



Off-line Filter Units

FNA 008 • FNA 016

- Operating pressure up to 4 bar
- Nominal flow rate up to 16 l/min
- For tank capacities up to 1500 l

Description

Application

Off-line filtration in hydraulic and lubricating oil systems.

Performance features

Protection

against wear: By means of filter elements that meet even the highest demands regarding cleanliness classes and dirt-holding capacity.

Protection against

malfunction: By means of permanent filtration in the off-line circuits excellent cleanliness classes can be achieved. This can lead to significantly longer intervals between maintenance work and oil changes, as well as reduction of machine failures due to contamination.

Special design features

Cover: The cover can be opened without special auxiliary tools. Because of the cover design the filter element can be changed almost without losing any oil. No pipes are needed except for the connection lines. The power units feature minimal noise output and low power consumption.

Pressure

relief valve: An integrated PRV (pressure relief valve) protects against overload.

Dirt

retention valve: Ensures that dirt accumulated in the filter is removed together with the element. Settled dirt cannot return into the system.

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

Filter maintenance

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

Materials

Pump housing: Aluminium alloy

Filter housing: Steel

Cover: Aluminium alloy

Seals: NBR (Viton on request)

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

Accessories

Water-absorbing filter elements (EXAPOR® AQUA) are available on request.

With Part No. FNA 008.1700 a mounting set that facilitates the fitting of incoming and outgoing pipes onto an existing filling/venting connection is available.

For installation in filter cooling circuits a version with by-pass valve is available on request.

Electrical and optical clogging indicators are available.

Dimensions and technical data see catalogue sheet 60.20.

Characteristics

Nominal flow rate

Up to 16 l/min at $v = 35 \text{ mm}^2/\text{s}$
(see Selection Chart, column 2)

Connection

Threaded port according to ISO 228 or DIN 13.
Sizes see Selection Chart, columns 9 and 10

Filter fineness

3 $\mu\text{m(c)}$... 12 $\mu\text{m(c)}$

β -values according to ISO 16889

(see Selection Chart, column 3 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 of fluids

0 °C ... +65 °C (also see viscosity range)

Ambient temperature range

0 °C ... +50 °C

Viscosity range

Electro motor air cooled type of protection: IP 55	Continous operation min.	Continous operation max.	Short-term operation max.
3 ~ 400 V / 460 V	15 mm ² /s	200 mm ² /s	400 mm ² /s
1 ~ 230 V	15 mm ² /s	200 mm ² /s	400 mm ² /s
1 ~ 110 V	15 mm ² /s	100 mm ² /s	200 mm ² /s
24 V	15 mm ² /s	100 mm ² /s	150 mm ² /s

Tank capacity

approx. 2,4 l

Maximum suction height

1,5 m

Operating pressure

Max. 4 bar, pressure protection with pressure relief valve;
cracking pressure see Selection Chart, column 11

Operating position

Vertical, pump block at the bottom

Recommended tank capacities

FNA 008: 100 l ... 800 l

FNA 016: 400 l ... 1500 l

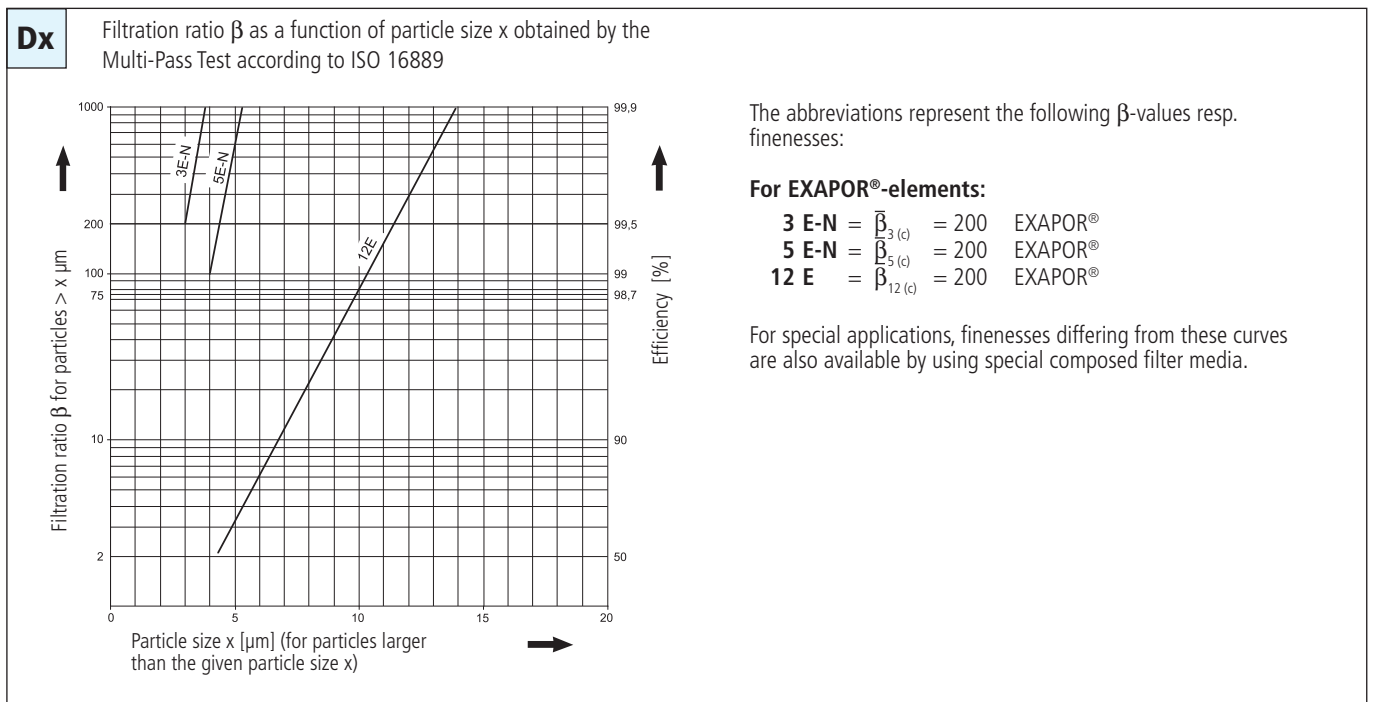
Off-line filter units for tank capacities exceeding 1500 l
see catalogue sheet 80.50

Selection Chart, columns 1-10

Part No.	Nominal flow rate	Filter fineness, see Diagr. Dx	Dirt-holding capacity	E-motor operating voltage	E-motor operating frequency (max.)	E-motor power (max.)	Engine speed at 50 Hz (max.)	Connection A Inlet	Connection B Outlet
1	2	3	4	5	6	7	8	9	10
FNA 008-763	8	3 E-N	180	1 ~ 110 V	(60)	0,25 (0,3)	1400 (1700)	1 1/16-12UN2B	3/4-16UN-2B
FNA 008-163	8	5 E-N	180	1 ~ 110 V	(60)	0,25 (0,3)	1400 (1700)	1 1/16-12UN2B	3/4-16UN-2B
FNA 008-573	8	3 E-N	180	1 ~ 230 V	50	0,25	1400 (1700)	G 3/4	G 1/2
FNA 008-553	8	3 E-N	180	3 ~ 400 V/460 V	50 (60)	0,25 (0,3)	1400 (1700)	G 3/4	G 1/2
FNA 008-753	8	3 E-N	180	3 ~ 400 V/460 V	50 (60)	0,25 (0,3)	1400 (1700)	1 1/16-12UN2B	3/4-16UN-2B
FNA 008-153	8	5 E-N	180	3 ~ 400 V/460 V	50 (60)	0,25 (0,3)	1400 (1700)	G 3/4	G 1/2
FNA 008-556	8	12 E	85	3 ~ 400 V/460 V	50 (60)	0,25 (0,3)	1400 (1700)	G 3/4	G 1/2
FNA 016-763	16	3 E-N	160	1 ~ 110 V	(60)	(0,3)	2800 (3300)	1 1/16-12UN2B	3/4-16UN-2B
FNA 016-163	16	5 E-N	160	1 ~ 110 V	(60)	(0,3)	2800 (3300)	1 1/16-12UN2B	3/4-16UN-2B
FNA 016-573	16	3 E-N	160	1 ~ 230 V	50	0,45	2700 (3200)	G 3/4	G 1/2
FNA 016-173	16	5 E-N	160	1 ~ 230 V	50	0,45	2700 (3200)	G 3/4	G 1/2
FNA 016-553	16	3 E-N	160	3 ~ 400 V/460 V	50 (60)	0,45 (0,55)	2700 (3200)	G 3/4	G 1/2
FNA 016-753	16	3 E-N	160	3 ~ 400 V/460 V	50 (60)	0,45 (0,55)	2700 (3200)	1 1/16-12UN2B	3/4-16UN-2B
FNA 016-153	16	5 E-N	160	3 ~ 400 V/460 V	50 (60)	0,45 (0,55)	2700 (3200)	G 3/4	G 1/2
FNA 016-773	16	5 E-N	160	3 ~ 400 V/460 V	50 (60)	0,45 (0,55)	2700 (3200)	1 1/16-12UN2B	3/4-16UN-2B
FNA 016-6553	16	3 E-N	160	24 V DC	–	0,25	2820	G 3/4	G 1/2
FNA 016-193	16	5 E-N	160	24 V DC	–	0,25	2820	G 3/4	G 1/2

Diagrams

Filter fineness curves in Selection Chart, column 3



Selection Chart, columns 11-17

Part No.	Cracking pressure of by-pass	Symbols hydraulic	Symbols electric	Measurements, Type No.	Replacement filter element Part No.	Clogging indicator	Remarks
	bar						
	11	12	13	14	15	16	17
FNA 008-763	4	1	3	2	V7.1220-113	optional	
FNA 008-163	4	1	3	2	V7.1220-13	optional	
FNA 008-573	4	1	3	1	V7.1220-113	optional	
FNA 008-553	4	1	1, 2	1	V7.1220-113	optional	
FNA 008-753	4	1	1, 2	2	V7.1220-113	optional	
FNA 008-153	4	1	1, 2	1	V7.1220-13	optional	
FNA 008-556	4	1	1, 2	1	V7.1220-06	optional	
FNA 016-763	4	1	3	2	V7.1220-113	optional	
FNA 016-163	4	1	3	2	V7.1220-13	optional	
FNA 016-573	4	1	3	1	V7.1220-113	optional	
FNA 016-173	4	1	3	1	V7.1220-13	optional	
FNA 016-553	4	1	1, 2	1	V7.1220-113	optional	
FNA 016-753	4	1	1, 2	2	V7.1220-113	optional	
FNA 016-153	4	1	1, 2	1	V7.1220-13	optional	
FNA 016-773	4	1	1, 2	2	V7.1220-13	optional	
FNA 016-6553	4	1	4	3	V7.1220-113	optional	
FNA 016-193	4	1	4	3	V7.1220-13	optional	

All filter units are delivered with an unplugged clogging indicator connection M12 x 1,5. As clogging indicators either manometers or electrical pressure switches can be used.

