MIST
ELIMINATORS

FINEPAC® STRUCTURES PVT. LTD.

ООО «ТИ-СИСТЕМС» ИНЖИНИРИНГ И ПОСТАВКА ТЕХНОЛОГИЧЕСКОГО ОБОРУДОВАНИЯ
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MIST ELIMINATION

In the chemical process industry there are a number of processes where gases and liquids come into contact with each other and whenever this happens the gas will entrain some amount of liquid particles. This liquid phase which gets carried away into the gaseous phase can lead to a number of problems like loss of product, equipment damage, process inefficiency etc. and needs to be eliminated.

Mist elimination can be defined as the mechanical separation of liquids from gases. The equipment used for the removal of this entrainment is referred to as a mist eliminator or demister.

DROPLET FORMATION

There are a number of factors in a process which may result in liquid entrainment. Some of the commonly observed causes are discussed below.

- Liquid entrainment may result from contact between gas and liquid phases in a mass transfer operation or condensation process. For example droplets can result from bubbles bursting or jetting at gas / liquid interface which is commonly seen in evaporators, bubble columns, distillation columns etc.

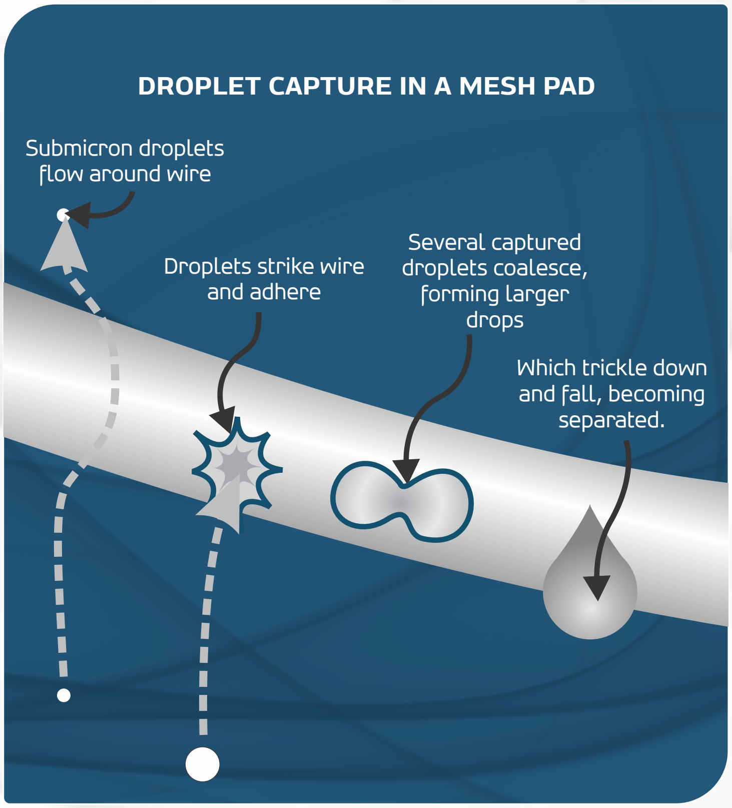
- Droplets can also be formed by thermodynamic changes in the system. For example vapour condenses when saturated gases are cooled in condensers and heat exchangers. The gas can become supersaturated causing droplet formation

- Also if the gas is travelling too fast to allow liquid droplets to settle at the under gravity they become entrained in gas or vapour.

