Return-Suction Filters

E 158 · E 198 · E 248

- Tank top mounting
- Connection up to -20 SAE
- Nominal flow rate up to 66 gpm

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 feed 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 feed pump.

Return filter
function: By means of full-flow filtration in the system return, the pumps above all are protected from dirt particles remainning 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 7.3 psi check valve (2) and supplied to the feed pump (B). The surplus oil flows filtered over the integral check valve into the reservoir. As the feed 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 feed pump (B) (no bypass valve function).

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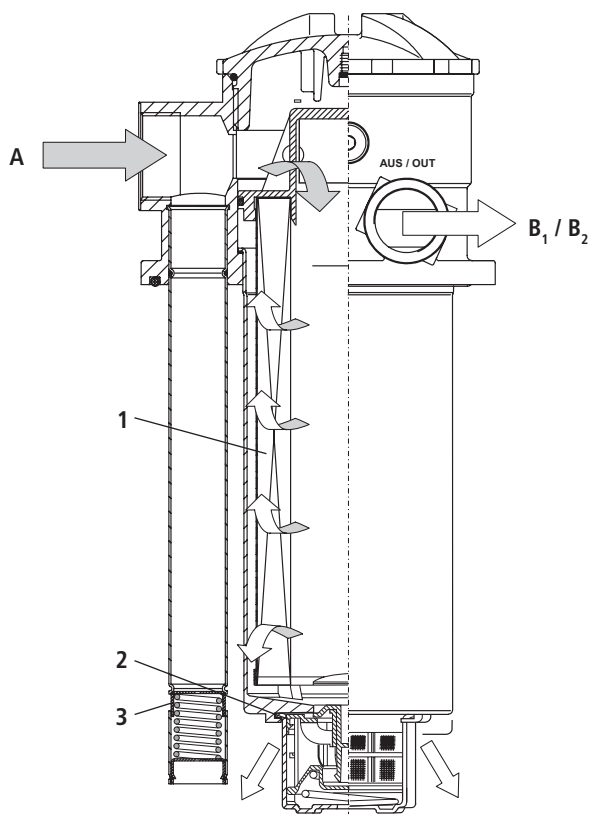
The emergency-suction valve (4) with 125 µm protection strainer (5) supplies the feed pump in case of a short term of lack of oil.
During normal operation, a lack of oil may definitely not occur (refer to „Design" section).

Emergency-suction (schematic):
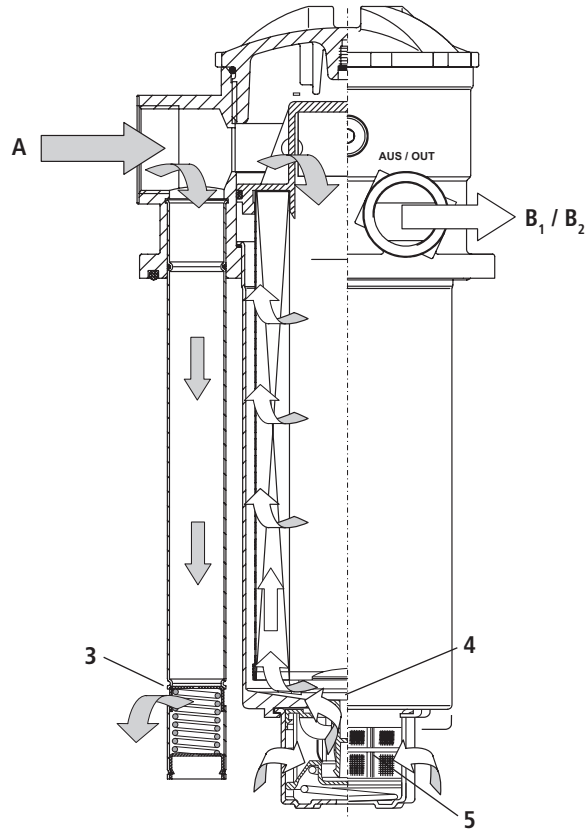
Start up / Deaeration

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 feed 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 center 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 and cannot re-enter the tank.

