

Filter Cooling Units**FNK 050 · FNK 100**

Operating pressure up to 10 bar / 145 psi · Nominal flow rate up to 125 l/min / 33 gpm · Cooling capacity up to 45 kW



Filter-Cooling-Unit FNK 050

Description**Application**

Return-flow or off-line filter in hydraulic systems with water cooling.

General

High power densities in modern hydraulic systems require on one hand excellent cleanliness classes of the oil and on the other hand powerful cooling systems. The ARGO-HYTOS filter cooling unit FNK meets both demands on smallest installation space.

Performance features*Protection against wear:*

By means of filter elements that even meet the highest demands regarding cleanliness classes.

Cooling:

Efficient discharge of large heat flow volumes by means of a powerful cooler.

Assembly and operating mode

Oil that has to be cooled is first cleaned over a fine filter element and then flows – through a check-valve and the high-performance tubular cooler – in cooled-down condition into the tank. Monitoring of filter clogging is effected by an optionally available differential pressure indicator. The integrated by-pass valve protects the filter element in cold start against increasing differential pressures.

Special design features

By combination of fine filter and cooler in one unit the necessary space is considerably reduced compared to conventional solutions. This also results in less assembling and piping. The filter element is hooked to the cover and is pulled upwards when it has to be changed. Because of the cover design the filter element can be changed almost without losing any oil. An integrated check valve prevents draining of oil from the tank when assembling the filter cooling unit below the oil level. With maintenance work at the cooler it simply can be removed from the housing after removing the water connections.

For in-line mounting, standalone versions are available. These are also suitable for retrofitting existing hydraulic systems. If you are interested, please send us your request.

Filter elements

Flow direction from outside to center.
The star-shaped pleating of the filter 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.

The cooler is maintenance-free up to a large extent. Unfavorable water qualities (e.g. high water hardness and PH-value) and high temperatures may lead to sediments in the water pipes and/or the cooler surface. The water quality therefore has to be controlled regularly and if necessary improved.

For cleaning of the water pipes the cover of the cooler can be removed.

The maintenance instructions give detailed information on the maintenance of the cooler.

Materials

Filter housing FNK 050:	GG, Filter head: Steel
Filter housing FNK 100:	Aluminum alloy
Filter cover:	GG
Cooler cover:	GG
Cooler catalyst tube:	Steel
Seals:	NBR (FPM on request)
Filter media:	EXAPOR®MAX 2 – inorganic multi-layer microfiber web

Accessories

Electrical and / or optical clogging indicators are available.
Dimensions and technical data see catalog sheet 60.30.

Characteristics

Operating pressure

Max. 10 bar / 145 psi

Cooling capacity

Up to 45 kW
(see Selection Chart, column 2).

Nominal flow rate

Up to 125 l/min / 33 gpm
(see Selection Chart, column 3).

Filter fineness

5 µm (c)
β-values according to ISO 16889
(see Selection Chart, column 5 and Diagram Dx).

Dirt-holding capacity

Values in g test dust ISO MTD according to ISO 16889
(see Selection Chart, column 6).

Hydraulic fluids

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

Temperature range of fluids

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

Mounting position

Filter preferably vertical and/or cooler horizontal.

Connection

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

In principle, the selection of the filter cooling unit requires the following steps:

1. Selection of the filter cooling unit according to the cooling performance chart

The displayed performance curves are based on:

- › Ratio flow rate water / oil 2:1
- › Water inlet temperature 25 °C / 77 °F
- › Oil discharge temperature 50 °C / 122 °F
- › Oil viscosity 35 mm²/s / 162 SUS

For differing viscosity the correction factor A can be read off from the viscosity correction chart on the right hand.