For the appropriate clogging indicators see catalogue sheet 60.20.

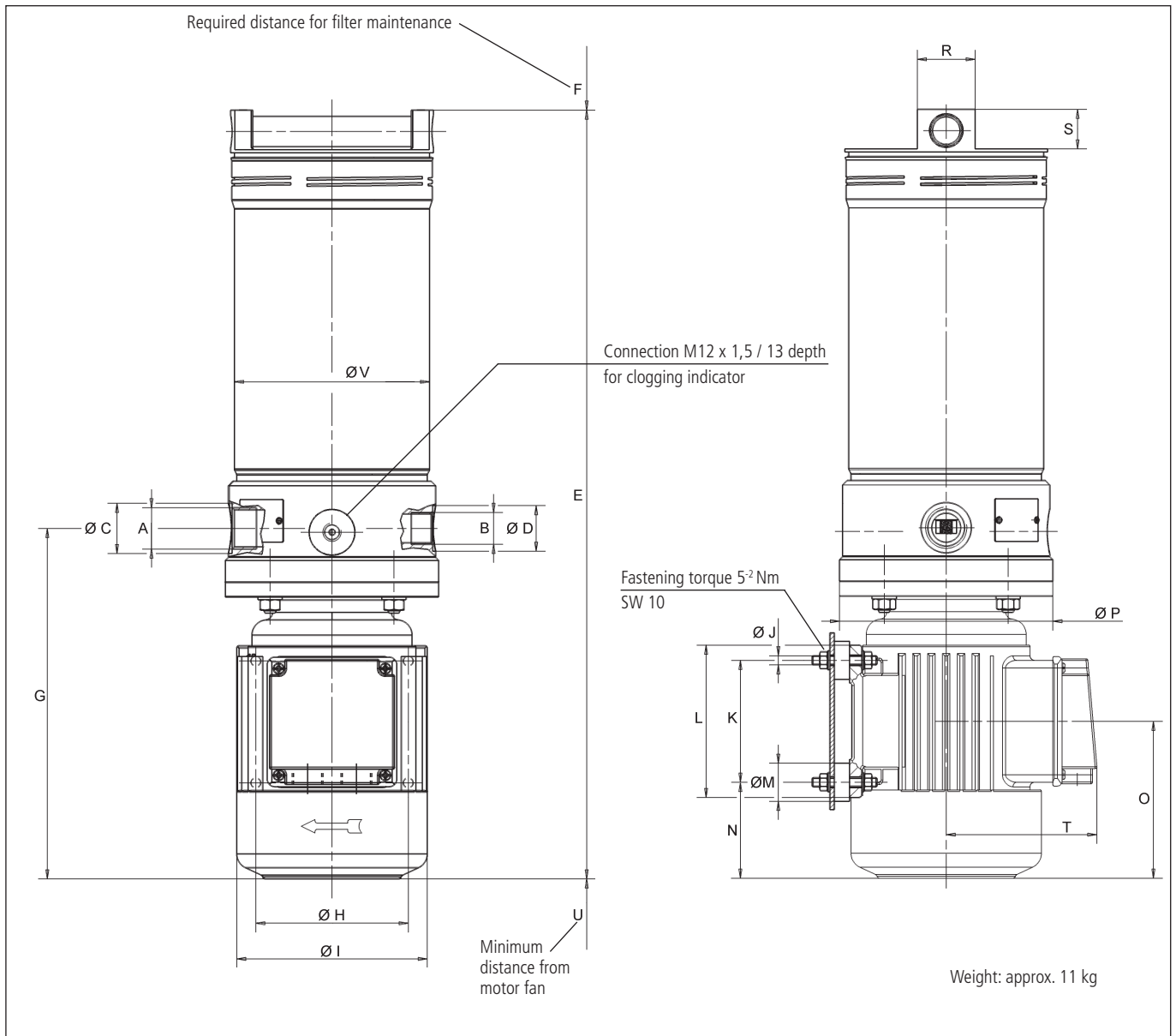
By the use of a manometer version DG 200-16* has to be chosen.

Remarks:

- If operating frequency increases, pump delivery will increase as well.
- The filter units listed in this chart are standard units. If modifications are required, e.g. with water-absorbing filter elements, pipe extensions or mounting sets, we kindly ask for your request.
- The clogging indicators are optionally available and then will be loosely provided.

* Manometer without throttle screw

Dimensions



Measurements

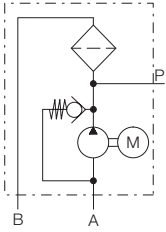
Type*	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	R	S	T	U	V
1	G3/4	G1/2	33	30	510	340	230	100	125	M6	80	100	25	63	105	140	38,5	27	100	20	128
2	1 1/16-12UN2B	3/4-16UN-2B	33	30	510	340	230	100	125	M6	80	100	25	63	105	140	38,5	27	100	20	128
3	G3/4	G1/2	33	30	550	340	265	100	125	M6	80	100	25	105	145	140	38,5	27	100	20	128

*Type see Selection Chart, column 14

Symbols

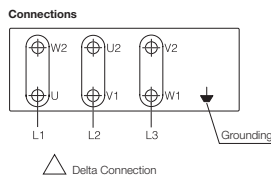
Hydraulic:

1

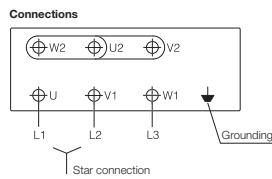


Electric:

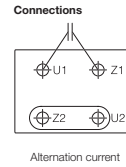
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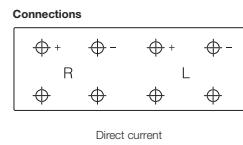
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3



4



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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Off-line Filter Units

FNA 045

- Operating pressure up to 4 bar
- Nominal flow rate up to 45 l/min
- For tank capacities up to 5000 l

Description

Application

In the off-line circuits of hydraulic and lubricating oil systems.

Performance features

Protection

against wear: By means of filter elements that, meet even the highest demands regarding cleanliness classes and dirt-holding capacity.

Protection against

malfunction: By means of permanent filtration in the off-line circuits excellent cleanliness classes can be achieved. This can lead to significantly longer intervals between maintenance work and oil changes, as well as reducing machine failure due to contamination.

Special design features

Cover: The fold-out handles at the cover facilitate opening. Because of the cover design the filter element can be changed almost without losing any oil. No pipes are needed except for the connection lines. The power units feature minimal noise output and low power consumption.

Pressure

relief valve: An integrated PRV (pressure relief valve) protects against overload.

Dirt

retention valve: Ensures that dirt accumulated in the filter is removed together with the element. Settled dirt cannot return into the system.

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

Filter maintenance

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

Materials

Pump and

filter housing: Aluminium alloy

Cover: Aluminium alloy

Seals: NBR (Viton on request)

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

Accessories

Water-absorbing filter elements (EXAPOR® AQUA) are available on request.

Electrical and optical clogging indicators are available on request – optionally with one or two switching points resp. temperature suppression. Dimensions and technical data see catalogue sheet 60.30.

Characteristics

Nominal flow rate

Up to 45 l/min at $v = 35 \text{ mm}^2/\text{s}$
(see Selection Chart, column 2)

Connection

Threaded port according to ISO 228.

Sizes see Selection Chart, columns 9 and 10

Filter fineness

$3 \mu\text{m(c)} \dots 5 \mu\text{m(c)}$

β -values according to ISO 16889

(see Selection Chart, column 3 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 of fluids

$0 \text{ }^\circ\text{C} \dots +65 \text{ }^\circ\text{C}$ (also see viscosity range)

Ambient temperature range

$0 \text{ }^\circ\text{C} \dots +50 \text{ }^\circ\text{C}$

Viscosity range

Electro motor air cooled type of protection: IP 55	Continuous operation min.	Continuous operation max.	Short-term operation max.
3 ~ 400 V / 460 V	15 mm ² /s	600 mm ² /s*	800 mm ² /s*
1 ~ 230 V	15 mm ² /s	600 mm ² /s*	800 mm ² /s*

* If the filter unit is operated together with the ARGO-HYTOS oil particle counter PODS, maximum viscosity in the "PODS" position is 400 mm²/s.

