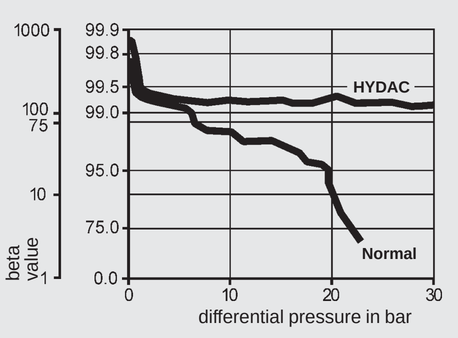
HYDAC INTERNATIONAL

Filter Elements

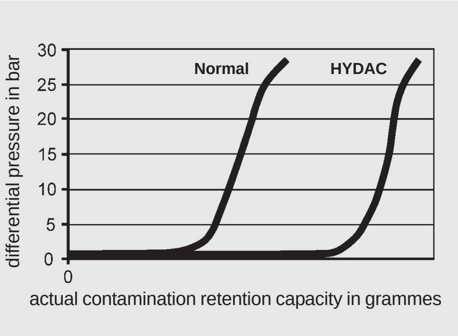
HYDAC Filter Elements safeguard the performance and service life of essential and expensive hydraulic components due to their high standard of quality

Technical details:

- Absolute filtration $\beta_x \geq 200$ from 3-20 micron
- Stable β_x-values across a wide range of differential pressures



- High differential pressure stability up to 210 bar



- High contamination retention capacity
- Disposable elements and cleanable elements
- Filtration of mineral oils, non-flam fluids and rapidly biodegradable fluids

1. …D… ../.. elements - suitable for use with the following filter types: DF, LF, MDF, DFDK, DFF, DFG, DF…P, DF…Z, DF…MA, DF...QE, filter module

1.1. GENERAL

- Elements pleated
- Flow direction from out to in

1.1.1 **Disposable Betamicron® element based on inorganic fibre with patented seam shaping (European patent no.: 94908357, US patent no: 5622624)**

- Superb adsorption of finest particles over a wide differential pressure range
- Exemplary beta value stability over a wide differential pressure range
- High contamination retention capacity
- Good fluid compatibility due to the use of epoxy resins for impregnation and bonding
- Element protection due to high collapse burst pressure resistance (i.e. during cold start and differential pressure surges)
- Excellent flow fatigue stability due to solid filter material supports
- Filtration ratings: 3µm, 5µm, 10µm, 20µm absolute

1.1.2 **Metal fibre element**

- Safeguards high filtration efficiency even at extreme dynamic loads
- High contamination retention capacity due to deep filtering which results in a longer service life
- High retention rate
- Low flow resistance with small size
- Corrosion protection due to stainless steel filter material and tin-plated steel parts
- High differential pressure
- Economical due to cleanability
- High temperature range
- Filtration ratings: 3µm, 5µm, 10µm, 20µm, nominal

1.1.3 **Wire mesh element**

- High temperature range
- Corrosion protection due to stainless steel filter mesh and tin-plated steel parts
- Cleanable
- High differential pressure
- Filtration ratings: 25µm, 50µm, 100µm, 200µm nominal

1.2. MODEL CODE

D - element (also order example)

0060 D 010 BH3HC / -V

Size
0030
0035
0055
0060
0075
0110
0140
0160
0240
0280
0330
0500
0660
0990
1320

Type
D

Filtration in µm

003, 005, 010, 020	BH3HC, BN3HC, V
025, 050, 100, 200	W, W/HC

Filter material

BH3HC	Betamicron®-H element
BN3HC	Betamicron®-N element
V	Metal fibre
W, W/HC	Wire mesh

Supplementary details
no details = standard

-V FPM (Viton) seals, element suitable for phosphate ester (HDF-R) and rapidly biodegradable oils

-W[1] element suitable for oil-water emulsions (HFA), water polymer solutions (HFC) (only for V and W elements)

[1] not available ex stock

1.3. HYDRAULIC DATA

1.3.1 Permissible Δp across element

Betamicron®-H (BH3HC): 210 bar
Betamicron®-N (BN3HC): 25 bar

Metal fibre (V): 210 bar

Wire mesh (W): 30 bar

1.3.2 Temperature range

δ min ... δ max ... =
- 30 °C ... + 100 °C

(Temperatures of -30 °C to -10 °C are only possible with NBR seals)

1.3.3 Compatibility with hydraulic media

Suitable for use with mineral oils, lubrication oils, non-flam fluids, synthetic and rapidly biodegradable oils.