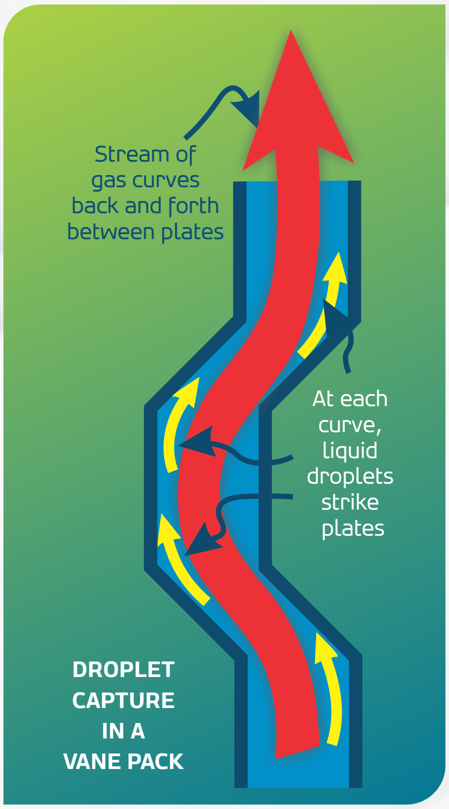
In most cases this entrainment must be removed to purify the gas and prevent process or environmental contamination.

DROPLET REMOVAL MECHANISM

The entrained liquid does not consist of same size of droplets but consists of a broad range of droplet sizes. The droplet size depends upon the mechanism by which they are generated. Droplet size distributions with sizes less than 3μm with an average size distribution in the submicron range are called as fogs. When the droplet size is in the range of 3μm or greater it is called as a mist and when it is 20μm or greater it is termed as a spray.



Mist elimination using mesh pad



Mist elimination using vane pack

The process of droplet removal takes place through a 4 stage process : Collision -adherence – coalescence – drainage. First step in engineering a mist eliminator is to determine the mechanism by which droplets are generated and assume an average droplet size. For fogs, fiberbed technology is used which will not be discussed in the manual. For particles in the mist region the wire knitted mesh pad mist eliminator is the most suitable. Whereas for particles around 20 μm or greater are mainly collected by means of inertial impaction using vane pack mist eliminators.

MIST ELIMINATOR APPLICATIONS

Oil and Gas Industry

Separating liquids & contaminants from the oil is a fundamental requirement to the oil & gas industry. Mist eliminators are used to remove carry over liquids, removal of condensed liquids and removal of contaminants etc.

Process Industry

Mist elimination plays a vital role in recovering lost product and in protecting downstream equipments and processes. They provide predictable operation even under heavy liquid loading. Appropriately designed mist eliminators allow process to run at high velocities facilitating small apparatus dimensions.

Flue Gas Desulphurisation

Appropriate use of mist eliminators in this application protects the environment by preventing droplets escaping into the atmosphere. It captures the liquid solvent, thus minimizing cost of cleaning gases. It cleans the exhaust gas phase from droplets thus protecting the downstream heat exchangers.

Sulphuric Acid Plants

Well designed mist eliminators play a significant role in cost effective operation of sulphuric acid plants. If mist eliminators are not designed properly it may lead to corrosion of blowers, heat exchangers and vessels adversely affecting plant efficiency.

MIST ELIMINATOR BENEFITS

- Improves throughput capacity
- Improves product purity
- Provides equipment protection
- Low pressure drop
- Provides environmental protection

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MIST ELIMINATOR SELECTION GUIDE

Mist eliminators find a wide variety of applications such as evaporators, three phase separators, knockout vessels, scrubbers etc. The choice of mist eliminator must be done on the basis of the application requirements. Products are available in a wide array of metals, plastics, thermoplastics to suit a variety of applications.

Mesh Pad Mist Eliminator

The mesh pad mist eliminator removes droplets by impingement on surface of a wire. The liquid collected on the filament is drained off under gravity. These mist eliminators provide almost complete removal of droplets down to 3 to 5 microns.

Plain Vane Pack Mist Eliminator

The plain vane pack mist eliminator is a high efficiency mist eliminator commonly used for removing entrained liquids from vapour flowing vertically upwards. These mist eliminators use corrugated vanes as a mechanism for mist elimination.

Pocketed Vane Pack Mist Eliminator

The high capacity vane pack mist eliminators use a hooked vane mechanism for higher capacity mist elimination. They provide for efficient droplet removal and superior resistance to fouling for high rate horizontal vapour flow.

