ARGO HYTOS

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

80.30-1e

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 diffential 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 x 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 ν_{ist}
ν_{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

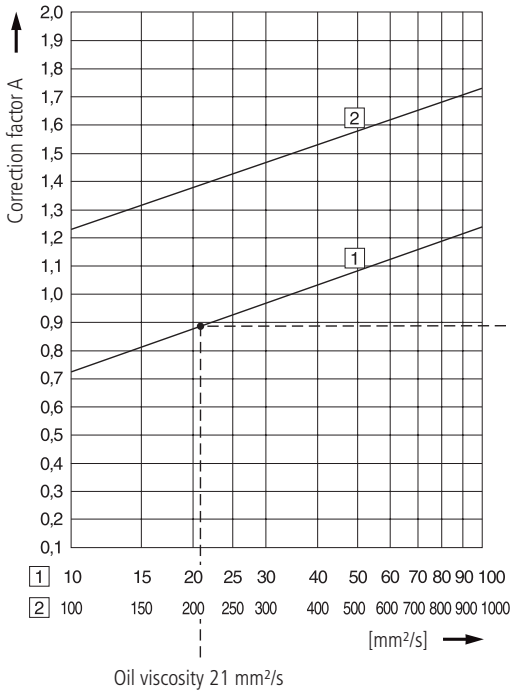
1.6. Selection of the filter cooling unit
The cooler performance chart shows
Q = 80 l/min and
$AW_{eff.}$ 20,6 kW the filter cooling unit: FNK 100-3153

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).

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).



Diagrams

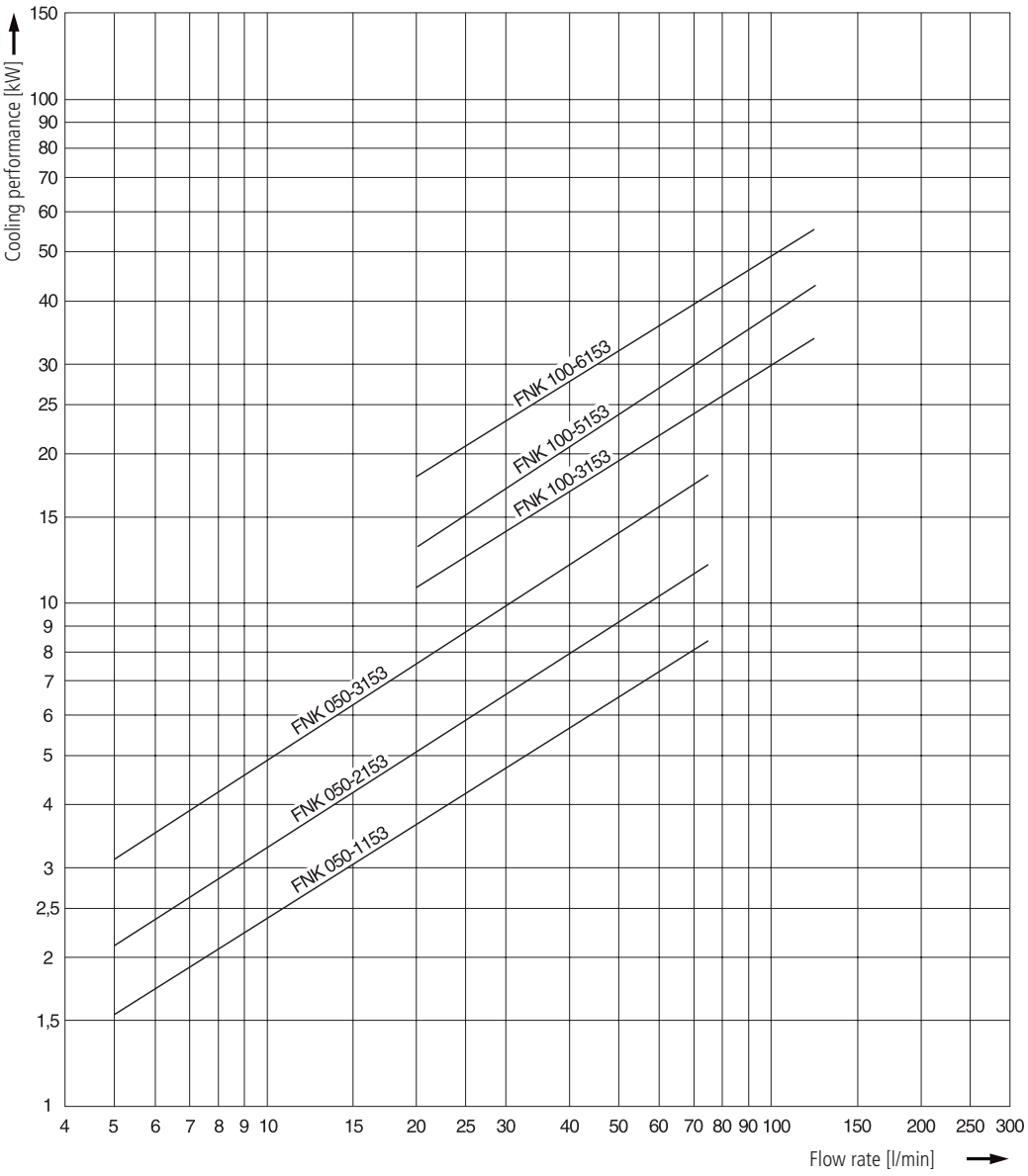
Characteristic curves cooler performance