For use with water, please contact our technical sales department.

1.3.4 Flow fatigue stability to ISO 3724

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

1.3.5 Approx. filter surface area (cm²) for ...D... V, W, W/HC

Size	V	W	W/HC
30	268	256	–
60	318	330	418
110	648	672	910
140	852	884	1200
160	1082	857	1144
240	1702	1348	1911
280	3615	2862	4264
330	2260	1795	3133
500	3640	2891	5207
660	4770	3795	6958
990	–	–	10091
1320	–	–	13916

1.3.6 Contamination retention capacity to ISO 4572 for Betamicron® elements

ISOMTD contamination retention quantity in grammes at Δp = 5 bar

BH3HC

Size	3 µm	5 µm	10 µm	20 µm
30	2.2	2.4	2.8	3.3
60	3.8	4.1	4.8	5.8
110	8.2	8.9	10.4	12.6
140	10.7	11.7	13.6	16.6
160	11.0	12.0	14.0	17.0
240	18.2	19.9	23.2	28.2
280	40.3	44.0	51.3	62.3
330	28.6	31.2	36.4	44.1
500	47.2	51.5	60.1	72.9
660	62.9	68.6	80.1	97.2
990	91.5	99.8	116.5	141.3
1320	125.8	137.2	160.2	194.4

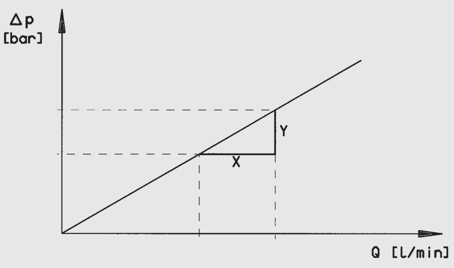
BN3HC

Size	3 µm	5 µm	10 µm	20 µm
30	3.9	4.1	4.7	5.2
60	5.3	5.7	6.4	7.1
110	11.1	11.9	13.3	15.4
140	14.6	15.6	17.6	19.5
160	15.0	16.0	18.0	20.0
240	25.8	27.5	31.0	34.4
280	56.5	60.3	67.8	75.3
330	36.9	39.4	44.3	49.2
500	60.7	64.8	72.9	81.0
660	80.4	85.7	96.4	107.2
990	117.3	125.1	140.7	156.4
1320	160.8	171.4	192.8	214.4

1.4. ELEMENT GRAPHS

The pressure drop for new, clean filter elements is calculated according to the following formula:

$\Delta p_{element}$ = Q x k
$\Delta p_{element}$ = in bar
Q = flow rate in l/min
k = gradient coefficient in $\frac{bar}{l/min}$



$k\Delta_{el} = \frac{Y}{X}\left[\frac{bar}{L/min}\right]$

1.5. GRADIENT COEFFICIENT K FOR ELEMENT PRESSURE DROP

Gradient coefficients apply to mineral oil with a kinematic viscosity of 30 mm²/s.