Tank capacity

approx. 10 l

Maximum suction height

1,5 m

Operating pressure

Max. 4 bar, pressure protection with pressure relief valve;
cracking pressure see Selection Chart, column 11

Operating position

Vertical, pump block at the bottom

Recommended tank capacities

From 500 l ... 5000 l

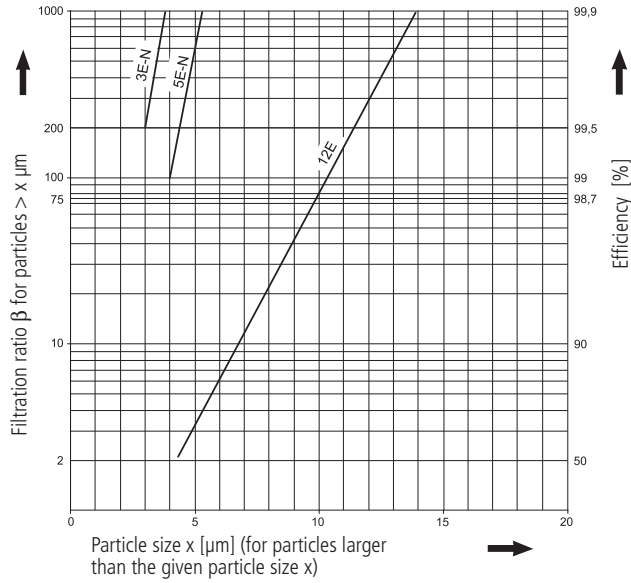
Off-line filter units for smaller tank capacities
see catalogue sheet 80.40.

Diagrams

Filter fineness curves in Selection Chart, column 3

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®-elements:

3 E-N = $\beta_{3(c)}$ = 200 EXAPOR®
5 E-N = $\beta_{5(c)}$ = 200 EXAPOR®
12 E = $\beta_{12(c)}$ = 200 EXAPOR®

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

Selection Chart

Part No.	Nominal flow rate	Filter fineness, see Diag. Dx	Dirt-holding capacity	E-motor operating voltage	E-motor operating power	E-motor operating frequency (max.)	Engine speed at 50 Hz	Connection A Inlet	Connection B Outlet	Cracking pressure of by-pass	Symbols hydraulic	Symbols electric	Replacement filter element Part No.	Clogging indicator
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FNA 045-1553	45	3 E-N	840	1 ~ 230 V	50 (60)	1,1	1500	G1¼	G1	4	1	3	V7.1560-103	optional
FNA 045-1153	45	5 E-N	840	1 ~ 230 V	50 (60)	1,1	1500	G1¼	G1	4	1	3	V7.1560-03	optional
FNA 045-4553	45	3 E-N	840	3 ~ 400 V/460 V	50 (60)	1,1	1500	G1¼	G1	4	1	1, 2	V7.1560-103	optional
FNA 045-4153	45	5 E-N	840	3 ~ 400 V/460 V	50 (60)	1,1	1500	G1¼	G1	4	1	1, 2	V7.1560-03	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 FNA 045-1553 has to be supplied with optical clogging indicator - response pressure 2,0 bar.

Order example: FN 045-1553 / DG 042-01 M mounted

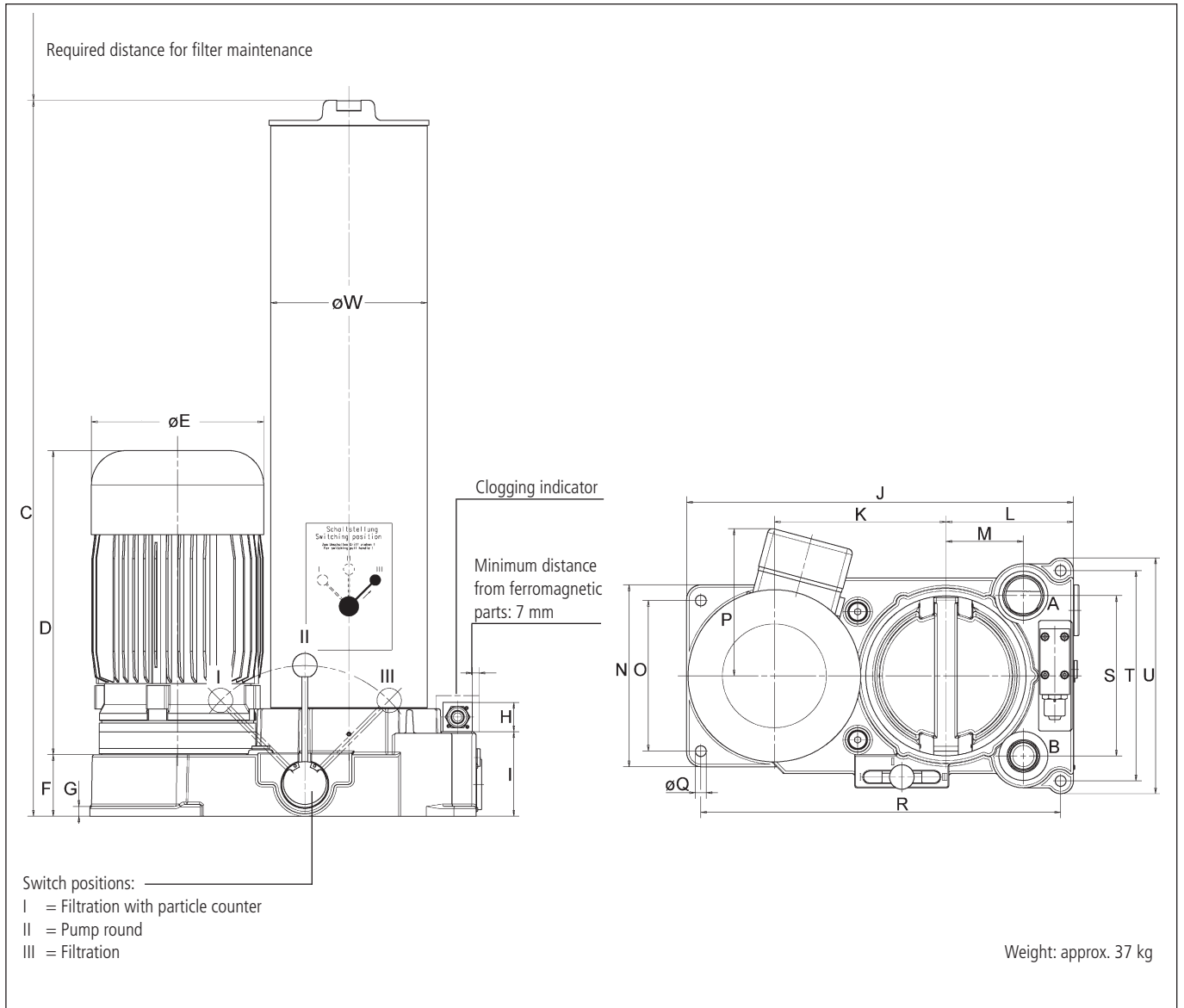
Part No. (Basic unit) _____

Clogging indicator _____

For the appropriate clogging indicators see catalogue sheet 60.30.

- Remarks:**
- If operating frequency increases, pump delivery will increase as well.
 - The filter units listed in this chart are standard units. If modifications are required, e.g. with water-absorbing filter elements, we kindly ask for your request.

Dimensions



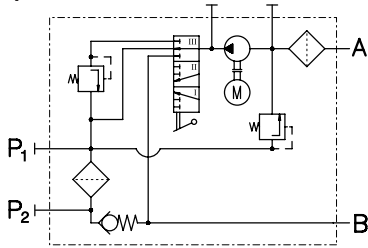
Measurements

Type	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
FNA 045	G1¼	G 1	735	312	176	63	10	30	87	395+2	175	130	79±0,3	186+2	154±0,3
	P	Q	R		S		T		U		V	W			
FNA 045	150	11	367±0,3		164±0,3		215±0,3		241+2		700	160			

Symbols

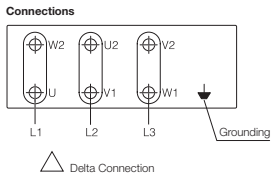
Hydraulic:

1

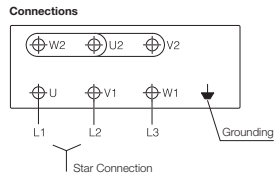


Electric:

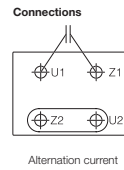
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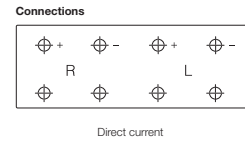
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3



4



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.

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Off-line Filters

FNS 060

- With flow control valve
- Operating pressure up to 320 bar
- Nominal flow rate up to 4 l/min

Description

Application

In the high pressure circuits of hydraulic and lubricating oil systems.

Performance features

Protection

against wear: By means of ultra-fine filter elements that meet even the highest demands regarding cleanliness classes and dirt-holding capacity.

Protection against malfunction: By means of permanent filtration in the off-line circuits excellent cleanliness classes can be achieved.

Special design features

Cover: The cover can be opened without special auxiliary tools. Because of the cover design the filter element can be changed almost without losing any oil. From the high-pressure circuit is cleaned by the fine filter element.

Dirt retention valve: Ensures that dirt accumulated in the filter is removed together with the element. Settled dirt cannot return into the system.

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

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 housing: Steel
Cover: Aluminium alloy
Seals: NBR (Viton on request)
Filter media: EXAPOR® - inorganic, multi-layer microfibre web

Accessories

Water-absorbing filter elements (EXAPOR® AQUA) are available on request. Electrical and optical clogging indicators are available on request. Dimensions and technical data see catalogue sheet 60.20.

Characteristics

Nominal flow rate

Up to 4 l/min (see Selection Chart, column 2)
Refers to the medium flow rate of the flow control valve. With selection of the flow control valve a sufficient surplus volume from the high-pressure circuit has to be guaranteed. If necessary the machine manufacturer should be consulted.