Dk

The displayed performance curves are based on:

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

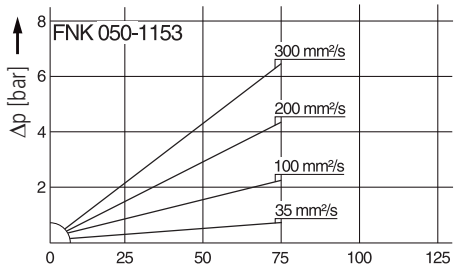
For differing viscosities the correction factor A can be read off from the viscosity correction chart.



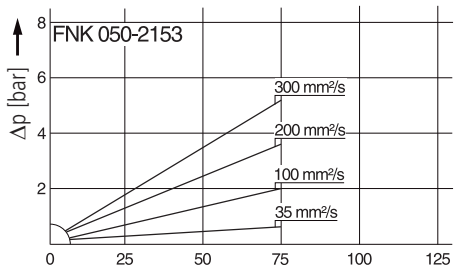
Diagrams

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

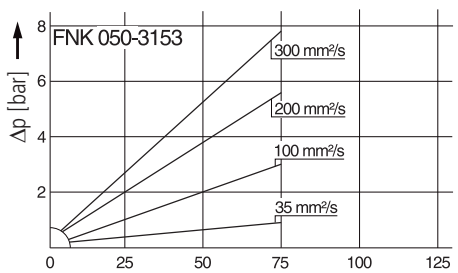
D1.1 Pressure drop as a function of the **flow volume**



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

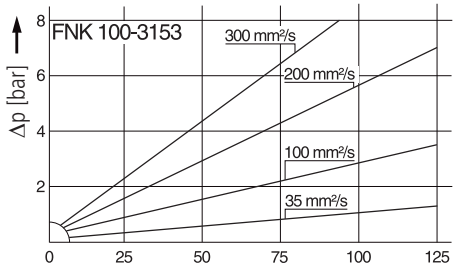


D1.3 Pressure drop as a function of the **flow volume**

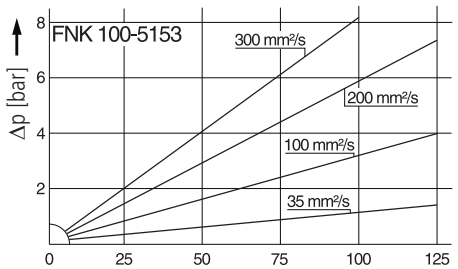


In general the pressure drop increases in line with a larger cooler length.
Exception:
Due to lower distances of the disk sheets in the cooler the pressure drop of the FNK 050-1153 is higher than the one of the larger FNK 050-2153.

