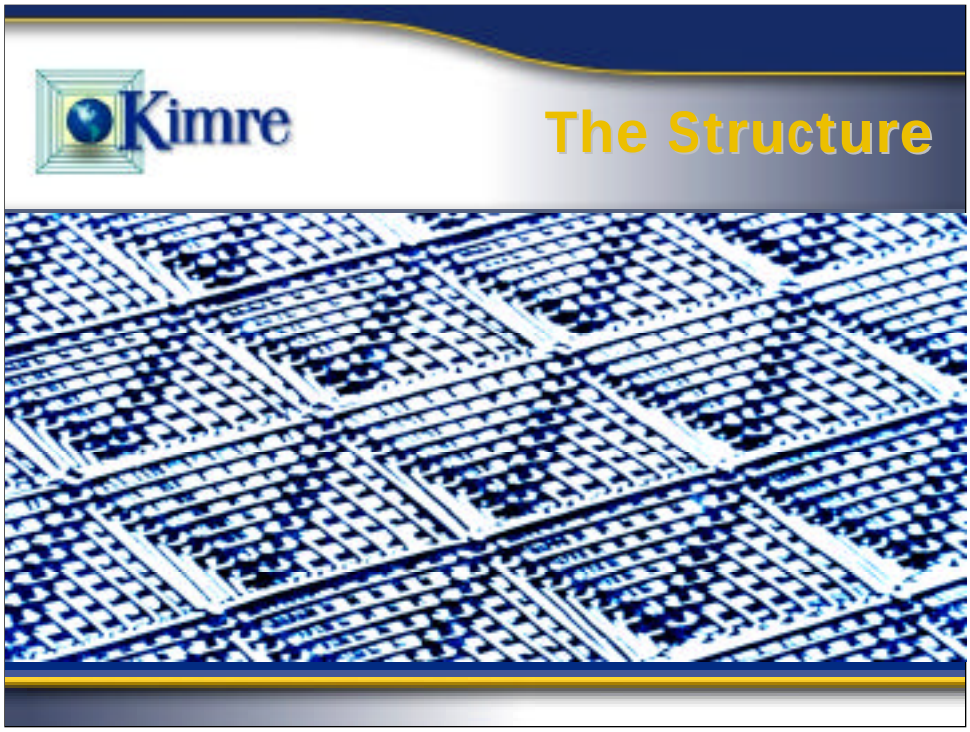
Mist eliminators have evolved over the years from packed bed types to knitted mesh mist collectors. Knitted mesh mist eliminators achieve much greater efficiency than the packed bed types where dumped packing is used as a collection device and impingement types where wave-like plates are used to collect mist.

This presentation will discuss the basic concepts of mist elimination, whether the collection device is a knitted mesh type, a dumped packing type, or a waveform type. In addition, the following information will give Kimre customers a better understanding of Kimre's technology and its advantages over other types of collection devices.

Knitted mesh structures are available in two basic types. The first type is a single-bed for simple entrainment removal and the second type is a more complex two-stage system. The two-stage system is comprised of a coalescer pad followed by an entrainment separator.

The simple entrainment separator can be described simply as a random monofilament, as pictured above. However, the coalescing pad is a little more complex to describe. The fibers in the coalescing pad are very small and are not considered random or oriented in structure. The coalescing pads are specifically designed to function as impaction and interception devices that are very sensitive to velocity and drop size.

The traditional knitted mesh mist eliminators were developed almost twenty years before the unique interlocking structure of the B-GON® Mist Eliminators. B-GON® Mist Eliminators have many advantages over the old fashioned knitted types.



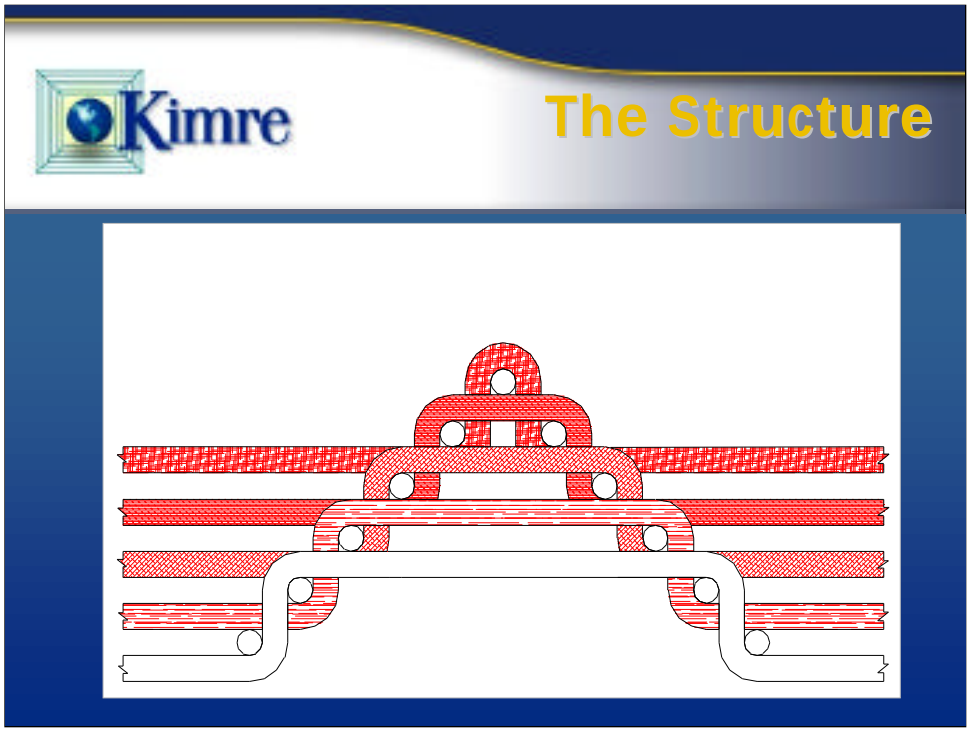
The monofilaments in the B-GON® structure align approximately 93% of the fibers perpendicular to the gas flow for maximum droplet removal efficiency. The conventional knitted types seldom exceed 67%. The high number of fibers perpendicular to the gas flow allow for higher removal efficiency per unit of pressure drop, which corresponds to lower energy usage, lower operating costs, and immediate results.