Connection

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

Filter fineness

3 µm(c)
β-values according to ISO 16889
(see Selection Chart, column 4 and diagram Dx)

Dirt-holding capacity

Values in g test dust ISO MTD according to ISO 16889
(see Selection Chart, column 5)

Hydraulic fluids

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

Temperature range

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

Viscosity at nominal flow rate

- at operating temperature: $v < 35 \text{ mm}^2/\text{s}$
- as starting viscosity: $v_{\text{max}} = 1200 \text{ mm}^2/\text{s}$

Operating pressure

Max. 320 bar
(max. 5 bar without flow control valve)
Minimum inlet pressure at the flow control valve: 10 bar

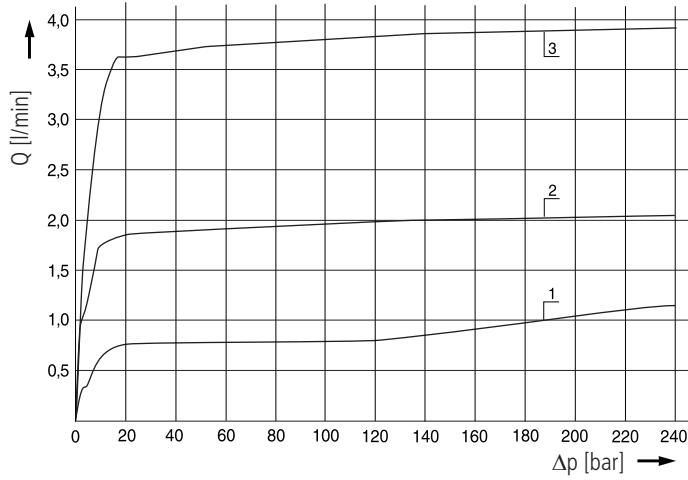
Mounting position

Vertical, connection port at the bottom

Diagrams

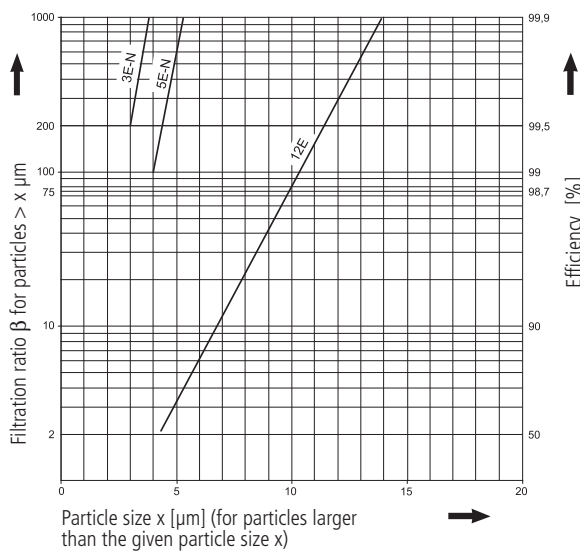
Δp -curves for complete filters in Selection Chart, column 3

D1 Flow volume as a function of the differential pressure at the flow control valve at $v = 35 \text{ mm}^2/\text{s}$



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



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

For EXAPOR®-elements:

$$\begin{aligned} 3 \text{ E-N} &= \beta_{3(c)} = 200 \text{ EXAPOR}^{\circledR} \\ 5 \text{ E-N} &= \beta_{5(c)} = 200 \text{ EXAPOR}^{\circledR} \\ 12 \text{ E} &= \beta_{12(c)} = 200 \text{ EXAPOR}^{\circledR} \end{aligned}$$

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

Selection Chart

Part No.	Nominal flow rate	Pressure drop see diagram D /curve no.	Filter fineness see Diagram Dx	Dirt-holding capacity	Connection A/B	Cracking pressure of by-pass	Symbol	Replacement filter element Part No.	Weight	Clogging indicator	Flow control valve	Remarks
1	l/min	3	g	bar	8	9	10	11	12	13		
FNS 060-163	*	D1 *	3 E-N	270	G¼ / G¼	3,5	1	V7.1230-153	5,2	optional	optional	basic unit
Flow control valve – inlet pressure min. 10 bar, max. 320 bar:												
HY 520-0051	1	D1 /1			G¾ / G¼							–
HY 520-0053	2	D1 /2			G¾ / G¼							–
HY 520-0054	4	D1 /3			G¾ / G¼							–

The housing of the off-line filter is designed for a max. operating pressure of 5 bar. To avoid back pressures no components as e.g. ball valves can be inserted at the housing outlet and in the continuative circuit.

Optical or electrical indicators are available to monitor the clogging condition of the element.

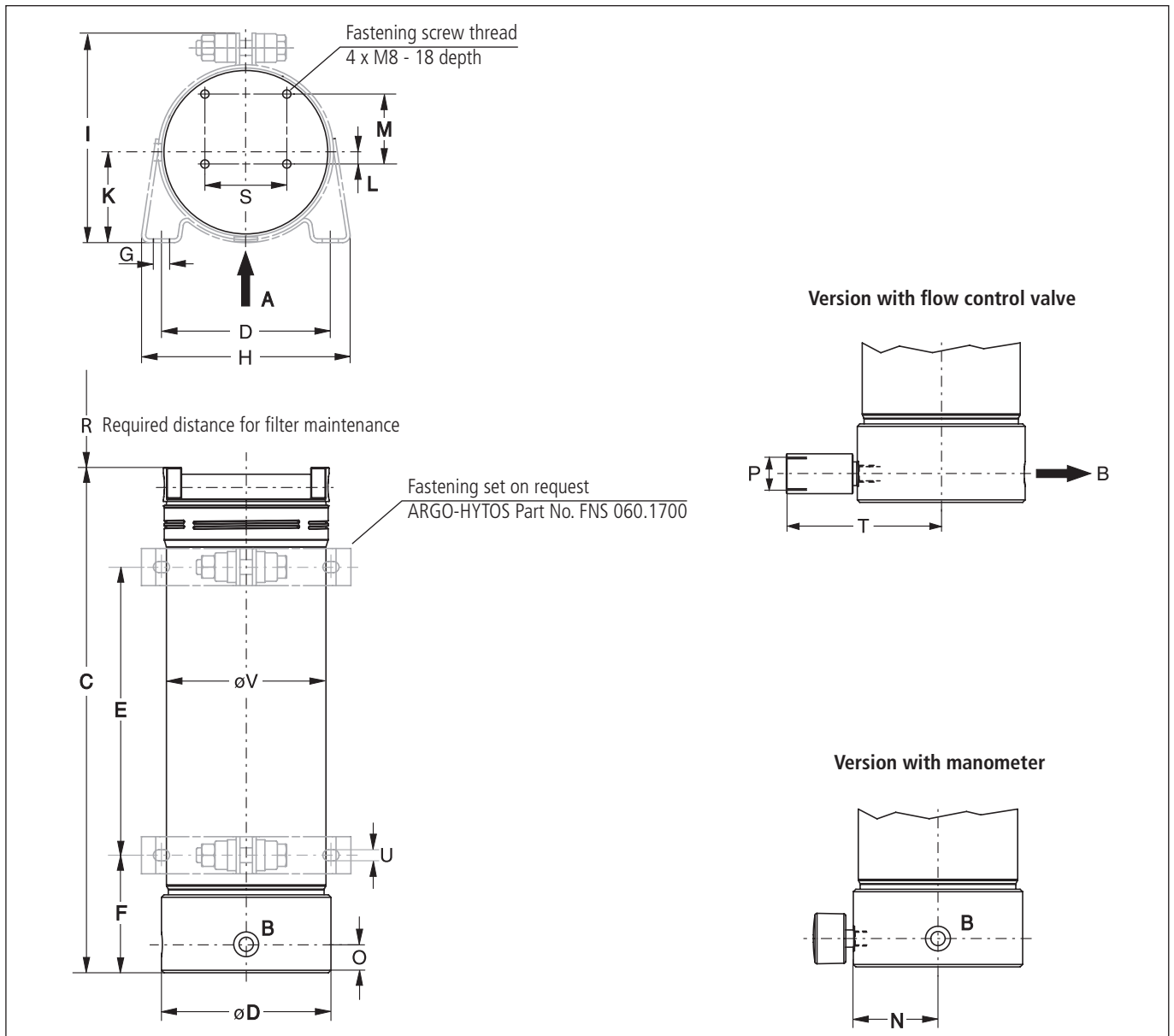
For the appropriate clogging indicators see catalogue sheet 60.20.

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 7).
- The clogging indicators and flow control valves are optional and always delivered detached from the filter.
- The filter units listed in this chart are standard units. If modifications are required, e. g. with water-absorbing filter elements, we kindly ask for your request.

* see Nominal flow rate of the flow control valves

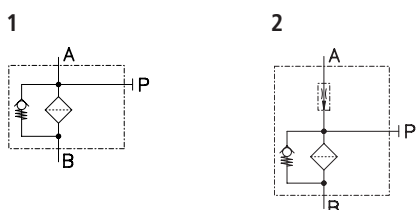
Dimensions



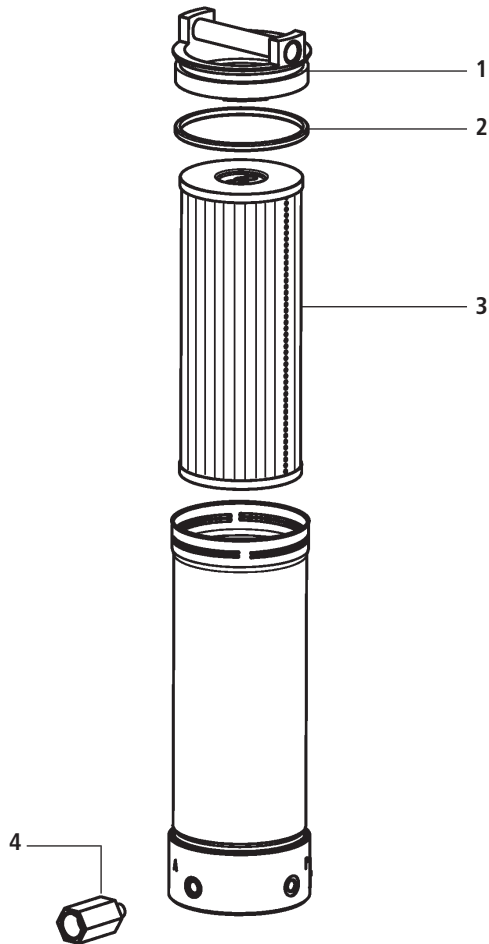
Measurement

Type	A / B	C	D	E	F	G	H	I	K	L	M	N	O	P	R	S	T	U	V
FNS 060	G $\frac{1}{4}$	410	136	233	95	12	170	169	73	9,5	56,5	67	23	G $\frac{3}{4}$	300	66	124	9	128

Symbols



Spare Parts



Pos.	Designation	Part No.
1	Cover	FNA 008.1250
2	O-ring	N007.1175
3	Filter element	see Selection Chart
4	Flow control valve	see Selection Chart

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:

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	Verification of fabrication integrity (Bubble Point Test)
ISO 3968	Evaluation of pressure drop versus flow characteristics
ISO 16889	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 advise 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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Tel: +49 7250 76-0 · Fax: +49 7250 76-199 · info.de@argo-hytos.com · www.argo-hytos.com



Off-line Filter

FN 060 · FN 300

- In-line mounting
- Operating pressure up to 12 bar
- Nominal flow rate up to 370 l/min

Description

Application

Main flow filter or off-line filter in hydraulic and lubricating 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).