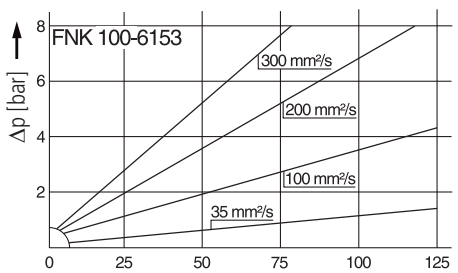
D2.1 Pressure drop as a function of the **flow volume**



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



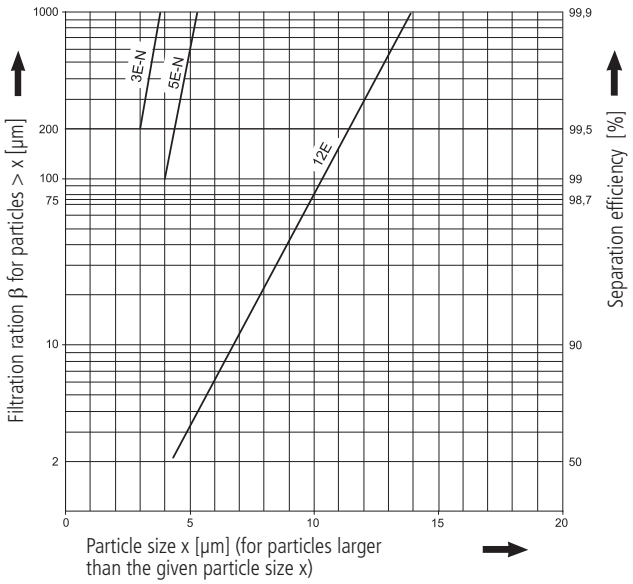
D2.3 Pressure drop as a function of the **flow volume**



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 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 = $\beta_{12\,(c)}$ = 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
	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**	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) — **FNK 100-3153**