Kimre, Inc. manufactures the B-GON® Mist Eliminators out of thermoplastics ranging from polypropylene to PFA-Teflon®. This is advantageous over the SS mesh when looking at corrosion resistance. B-GON® Mist Eliminators do not lose their shape in service due to corrosion as stainless steel mesh can.

The B-GON® Mist Eliminators combine the best features of knitted mesh and plate-type mist eliminators. The ladder-like structure of the B-GON® mesh causes a change in direction of vapor flow which enhances droplet removal by impaction, interception, and centrifugal actions.

This also produces a cross flow of captured liquid that flushes particulates from the media. The improved drainage of the geometric structure is a big advantage over the knitted mesh pads shown on the following page.

The interlocking structure also provides the B-GON® Mist Eliminator with excellent resiliency and resistance to compression or “cold flow” of the media.



The cross-sectional view of the B-GON® structure shows that 93% of the fibers are perpendicular to the gas flow. When compared to traditional knitted mesh mist eliminators, the B-GON® Mist Eliminators offer the same level of performance with smaller bed depths and lower pressure drops.

The strength, resiliency, and ability to handle high flows and a wide range of flows provide the B-GON® Mist Eliminators with many advantages over the traditional knitted mesh mist eliminators.

B-GON® Mist Eliminators are manufactured in 6’ wide rolls that can be cut to any required shape or size. The large pieces allow for many installation options.

Also the various styles of material: 2/96, 4/96, 8/96, 16/96, 37/94, and 37/97 allow for various thicknesses, efficiencies, pressure drops, prices, and liquid handling abilities. The styles of material are specified by the monofilament diameter (in mils) / percent void space in terms of volume.

The functions of B-GON® Mist Eliminators apply to all mist eliminators. The functions of collecting and capturing droplets, removing droplets, avoiding maintenance problems, and keeping costs as low as possible are not unique to Kimre, although Kimre does them very well.

In order for a mist eliminator to work properly, it must be designed to collect and capture the droplets present in the system. Therefore, it is imperative to define the size of the droplets present. After the droplets have been captured, the mist eliminator must be able to remove the droplets from the system by draining effectively. Through the initial selection process, the most appropriate mist eliminator media must be selected so that liquid hold-up in the pad does not become an issue after the mist eliminator is installed. When designing a mist eliminator, engineers are also responsible for defining the environment the mist eliminator will operate in so that maintenance requirements are minimized.

Finally, the mist eliminator must keep the operating costs of the system as low as possible and match the budget of the end user.