Special design features

Cover: The cover of the FN 060 can be opened without special auxiliary tools. Fold-out handle parts at the cover of the FN 300 for easy opening.

Automatic ventilation valve (only FN 300): The quick automatic deaeration after putting into operation prevents components from consequential damage by a too high air amount in the oil as e.g. prevention of cavitation damages and micro diesel effect.

Dirt retention valve: On the bottom of the from inside to outside flown through filter elements, there is a dirt retention valve. If the filter element is pulled out of the filter housing with the cover the dirt retention valve will close. Sedimented dirt is removed from the housing with the filter element. Because of the design of the cover the filter element can be changed almost without losing any oil.

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

Filter maintenance

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

Materials:

Filter head: Aluminium alloy

Filter housing: Steel (FN 060)

Aluminium alloy (FN 300)

Cover: Aluminium alloy

Seals: NBR (Viton on request)

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

Seals: NBR (Viton on request)

Accessories

Water-absorbing filter elements (EXAPOR® AQUA) are available on request.

For FN 060 a bleeder screw is available on request and with

Part no. FNS 060.1720 a fastening kit.

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

Dimensions and technical data of the clogging indicators see catalogue sheet 60.30.

Characteristics

Operating pressure

Max. 12 bar (FN 060)

Max. 10 bar (FN 300)

Nominal flow rate

Up to 370 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 10 bar $\leq 4,5 \text{ m/s}$

Filter fineness

3 $\mu\text{m(c)}$... 12 $\mu\text{m(c)}$

β -values according to ISO 16889

(see Selection Chart, column 4 and diagram Dx)

Dirt-holding capacity

Values in g test dust ISO MTD according to ISO 16889

(see Selection Chart, column 5)

Hydraulic fluids

Mineral oil and biodegradable fluids

(HEES and HETG, see info-sheet 00.20)

Temperature range

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

Viscosity at nominal flow rate

- at operating temperature: $v < 35 \text{ mm}^2/\text{s}$
- 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% 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.

Mounting position

Vertical, connection port at the bottom

Connection

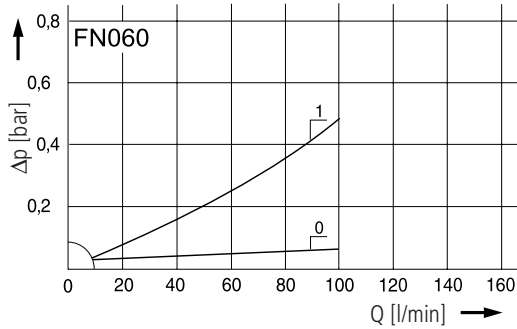
Threaded ports according to ISO 228 or DIN 13 (FN 060) or flange mounting according to SAE-J518 (FN 300).

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

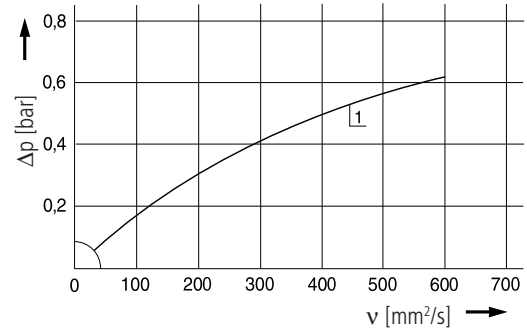
Diagrams

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

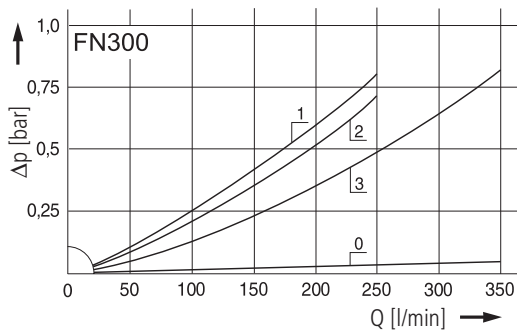
D1 Pressure drop as a function of the **flow volume**
at $v = 35 \text{ mm}^2/\text{s}$ (0 = casing empty)



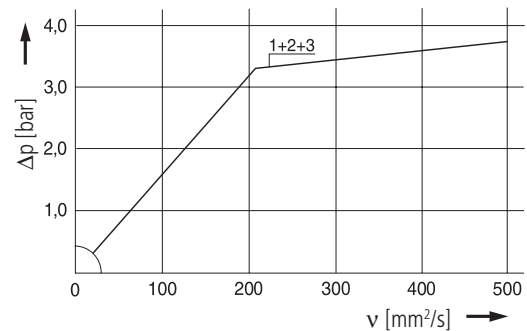
Pressure drop as a function of the **kinematic viscosity**
at nominal flow



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

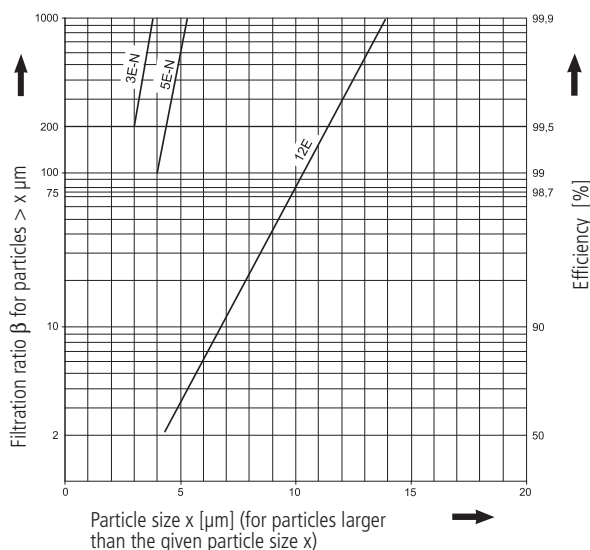


Pressure drop as a function of the **kinematic viscosity**
at nominal flow



Filter fineness curves in Selection Chart, column 4

Dx Filtration ratio 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®-Elements:

3 E-N = $\bar{\beta}_{3(c)} = 200$ EXAPOR®
5 E-N = $\bar{\beta}_{5(c)} = 200$ EXAPOR®
12 E = $\bar{\beta}_{12(c)} = 200$ EXAPOR®

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 Dx	Dirt-holding capacity	Connection A/B	Cracking pressure of by-pass Symbol	Replacement filter element Part No.	Weight	Clogging indicator	Remarks	
1	2	3	4	5	6	7	8	9	10	11	12
FN 060-273	100	D1/1	5 E-N	210	G1	3,5	1	V7.1230-53	5	optional	–
FN 300-163	170	D2/1	3 E-N	710	SAE 2½	3,5	2	V7.1560-103	20	optional	*
FN 300-153	220	D2/2	5 E-N	660	SAE 2½	3,5	2	V7.1560-03	20	optional	*
FN 300-156	370	D2/3	12 E	350	SAE 2½	3,5	2	V7.1560-06	20	optional	*