With deviating oil discharge and/or oil entry temperatures and viscosities please calculate as shown in the following example:

Given

Heat to be discharged (AW)	=	17 kW
Oil flow (Q)	=	80 l/min / 21.1 gpm
Oil discharge temperature (T _{oil out})	=	45 °C / 113 °F
Water entry temperature (T _{water in})	=	25 °C / 77 °F
Oil species	=	ISO VG 32

Procedure

Calculation of the temperature difference ΔT

$$\text{Temperature difference } \Delta T \text{ (°C)} = (AW \times 34,1) / Q = 7.2$$

Calculation of the middle oil temperature

$$(2 \times T_{\text{oil out}} + \Delta T) / 2 \cong 49 \text{ °C} / 120 \text{ °F}$$

Calculation of the viscosity with middle oil temperature v_{actual}

$v_{\text{act.}}$ from the oil manufacturer chart
for ISO VG 32 at 49 °C / 120 °F: 21 mm²/s / 97.3 SUS

Viscosity factor "A"

From the viscosity correction chart "A" at 21 mm²/s / 97.3 SUS: 0.88

Determination of the necessary cooling performance

$$\begin{aligned} \text{Heat to be discharged} \\ AW_{\text{eff.}} &= (AW \times 27.5 \times A) / (T_{\text{oil out}} - T_{\text{water in}}) \\ &= (17 \times 27.5 \times 0.88) / 20 = 20.6 \text{ kW} \end{aligned}$$

Selection of the filter cooling unit

The cooler performance chart shows

Q = 80 l/min and

AW_{eff.} 20.6 kW the filter cooling unit: FNK 100-3153

2. Controlling pressure drop

To determine the pressure drop it is possible to interpolate within the given set of curves in the diagrams D1.1-D2.3 between 35 mm²/s / 162 SUS and 300 mm²/s / 1395 SUS.

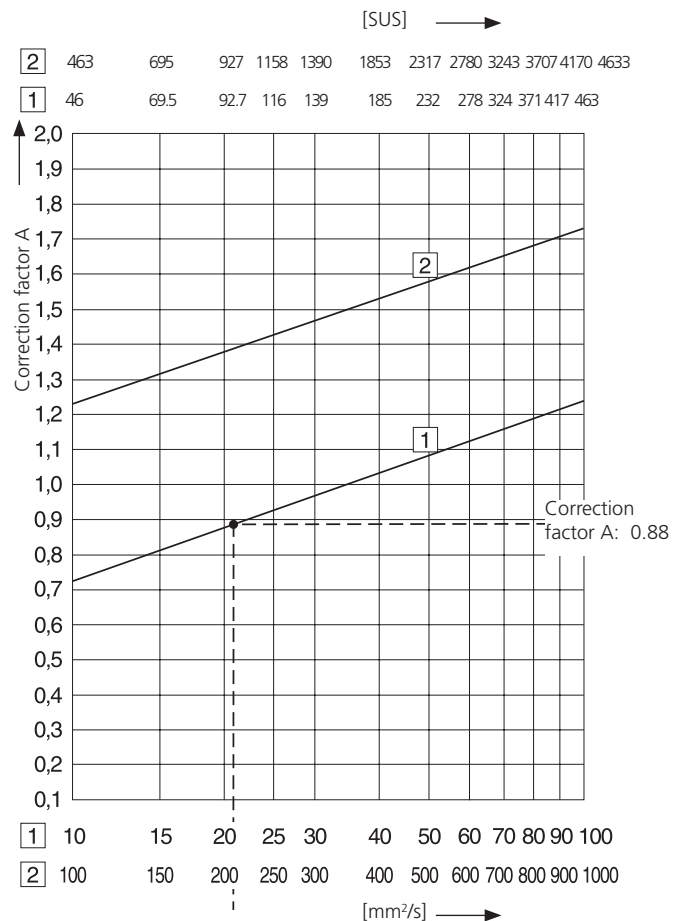
Finally it has to be checked, if there is enough operating pressure for the determined pressure drop of the filter cooling units.

In case the pressure drop of the selected filter cooling unit should be too high, on the basis of the pressure drop curves an adequate version has to be chosen. If necessary the cooling performance has to be verified again.

With volume flows over 100 l/min / 26.4 gpm and operating viscosities from 200 mm²/s / 927 SUS on (e.g. at cold start) the by-pass valve can be open with a partially contaminated filter element (temporary poor filtration performance).

Viscosity correction chart

For determination of the correction factor "A" with oil viscosities differing from 35 mm²/s / 162.2 SUS (in the displayed calculation example 21 mm²/s / 97.3 SUS).