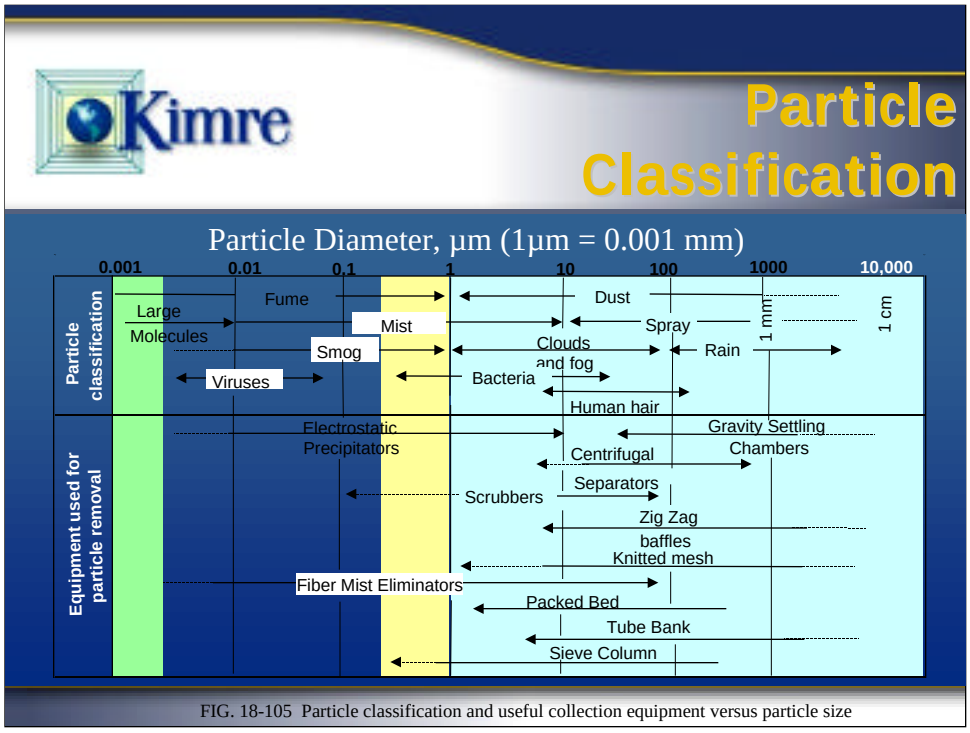


FIG. 18-105 Particle classification and useful collection equipment versus particle size

In order to better understand the functions of a mist eliminator it is worthwhile to understand the basic categories of droplets:

Sprays are droplets greater than 10 microns in diameter.

Mists are droplets less than or equal to 10 microns in diameter.

Aerosols are less than or equal to 1 micron in diameter.

The three mechanisms of collection are inertial impaction, interception, and brownian diffusion.

When droplets deviate from the flow of the gas and strike the surface of a cylinder due to inertia, inertial impaction is in effect. The collection mechanism is significant for large droplets (≈20µm and larger) travelling in a straight line. However, as droplet sizes decrease and the droplets travel along the line of the gas, inertial impaction decreases.

When a droplet travels along the flow path of the gas, the droplet can come into contact with the cylinder as it passes very close to the monofilament. Interception is inversely proportional to fiber diameter. The finer the fiber, the higher the efficiency or the smaller the droplet that can be collected. This mechanism of collection is applicable down to about 1µm in size.

Brownian movement applies to particles under 1 micron in diameter. The random movement of the fine particles contribute to the diffusional deposition of the particles on fine fibers.

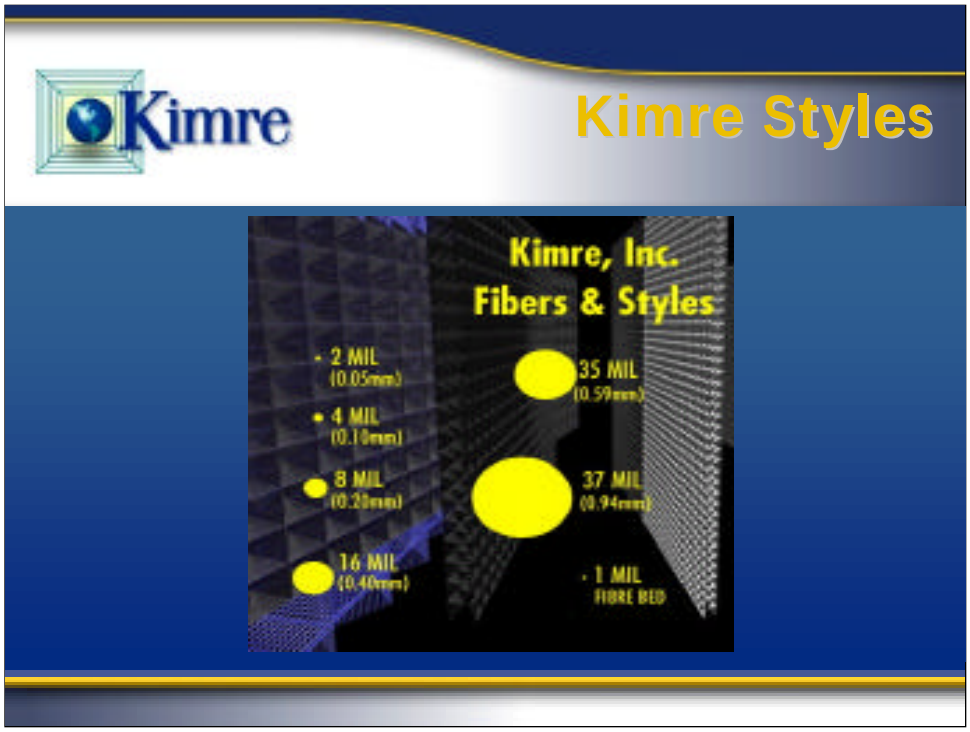
Particle Size Range (Microns)	Elimination Technology	Kimre Advantages
< 1	Fiber Pads, (Separate Vessel)	Low Capital Investment, Ease of Maintenance, Low Pressure Drop
2-20	Mesh Pad Mist Eliminator	Range of Styles, Low Pressure Drop, Resistance to Plugging, Material Selection
> 20	Wave Form Droplet Eliminator	Flexibility of Pads, Particle Size Range, Ease of Cleaning

Kimre, Inc. utilizes the AEROSEP® Multi-Stage Aerosol Separation System for the collection of sub-micron particles down to 0.2 microns in diameter. This technology is designed for lower capital investment and easier maintenance than the competing technology.