Example:
Element: 0140 D 010 BH3HC
Required: pressure drop at 15 l/min

Solution:
$\Delta p_{element}$ = 15 x 0.00813
$\Delta p_{element}$ = 0.12 bar

1.5.1 **…D… Betamicron®-N elements**

Size	3 µm	5 µm	10 µm	20 µm
30	0.08733	0.04900	0.03000	0.02000
60	0.02600	0.01750	0.01317	0.00945
110	0.01400	0.00973	0.00764	0.00545
140	0.01200	0.00700	0.00450	0.00367
160	0.01188	0.00756	0.00538	0.00408
240	0.00842	0.00529	0.00375	0.00318
280	0.00446	0.00271	0.00186	0.00143
330	0.00485	0.00361	0.00297	0.00209
500	0.00300	0.00200	0.00149	0.00116
660	0.00212	0.00156	0.00113	0.00088
990	0.00140	0.00104	0.00075	0.00059
1320	0.00106	0.00078	0.00056	0.00044

1.5.2 **…D… Betamicron®-H elements**

Size	3 µm	5 µm	10 µm	20 µm
30	0.08733	0.05233	0.03500	0.02073
60	0.04800	0.02900	0.01960	0.01455
110	0.02400	0.01450	0.00938	0.00727
140	0.02000	0.01207	0.00813	0.00616
160	0.01429	0.00906	0.00643	0.00473
240	0.00900	0.00596	0.00444	0.00333
280	0.00487	0.00293	0.00196	0.00150
330	0.00700	0.00421	0.00312	0.00218
500	0.00361	0.00226	0.00160	0.00128
660	0.00279	0.00167	0.00121	0.00097
990	0.00185	0.00111	0.00081	0.00065
1320	0.00140	0.00083	0.00060	0.00048

1.5.3 **…D… V elements**

Size	3 µm	5 µm	10 µm	20 µm
30	0.01844	0.01350	0.00750	0.00364
60	0.01600	0.00933	0.00540	0.00333
110	0.00824	0.00555	0.00332	0.00216
140	0.00583	0.00476	0.00314	0.00229
160	0.00458	0.00323	0.00225	0.00144
240	0.00308	0.00250	0.00170	0.00113
280	0.00229	0.00170	0.00117	0.00075
330	0.00220	0.00177	0.00118	0.00078
500	0.00147	0.00118	0.00080	0.00051
660	0.00114	0.00091	0.00062	0.00039
990	0.00078	0.00062	0.00041	0.00027
1320	0.00059	0.00047	0.00032	0.00021

1.5.4 **…D… W elements**

Size	25 / 50 / 100 / 200 µm
30	0.003367
60	0.001683
110	0.000918
140	0.000721
160	0.000631
240	0.000421
280	0.000361
330	0.000307
500	0.000202
660	0.000153
990	0.000102
1320	0.000077

1.6. FILTER SELECTION

TOTAL DIFFERENTIAL PRESSURE ACROSS COMPLETE FILTER

The total differential pressure of the clean filter is the sum of housing and 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 filter

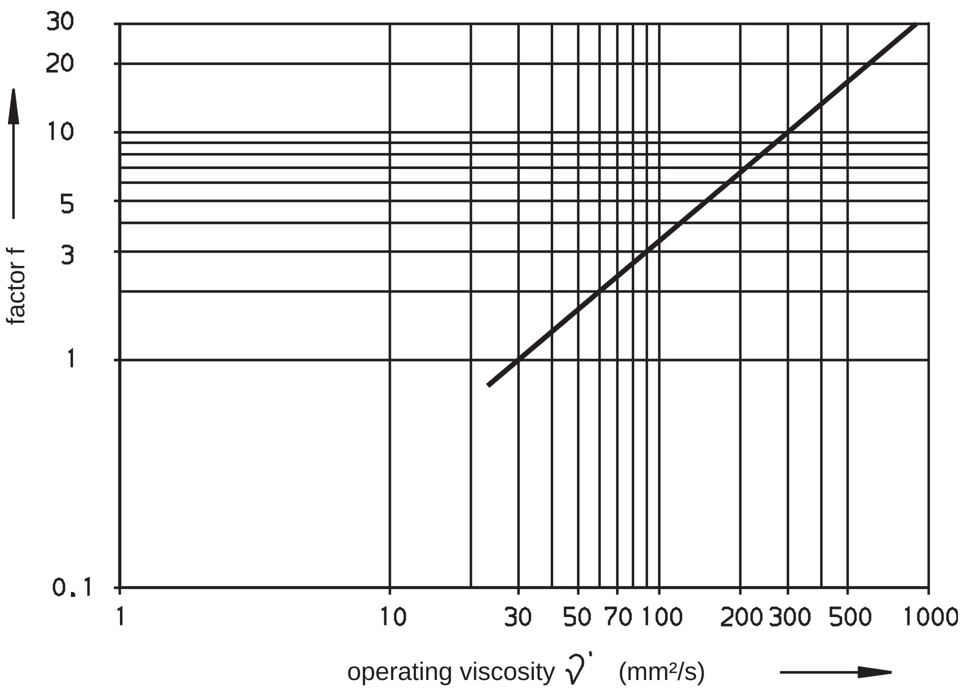
$\Delta p_{housing\ at\ Q}$ = housing differential pressure (determined with the aid of housing graphs - see relevant filter brochure)