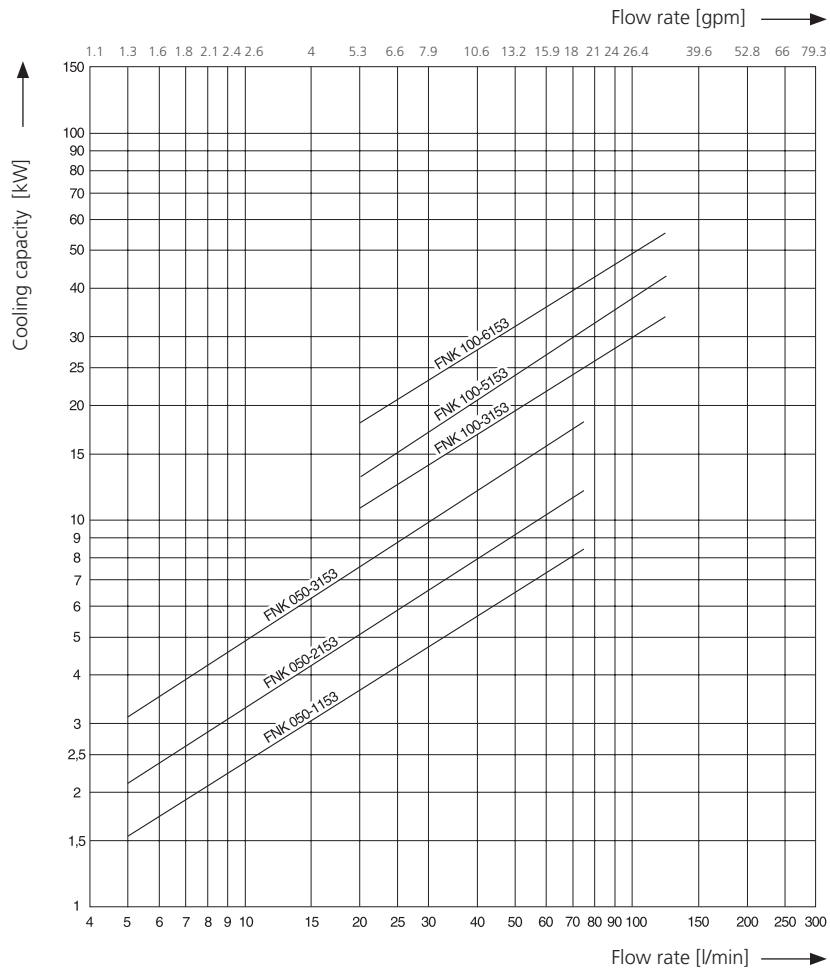
Oil viscosity 21 mm²/s or 97.3 SUS resp.

Characteristic curves cooling capacity

Dk The displayed performance curves are based on:

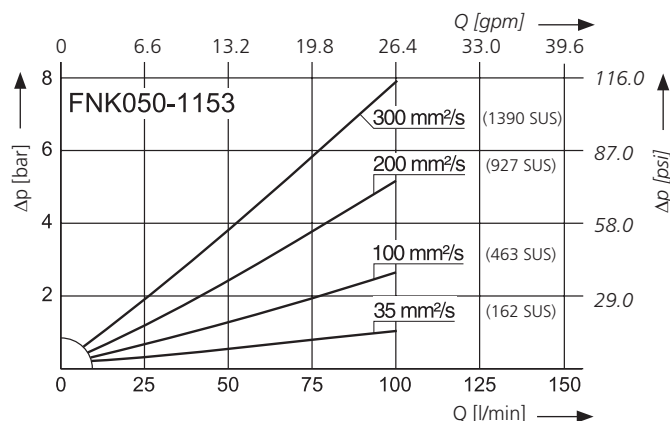
- › Water inlet temperature +25 °C / +77 °F
- › Oil discharge temperature +50 °C / +122 °F
- › Oil viscosity 35 mm²/s / 162 SUS

For differing viscosities the correction factor A can be read off from the viscosity correction chart.