Clogging indicator — **DG 041-32**

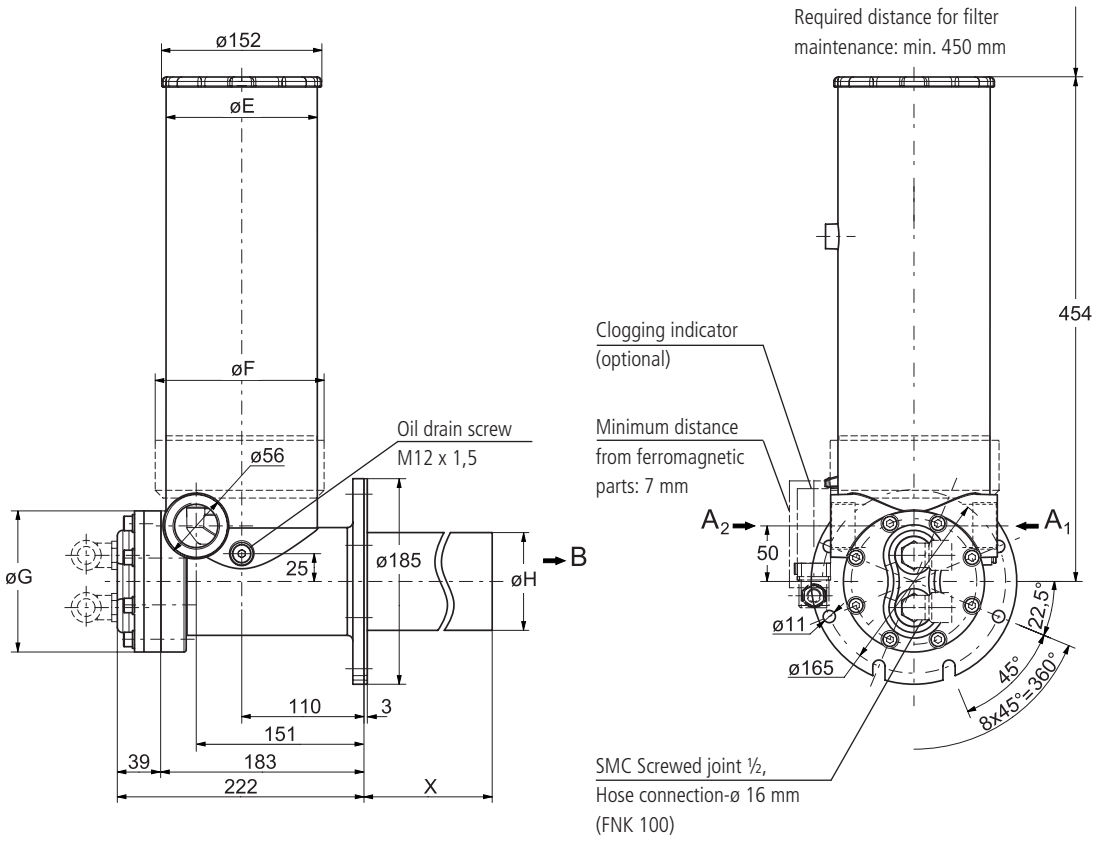
Mounted — **M**

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

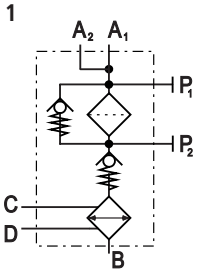


Measurements

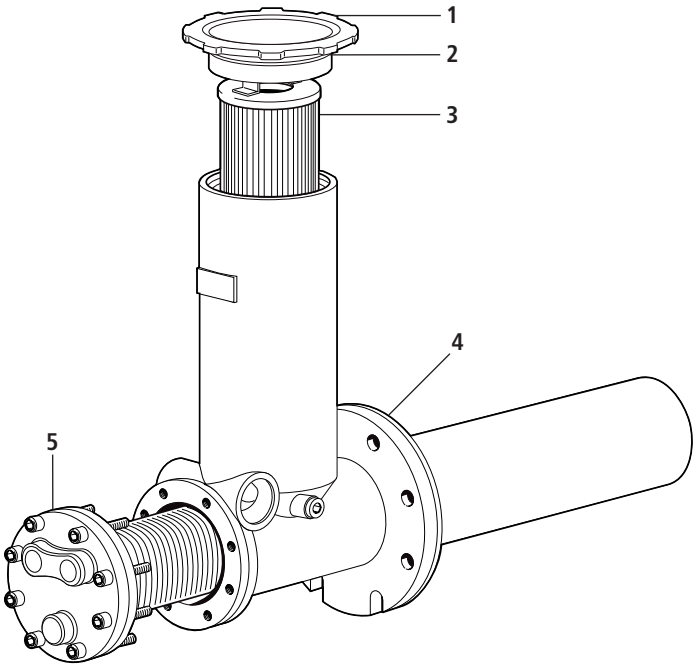
Type	A_1 / A_2	E	F	G	H	X				
FNK 050-1153	G 1¼	133	152	105	65	203				
FNK 050-2153	G 1¼	133	152	105	65	203				
FNK 050-3153	G 1¼	133	152	105	65	457				
FNK 100-3153	G 1¼	145	-	127	88	330				
FNK 100-5153	G 1¼	145	-	127	88	480				
FNK 100-6153	G 1¼	145	-	127	88	785				

Symbols

1



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 / column12

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 advice you in questions concerning filter application, selection as well as the cleanliness class of the filtered medium attainable under practical operating conditions.

We produce fluid power solutions
ARGO-HYTOS GMBH · Industriestraße 9 · D-76703 Kraichtal
Tel: +49 7250 76-0 · Fax: +49 7250 76-199 · info.de@argo-hytos.com · www.argo-hytos.com

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