$\Delta p_{element\ at\ Q}$ = element differential pressure at 30 mm²/s at operating flow rate, Q in l/min (determined with the aid of the table of gradient coefficients)

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

f = viscosity conversion factor

1.6.1 **Viscosity conversion factor f**



$\Delta p_{element\ at\ V}$ = element differential pressure at operating viscosity in mm²/s

$= \Delta p_{element\ at\ Q} \times \frac{\nu}{30}$

Example:

Element: 0140 D 010 BH3HC

Required: $\Delta p_{element}$ at operating viscosity
ν = 46 mm²/s for
Q = 15 l/min

Solution: $\Delta p_{element\ for\ 46\ mm^2/s} = 0.12 \times \frac{46}{30}$

$= 0.184$ bar

2. ...R.../.. elements - suitable for use with the following filter types: RF, RFD, RFM, RFL, RFLD, NF, NFD, oil service units

2.1. GENERAL

- Fitted with bypass valve
- Elements pleated
- Flow direction from out to in
- Contamination retainer is available as an accessory

2.1.1 **Disposable Betamicron®-element based on inorganic fibres with patented seam shaping (European patent no.: 94908357, US patent no.: 5622624)**

- Superb adsorbtion of finest particles over a wide differential pressure range
- Exemplary beta value stability over a wide differential pressure range
- High contamination retention capacity
- Good chemical resistance due to the use of epoxy resins for impregnation and bonding
- Element protection due to high collapse burst pressure resistance (i.e. during cold start and differential pressure surges)
- Excellent flow fatigue stability due to solid filter material supports
- Filtration ratings: 3µm, 5µm, 10µm, 20µm, absolute

2.1.2 **Disposable paper element**

- High contamination retention capacity due to deep filtration
- Low flow resistance
- Paper supported on both sides with wire mesh
- Good fluid compatibility due to paper being free of bonding agent
- Filtration ratings: 10µm, 20µm, nominal

2.1.3 **Wire mesh element**

- High temperature range
- Corrosion protection due to stainless steel filter mesh and tin-plated steel parts
- Cleanable
- High differential pressure
- Filtration ratings: 25µm, 50µm, 100µm, 200µm nominal

2.2. MODEL CODE

R - element (also order example)

0330 R 010 BN3HC / -KB

Size
0030
0060
0075
0110
0160
0165
0240
0330
0500
0660
0850
0950
1300
1700
2600

Type
R

Filtration in µm

003, 005, 010, 020	BN3HC
010, 020	P/HC
025, 050, 100, 200	W/HC

Filter material

BN3HC	Betamicron®-N element
P/HC	paper
W/HC	wire mesh

Supplementary details

no details = standard

-V	=	FPM (Viton) seals, element suitable for phosphate ester (HDF-R) and rapidly biodegradable oils
-W	=	element suitable for oil-water emulsions (HFA), water polymer solutions (HFC) (only for W elements)
-KB	=	without bypass valve
-B1	=	Cracking pressure of bypass valve 1 bar
-B6	=	Cracking pressure of bypass valve 6 bar

2.3. HYDRAULIC DATA

2.3.1 **Permissible Δp across the element**

Betamicron®-N (BN3HC): 25 bar
Paper (P/HC): 10 bar
Wire mesh (W/HC): 30 bar

2.3.2 **Temperature range**

δmin... δmax... =
-30 °C... +100 °C
(Temperatures of –30 °C to –10 °C are only possible with NBR seals)

2.3.3 **Compatibility with hydraulic media**

Suitable for use with mineral oils, lubrication oils, non-flam fluids, synthetic and rapidly biodegradable oils.

