## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Gas Liquid Separation</td>
<td>2</td>
</tr>
<tr>
<td>Principles of Mist Capture</td>
<td>2</td>
</tr>
<tr>
<td>Wire Mesh Mist Eliminator</td>
<td>4</td>
</tr>
<tr>
<td>Vane Mist Eliminator</td>
<td>5</td>
</tr>
<tr>
<td>FiberBed Mist Eliminators</td>
<td>7</td>
</tr>
<tr>
<td>Worldwide Locations</td>
<td>8</td>
</tr>
</tbody>
</table>
Engineered to Innovate®

GTC Technology is a global licensor of process technologies and mass transfer/separation solutions. We provide our advanced technologies to refining, chemical and petrochemical companies to improve their capacity and efficiency, as well as to maximize production. Widely known for our innovation, technical knowledge and commitment to quality, we have built a reputation of excellence by designing and delivering high-quality, strategic solutions for clients worldwide.

Separation Technology Solutions℠

GTC’s dedicated Process Equipment Technology (PET) team provides separation technology solutions that cover a broad spectrum of gas-liquid and liquid-liquid separators which achieve optimum capacity and efficient solutions for our clients. We customize our extensive line of separation technology and products for their specific processes and equipment. Our offerings include a wide variety of separation equipment such as wire mesh, vane type, fiber bed mist eliminators, liquid-liquid separators and inlet devices which provide enhanced capacity and efficiency.

Our diverse portfolio may be customized to each client’s needs, applications and markets.

Products and services include:

• Process design
• Engineering design, fabrication and delivery
• Revamp/replacement solutions
• Feasibility studies
• Equipment installation at plant site or vessel shop
• Site installation supervision
• Start-up assistance
• Emergency replacement services
Gas-Liquid Separation
Mists are generated by the entrainment of liquid droplets into gas streams where gas and liquid are in contact. The presence of mists may result in process inefficiency, product loss, pollution and damage to downstream equipment. Thus, it is vital to remove these liquid droplets from the gas stream. (Fig. 1)

Mist formation: Liquid entrainment in the gas streams can be formed either by dynamic processes (mass transfer operation), thermal processes (condensation), or chemical reactions.

Mechanical Action: Due to mechanical action, droplets of 5 to 10 microns generate. In the drying and absorbing towers of a sulfuric acid plant, larger acid mist particles form as a result of the splash and lateral shifting of the liquid acid in the distributor and over the tower packing. These liquid sulfuric acid particles are then entrained in the upward gas flow. If the particles are not stopped, downstream equipment corrosion and serious air pollution will occur.

Chemical Reaction: When two gases react to form a liquid product, large quantities of sub-micron droplets are generated. The resulting mist, consisting of sub-micron sized aerosol particles, are the most difficult to capture.

Condensation: Due to condensation, the majority of liquid droplets (50 microns or above) are drained from the surface of the equipment. The remaining particles formed as a result of cooling and condensed vapor are usually very small and sub-micron in size (less than one micron in diameter).

Principles of Mist Capture
Inertial Impaction: Due to mass, certain liquid droplets in the gas stream (those 3 microns or larger) have sufficient momentum to break through the gas streamlines and continue to move in a straight line until they impinge on the target. This is common with wire mesh and vane type mist eliminators. Since momentum is the product of mass and velocity, large droplets will be collected more efficiently than small droplets travelling at the same velocity. (Fig. 2)
**Direct Interception:** Particles in the gas stream that are smaller than 3 microns in diameter do not have sufficient momentum to break through the gas streamlines. Instead they are carried by the gas stream. As the particle follows the gas streamline around the fiber element, it may come sufficiently close, such that it will touch the fiber and become collected. This is common in ‘Co-Knit’ mesh pads and ‘Impaction’ type fiber beds. (Fig. 3)