FINEPAC MESHPAD MIST ELIMINATOR

Mist Eliminators for high efficiency mist elimination

The Finepac meshpad mist eliminators remove droplets by impingement on the wire surface. The liquid collected on the filaments drains off under gravity. They provide almost complete removal of droplets down to about 3-5 microns. They provide a turndown range of vapour rate of around 3:1.

At excessively high velocity the liquid droplets that impinge on the wire surface are sheared off by the vapour and entrained before they are able to drain. At very low vapour velocities all but the larger droplets are able to follow the vapour path through the mesh and thus avoid impingement. However, the inherent design of the separator vessel means that in most applications an effective turndown of 10:1 can be achieved.

Finepac meshpad mist eliminators can provide liquid entrainment solutions in a variety of equipments including

- Scrubbers & distillation columns
- 3 phase separators
- Knock out vessels
- Evaporators
- Falling film condensers
- Desalination plants
- Steam drums
- Gas dehydration plants

General Meshpad Configuration

Wiremesh meshpad mist eliminators consists of a pad of knitted metal or plastic wire mesh usually sandwitched between grids for mechanical support. Units above 600 mm diameter are normally split into sections in the range of 300 to 400 mm to facilitate installation through a normal vessel manway. The pads are cut slightly oversized to ensure a snug fit and eliminate possibility of a vapour bypass either between sections or between pad and vessel wall. Each meshpad is formed from crumpled layers of fabric knitted form a monofilament with the direction of crimp rotated 90° in each adjacent layer to provide a uniform voidage with a high ratio of filament surface.

Single unit mist eliminator

Segmented mist eliminator

Material of Construction

Stainless steel, Nickel based alloys, Titanium, Polypropylene, PTFE, Copper, Kynar.
Other special materials available on request.

MIST ELIMINATOR DESIGN

Meshpads should be designed so that the face area provides a vapour rate of approximately 80% of maximum allowable re-entrainment velocity. For the purpose of estimation, suitable design velocities occur at a K-factor of 0.107 m/s for vertical flow or 0.150 m/s for horizontal gas flow (due to better drainage) where,

$$Vs = K \sqrt{(\rho_L - \rho_V) / \rho_V}$$

where, Vs = Actual vapour velocity (m/s)

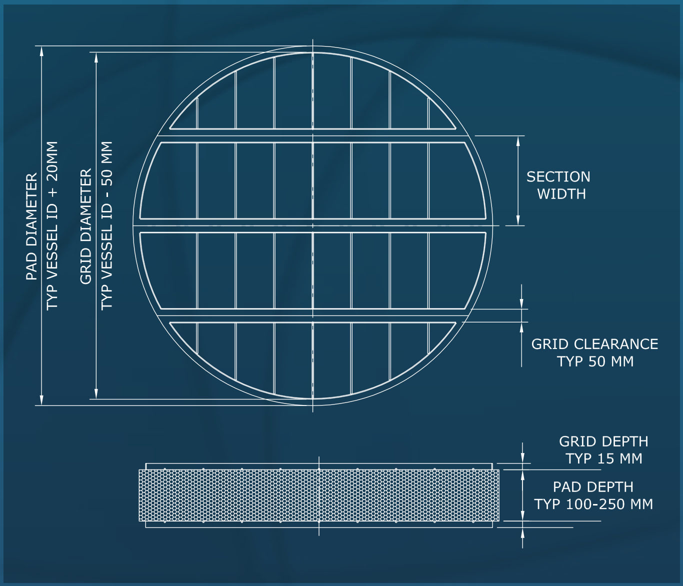
ρ_v = Vapour density (kg/m^3)

ρ_L = Liquid density (kg/m^3)

An approximate pressure drop can be estimated from the following formula.

$$\text{Wet } \Delta P \text{ (kPa)} = C.\ (\rho_L - \rho_V)\ .\ K^2\ .\ t$$

Where C = 0.20 for a typical meshpad demister, and t is the pad thickness in meters. Note that the dry pressure drop is half of the wet figure.



