Mist Eliminator Flooding and the Use of Mesh Pre-Coalescers to Enhance Small Droplet Capture

Fig. 1A: Vertical gas flow with counter-current drainage means lower K-factors and gas velocities are used for sizing and the liquid mist load is limited to avoid flooding

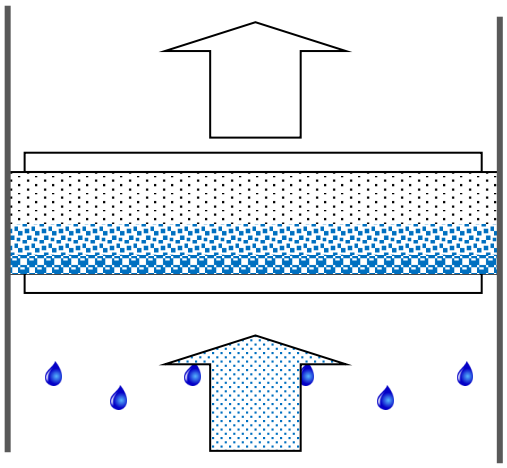


Fig. 1B: Above the flood point, the mist eliminator will not capture any liquid; it will coalesce and re-entrain in the gas flow as larger globules / droplets. This phenomenon is means mesh pads can be used as the first stage in a multi-stage mist eliminator offering better turn-down and/or performance than a single stage:

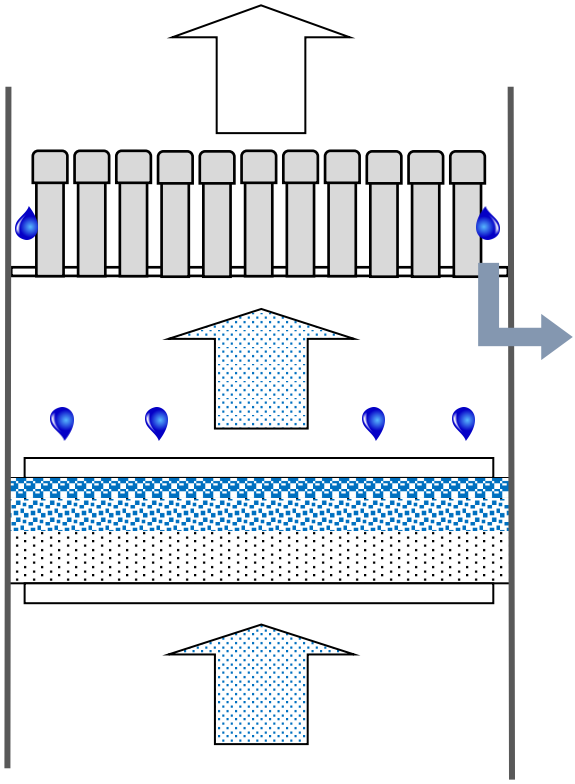


Fig.2A: Horizontal gas flow with cross-flow drainage means design gas velocity and/or liquid loading can be higher