In cases with droplets down to 0.8-0.9 microns in diameter, Kimre, Inc. achieves excellent results with multi-stage B-GON® Mist Eliminators designed to coalesce finer droplets and collect them with entrainment separators. The advantages of the B-GON® System are the same as those listed above.

Droplets in the 5-20 micron size range are traditionally collected with knitted mesh mist eliminators. The B-GON® Mist Eliminators achieve the same level of collection efficiencies with lower pressure drops. The construction of the B-GON® Mist Eliminators also allows for easier maintenance, more pluggage resistance, and easier installation.

B-GON® Mist Eliminators are also available in coarse styles that can give equivalent efficiencies to the wave-form mist eliminators. The B-GON® Mist Eliminators do not experience the same drop in efficiency with turndowns and problems with flooding with changes in liquid loads.



Kimre, Inc. has fibers smaller and larger than the traditional 11-mil knitted mesh. Therefore, we can compete with all technologies from chevrons to candles. Kimre, Inc. can design a B-GON® Mist Eliminator equivalent to the traditional knitted mesh mist eliminator by approximating that 1 layer of style 16/96 is equivalent in performance to 1" of knitted mesh.

The main advantages of the B-GON® material is the lower pressure drop per unit of collection efficiency and the improved liquid handling ability and pluggage resistance.

When Kimre, Inc. recommends a B-GON® Mist Eliminator to a customer, calculations are run on the various styles of material to optimize the price, performance, life, and operating costs of the mist eliminator. The wide variety of styles allows Kimre, Inc. to provide our customers with customized solutions for each individual process.

The liquid handling ability of the mist eliminator is related to the void fractions of the media. Therefore the 96-97% void space of the B-GON® Mist Eliminators allow for a wide range of liquid loads and plugging conditions.

The media is also available in a variety of thermoplastics depending on the needs of the particular application.

The collection efficiency of a mist eliminator is the key aspect in the design and selection of a specific mist eliminator. However, several factors must also be considered in the design of a mist eliminator.

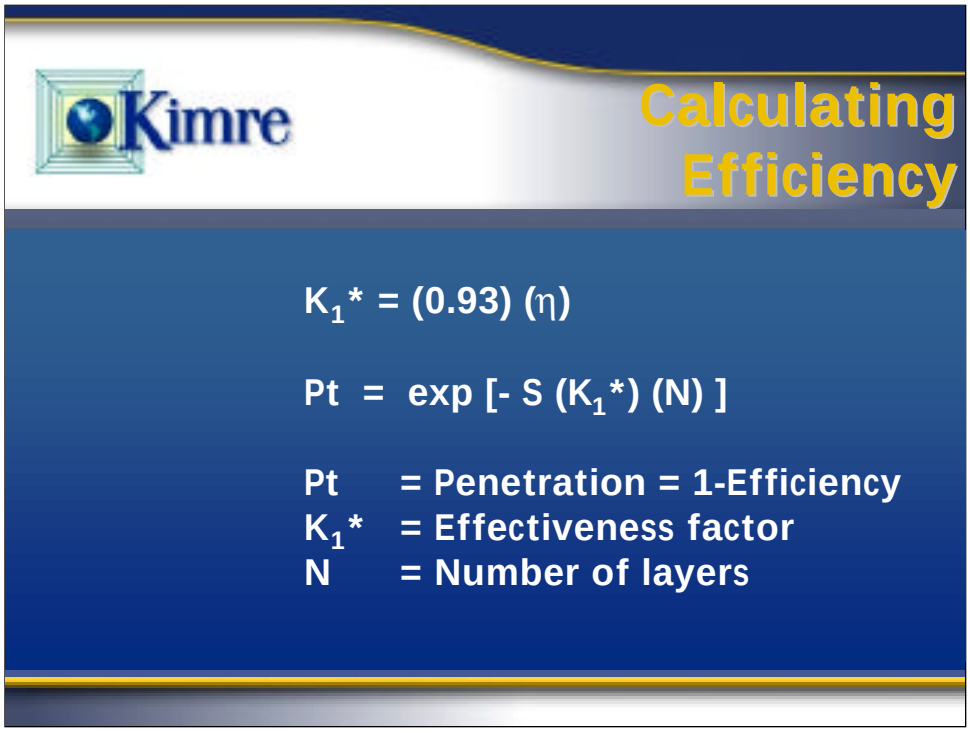
Collection efficiency is the measurement of a mist eliminator's ability to remove droplets from a gas/liquid stream. Collection efficiency is measured and reported as a percentage of entire droplet concentration, usually at a given droplet size.