Accessories

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

General

In machines with a hydrostatic drive and combined working hydraulic system, return-suction 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 return-suction 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 return-suction 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. 7.3 psi at the intake of the feed pump, the return flow must exceed the suction flow <u>under any operating condition</u>:

Special feature:

• Versions with hole (Ø 0.16 inch) in the pressurizing valve:
  at least 5.3 gpm of excess flow

Permitted feed pump flow rate

• at operating temperature ($v < 280$ SUS, rpm=max):
  feed pump flow rate ≤ 0.5 x rated return flow according to column 2 of selection table
• at cold start-up ($v < 4635$ SUS, rpm = 1.000 min^{-1}):
  feed pump flow rate ≤ 0.2 x 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 ≤ 14.8 ft/s
• Flow velocity in the suction lines ≤ 4.9 ft/s

Permitted pressure in the suction lines

At cold start up ($v < 4635$ SUS, rpm = 1.000 min^{-1}):
feed pump flow rate ≤ 0.2 x rated return flow. The pressure loss in the suction lines must not exceed 5.8 psi.

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:

• 10EX2: 18/15/11 ... 14/11/7
• 16EX2: 20/17/12 ... 17/14/10

Even with the 16EX2 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 10EX2 filter fineness grade.

Suggested circuit layouts

A) The leakage oil of the hydrostatic drive is routed across the filter.
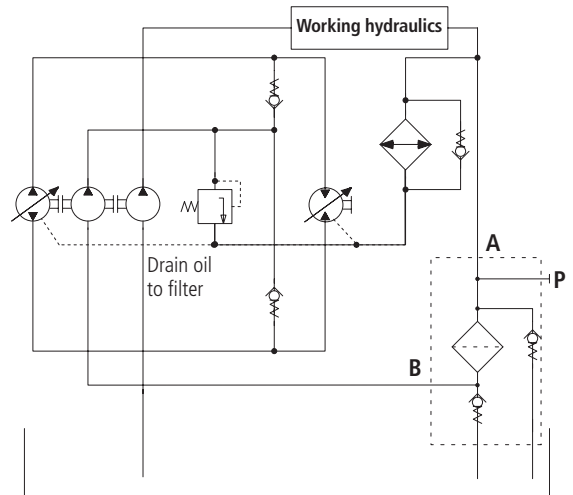
The entire dirt produced in the hydrostatic drive by abrasion is filtered out immediately and is thus not taken in by the pump of the open-loop circuit.

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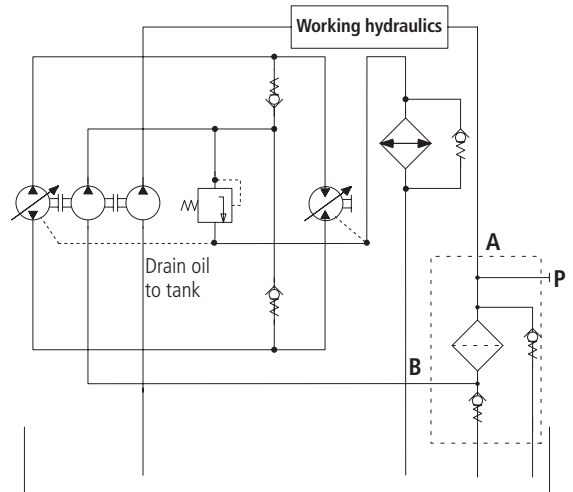
This circuit layout has the advantage that drain oil pressures are comparatively low.

Characteristics

Nominal flow rate

Up to 66 gpm in return line (see Selection Chart, column 2)
Up to 33 gpm 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 $\nu \leq 930$ SUS
- element service life > 1,000 operating hours at an average fluid contamination of 0.27 g per gpm flow volume
- flow velocity in the return lines ≤ 14.8 ft/s
- flow velocity in the suction lines ≤ 4.9 ft/s

Connection

Threaded ports according to SAE standard J514. Sizes see Selection Chart, column 6 and 7
(other port threads on request)

Filter fineness

10 µm(c) ... 16 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-service 00.20).

