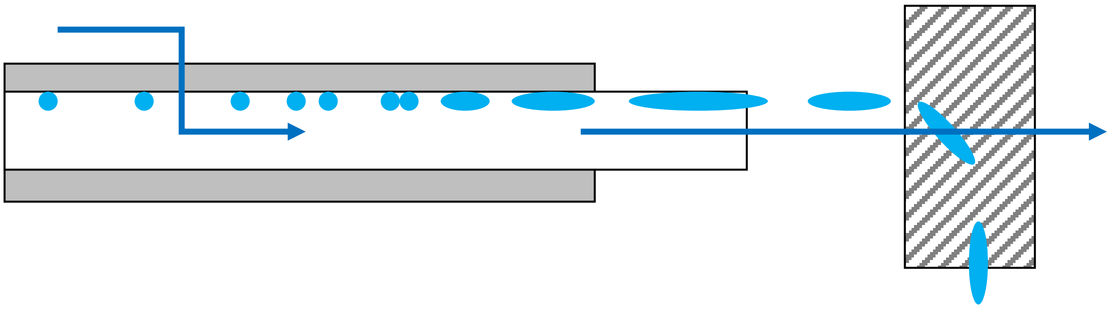
HORIZONTAL FILTER-SEPARATORS: DROPLET FRAGMENTATION

Fig.1: Coalescence of fine mists into larger droplets and their subsequent capture



The above diagram shows how a well designed unit works with the two separation stages (cartridges and vane pack) working together to capture very fine mists, coalesce them into larger globules and remove them from the gas stream.

This mechanism relies upon the gas velocity in the inner core of the filters always being low enough to transport the coalesced droplets without damage or re-fragmentation. At higher velocities this causes a loss of separation performance in the 2nd (vane pack) stage because the mean droplet size reduces below the effective capture diameter.

Clearly, to be competitive, the designer wants to minimise the number of filter elements (and body diameter), whilst maintaining performance. The key judgement is therefore to know the limiting cartridge core velocity for the application.

OPERATING FEEDBACK

Regarding re-entrainment through filter cores and standpipes in horizontal filter-separators, a limit of momentum (pV^2 in the core) of 1000 Pa was introduced based on feedback by BP on Umm Shaif / Das Island where some large filter-separators using out-in Peco filters failed to perform. It was found that the coalesced drops broke up as they travelled along the cores (internal diameter Di), resulting in difficulty in re-capturing in the 2nd stage demister. Strictly speaking this limit is set by the Weber Number (We) which considers also the surface tension (ST):

$We = pV^2 * Di / ST$ (We max < 5000 is suggested; although consider minimum 1000 Pa)

EXAMPLES

Water:	We = 3000Pa * 0.1m / 0.06N/m	=	5,000
Condensate:	We = 1000Pa * 0.1m / 0.01N/m	=	10,000

Thus lighter liquid requires approx double the number of filters. Possibly this is why companies that ignore such limits sell more equipment....