Calculation of efficiency is based on the probability of collection due to the three mechanisms of collection.

Liquid handling is the mist eliminators ability to remove the collected droplets from the gas stream. Flooding is reported as a percentage of flood. At 100% of flood the mist eliminator cannot completely remove the collected droplets. Kimre, Inc. designs the B-GON® Mist Eliminators to operate up to 80% of the flooded conditions to compensate for possible variations in the specified design conditions. This 80% of flood specification also allows for operation of the mist eliminator if the pad begins to plug or foul.

Pluggage should be taken into account when dealing with insolubles and cohesive particles. Pluggage and flooding potential for mist eliminators is inversely proportional to the fiber diameter. Therefore the larger the fiber diameter, the better the resistance to flooding and plugging. Kimre utilizes the largest fiber diameters (37-mil).

The supports and hold-downs for a mist eliminator should be given as much thought as the design of the mist eliminator itself.

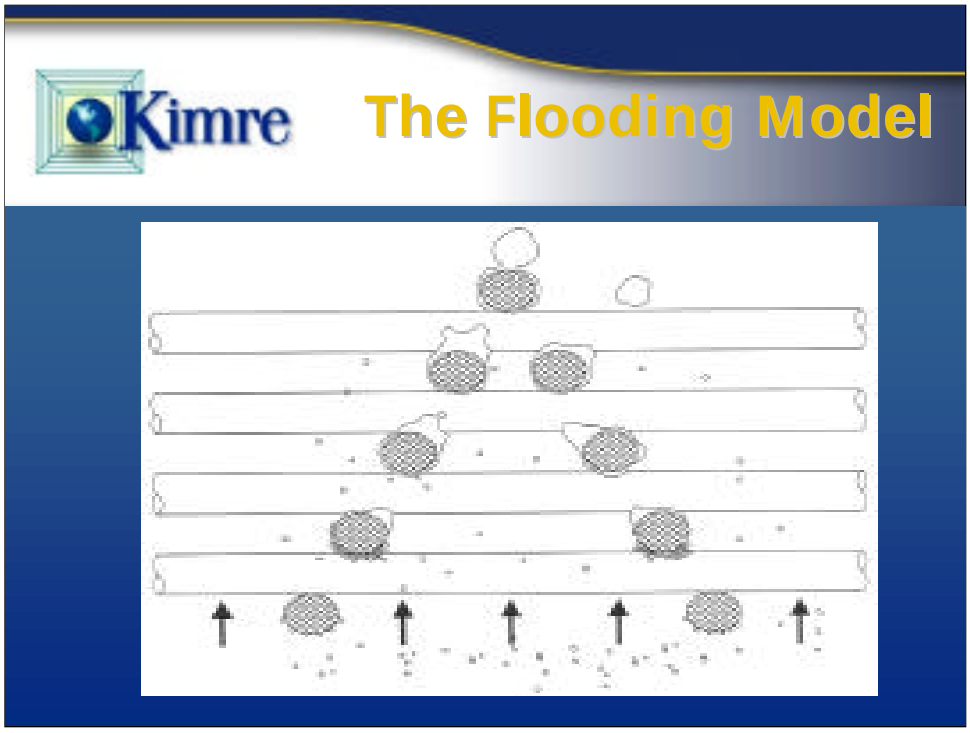


The effectiveness factor K_1^* equals .93 (percent of fibers perpendicular to the gas flow) times **h**, single fiber efficiency. Other mesh suppliers must use similar equations to determine the efficiency of the mist eliminators. However, the K_1^* for traditional knitted mesh should be approximately 0.6.

The single fiber efficiency **h** is a summation of the fiber efficiencies due to the three collection mechanisms ($\mathbf{h}_P$, $\mathbf{h}_I$, $\mathbf{h}_B$).

The effectiveness factor is used to determine the penetration of the droplets through the mist eliminator. The sum of the effectiveness factor, for a particular style of material, times the number of layers of that particular style is used to determine the penetration and efficiency of a mist eliminator.

Kimre works with a mist eliminator design program to determine K1*, pressure drop per layer, and percentage of flood from the inputs of the gas and liquid properties, the operating temperature, operating pressure, and the liquid to gas ratio.