Finepac meshpad mist eliminators can be installed for either vertical or horizontal vapour flow. The meshpads are generally 100-150 mm thick for vertical vapour flow and 150-200 mm for horizontal vapour flow. Where meshpad thickness exceeds 300 mm, the unit is usually divided into 2 separate layers so that the section will pass through normal vessel manways and in these cases wire screens are fitted between layers to maintain pad integrity during installation.

FINEPAC WIREMESH MIST ELIMINATOR SPECIFICATION SHEET

Mist Eliminator Table

Application	Material	Style	Wire Diameter (mm)	Mesh Density (kg/m³)	Surface Area (m²/m³)	Normal Micron Rating*
Very high efficiency in clean service	Metal	FP-HE-A1	0.15	195	650	3μ
Fine droplet removal in clean service	Metals	FP-HE-A2	0.15	145	480	4μ
General purpose clean service	Metal	FP-HE-A3	0.15	112	375	5μ
Optimum efficiency and pressure drop	Metal	FP-GP-B1	0.274	195	355	5μ
General purpose not totally clean	Metal	FP-GP-B2	0.274	170	310	6μ
Heavy duty e.g. Oil& Gas separators	Metal	FP-GP-B3	0.274	145	265	8μ
Light fouling	Metal	FP-DS-C1	0.274	110	200	10μ
Moderate fouling	Metal	FP-DS-C2	0.274	80	145	12μ
Heavy fouling e.g. evaporators	Metal	FP-DS-C3	0.274	50	90	15μ
Acid mists	Polypropylene	FP-HE-A1P	0.25	75	1120	5μ
Mist removal of polar and non-polar mixtures	Metal + Polypropylene	FP-HE-A1MIX	0.25	200	625	3m
Chemical scrubber towers	Polypropylene	FP-GP-B1P	0.25	50	750	6μ

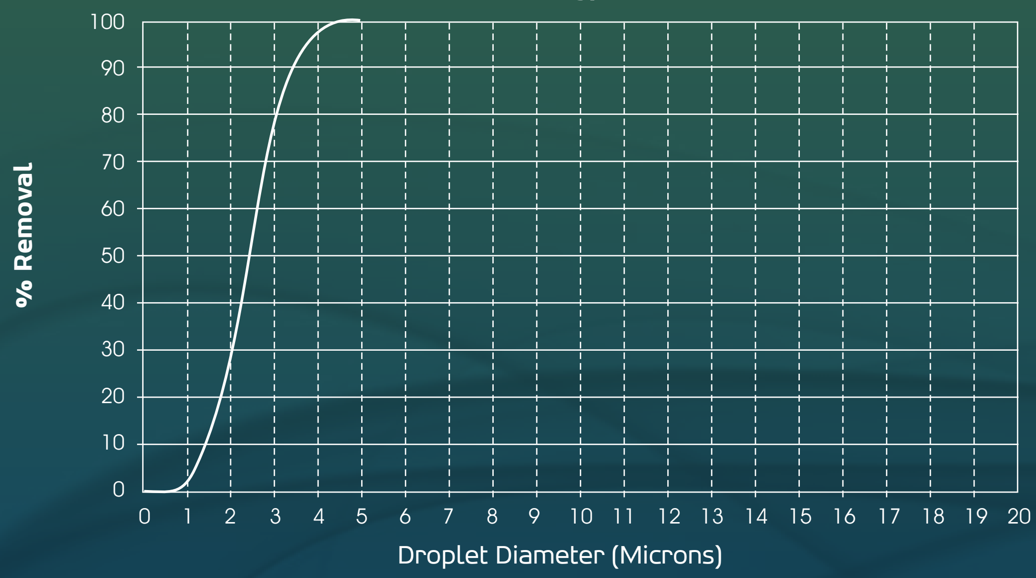
For optimum designs, the K factor should be modified to take into account the operating pressure, liquid viscosity, surface tension, liquid entrainment etc.

