HYDAC INTERNATIONAL

Combined Betamicron®/ Aquamicron® Filter Elements

The high quality of the HYDAC Betamicron® / Aquamicron® filter elements safeguards the operation and service life of important and expensive hydraulic components. They are designed to be used with fluids where the water content caused by external factors is too high. At the same time as extracting water, absolute filtration of solid particles is also achieved.

Technical features:

- high water retention capacity
- high contamination retention capacity
- absolute filtration rating
- $\beta_x \geq 100$ for 3 and 10 micron
- stable β_x values over a wider differential pressure range
- differential pressure stability up to 10 bar

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1. ... R ... BN/AM ELEMENTS

1.1. GENERAL

The presence of water in hydraulic media causes many problems, for example, the saturation of very fine filters or the jamming of valves, and these problems are often wrongly attributed to excessive levels of solid particle contamination. In addition to this the build-up of rust and the reduction in lubrication on bearings and slides can lead to considerable impairment of the functioning of a system. In other words, along with solid particles, water is a serious “contaminant” of hydraulic media.
Since methods usually employed up to now to extract water have, on the whole, proved to be uneconomical compared with the purchase price of the system, HYDAC BN/AM technology provides an economically sound, yet effective, method of separating water from hydraulic media, which at the same time achieves absolute filtration of solid particles.

1.1.1. Description

BN/AM filter elements are specially designed to separate water, and achieve absolute filtration of solid particles, from mineral oils, HFD-R oils and rapidly biodegradable oils.
A super absorber reacts with the water present in the medium and expands to form a gel, from which the water can no longer be extracted even by increasing the pressure. These filter elements cannot remove dissolved water from the system, i.e. water below the saturation level of the hydraulic medium.
Solid particle filtration (3 µm, 10 µm absolute) is achieved due to the Betamicron® filter construction.

1.1.2. Principles of the BN/AM combined filter elements

- BN/AM disposable element based on inorganic and water-absorbent fibres
- Exemplary absorption of water from mineral oils with the aid of a super absorber embedded in the filter material
- Excellent adsorption of finest particles over a wide differential pressure range (3 µm, 10 µm absolute)
- Exemplary Beta stability over wide differential pressure ranges
- Very high contamination retention capacity
- Good chemical resistance due to the use of epoxy resins for impregnation and bonding
- Element protection due to high burst pressure resistance (e.g. during cold starts and dynamic differential pressure surges)

1.1.3. The following principles apply to water separation

High water content	⇒	high absorption rate	
Low water content	⇒	low absorption rate	
Unsaturated filter element	⇒	high absorption rate	
Saturated filter element	⇒	low absorption rate	
Hydraulic filter surface load (l/min cm^2)	↘	absorption rate	↗
		water retention capacity	↗
		residual water content	↘
Static pressure	↘	absorption rate	=
		water retention capacity	=
		residual water content	↘
Pressure and flow-rate fluctuations present		absorption rate	↘
		water retention capacity	↘
		residual water content	↗
Dispersion / detergent additive present		absorption rate	↘
		water retention capacity	=
		residual water content	↗

Key to symbols: ↗ increases ↘ decreases = constant

1.2. MODEL CODE
(also order example)

0660 R 010 BN/AM / -V

Size
0330
0660
0950
1300
2600

Type
R

Filtration rating in µm
003
010

Filter material
BN/AM combined Betamicron®/ Aquamicron®

Supplementary details
-V seals FPM (Viton)

1.3. HYDRAULIC DETAILS

1.3.1. Max. permissible Δp across the element

10 bar

1.3.2. Temperature range

δmin... δmax... = 0 °C...+100 °C

1.3.3. Compatibility with hydraulic media

Test criteria to ISO 2943

Flow fatigue resistance to ISO 3724

High fatigue resistance due to solid filter material supports on both sides and high inherent stability of the filter materials.

1.3.4. Cracking pressure of bypass valve

p_O = 3 bar + 10%

1.3.5. Water retention - Quick sizing table

Size	Recommended filter flow rate in l/min	Water retention capacity in cm^3 when Δp = 2.5 bar and viscosity = 30 mm^2/s
0330	13	190
0660	28	400
0950	39	560
1300	54	790
2600	109	1570

1.3.6. Actual contamination retention capacity to ISO 4572

ISOMTD - contamination retention quantity in grams when Δp = 2.5 bar and under recommended flow conditions

Size	3µm	10µm
0330	55	60
0660	120	140
0950	170	190
1300	240	270
2600	490	540

1.4. RETENTION RATES

Absolute retention rate

The data in the brochures has been established in line with ISO 4572 in the multi-pass test (multi-pass test procedure for determination and proof of the filtration performance, extended to finest filtration) on the HYDAC test rig.