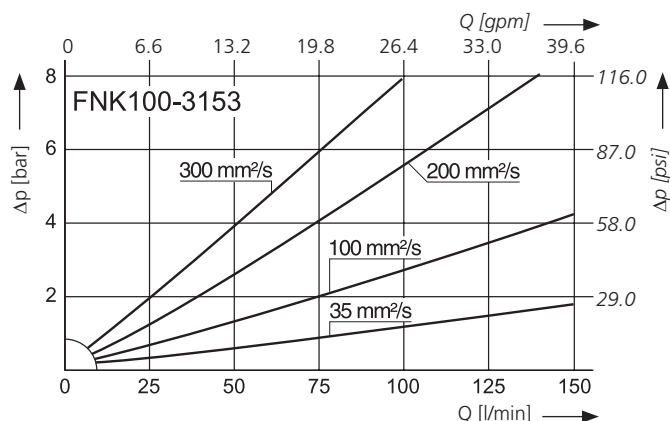


Δp-curves for complete filters in Selection Chart, column 4

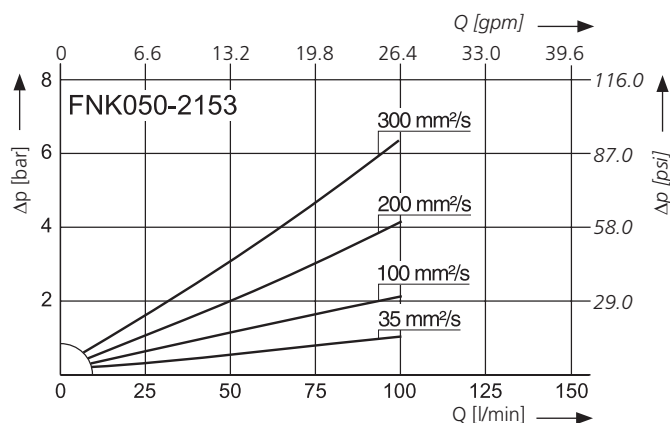
D1.1 Pressure drop as a function of the **flow volume**



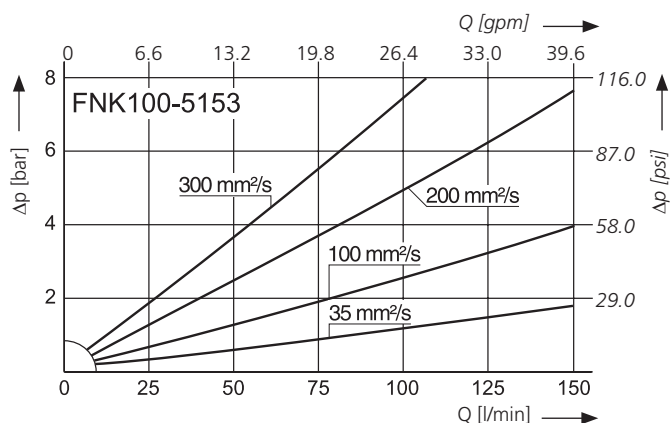
D2.1 Pressure drop as a function of the **flow volume**



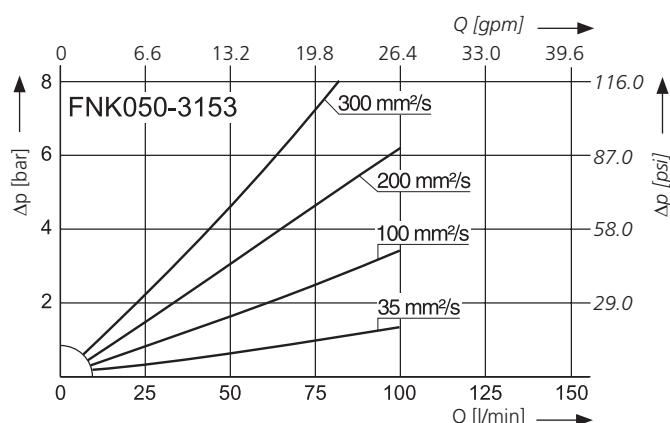
D1.2 Pressure drop as a function of the **flow volume**