MESHPAD DEMISTER PERFORMANCE

Meshpad Demister Separation Efficiency Chart

at Design velocity

Mist Eliminator Type: FP-GP-B1



Vessel Type: Vertical Separator
Case reference: Air/Water reference
Vessel ID: 1000 mm

Vessel orientation: Vertical
Demister orientation: Horizontal
Efficiency at 5.4 microns: 99.90%

Operating Parameters

Operating pressure	0	Bar.g
Gas density	1.12	kg/m^3
Gas flow rate	10120	kg/h
Gas viscosity	0.01	Cp
Gas flow rate	2.51	am^3/s
Gas MW	29	#
Liquid density	1000	kg/m^3
K-factor - max rec.	0.107	m/s
K-factor actual	0.107	m/s
Gas velocity	3.2	m/s
Pad type	B1	FP-GP
Pad thickness	150	mm
Pad pressure drop	3.345	mbar
Area required	0.786	sq.m
Pad shape	Circular	

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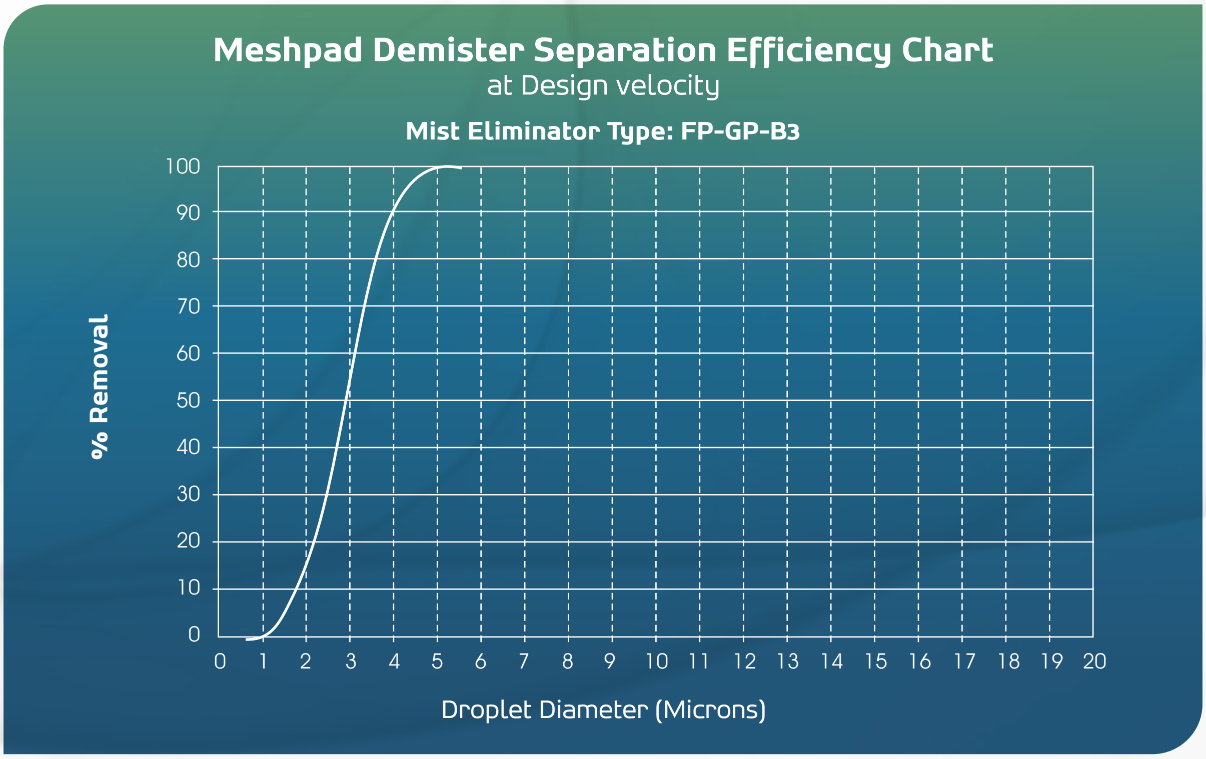