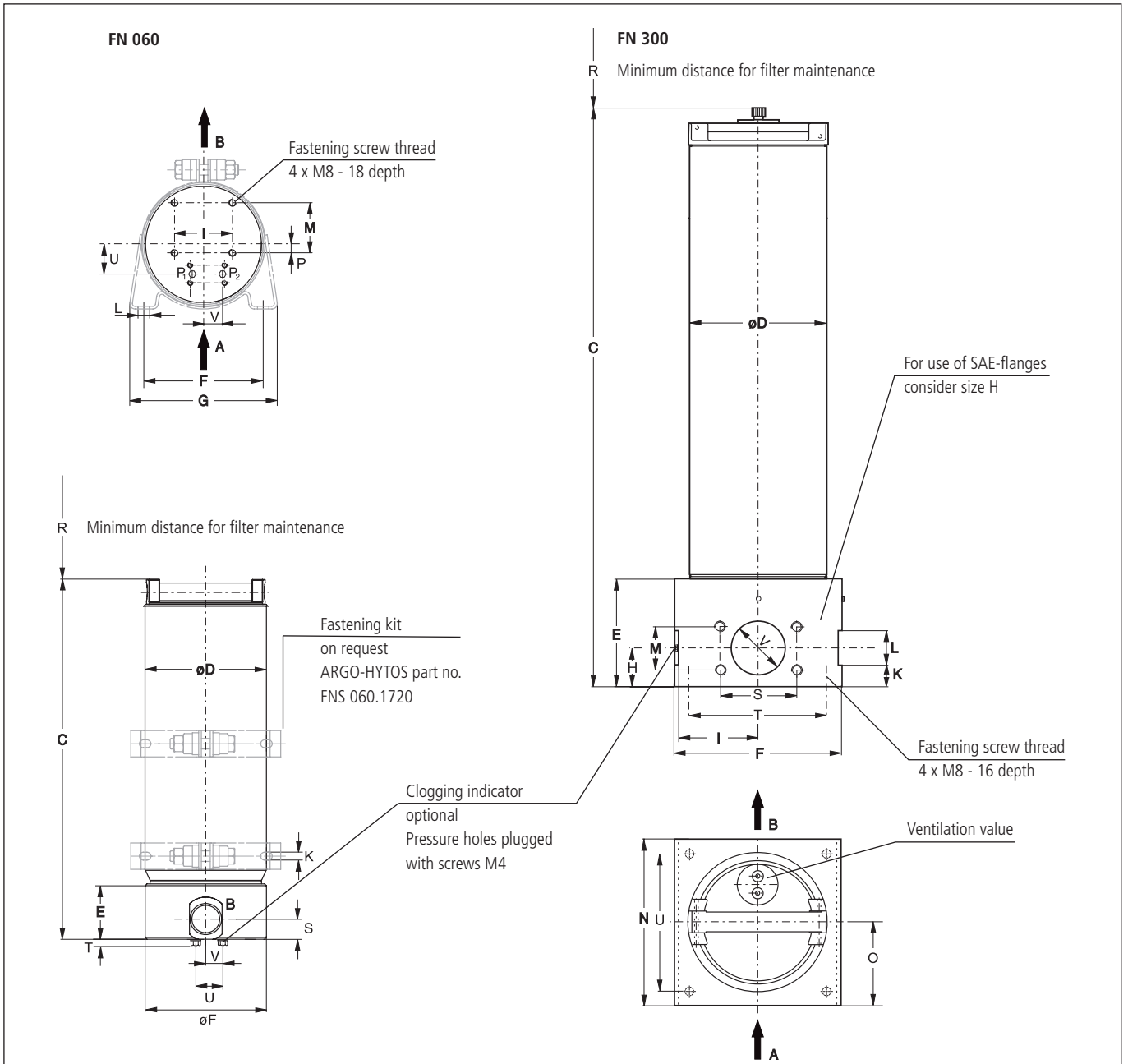
Optical or electrical indicators are available to monitor the clogging condition of the element.

For the appropriate clogging indicators see catalogue sheet 60.20.

- 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 7).
 - 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 water-absorbing filter elements or fastening kit, we kindly ask for your request.

* with automatic ventilation valve

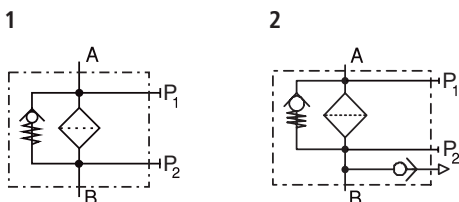
Dimensions



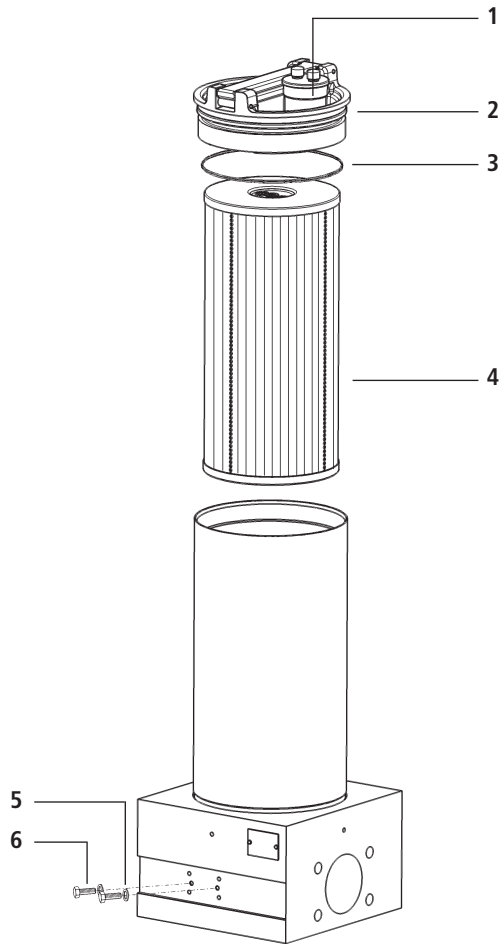
Measurements

Type	A / B	C	D	E	F	G	H	I	K	L	M	N	O	P	R	S	T	U	V
FN 060	G1	410	138	63	136	170	95	66	9	12	56,5	177	78	9,5	300	23	4	34	21
FN 300	SAE 2½	775	160	126	200	231	45	96	25	40	50,8	195	97,5	112,5	700	88,9	170	165	63

Symbols



Spare Parts



Pos.	Designation	Part No.
1	Automatic ventilation valve (FN 300)	FA 016.1801
2a	Cover (FN 060)	FNA 008.1290
2b	Cover (FN 300) (with automatic ventilation valve and Pos. 3b)	FNA 045.1210
3a	O-ring 117,48 x 5,3 (FN 060)	N007.1175
3b	O-ring 145,42 x 5,33 (FN 300)	N007.1455
4	Filter element	see Chart/col. 9
5	Bonded seal 4,1 x 7,2 x 1	3404074
6	Hexagonal head screw M4x8 DIN 933-88	3301051

The function 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:

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.

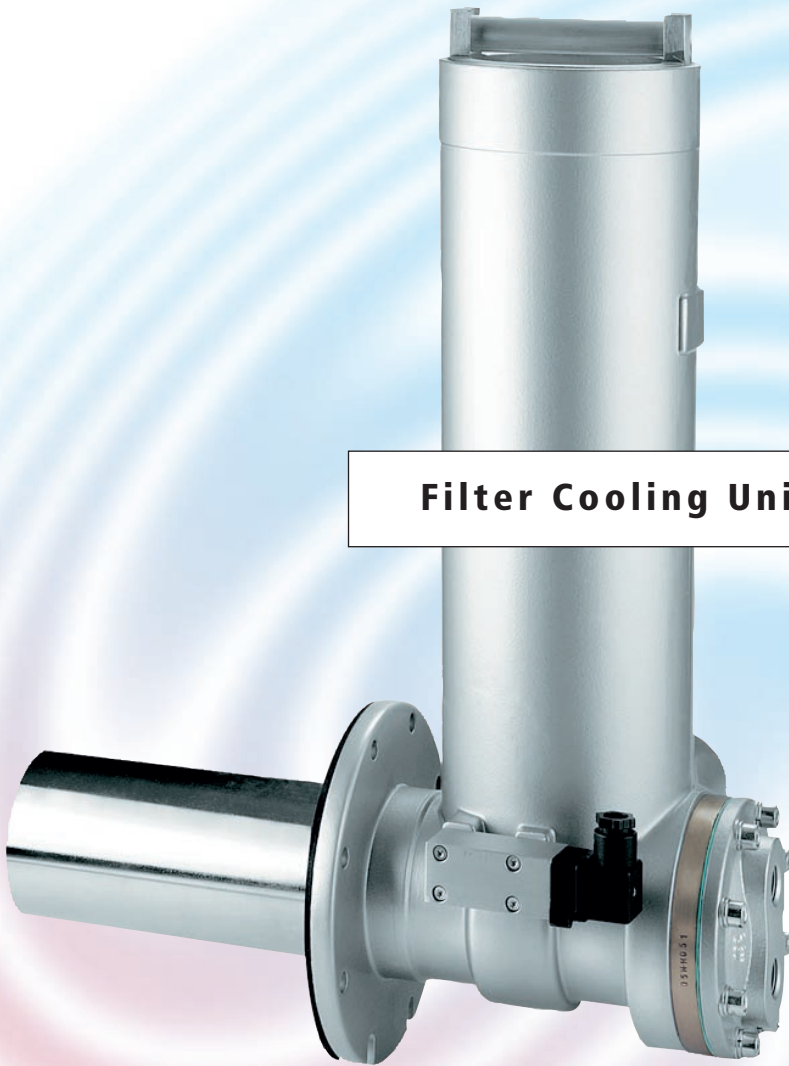


We produce fluid power solutions

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Filter Cooling Units



FNK 050 • FNK 100

- Operating pressure up to 10 bar
- Nominal flow rate up to 125 l/min
- Cooling capacity up to 45 kW

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 meet even 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.

Filter elements

Flow direction from outside to centre. 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.

Unfavourable 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 (Viton on request)

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

Accessories

Electrical and optical clogging indicators are available. Dimensions and technical data see catalogue sheet 60.30.

Characteristics

Operating pressure

Max. 10 bar

Cooling capacity

Up to 45 kW

Nominal flow rate

Up to 125 l/min

(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)

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.