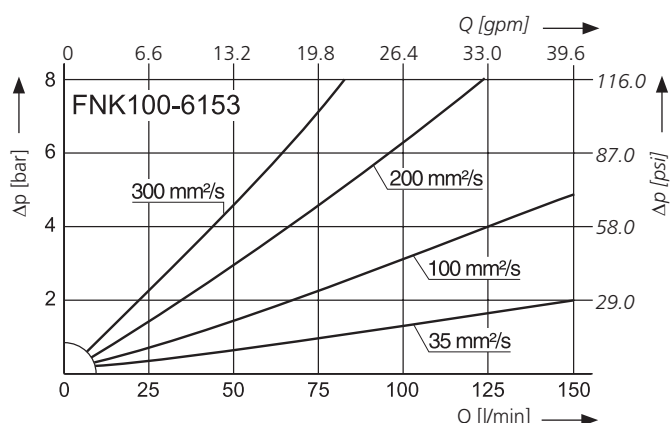
D2.2 Pressure drop as a function of the **flow volume**



D1.3 Pressure drop as a function of the **flow volume**



D2.3 Pressure drop as a function of the **flow volume**



In general the pressure drop increases in line with a larger cooler length.

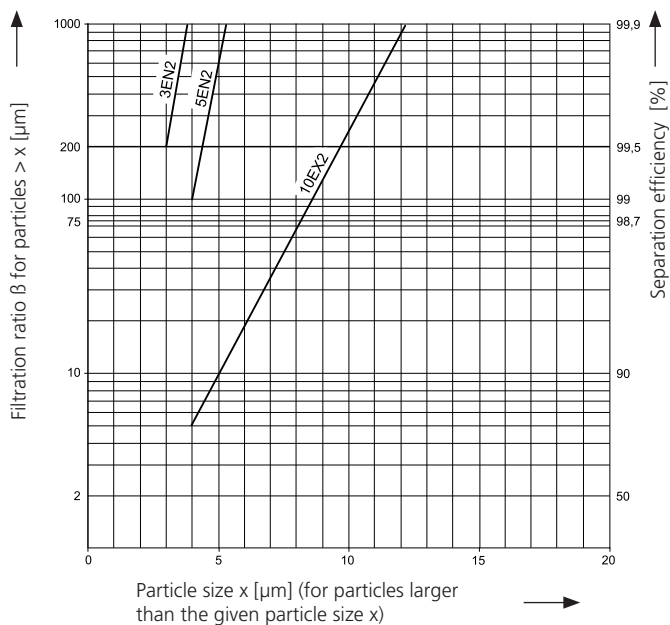
Exception:

Due to lower distances of the disk sheets in the cooler the pressure drop of the FNK 050-1153 is higher than the one of the larger FNK 050-2153.

Due to lower distances of the disk sheets in the cooler the pressure drop of the FNK 100-3153 is higher than the one of the larger FNK 100-5153.

Filter fineness curves in Selection Chart, column 5

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



The abbreviations represent the following β -values resp. finenesses:

For EXAPOR®MAX 2-Elements:

3EN2	=	$\bar{\beta}_{3(c)} = 200$	EXAPOR®MAX 2
5EN2	=	$\bar{\beta}_{5(c)} = 200$	EXAPOR®MAX 2
10EX2	=	$\bar{\beta}_{10(c)} = 200$	EXAPOR®MAX 2

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

Selection Chart

Part No.	Nominal cooling capacity	Nominal flow rate	Pressure drop see diagram D /curve no.	Filter fineness see diagr. Dx	Dirt-holding capacity	Connection A ₁ /A ₂ inlet	Cracking pressure of by-pass	Replacement filter element	Clogging indicator	Weight	Cooler element
	kW	l/min			g		bar			kg	
1	2	3	4	5	6	7	8	9	10	11	12
FNK 050-1153	5	75	D1.1	5EN2	190	G1¼	3.5	V7.1235-53	optional	23	FNK 050.1700
FNK 050-2153	8	75	D1.2	5EN2	190	G1¼	3.5	V7.1235-53	optional	24	FNK 050.1710
FNK 050-3153	13	75	D1.3	5EN2	190	G1¼	3.5	V7.1235-53	optional	26	FNK 050.1720
FNK 100-3153	33	125	D2.1	5EN2	150	G1¼	3.5	V7.1235-53	optional	15	FNK 100.0703
FNK 100-5153	40	125	D2.2	5EN2	150	G1¼	3.5	V7.1235-53	optional	16	FNK 100.0705
FNK 100-6153	45	125	D2.3	5EN2	150	G1¼	3.5	V7.1235-53	optional	17	FNK 100.0706