For use with water, please contact our technical sales department.

2.3.4 **Flow fatigue stability to ISO 3724**

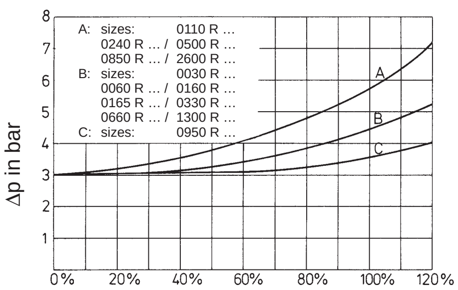
High fatigue resistance due to solid filter material supports on both sides and high inherent stability of filter materials.

2.3.5 **Cracking pressure of bypass valve**

Δp_o = 3 bar + 0.5 bar

2.3.6 **Graphs of bypass valve**

The bypass valve graphs apply to mineral oils with a density of 0.86 kg/dm³. The differential pressure of the valves changes proportionally to the density.



Q in l/min as a percentage of the size

2.3.7 **Approx. filter surface area (cm²) for ...R... P/HC W/HC**

Size	P/HC	W/HC
30	283	256
60	572	507
110	1166	1034
160	1978	1607
165	1915	1556
240	3110	2527
330	4230	3695
500	6470	5651
660	8722	8232
850	11230	10599
950	15221	11521
1300	21269	16099
1700	23020	21730
2600	43394	32847

2.3.8 **Actual contamination retention capacity to ISO 4572 for Betamicron® elements**

ISOMTD contamination retention quantity in grammes at Δp = 2 bar

Size	3 µm	5 µm	10 µm	20 µm
30	2.1	2.4	2.7	3.2
60	4.6	5.2	5.7	6.9
110	9.3	10.4	11.6	13.9
160	16.0	18.0	20.0	24.0
165	14.5	16.3	18.1	21.8
240	24.7	27.8	30.9	37.1
330	33.1	37.2	41.4	49.6
500	50.2	56.5	62.8	75.3
660	73.7	82.9	92.1	110.6
850	94.5	106.4	118.2	141.8
950	109.5	123.2	136.9	164.3
1300	151.8	170.8	189.8	227.8
1700	179.6	202.2	224.6	269.4
2600	303.7	341.7	379.6	455.6

2.4. FILTER CALCULATION

TOTAL DIFFERENTIAL PRESSURE ACROSS THE COMPLETE FILTER

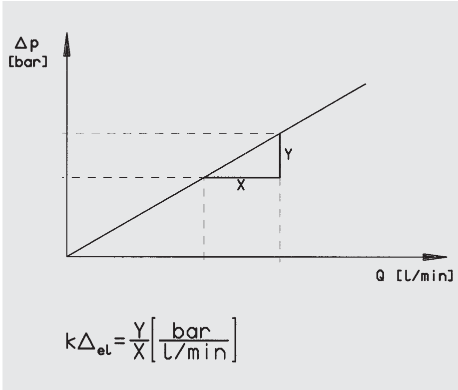
The total differential pressure of the clean filter is the sum of housing and element differential pressure at operating viscosity.

For further details, please refer to point 1.6. on page 6.

2.5. ELEMENT GRAPHS

The pressure drop for new, clean filter elements is calculated according to the following formula:

$\Delta p_{element}$ = Q x k
$\Delta p_{element}$ = in bar
Q = flow rate in l/min
k = gradient coefficient in $\frac{\text{bar}}{\text{l/min}}$



2.6. GRADIENT COEFFICIENT K FOR ELEMENT PRESSURE DROP

Gradient coefficients apply to mineral oil with a kinematic viscosity of 30 mm²/s.