Temperature range

- 22 °F ... + 212 °F (temporary - 40 °F ... + 248 °F)

Viscosity at nominal flow rate

- at operating temperature: $\nu < 280$ SUS
- as starting viscosity: $\nu_{max} = 4635$ SUS
- at initial operation: The recommended starting viscosity can be read from the diagram D (pressure drop as a function of the kinematic viscosity) as follows: Find the 70 % 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. 145 psi

Materials

Screw-on cap:	Polyester, GF reinforced
Filter head:	Aluminum alloy
Filter bowl:	Aluminum alloy
Seals:	NBR (FKM on request)
Filter media:	EXAPOR®MAX 2 - 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
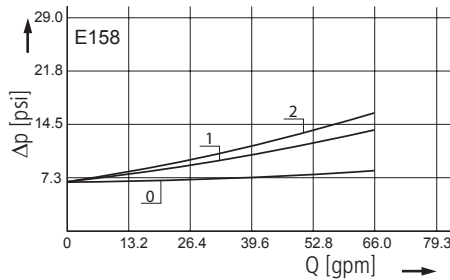- Models with hole Ø 4 mm in the check valve can vary up to 45° from the vertical

Even under unfavourable operating conditions (min. oil level, max. sloping) the oil outlet resp. emergency suction has to be below the oil level.
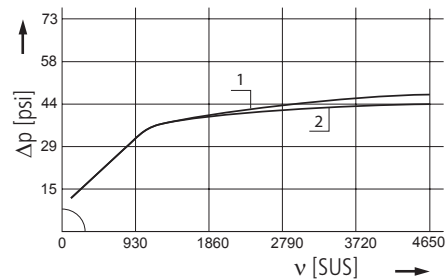Special designs are available for horizontal assembly.

Diagrams

Δp-curves for complete filters in Selection Chart, column 3
(50 % of the nominal flow volume via connection B)

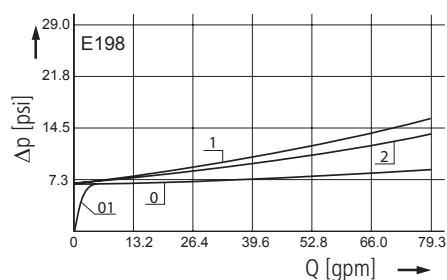**D1** Pressure drop as a function of the **flow volume**
at $\nu = 35$ mm²/s (0 = casing empty with hole Ø 4 mm)

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

E158

Δp [psi] — Q [gpm]

Δp [psi] — ν [SUS]

D2 Pressure drop as a function of the **flow volume**
at $\nu = 35$ mm²/s (00/01 = casing empty without/with hole Ø 4 mm)

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

E198

Δp [psi] — Q [gpm]

Δp [psi] — ν [SUS]

D3 Pressure drop as a function of the **flow volume**
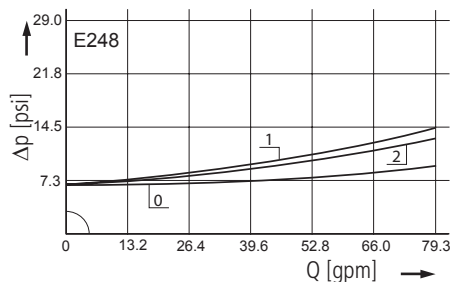at $\nu = 35$ mm²/s (0 = casing empty with hole Ø 4 mm)

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

E248

Δp [psi] — Q [gpm]

Δp [psi] — ν [SUS]
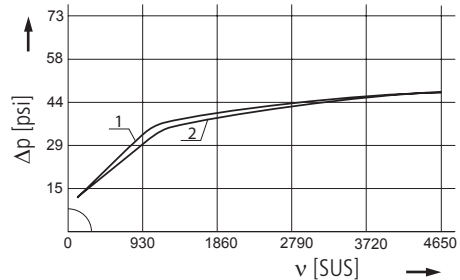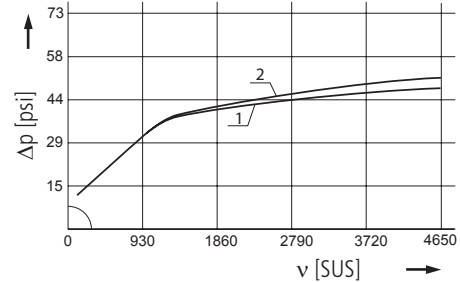
Filter fineness curves in Selection Chart, column 4

Dx Filtration ratio β as a function of particle size x obtained by the
Multi-Pass-Test according to ISO 16889

Filtration ratio β for particles > x µm — Particle size x [µm] (for particles larger than the given particle size x)

