-1508	150	<b>D3/6</b>	16 E-X	24	7	1	V3.0623-08	3,9	-
HD 319-0213	85	<b>D4/1</b>	5 E-X	14	-	5	V3.0817-13*	6,5	with screw-in bushing
HD 319-1503	95	<b>D4/2</b>	5 E-X	18	7	1	V3.0817-03	6	-
HD 319-0216	135	<b>D4/3</b>	12 E-X	22	-	5	V3.0817-16*	6,5	with screw-in bushing
HD 319-1506	160	<b>D4/4</b>	12 E-X	28	7	1	V3.0817-06	6	-
HD 319-0218	240	<b>D4/5</b>	16 E-X	24	-	5	V3.0817-18*	6,5	with screw-in bushing
HD 319-1508	270	<b>D4/6</b>	16 E-X	30	7	1	V3.0817-08	6	-
HD 419-0213	115	<b>D5/1</b>	5 E-X	20	-	5	V3.0823-13*	8,8	with screw-in bushing
HD 419-1503	130	<b>D5/2</b>	5 E-X	26	7	1	V3.0823-03	8,2	-
HD 419-0216	180	<b>D5/3</b>	12 E-X	32	-	5	V3.0823-16*	8,8	with screw-in bushing
HD 419-1506	210	<b>D5/4</b>	12 E-X	41	7	1	V3.0823-06	8,2	-
HD 419-0218	300	<b>D5/5</b>	16 E-X	34	-	5	V3.0823-18*	8,8	with screw-in bushing
HD 419-1508	340	<b>D5/6</b>	16 E-X	46	7	1	V3.0823-08	8,2	-
HD 619-0213	170	<b>D6/1</b>	5 E-X	29	-	5	V3.0833-13*	11,9	with screw-in bushing
HD 619-1503	190	<b>D6/2</b>	5 E-X	36	7	1	V3.0833-03	11,1	-
HD 619-0216	270	<b>D6/3</b>	12 E-X	46	-	5	V3.0833-16*	11,9	with screw-in bushing
HD 619-1506	300	<b>D6/4</b>	12 E-X	58	7	1	V3.0833-06	11,1	-
HD 619-0218	450	<b>D6/5</b>	16 E-X	50	-	5	V3.0833-18*	11,9	with screw-in bushing
HD 619-1508	450	<b>D6/6</b>	16 E-X	67	7	1	V3.0833-08	11,1	-

### Remarks:

- Filter versions without by-pass valves must be equipped with a clogging indicator.
- The filter sets listed in this chart are standard filters. If modifications are required, we kindly ask for your request.
- Clogging indicators to screw into the hydraulic block see section Dimensions.
- For the appropriate, flange-mounted clogging indicators see catalogue sheet 60.30.

\* Element differential pressure stable up to 160 bar, clogging indicator obligatory

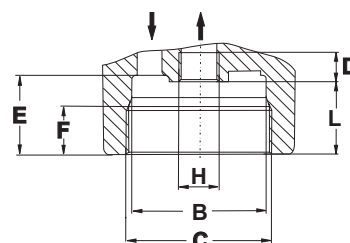
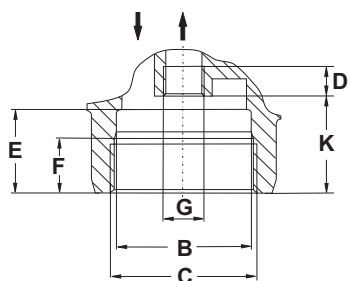
## Dimensions



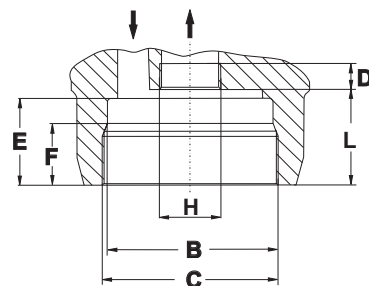
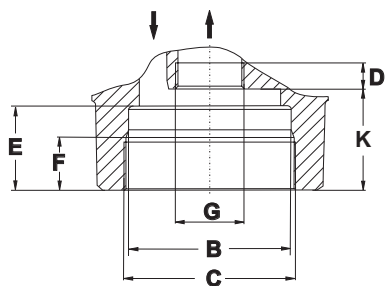
Version with by-pass valve