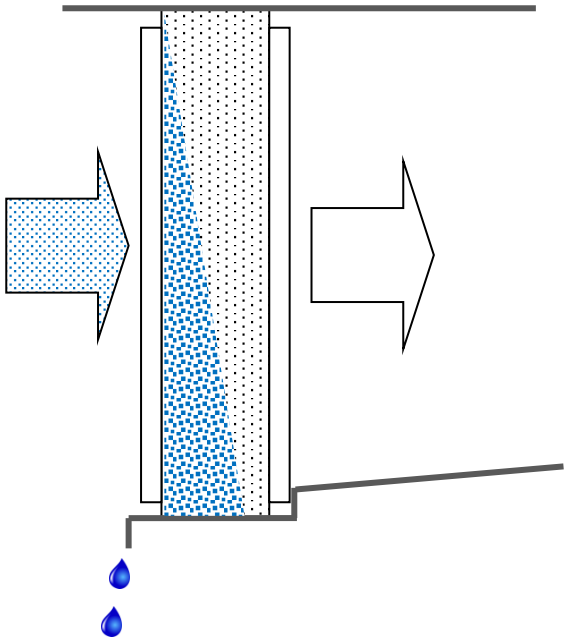
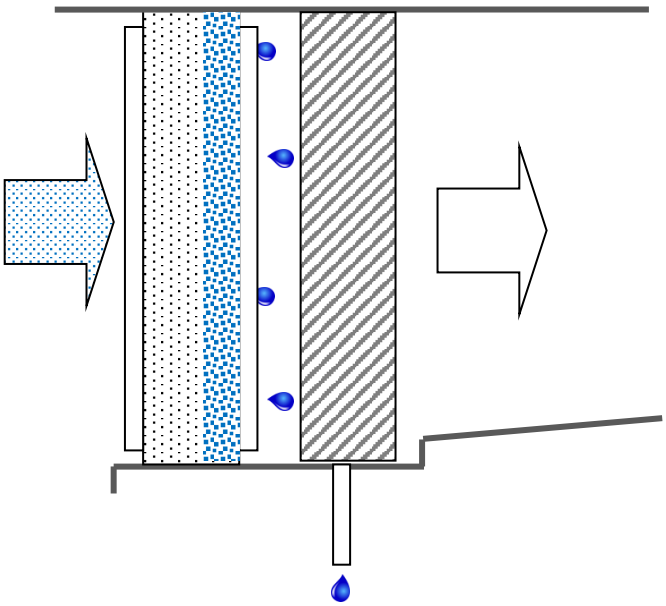


Fig.2B: Above the flood point, the mist eliminator will not capture any liquid; it will coalesce and re-entrain in the gas flow as larger globules / droplets. This phenomenon is means mesh pads are often used as the first stage in a mesh+vane combi mist eliminator offering better turn-down and/or performance than a single device:



Points to consider when deciding whether to use a mesh pre-coalescer before a secondary mist eliminator device include:

Nature of the liquid	If the liquid is very light or of very low surface tension, then the re-entrainment velocity (mist eliminator capacity and/or efficiency) is likely to be low. This can be off-set by the use of multiple devices.
Operating pressure	Typically, separation at high pressure is more challenging than at low-intermediate pressure due to density and viscosity changes. This can be mitigated through the use of multiple devices, or through enhanced gravity devices.
Feed velocity / momentum	If the inlet gas momentum is high, then the dispersed liquid droplet diameter is likely to be small and more difficult to remove. If the liquid is light or the operating pressure high, then it will be even more challenging. But if the liquid quantity is high, the droplet diameter will also be larger meaning easier separation.
Presence of solids or corrosive fluids	This would normally mean that a mesh pre-coalescer could be a cause of increased maintenance for cleaning or due to corrosion. It can cause a trade-off between maintenance and performance.
Operating envelope	Where a narrow operating range is specified (e.g. a compression train) then single devices are normally adequate; for wide flow ranges the use of multiple devices should be considered.
Pressure drop	Additional devices will cause additional pressure drop for the lifetime of the vessel. This may be a factor for consideration.
Vessel height	Additional disengagement height between the inlet distributor and the mist eliminator is used to reduce the liquid load on the device and thus improve efficiency. This is commonly used where the gas may carry solids, allowing the majority to drop out with the bulk of the liquid droplets. Or the height may be utilised for an additional device. Or the vessel could be shorter if these considerations are not needed.
Target performance	For low carryover levels e.g. 0.1 USG/MMSCF or <25 ppmw in challenging separation environments it may be necessary to consider multiple devices. For moderate carryover loads e.g. 0.2 to 0.5 USG/MMSCF or 50-150 ppmw it may not be necessary. For light duty and bulk removal only e.g. to 1 USG/MMSCF or 200-300ppmw, multiple mist eliminators are rarely needed.