**Brownian-Diffusion:** A ‘Transport Phenomenon’ of extremely small acid particles, or mist, are so small that they do not follow the gas streamlines but exhibit a random path as they collide with gas molecules. These ‘sub-micron’ particles are collected when they collide or touch an object. As the molecules collide with airborne sub-micron sized particles, they create a spontaneous intermingling that causes them to travel in an erratic path within the air stream (Brownian movement). This improves their chances of colliding with the filter fibers, at which point they are retained by the intermolecular ‘van der Waals forces’. The ‘Brownian-Diffusion’ rate is inversely related to gas velocity. The lower the air flow velocity, the greater the possibility of a particle colliding with the fibers. This approach, therefore, works even when the space between the fibers may be greater than the captured particle. Particle sizes greater than one micron in size are virtually not affected by this capture mechanism. The relation of inertia to interception/diffusion is based not only on particle size retention, but airflow velocity as well. (Fig. 4)

Typical mist elimination cases, with ‘Inertial Impaction’ and ‘Direct Interception’, are based on high-velocity impaction of the droplets, while the ‘Sub-Micron mist’ cases depend on much lower velocities. For particles sizes <1.0 micron, filter efficiency increases with decreasing particle size and decreases with the increase of air velocity.
GT-ME™ Wire-Mesh Mist Eliminators

GT-ME Wire-Mesh mist eliminators consist of woven metal wire that is crimped and formed into a flat pad that fits into a tower. The crimped mesh layers are held together by a grid placed above and below the pad. The eliminators operate primarily on inertia impaction and efficiently remove particles 3 microns or larger, depending upon process conditions and applications.

Layers of crimped mesh provide a large surface area for the gas entering the mesh. Liquid droplets from the gas stream impinge and coalesce on the wire surface and then drain due to gravity.

The proper operation of a Wire-Mesh mist eliminator is limited by both lower and upper limits of velocity. The lower limit is set to maintain a reasonable efficiency while the upper limit prevents re-entrainment of collected liquid droplets from the downstream face of the Wire-Mesh pad. GT-ME Wire-Mesh mist eliminators are normally installed for vertical upward gas flow, although horizontal flows are employed in some specialized applications and compact separators.

Special Styles

In addition to the styles listed in Table 1, the following customizations are available:

- Special applications - H₂SO₄ drying tower, glycol (dehydrators) application
- Design - vertical flow, horizontal flow, compact separators
- High efficiency requirements - to capture fine particles, co-knitted (metal + fiberglass/PTFE/PP/Polyester) mesh
- Process environment - corrosive, toxic environment styles in PP, FRP, PVDF
- Combination Style - special combination styles available such as Mesh-Vane, Vane-Mesh for compact separators and special cases, such as where extremely high liquid loads.

GT-ME Wire Mesh Mist Eliminator Styles & Characteristics (Table 1)

<table>
<thead>
<tr>
<th>Style</th>
<th>Density Kg/m³</th>
<th>Free Volume %</th>
<th>Surface Area m²/m³</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>GT-ME 80</td>
<td>80</td>
<td>99</td>
<td>158</td>
<td>High Open area</td>
</tr>
<tr>
<td>GT-ME 120</td>
<td>120</td>
<td>98.5</td>
<td>210</td>
<td>High Capacity</td>
</tr>
<tr>
<td>GT-ME 128</td>
<td>128</td>
<td>98.4</td>
<td>460</td>
<td>High Efficiency</td>
</tr>
<tr>
<td>GT-ME 144</td>
<td>144</td>
<td>98.2</td>
<td>280</td>
<td>General Purpose</td>
</tr>
<tr>
<td>GT-ME 173</td>
<td>173</td>
<td>97.7</td>
<td>360</td>
<td>Heavy Duty, High Efficiency</td>
</tr>
<tr>
<td>GT-ME 193</td>
<td>193</td>
<td>97.6</td>
<td>375</td>
<td>High Efficiency</td>
</tr>
<tr>
<td>GT-ME 220</td>
<td>220</td>
<td>97.2</td>
<td>905</td>
<td>High Efficiency, Dense</td>
</tr>
</tbody>
</table>
Materials of Construction

- Stainless/duplex steel
- Alloy 20/C276/400/625/825
- Titanium
- Copper
- Polypropylene
- FEP
- ETFE
- Fiber glass

Applications

GT-ME Wire-Mesh mist eliminators are applicable in most process equipment, typically installed in the following applications:

- Steam drums
- KO drums
- Drying towers
- Upstream separators to compressors
- Sulfur condensers
- Desalination plants
- Evaporators
- Gas scrubbers and absorbers
- Distillation/vacuum columns
- Gas plants
- Glycol plants