Efficiency [%]
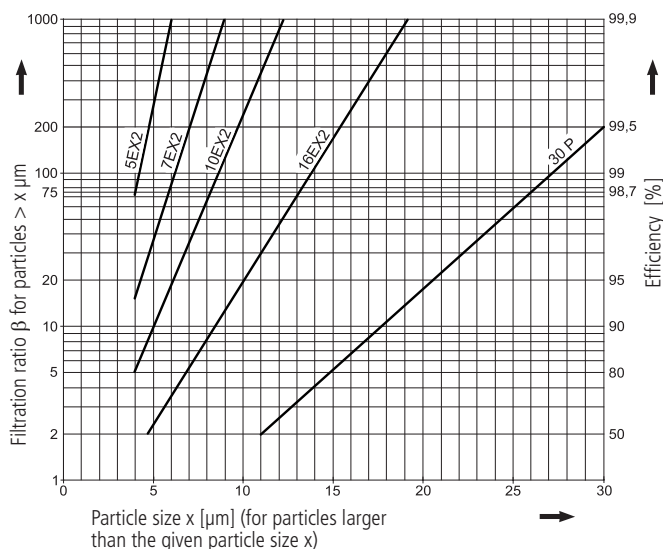
The abbreviations represent the following β-values resp.
finenesses:

For EXAPOR®MAX 2 and Paper elements:

$\mathbf{5EX2} = \bar{\beta}_{5\,(c)} = 200$ EXAPOR®MAX 2
$\mathbf{7EX2} = \bar{\beta}_{7\,(c)} = 200$ EXAPOR®MAX 2
$\mathbf{10EX2} = \bar{\beta}_{10\,(c)} = 200$ EXAPOR®MAX 2
$\mathbf{16EX2} = \bar{\beta}_{16\,(c)} = 200$ EXAPOR®MAX 2
$\mathbf{30P} = \bar{\beta}_{30\,(c)} = 200$ Paper

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

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

Selection Chart

Part No.	Nominal return flow rate	Pressure drop see diagram D/curve no.	Filter fineness see Diagr. Dx	Dirt-holding capacity	Connection A	Connections B₁/B₂	Cracking pressure of CV[1]	Cracking pressure of PRV[2]	Symbol	Suction valve	Replacement filter element Part No.	Weight	Remarks
	gpm			g	SAE	SAE	psi	psi				lbs	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
E 158-766	39.6	**D1**/1	10EX2	50	-20[3]	-16[4]	7.3	36	4	•	V3.0924-06	6.6	[6]
E 158-768	47.6	**D1**/2	16EX2	53	-20[3]	-16[4]	7.3	36	4	•	V3.0924-08	6.6	[6]
E 198-786	47.6	**D2**/1	10EX2	73	-20[3]	-16[4]	7.3	36	4	•	V3.0934-06	8.4	[6]
E 198-788	52.8	**D2**/2	16EX2	73	-20[3]	-16[4]	7.3	36	4	•	V3.0934-08	8.4	[6]
E 248-756	50.2	**D3**/1	10EX2	89	-20[3]	-16[4]	7.3	36	4	•	V3.0941-06	9.5	[6]
E 248-758	66.0	**D3**/2	16EX2	90	-20[3]	-16[4]	7.3	36	4	•	V3.0941-08	9.5	[6]

All filters are delivered with three plugged clogging indicator connections M12 x 1.5 mm. As clogging indicators on the return side (P_1) either manometers or electrical pressure switches can be used. The monitoring of the vacuum on the suction side (P_2) is additionally possible.
A second return port A_2 can be opened on request.

For the appropriate clogging indicators see catalog 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).
- 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 bleed screw (for connection P_1) with Part No. SV 0112.15 or a start-up set for units with emergency-suction valve and protection strainer with Part No. E 198.1710 is available, for technical details see catalog sheet 20.870.