Vessel Type: Vertical Separator
Case reference: Air/Water reference
Vessel ID: 1000 mm

Vessel orientation: Vertical
Demister orientation: Horizontal
Efficiency at 7 microns: 99.90%

Operating Parameters

Operating pressure	0	Bar.g
Gas density	1.12	kg/m^3
Gas flow rate	10120	kg/h
Gas viscosity	0.01	Cp
Gas flow rate	2.51	am^3/s
Gas MW	29	#
Liquid density	1000	kg/m^3
K-factor - max rec.	0.107	m/s
K-factor actual	0.107	m/s
Gas velocity	3.2	m/s
Pad type	B1	FP-GP
Pad thickness	150	mm
Pad pressure drop	3.345	mbar
Area required	0.786	sq.m
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FINEPAC VANE TYPE MIST ELIMINATORS

Mist Eliminators for low pressure drops

Vane type mist eliminators consist of a series of vane modules appropriately spaced to provide passage for vapour flow. They consist of an angled profile to provide sufficient change of direction for liquid droplets to impact, coalesce and drain of the vanes.

Plain Vane Type Mist Eliminators

The plain vane type mist eliminators are generally used for removing entrained liquids flowing vertically upwards and for fouling services. In this type of a mist eliminator, liquid droplets impinge, coalesce, and drain off the vanes as the vapour flow is deflected around the vane profile. These are generally used in applications involving course entrainment with high liquid load and fouling services.

Characteristics

- Low pressure drop
- Resistance to fouling
- Good turndown
- Effective in applications involving high liquid load
- High vapour capacity.

Material of Construction

Stainless steel, Nickel based alloy, Titanium, Carbon steel, Polypropylene, Fluoroplastics
Other special materials available on request.

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Custom engineered for efficiency

Hooked Vane Pack

Pocketed Vane Pack

The high capacity vane type mist eliminators provide efficient droplet removal and resistance to fouling for high rate horizontal vapour flow. They can also be designed for vertical vapour flow. Entrained liquid droplets impinge on the vanes and collect in pockets that trap the coalesced liquid which drains from the unit rather than being blown through by the vapour. The collection efficiency is a function of vapour velocity and the difference in density of liquid

Characteristics

- Low pressure drop
- Effective function at high pressure
- Sturdy and durable operation
- Effective resistance to fouling

Material of Construction

Stainless steel, Nickel based alloys, Titanium, Carbon steel, Polypropylene, Fluoroplastics
Other special materials available on request.

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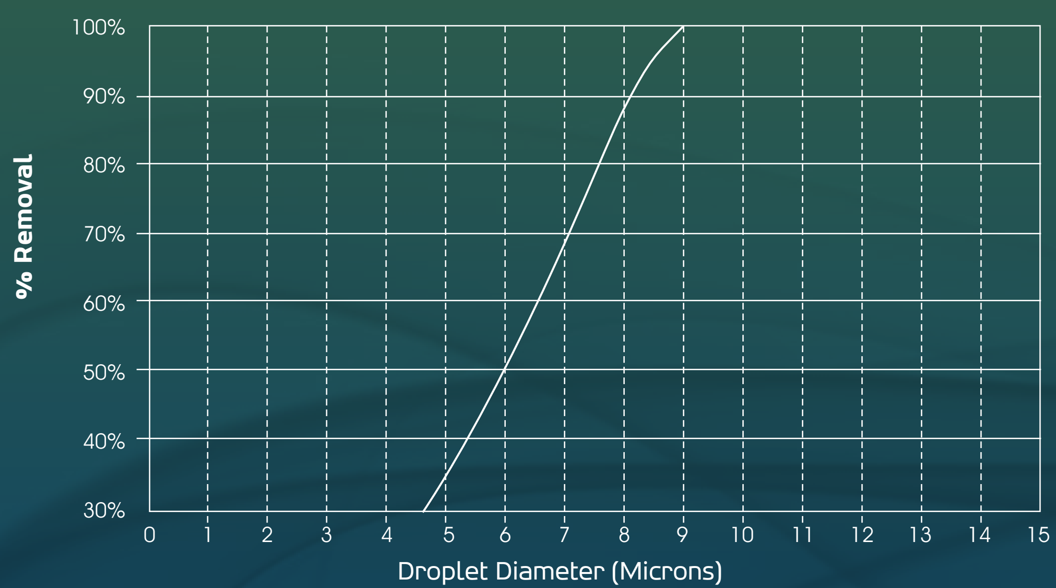
VANE TYPE DEMISTER PERFORMANCE