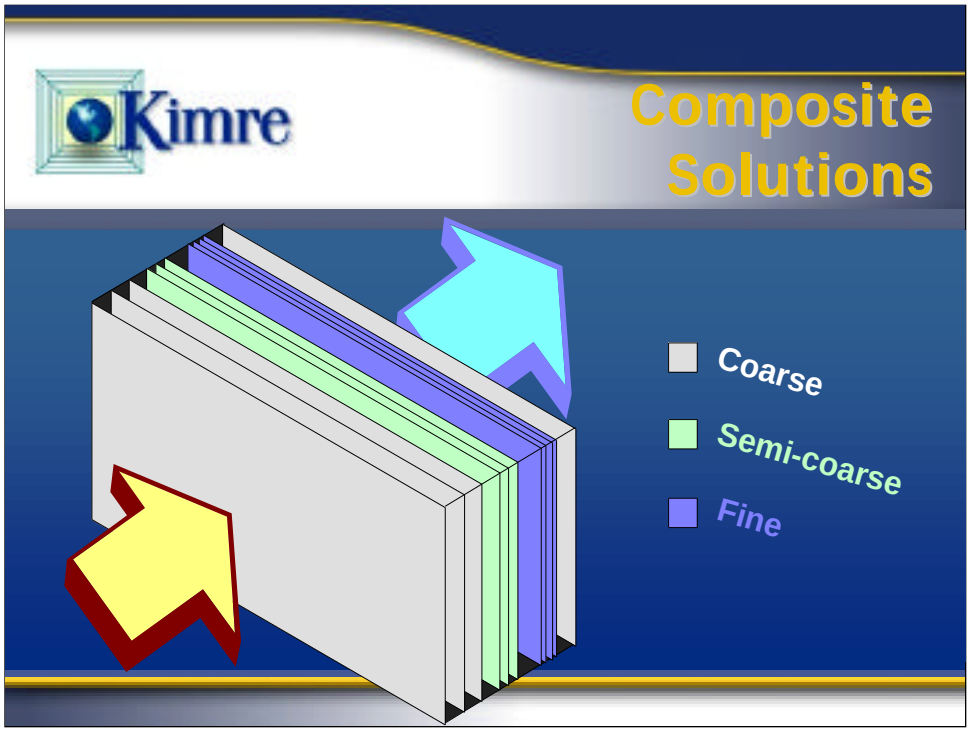
Several factors contribute to the flooding of a mist eliminator. High velocities and high liquid loads can lead to flooding. However, larger fiber diameters and larger free volumes improve a mist eliminator's liquid handling ability.

Some B-GON® Mist Eliminators are designed to operate in a flooded state. Coalescers are designed to flood in order to collect droplets below one micron in diameter. Coalescers are followed by entrainment separators to collect the entrained mist. The multi-stage systems can be more economical in terms of capital costs due to the smaller sizes of the mist eliminators and the lower volume of material required to agglomerate the droplets and operating costs due to the improved K_1^* /**D**P at higher velocities.

When a mist eliminator faces an environment with particulates that may plug the media, the required efficiency does not need to be sacrificed for the maintenance of the system. Many customers believe in using waveform separators in these operations because of misconceptions of pluggage resistance and knitted mesh.

Kimre has solved the problem of plugging knitted mesh mist eliminators in the harshest environments by offering our customers composite mist eliminators designed to resist fouling. Coarse styles of media made of larger fiber diameters and higher void spaces are combined with finer styles of media to achieve improved resistance to fouling and the required collection efficiency.

In order to minimize the maintenance requirements of the system, the mist eliminator most be easily accessible and removable. Kimre has worked with our end users to design special housings and cartridges for the mist eliminator to maximize the up-time of our clients' facilities.



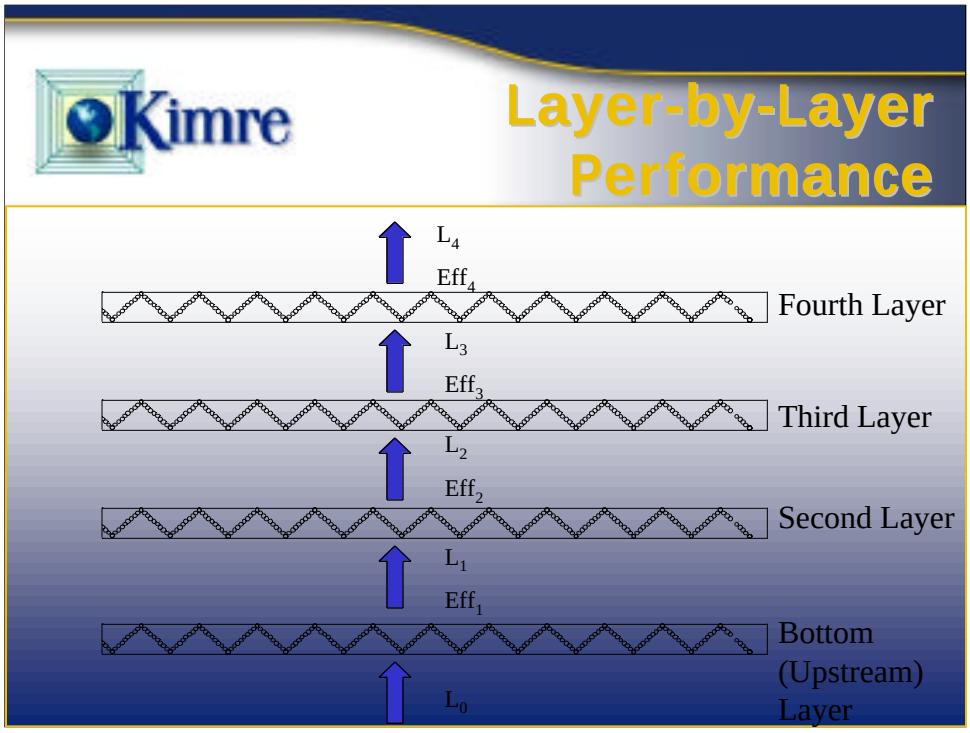
A composite mist eliminator is a mist eliminator comprised of more than one style of material (more than one fiber diameter).