Example:

Element: 0110 R 010 BN3HC

Required: pressure drop at 15 l/min

Solution:

$\Delta p_{element}$ = 15 x 0.006

$\Delta p_{element}$ = 0.09 bar

2.6.1 **...R... Betamicron®-N elements**

Size	3 µm	5µm	10 µm	20 µm
30	0.062000	0.038349	0.026700	0.020000
60	0.025200	0.015619	0.010900	0.007717
75	0.022500	0.013053	0.008400	0.006267
110	0.014000	0.008640	0.006000	0.004318
160	0.008700	0.005417	0.003800	0.002750
165	0.010700	0.006814	0.004900	0.003030
240	0.005300	0.003491	0.002600	0.001667
330	0.003600	0.002327	0.001700	0.001121
500	0.002700	0.001762	0.001300	0.000788
660	0.001700	0.001030	0.000700	0.000483
850	0.001306	0.000906	0.000600	0.000400
950	0.001000	0.000665	0.000500	0.000334
1300	0.000700	0.000499	0.000400	0.000250
1700	0.000653	0.000453	0.000300	0.000200
2600	0.000350	0.000250	0.000200	0.000127

2.6.2 **...R... P/HC-Elemente**

Size	10 µm	20 µm
30	0.00333	0.00167
60	0.00167	0.00083
75	0.00129	0.00065
110	0.00091	0.00046
160	0.00063	0.00031
165	0.00061	0.00030
240	0.00042	0.00021
330	0.00030	0.00015
500	0.00020	0.00010
660	0.00015	0.00006
850	0.00012	0.00006
950	0.00011	0.00005
1300	0.00008	0.00004
1700	0.00006	0.00003
2600	0.00004	0.00002

2.6.3 **...R... W/HC-Elemente**

Size	25 / 50 / 100 / 200 µm
30	0.002
60	0.001
75	0.00078
110	0.00055
160	0.000375
165	0.00036
240	0.00025
330	0.00018
500	0.00012
660	0.00009
850	0.00007
950	0.00006
1300	0.00005
1700	0.000035
2600	0.00002

3. FILTRATION EFFICIENCY

3.1. RETENTION RATES FOR METAL FIBRE (V), WIRE MESH (W, W/HC) AND PAPER ELEMENTS (P, P/HC)

Nominal retention rate

The filtration ratings shown in the model code for these qualities are based on a works norm filter test. This test consists of a large amount of contamination (ISOMTD) being introduced at the beginning of the test and the subsequent separation of contamination particles over a period of one hour.

During this test the filter must retain 90-95% of the particles larger then the given micron rating.

3.2. RETENTION RATES AND BETA VALUES FOR BETAMICRON® ELEMENTS

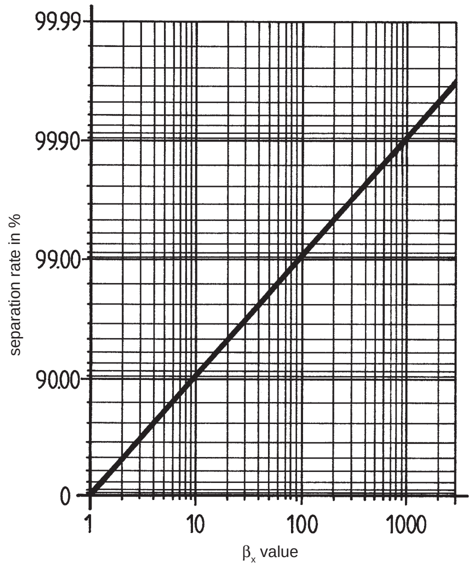
Absolute retention rate

The data in the brochures has been established 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 in line with ISO 4572.