Selection Recommendations

In principle the filter cooling unit is selected as follows:

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
- Oil discharge temperature 50 °C
- Oil viscosity 35 mm²/s

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
Oil discharge temperature (T _{oil out})	=	45 °C
Water entry temperature (T _{water in})	=	25 °C
Oil species	=	ISO VG 32

Procedure

- 1.1. Calculation of the temperature difference ΔT
 Temperature difference ΔT (°C) = $(AW \times 34,1) / Q = 7,2$

- 1.2. Calculation of the middle oil temperature
 $(2 \times T_{oil\ out} + \Delta T) / 2 \cong 49$ °C

- 1.3. Calculation of the viscosity with middle oil temperature v_{ist}
 v_{ist} from the oil manufacturer chart
 for ISO VG 32 at 49 °C: 21 mm²/s

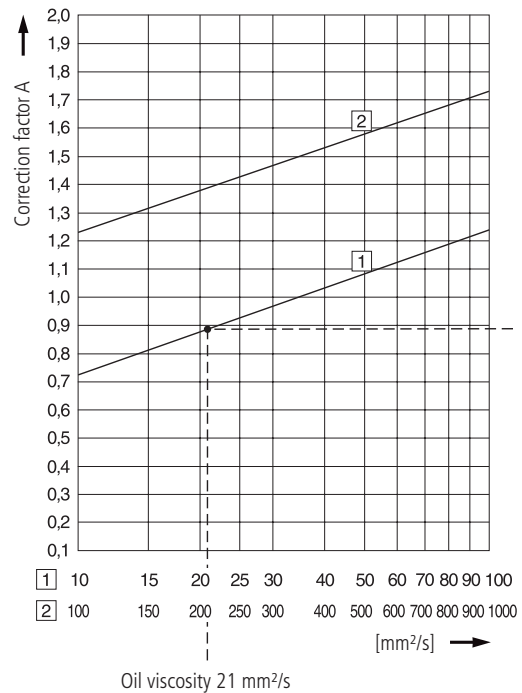
- 1.4. Viscosity factor „A“
 From the viscosity correction chart „A“ at 21 mm²/s: 0,88

- 1.5. Determination of the necessary cooling performance
 Heat to be discharged
 $AW_{eff} = (AW \times 27,5 \times A) / (T_{oil\ out} - T_{water\ in})$
 $= (17 \times 27,5 \times 0,88) / 20 = 20,6$ kW

- 1.6. 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

Viscosity correction chart

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



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 and 300 mm²/s.

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 and operating viscosities from 200 mm²/s on (e.g. at cold start) the by-pass valve can be open with a partially contaminated filter element (temporary poor filtration performance).

Diagrams

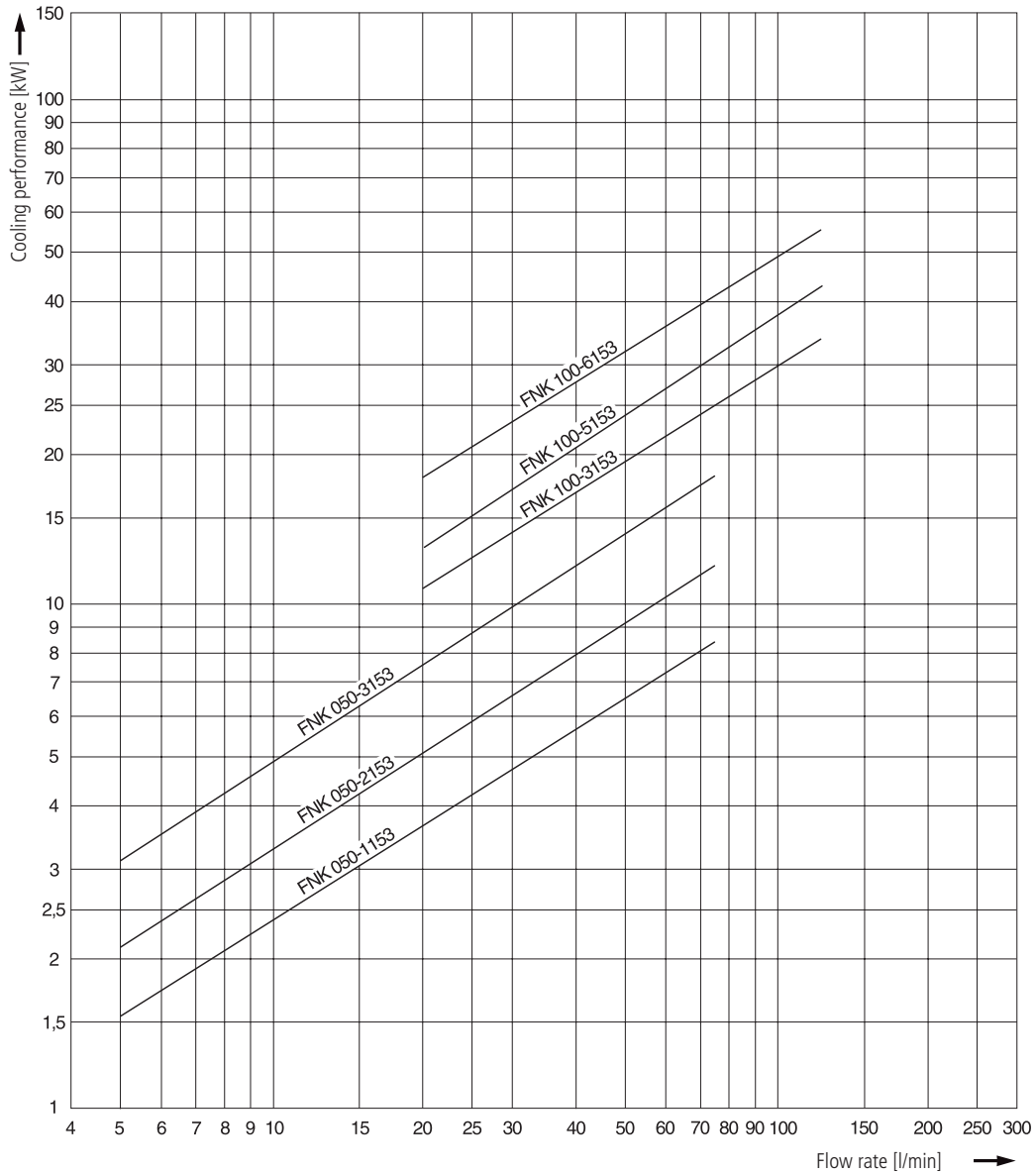
Characteristic curves cooler performance

Dk

The displayed performance curves are based on:

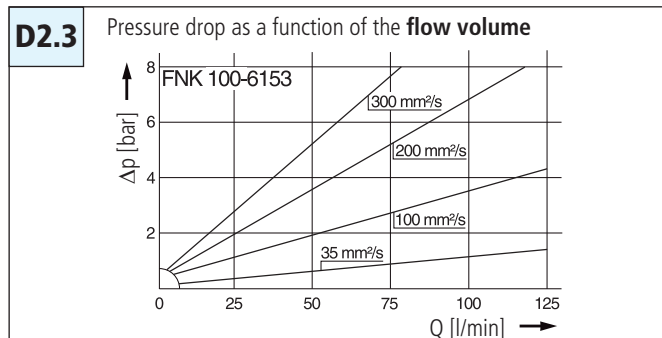
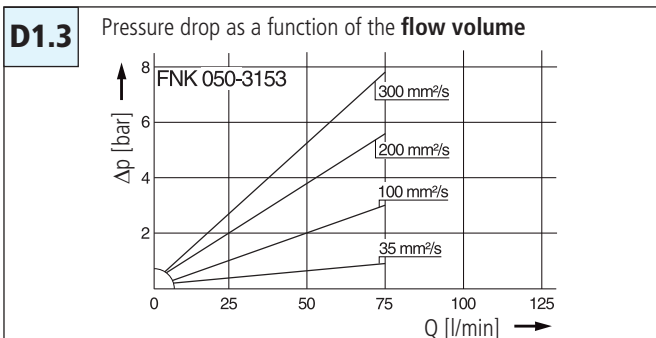
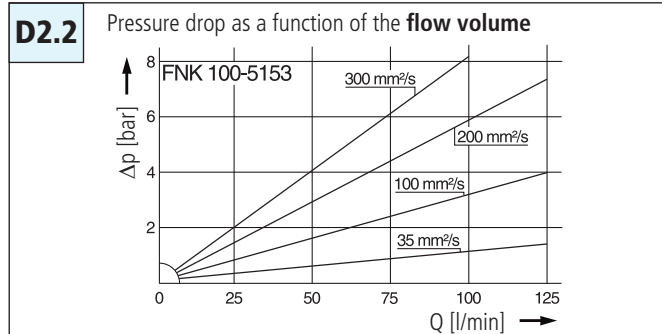
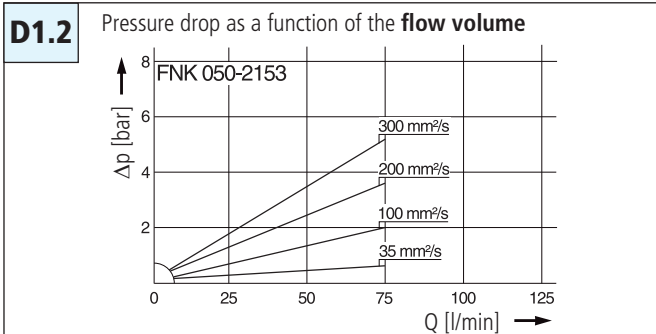
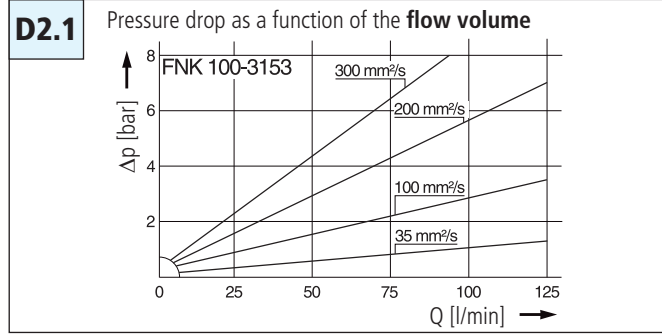
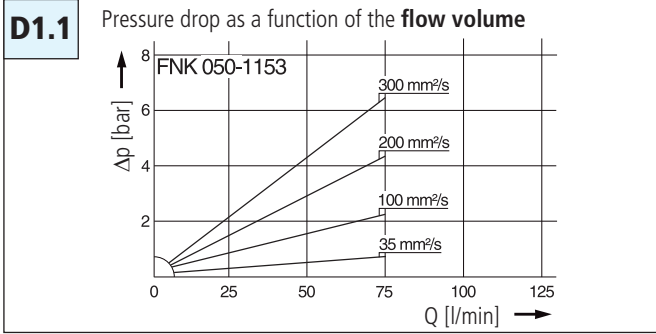
- Water inlet temperature 25 °C
- Oil discharge temperature 50 °C
- Oil viscosity 35 mm²/s