The composite mist eliminators utilize the best qualities of each style of material. This design ability sets Kimre apart from the other mesh suppliers.

B-GON® Mist Eliminators can be designed layer-by-layer to provide the best composite design and optimize on performance in terms of efficiency, pluggage resistance, and pressure drop.

B-GON® Mist Eliminators achieve multiple needs by using the best qualities of each style. Our composite mist eliminators work well in environments with high velocities and high liquid and particulate loadings.

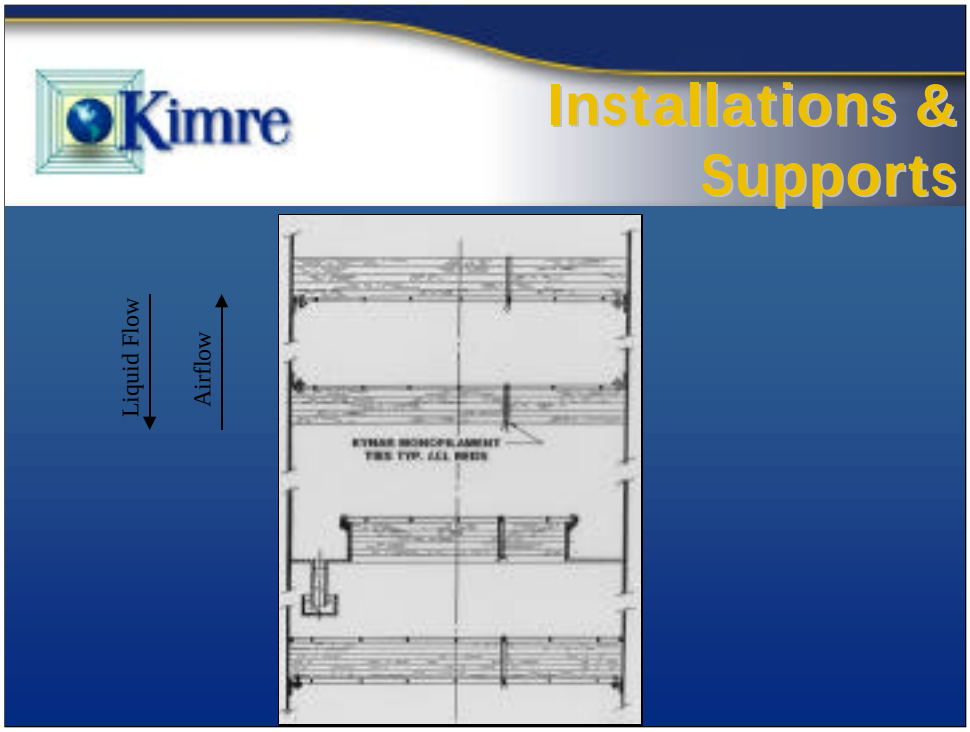
The media can be supplied in any size or shape with frames or grids to ease your maintenance requirements.



Kimre engineers custom design each mist eliminator to match the requirements of your system. A layer-by-layer analysis is performed on every mist eliminator to ensure that the correct efficiency and liquid handling ability are met. The unique structure allows Kimre to fit each mist eliminator to your process and does not require you to alter your process for our products. We take great care to minimize any retrofit requirements before installing our pads,