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[1] Cracking pressure of check valve
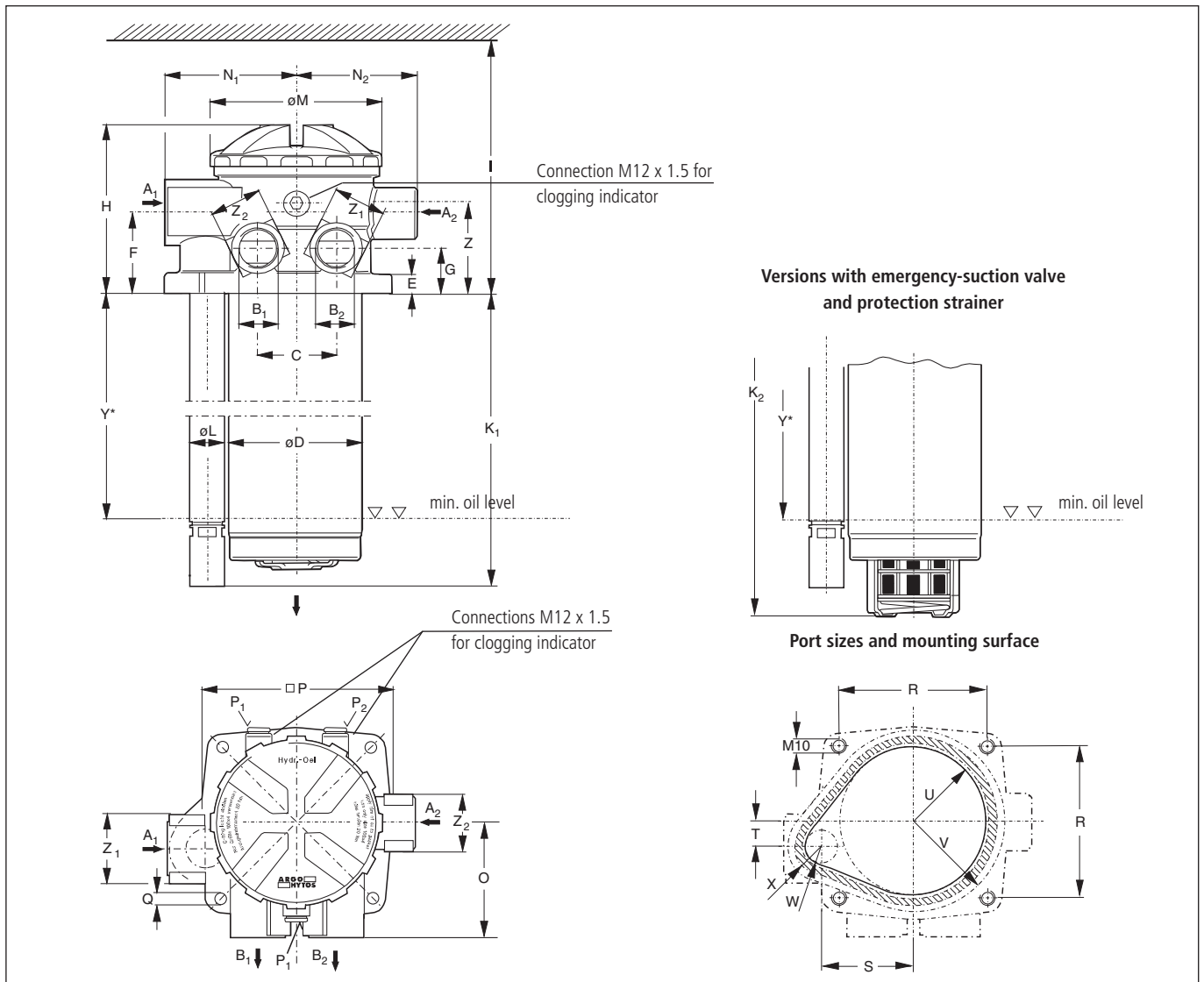[2] Cracking pressure of pressure relief valve
[3] corresponds to 1⁵/₈-12 UN
[4] corresponds to 1⁵/₁₆-12 UN
[5] With hole Ø 0.16 inch in the check valve for oil drain when opening the filter cover
[6] With emergency-suction valve and protection strainer (mesh size 125 µm)

Dimensions

Connection M12 x 1.5 for clogging indicator

min. oil level

Connections M12 x 1.5 for clogging indicator

Versions with emergency-suction valve and protection strainer

min. oil level

Port sizes and mounting surface

Measurements

Type	A₁	A₂	B₁/₂	C	D	E	F	G	H	I	K₁	K₂	L	M	N₁	N₂	O	P	Q
E 158	-20	–	-16	2.20	3.94	0.45	2.42	1.20	5.12	16.93	9.37	9,84	1.12	4.98	3.82	3.21	3.37	5.55	0.43
E 198	-20	–	-16	2.20	3.94	0.45	2.42	1.20	5.12	20.87	13.31	13.94	1.12	4.98	3.82	3.21	3.37	5.55	0.43
E 248	-20	–	-16	2.20	3.94	0.45	2.42	1.20	5.12	23.62	15.91	16.42	1.12	4.98	3.82	3.21	3.37	5.55	0.43