During this test the filter has to retain at least 99% of the particles larger than the stated micron rating and up to the given differential pressure.
A separation rate of 99% corresponds to a β_x value of 100 (β_x = 100), i.e. absolute filtration. The elements guarantee an absolute filtration over a wide differential pressure range.

Filtration rating	Specification	Typical measured results (when Δp = 2.5 bar)
3µm	$\beta_3 \geq 100$	$\beta_3 \geq 500$
10µm	$\beta_{10} \geq 100$	$\beta_{10} \geq 500$

1.5. DETERMINATION OF THE WATER CONTENT G_W PRESENT IN THE SYSTEM

Two methods can be employed to determine the water content G_w present in the system:

- The hydrogen gas method
- The Karl Fischer method to DIN 51777

The hydrogen gas method can be carried out using portable test equipment, e.g. the HYDAC water test kit WO-1 (order no. 637 398), however, reading accuracy at water contents below 500 ppm is limited. The Karl Fischer method, on the other hand, can only be conducted in the laboratory. It is available from HYDAC as a laboratory service (order no. 300 757). The water content G_W is usually given in ppm (parts per million) or in percent (100 ppm correspond to 0.01%).

2. FILTER CALCULATION

2.1. TOTAL DIFFERENTIAL PRESSURE ACROSS COMPLETE FILTER

The total differential pressure with clean element is the sum of the housing differential pressure and the element differential pressure at operating viscosity.

$\Delta p_{total} = \Delta p_{housing\ at\ Q} + f \times \Delta p_{element\ at\ Q}$

Δp_{total} = total differential pressure across complete filter

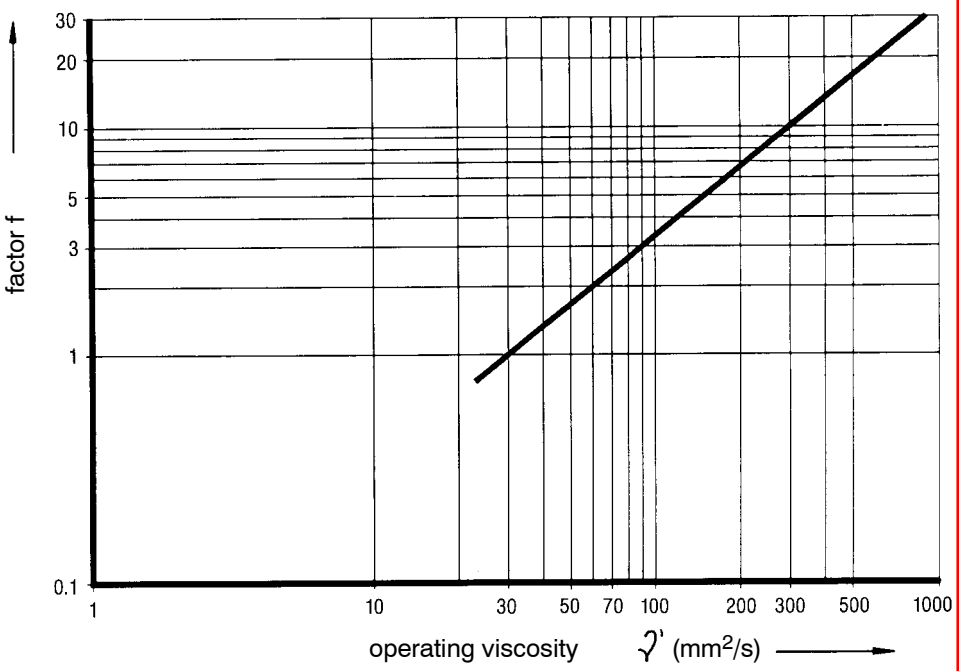
$\Delta p_{housing\ at\ Q}$ = housing differential pressure at max. flow rate in l/min:
(determined with the aid of the housing graphs, see relevant brochure)

$\Delta p_{element\ at\ Q}$ = element differential pressure at 30 mm^2/s at max. flow rate in l/min:
determined with the aid of the gradient coefficients, see 2.2.1.

Q = max. flow rate in l/min through the filter

f = viscosity conversion factor, see point 2.1.1.

2.1.1. Viscosity conversion factor f



2.2. ELEMENT GRAPHS

The pressure drop for the clean filter elements is determined according to the following formula:

$\Delta p_{el} = \mathbf{Q \times k_{el}}$

Δp_{el} = element differential pressure in bar

Q = flow rate in l/min

k_{el} = gradient coefficient in $\frac{bar}{l/min}$

2.2.1. Gradient coefficient for element pressure drop

The gradient coefficients apply to mineral oil with a kinematic viscosity of 30 mm^2/s. ...R..BN/AM

Size	3 µm	10 µm
0330	0.0087	0.0030
0660	0.0035	0.0012
0950	0.0024	0.00082
1300	0.0016	0.00061
2600	0.00095	0.00034

3. NOTE

All details given in this brochure are subject to technical modifications.