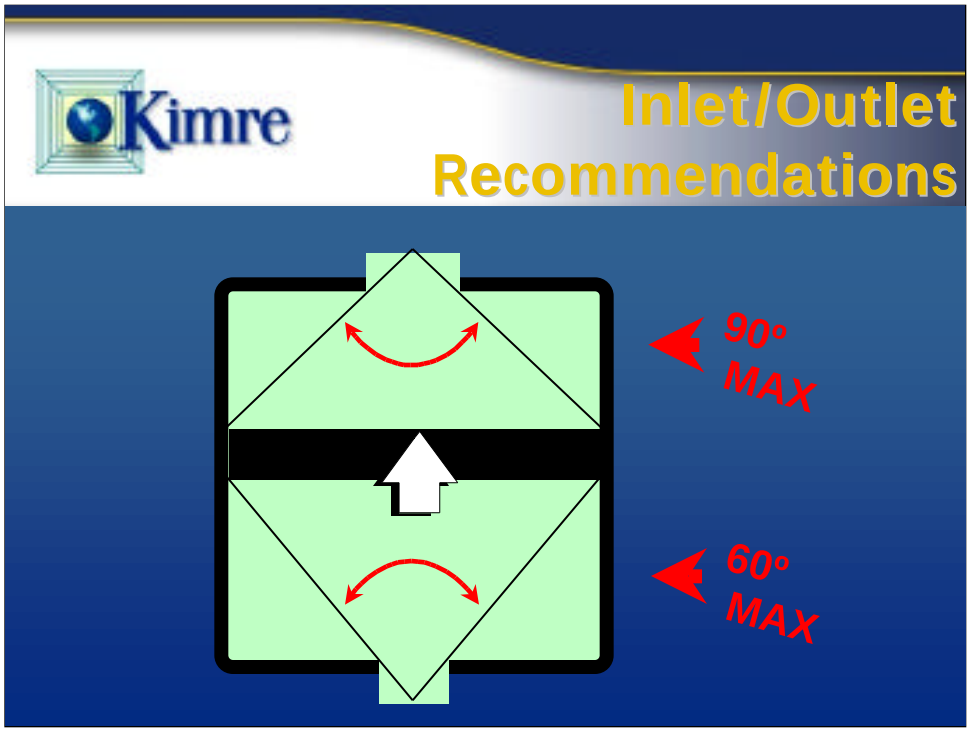
If Kimre cannot meet your needs with a single mesh pad design, we can offer you multi-stage designs combining coalescer pads and entrainment separators. The coalescer pads will operate at higher velocities and in flooded states.

Therefore it is important that the mist eliminator is installed in a fashion that maximizes the drainage from the pad. The picture above is a great example of coalescers installed in an incline to maximize operating area and minimize the chances for liquid hold-up.



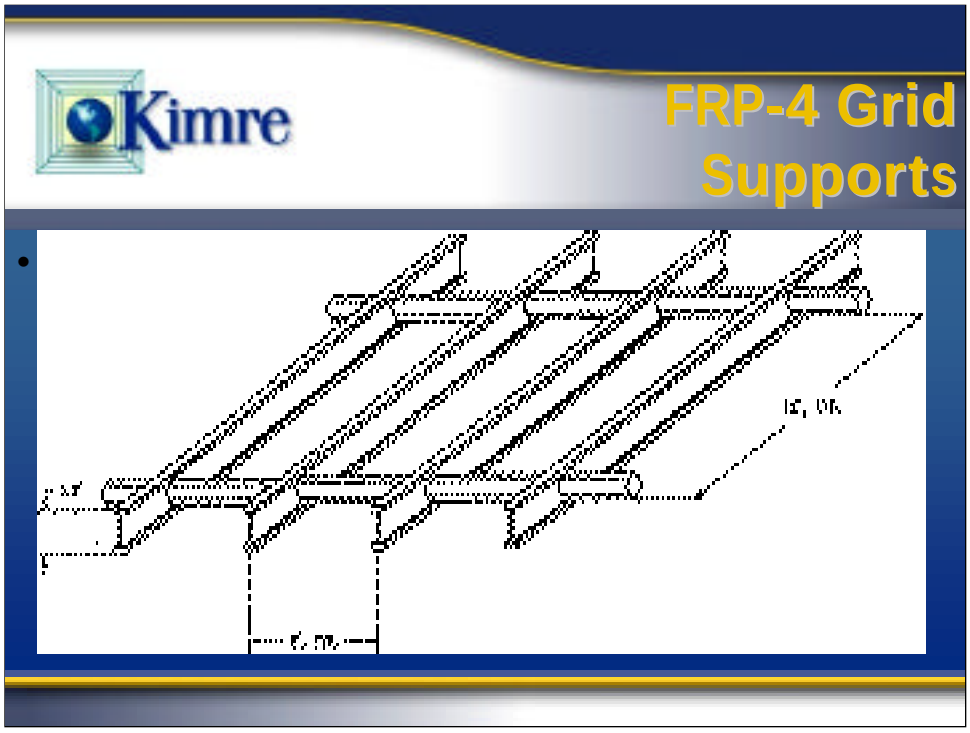
Kimre works closely with our customers to ensure that once the correct mist eliminator is designed, that mist eliminator is installed properly. There are many option for installing the mist eliminators in your vessels. The existing supports are always factored into the design of the mist eliminator to minimize the retrofit construction.

Most mist eliminators are supplied with top and bottom grid supports and will easily clamp or bolt into your tower. For special installations requiring improved draining, higher velocities, or more involved maintenance, Kimre will work with you to customize the installation.



For new installations, Kimre normally recommends the inlet and outlet transitions shown above. These transitions will ensure proper flow distribution through the mist eliminator and minimize the chances for flooding.

If your system does not follow these transition recommendations, Kimre can design a special pad to resist flooding in the high-flow areas.



Kimre supplies grid supports made of fiberglass, plastic, and all metals. We look forward to supplying all of your support requirements.