

## Usable filter area at star filters

New using areas for star filters are found daily. Some call them cartouche filters, others call them cartridge filters. In the building machine area high-performance-air filter cartridges are used for decades. They filtrate the suction air of the big internal combustion engine. The application takes place as collecting- respectively storage filters. Partly these filter cartridges are now used as star filters in the process engineering. The experiences to use filter cartouches from the fluid filtration for the bulk material separation does increase.

The hose filter has proved worthwhile for decades at the separation of bulk material and developed to a steady application in this separation technic. Settling chambers and cyclones were replaced. The tube execution of the hose has no dent and so the separated product can not hook or even squeeze anywhere. The filter area can be increased by choosing a longer hose filter. In spite of - physical limits are placed because the air takes the way of the lowest resistance. At hoses which are longer than 1 m the usable filter area can not fully be used.

The task now was to find a hose with more filter area at the same space. This took place in form of a pocket; different alterations were there too; the lane distance and the pocket width were altered several times. The gained experiences in the application of hose and pocket filters in filter units lead within the bounds of technical possibility to the fact that these technical solutions can certainly be applied. At the end of the 70s the first cartridge filters were used for the separation of bulk material. The experiences were different. One of the most difficult technical problem was that the pleated filter media available did not reach the high mechanical consistency of a needle and textile media. In the last 10 years a developing boom started, so nowadays nearly each filter media can be pleated and can be used in the process engineering.

More and more applications for pleated "hoses" are developed.

It is now the task to find out an evaluation criterion and by this an utilization-code number to develop the usable filter area at the star filter application.

1. utilization-code number to evaluate the ratio of the filtration speed to the geometry of the pleats
2. utilization-code number to evaluate the ratio of the nominal filter area to the geometry of the pleats
3. utilization-code number to evaluate the ratio of the nominal filter area to the volume of the filter case.

formula signs and units:

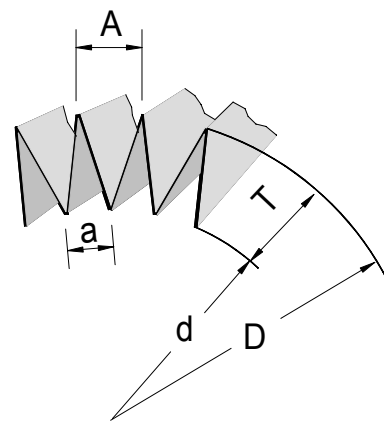
- A = distance pleats outside [mm]
- a = distance pleats inside [mm]
- D = diameter star filter outside [mm]
- d = diameter star filter inside [mm]
- F<sub>AST</sub> = filter area for each star filter [m<sup>2</sup>]
- F<sub>A</sub> = total filter area [m<sup>2</sup>]
- i<sub>FA</sub> = ratio number - distance pleats to depth of pleats
- i<sub>FV</sub> = ratio number - depth of pleats to distance of pleats
- K<sub>FR</sub> = characteristic filter space to filter area [dm<sup>3</sup>/m<sup>2</sup>]
- n = quantity of pleats per star filter
- n<sub>ST</sub> = quantity of star filters per filter apparatus
- T = depth of pleats [mm]
- V<sub>B</sub> = volume of the filter case [dm<sup>3</sup>]

$$A = \frac{\pi \cdot D}{n}$$

$$i_{FV} = \frac{T \cdot n}{\pi \cdot D}$$

$$K_{FR} = \frac{V_B}{F_A}$$

$$i_{FA} = \frac{\pi \cdot D}{T \cdot n}$$



	A	B	C	D	E	F
A [mm]	∞	9,0	12,4	7,4	6,1	8,0
D [mm]	∅ 125	∅ 110	∅ 118	∅ 118	∅ 140	∅ 325
F <sub>A</sub> [m <sup>2</sup> ]	2,16	6,30	6,30	10,80	8,00	7,00
F <sub>AST</sub> [m <sup>2</sup> ]	0,24	0,70	0,70	1,20	2,00	7,00
i <sub>FA</sub>	∞	0,6	0,7	0,4	0,2	0,2
i <sub>FV</sub>	0	1,6	1,5	2,6	4,1	6,0
K <sub>FR</sub> [dm <sup>3</sup> /m <sup>2</sup> ]	71	25	25	14	19	22
n	0	40	30	50	72	127
n <sub>ST</sub>	9	9	9	9	4	1
T [mm]	0	14	19	19	25	48
V <sub>B</sub> [dm <sup>3</sup> ]	154	154	154	154	154	154

At example A a hose filter was calculated. Examples B to F show the calculation with star filters. Since 2 years Type B is on the market and type C is on the market since 20 years.

The ratio figure i<sub>fa</sub> shows if much filter area was placed. The less the figure the less usable area can be calculated in the product separation. This leads to a reduction of usable filter area similar to the length of the hose filter.

The ratio figure i<sub>fv</sub> shows if a deep pleat with a low distance of pleats was chosen. The higher the figure, the higher the risk of blocking.