Version with screw-in bushing

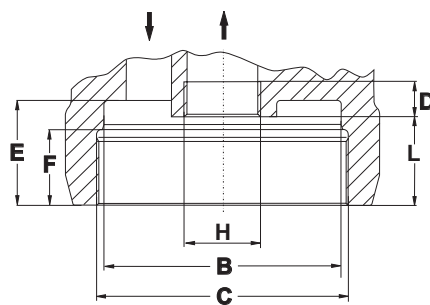
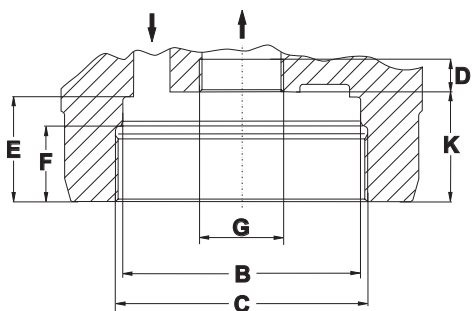
HD 049 / 069



HD 172



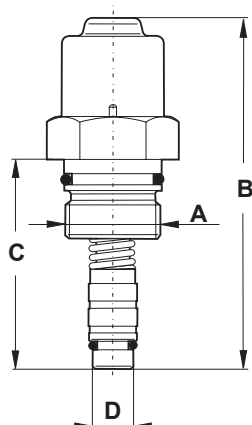
HD 319 / 419 / 619



## Dimensions

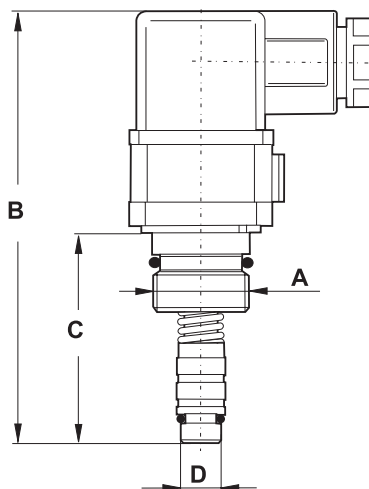
### Optical differential pressure indicator

DG 032.1700



### Electrical differential pressure switch (change over)

DG 031.1700

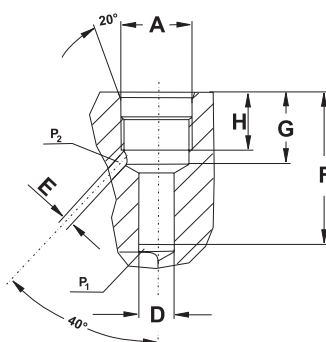
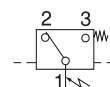


**Response/Switching pressure of the clogging indicators**  
5 bar

#### Electrical clogging indicator

- Switching voltage: max. 120 V AC / 175 V DC
- Switching current: max. 0,17 A AC / 0,25 A DC
- Switching power: max. 3,5 VA AC / 5 W DC
- Type of contact: change over
- Electrical protection: IP 65 (with mounted and secured socket)

#### Terminal connection



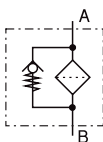
## Measurements

Type	A	B	C	D	E	F	G	H	I	K	L	SW
HD 049/069	133/227,5	60	M65 x 1,5	min. 13	35,5	22,5	M18 x 1,5	M18 x 1,5	55	42	32,5	36
HD 172	256,5	71	M75 x 1,5	min. 13	37	22,5	M30 x 1	M26 x 1,5	70	44,5	41	27
HD 319/419/619	218/282/383	102	M108 x 1,5	min. 14	45	32,5	M36 x 1	M36 x 1,5	80	47	38	32
DG 031.1700	M20 x 1,5	93	44	Ø10	Ø2,5	43,8	20,5	16,5	-	-	-	-
DG 032.1700	M20 x 1,5	74	44	Ø10	Ø2,5	43,8	20,5	16,5	-	-	-	-

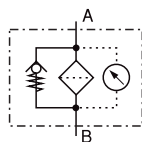
All measurements and tolerances required for machining are available on request.