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



Diagrams

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



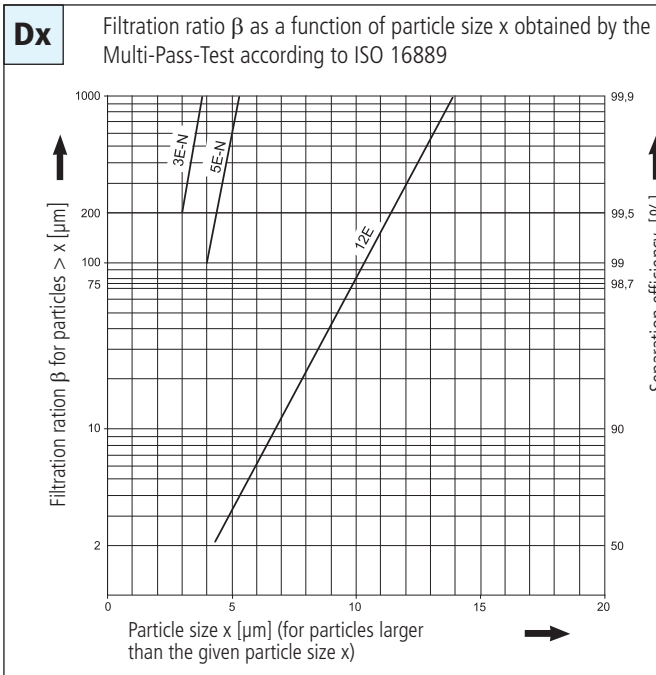
In general the pressure drop increases in line with a larger cooler length.

Exception:

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

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

Filter fineness curves in Selection Chart, column 4



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

For EXAPOR®-Elements:

3 E-N = $\beta_{3(c)}$ = 200 EXAPOR®

5 E-N = $\beta_{5(c)}$ = 200 EXAPOR®

12 E = $\beta_{12(c)}$ = 200 EXAPOR®

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	Pressure drop see diagram D	Filter fineness see Diagr. Dx	Dirt-holding capacity	Connection A ₁ / A ₂ inlet	Cracking pressure of by-pass	Replacement filter element Part No.	Clogging indicator	Weight	Cooler element
1	kW	l/min	4	5	g	7	8	9	10	11	12
FNK 050-1153	5	75	D1.1	5 E-N	230	G 1¼	5,0	V7.1235-53	optional	23	FNK 050.1700
FNK 050-2153	8	75	D1.2	5 E-N	230	G 1¼	5,0	V7.1235-53	optional	24	FNK 050.1710
FNK 050-3153	13	75	D1.3	5 E-N	230	G 1¼	5,0	V7.1235-53	optional	26	FNK 050.1720
FNK 100-3153	33	125	D2.1	5 E-N	230	G 1¼	5,0	V7.1235-53	optional	15	FNK 100.0703
FNK 100-5153	40	125	D2.2	5 E-N	230	G 1¼	5,0	V7.1235-53	optional	16	FNK 100.0705
FNK 100-6153	50	125	D2.3	5 E-N	230	G 1¼	5,0	V7.1235-53	optional	17	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.

Order example: The filter FNK 100-3153 has to be supplied with electrical clogging indicator – response pressure 2,0 bar.

Order description: **FNK 100-3153 / DG 041-32 M**

Part No. (Basic unit) _____ Mounted

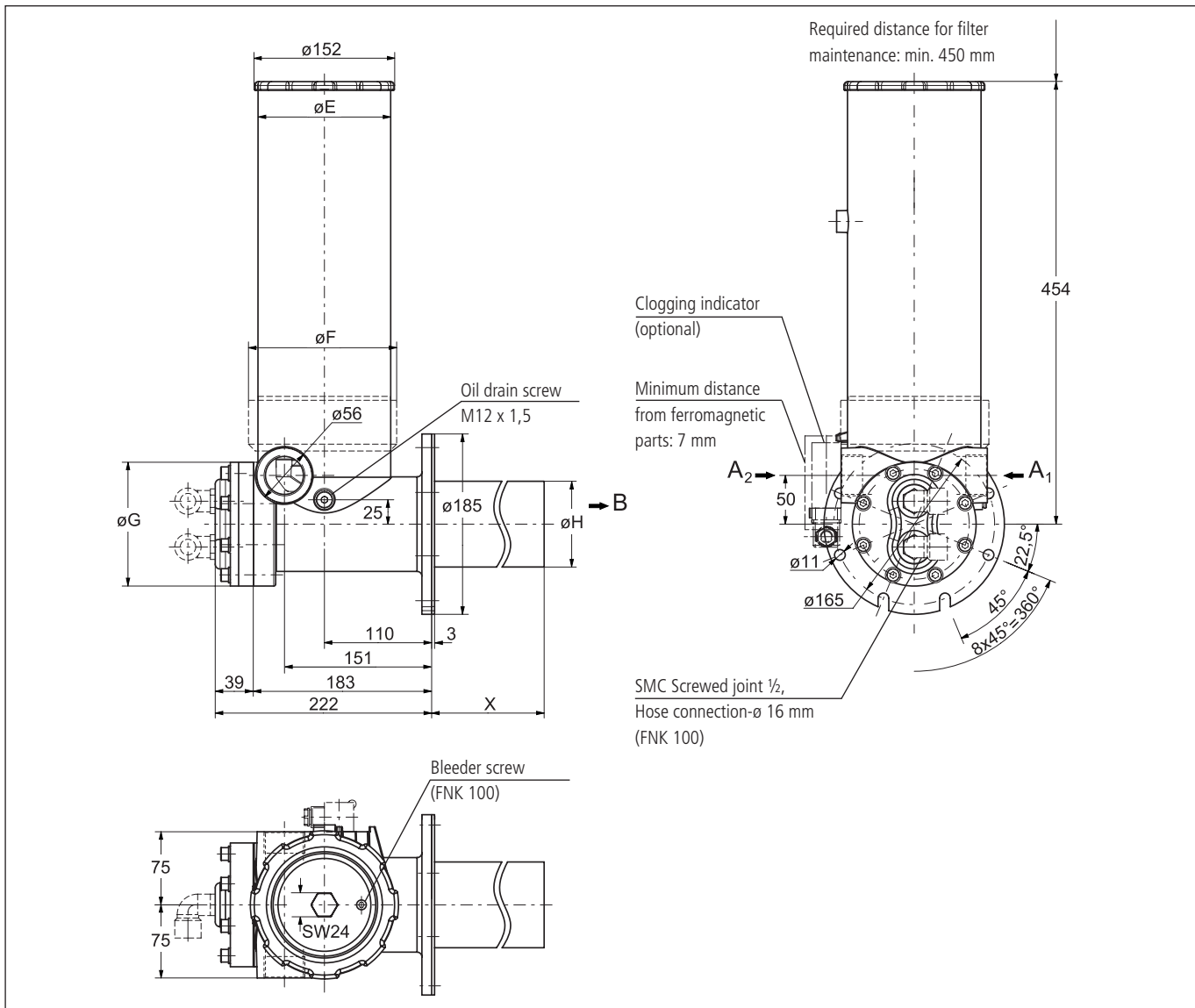
Clogging indicator _____

For the appropriate clogging indicator see catalogue 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 10).
- The filter units listed in this chart are standard units. If modifications are required, we kindly ask for your request.

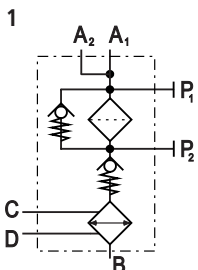
Dimensions



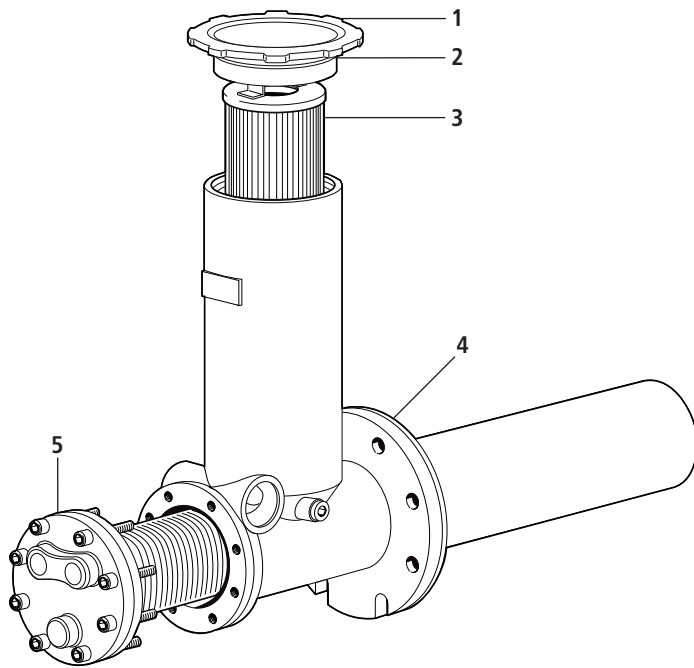
Measurements

Type	A ₁ / A ₂	E	F	G	H	X				
FNK 050-1153	G 1¼	133	152	105	65	203				
FNK 050-2153	G 1¼	133	152	105	65	203				
FNK 050-3153	G 1¼	133	152	105	65	457				
FNK 100-3153	G 1¼	145	-	127	88	330				
FNK 100-5153	G 1¼	145	-	127	88	480				
FNK 100-6153	G 1¼	145	-	127	88	785				

Symbols



Spare Parts



Pos.	Designation	Part No.
1	Cover complete (with pos. 2)	FNK 100.1210
2	O-ring	N007.1245
3	Filter element	V7.1253-53 K27
4	Flat seal	FNK 100.0110
5	Cooler (with water supply cover and seal)	s. 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 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 advise 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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