	kW	gpm			g		psi			lbs	
1	2	3	4	5	6	7	8	9	10	11	12
FNK 050-1153	5	19.8	D1.1	5EN2	190	G1¼	50.8	V7.1235-53	optional	50.7	FNK 050.1700
FNK 050-2153	8	19.8	D1.2	5EN2	190	G1¼	50.8	V7.1235-53	optional	52.9	FNK 050.1710
FNK 050-3153	13	19.8	D1.3	5EN2	190	G1¼	50.8	V7.1235-53	optional	57.3	FNK 050.1720
FNK 100-3153	33	33.0	D2.1	5EN2	150	G1¼	50.8	V7.1235-53	optional	33.1	FNK 100.0703
FNK 100-5153	40	33.0	D2.2	5EN2	150	G1¼	50.8	V7.1235-53	optional	35.3	FNK 100.0705
FNK 100-6153	45	33.0	D2.3	5EN2	150	G1¼	50.8	V7.1235-53	optional	37.5	FNK 100.0706

Optical or electrical clogging indicators are available to monitor the clogging condition of the element. If the indicator should be already mounted use the abbreviation "M" behind the part number of the indicator. The printed order acknowledgements show both items separately. For optimal element utilization we recommend clogging indicators with a start-up pressure of 2.5 bar / 36 psi.

Order example: The filter FNK 100-3153 has to be supplied with electrical clogging indicator - response pressure 2.5 bar / 36 psi.

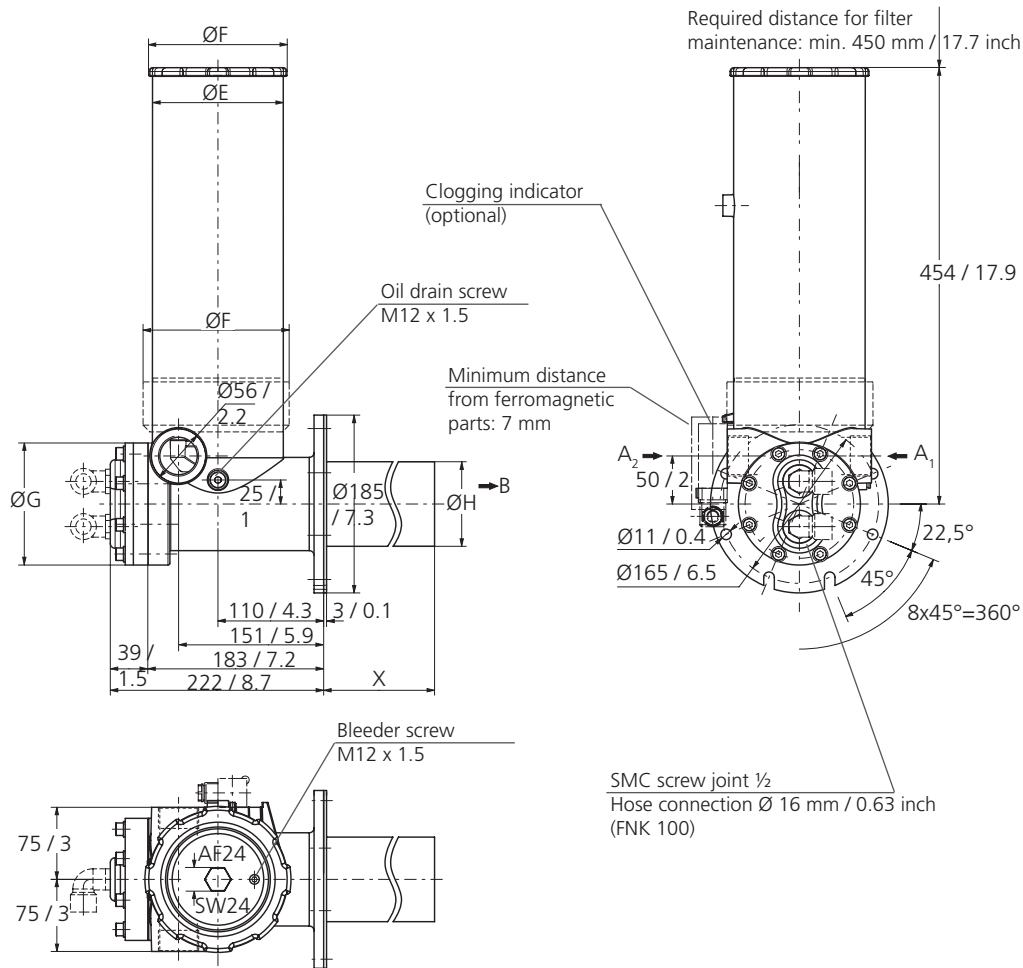
Order description: **FNK 100-3153** / **DG 041-32** **M**
 Part No. (Basic unit) _____
 Clogging indicator _____ **Mounted**