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

3.3. RATIO

Beta value β_x, to separation rate in %



3.4. QUALITY ASSURANCE

Continuous filtration efficiency and quality control checks by means of the bubble test to ISO 2942 guarantee the high quality standards of HYDAC filter elements.

3.5. MULTI-PASS FILTER PERFORMANCE DATA TO ISO 4572

3.5.1 **Multi-pass filter performance data to ISO 4572 for Betamicron®-H elements (BH3HC)**

The allocation of the β_x-values to the filter element differential pressure is based on the cracking pressure of the differential pressure indicator. The β_x-values for higher differential pressures indicate the differential pressure resistance of the filter element.

Betamicron®-Element Type ...D... BH3HC	Beta values depending on differential pressure across filter element										
	Δp across filter element [bar]	$\beta_x = \frac{\text{particle quantity} > x\ \mu m \text{ before filter}}{\text{particle quantity} > x\ \mu m \text{ after filter}}$									
		β_2	β_3	β_4	β_5	β_6	β_8	β_{10}	β_{12}	β_{15}	β_{20}
3µm	5	100	200	600	> 1000	–	–	–	–	–	–
	8	150	300	600	> 1000	–	–	–	–	–	–
	25	200	400	> 1000	> 1000	–	–	–	–	–	–
5µm	5	–	75	150	200	500	–	–	–	–	–
	8	–	75	150	200	500	–	–	–	–	–
	25	–	100	200	300	500	–	–	–	–	–
10µm	5	–	–	–	50	90	250	500	> 1000	–	–
	8	–	–	–	100	120	400	> 1000	> 1000	–	–
	25	–	–	–	300	500	> 1000	> 1000	> 1000	–	–
20µm	5	–	–	–	–	–	–	20	–	90	280
	8	–	–	–	–	–	–	75	–	230	500
	25	–	–	–	–	–	–	200	–	300	500

3.5.2 **Multi-pass filter element performance data to ISO 4572 for Betamicron®-N elements (BN3HC)**

The allocation of the β_x-values to the filter element differential pressure is based on the pressure setting of the differential pressure indicator and the cracking pressure of the bypass valve.

Betamicron®-Element Type ...D... BN3HC ...R... BN3HC	Beta values depending on differential pressure across filter element										
	Δp across filter element [bar]	$\beta_x = \frac{\text{particle quantity} > x\ \mu m \text{ before filter}}{\text{particle quantity} > x\ \mu m \text{ after filter}}$									
		β_2	β_3	β_4	β_5	β_6	β_8	β_{10}	β_{12}	β_{15}	β_{20}
3µm	5	100	200	600	> 1000	–	–	–	–	–	–
	8	100	200	600	> 1000	–	–	–	–	–	–
	15	200	300	> 1000	> 1000	–	–	–	–	–	–
5µm	5	–	75	150	200	500	–	–	–	–	–
	8	–	75	150	200	500	–	–	–	–	–
	15	–	100	200	300	500	–	–	–	–	–
10µm	5	–	–	–	40	60	150	500	> 1000	–	–
	8	–	–	–	75	100	200	500	> 1000	–	–
	15	–	–	–	100	150	200	500	> 1000	–	–
20µm	5	–	–	–	–	–	–	6	–	40	150
	8	–	–	–	–	–	–	10	–	90	500
	15	–	–	–	–	–	–	50	–	180	500

3.6. FILTRATION RATING AND OIL-CLEANLINESS CLASSES

Hydraulic system	Recommended absolute filtration rating ($\beta_x \geq 200$)	Achievable cleanliness class[1] to NAS 1638 for particles 5µm - 15µm	Achievable cleanliness class[1] to ISO 4406 for particles 5µm - 15µm
Systems with servo valves	3	4 to 5	13/10 to 14/11
Systems with proportional valves	5	6 to 8	15/12 to 17/14
General hydraulic systems	10	9 to 10	18/15 to 19/16

[1] with optimum filter design

4. PLEASE NOTE

The information in this brochure relates to the operating conditions and applications described.

For applications or operating conditions not described, please contact the relevant technical department.

Subject to technical modifications.