Vessel Type: Vertical Separator
Case reference: Air/Water reference
Vane type: FP-VV

Gas flow orientation: Horizontal
Vane spacing: 18 mm

Operating Parameters

Liquid density	1000	kg/m^3
Liquid viscosity	0.7	cP
Gas density	1.12	kg/m^3
Gas viscosity	0.01	cP
Gas flow rate	2.51	am^3/s
Design gas K-factor	0.2	m/s
Actual gas velocity	2.99	m/s
Actual K factor in pack	0.1	m/s
Actual momentum in pack	9.99	Pa
Area required	0.84	sq.m
Pressure drop	0.4	mbar
99% droplet removal above	8.6	microns

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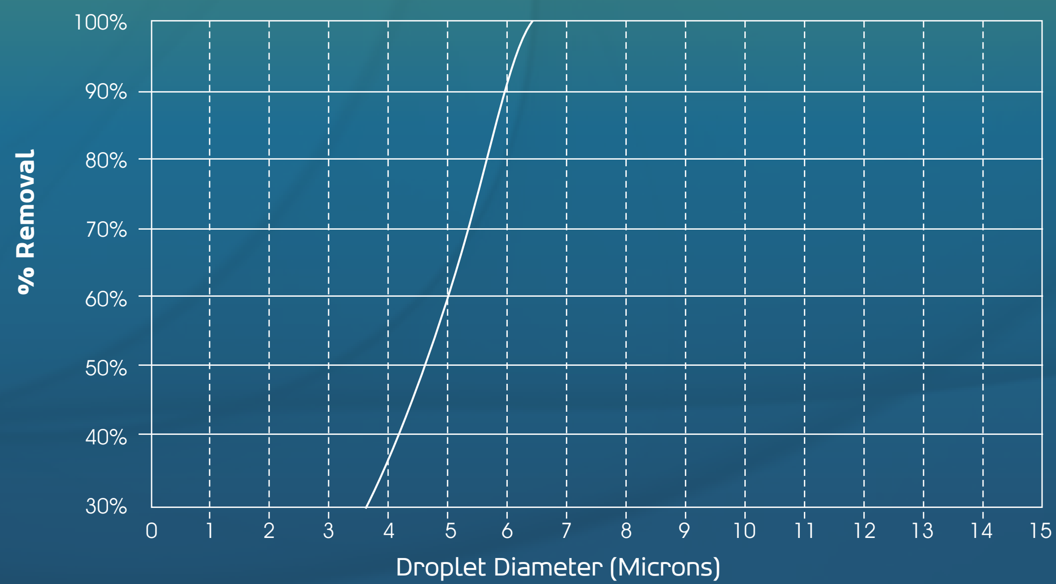
Vane Pack Separation Efficiency Chart

at Design velocity

Mist Eliminator Type - FP-VH1



Vessel Type: Vertical Separator
Case reference: Air/Water reference
Vane type: FP-VH1

Gas flow orientation: Horizontal
Vane spacing: 18 mm

Operating Parameters

Liquid density	1000	kg/m³
Liquid viscosity	0.7	cP
Gas density	1.12	kg/m³
Gas viscosity	0.01	cP
Gas flow rate	2.51	am³/s
Design gas K-factor	0.225	m/s
Actual gas velocity	3.36	m/s
Actual K factor in pack	0.113	m/s
Actual momentum in pack	12.64	Pa
Area required	0.75	sq.m
Pressure drop	0.57	mbar
99% droplet removal above	6.1	microns

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