## Symbols

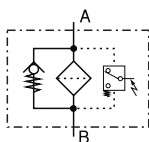
1



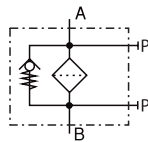
2



3



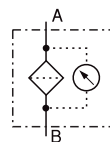
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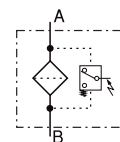
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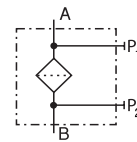
6



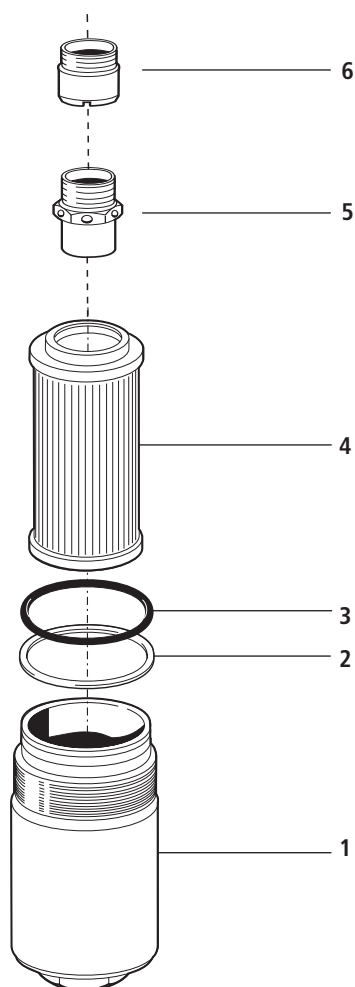
7



8



## Spare Parts



### HD 049 / HD 069

Pos.	Designation	Part No.
1	Filter bowl HD 049	HD 052.0102
1	Filter bowl HD 069	HD 072.0102
3	O-ring 53,57 x 3,53	N 007.0543/1
4	Filter element (with seal)	see Chart / col. 7
5	By-pass valve	HD 045.1510
6	Screw-in bushing	HD 049.0503

### HD 172

Pos.	Designation	Part No.
1	Filter bowl HD 172	HD 171.0102
3	O-ring 63 x 3,5	N 007.0634
4	Filter element (with seal)	see Chart / col. 7
5	By-pass valve	HD 172.1500
6	Screw-in bushing	HD 171.0205

### HD 319 / HD 419 / HD 619

Pos.	Designation	Part No.
1	Filter bowl HD 319	HD 250.0105
1	Filter bowl HD 419	HD 411.0102
1	Filter bowl HD 619	HD 611.0102
2	Back-ring	HD 255.0102
3	O-ring 94,84 x 3,53	N 007.0953
4	Filter element (with seal)	see Chart / col. 7
5	By-pass valve	HD 319.1510
6	Screw-in bushing	HD 411.0209

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 DIN and ISO standards:

<b>DIN ISO 2941</b>	Verification of collapse/burst resistance
<b>DIN ISO 2943</b>	Verification of material compatibility with fluids
<b>DIN ISO 3724</b>	Verification of flow fatigue characteristics

### ISO 2942 ISO 3968 ISO 16889

Verification of fabrication integrity (Bubble Point Test)  
Evaluation of pressure drop versus flow characteristics  
Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)

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 leakfree function and solidity of our filters.

Our engineers will be glad to advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

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



### We produce fluid power solutions

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