Type	R	S	T	U	V	W	X	Y*	Z	Z₁ mm	Z₂ mm
E 158	4.59	2.68	0.77	2.01	2.52	0.57	1.06	7.28	2.68	AF 55	AF 41
E 198	4.59	2.68	0.77	2.01	2.52	0.57	1.06	11.22	2.68	AF 55	AF 41
E 248	4.5	2.68	0.77	2.01	2.52	0.57	1.06	13.78	2.68	AF 55	AF 41

* Oil outlet resp. emergency suction has to be under all operating cond. below min. oil level (given by Y)
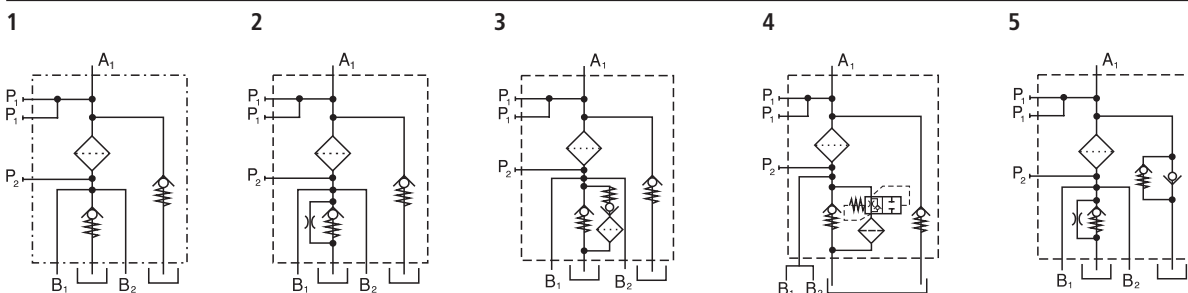
Symbols
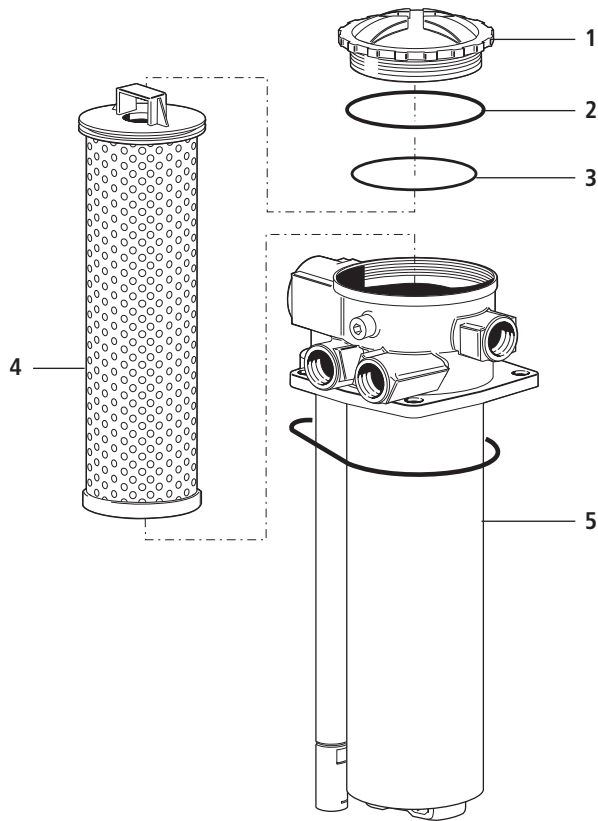
Pos.	Designation	Part No.
1	Screw-on cap	ES 074.0206
2	O-ring 3.94 x 0.16	N007.1004
3	O-ring 3.86 x 0.12	N007.0983
4	Filter element	see Chart / col. 11
5	O-ring 4.88 x 0.18	N007.1245

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 ISO standards:

ISO 2941 Verification of collapse/burst pressure rating
ISO 2942 Verification of fabrication integrity (Bubble Point Test)
ISO 2943 Verification of material compatibility with fluids

ISO 3968 Evaluation of pressure drop versus flow characteristics
ISO 16889 Multi-Pass-Test (evaluation of filter fineness and dirt-holding capacity)
ISO 23181 Determination of resistance to flow fatigue using high viscosity fluid

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.