For the appropriate clogging indicator see catalog sheet 60.30.

Remarks:

- › The response / switching pressure of the clogging indicator used must be lower than the cracking pressure of the by-pass valve (see Selection Chart, column 8).
- › The filter units listed in this chart are standard units. If modifications are required, we kindly ask for your request.

Dimensions in mm



Measurements in mm

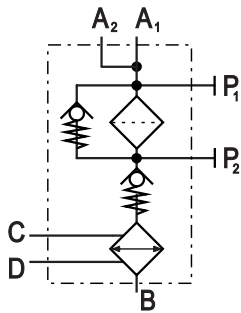
Type	A ₁ / A ₂	E	F	G	H	X				
FNK 050-1153	G1¼	133	152	105	65	203				
FNK 050-2153	G1¼	133	152	105	65	203				
FNK 050-3153	G1¼	133	152	105	65	457				
FNK 100-3153	G1¼	145	-	127	88	330				
FNK 100-5153	G1¼	145	-	127	88	480				
FNK 100-6153	G1¼	145	-	127	88	785				

Measurements in inch

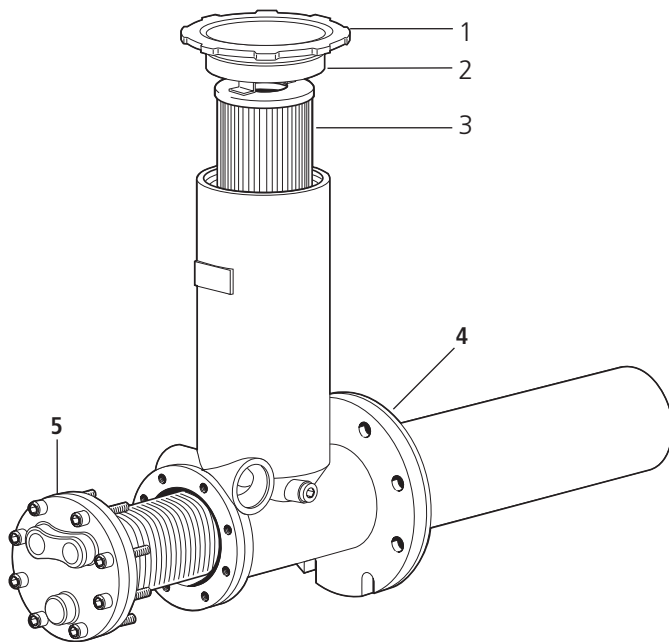
Type	A ₁ / A ₂	E	F	G	H	X				
FNK 050-1153	G1¼	5.24	5.98	4.13	2.56	7.99				
FNK 050-2153	G1¼	5.24	5.98	4.13	2.56	7.99				
FNK 050-3153	G1¼	5.24	5.98	4.13	2.56	17.99				
FNK 100-3153	G1¼	5.71	-	5.00	3.46	12.99				
FNK 100-5153	G1¼	5.71	-	5.00	3.46	18.90				
FNK 100-6153	G1¼	5.71	-	5.00	3.46	30.91				

Symbol

1



Spare Parts



Pos.	Designation	Part No.
1	Cover complete (with pos. 2)	FNK 100.1210
2	O-ring	N007.1245
3	Replacement filter element	V7.1235-53 K27
4	Flat seal	FNK 100.0113
5	Cooler (with water supply cover and seal)	s. Selection Chart / column 12

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.

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