GT-VANEPAK™ Mist Eliminators

GT-VANEPAK Mist Eliminators are manufactured in a broad variety of materials, sizes and configurations. They are designed in baffle/zigzag blade configurations which are arranged for both vertical and horizontal flow installations. These ‘high-capacity’ separators can capture 100% of all particles in the range of 8 to 40 microns in diameter, based on the process and design situation. Assembled as banks of parallel vane profiles, the eliminators cause gas to change direction a number of times from inlet to outlet through the vane profiles. The inertia of the liquid droplets forces the entrained liquid droplets to impinge on the blade surfaces forming a liquid layer that drains due to gravity. These designs are appropriate for applications with a substantial risk of fouling due to solid particles or high viscosity liquids in the gas.

GT-VANEPAK can be oriented in either a horizontal or vertical direction, and can also be designed in combination with the GT-ME Wire-Mesh pads. The Wire-Mesh unit precedes the vane-unit, in order to ‘agglomerate’ the small particles into large particles. Wire-Mesh pads are generally operated in a ‘flooded’ condition, to combine small particles into larger drops. The liquid exiting the mesh pads is removed by the downstream GT-VANEPAK Mist Eliminators.

GT-VANEPAK Mist Eliminator Styles & Characteristics (Table 2)

<table>
<thead>
<tr>
<th>Style</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>GT-VANEPAK A-VF</td>
<td>Vertical flow/</td>
</tr>
<tr>
<td></td>
<td>Horizontal vane configuration</td>
</tr>
<tr>
<td>GT-VANEPAK A-HF</td>
<td>Horizontal flow/</td>
</tr>
<tr>
<td></td>
<td>Vertical vane configuration</td>
</tr>
</tbody>
</table>
Special Styles
In addition to the styles in Table 2, the following customizations are available:
• Special applications - H₂SO₄ drying tower, glycol (dehydration) application
• Design - Vertical flow, horizontal flow, compact separators
• High efficiency requirement - to capture fine particles, co-knitted (metal + fiberglass/PTFE/PP/Polyester) mesh
• Process environment - corrosive, toxic environment styles in PP, FRP, and PVDF

Materials of Construction
• Stainless/Duplex Steel
• Alloy C276/400/625/825
• Polypropylene
• FRP

Applications
GT-VANEPAK Mist Eliminators are mainly installed for the following applications:
• Scrubbers in Flue Gas Desulfurization (FGD) units
• LP evaporators in chemical plants
• Paper mill, sugar mill evaporators
• Refinery vacuum columns
• Sulfuric and phosphoric acid plants
• Gas and LNG plants

Benefits of GT-VANEPAK Mist Eliminators
• Applicable where solid particles (present in the gas inlet) increase the chances of fouling and clogging of a typical wire mesh mist eliminator
• Structured in both vertical and horizontal flow designs
• Greater reduced pressure drop due to increased open area
• Increased handling of very high liquid and gas loads – about 5 to 10 times that of mesh pads
• Efficient turndown characteristics
• With less chance of re-entrainment, operation permissible at 30 to 40% higher velocity than wire mesh mist eliminators
• Longer corrosion life
• Capability to handle higher viscosity liquids
• Suitability for foaming application
GT-FiberBed™ Mist Eliminators
GT-FiberBed Mist Eliminators offer removal of extremely fine submicron liquid and soluble solid droplet particles from the gas stream in different complex processes. FiberBeds are applicable in sulfuric, nitric and phosphoric acid plants as well as the chlorine, pulp and food processing industries.

A GT-FiberBed unit consists of specific fibers in the bed form placed between two concentric corrosion resistant screens (cage arrangement). The orientation of each unit is either hanging at the top of the vessel or standing. The configuration, fiber type, density, depth, and height of the unit changes from case to case.

Benefits of GT-FiberBeds
- Removal of visible stack gas plumes by controlling air pollution within specified norms
- Reduction in direct emissions of acid mist into the environment
- Easily replaceable
- Unlimited turndown from the design capacity
- Reduced pressure drop (less than 40 mm of water)
- Economical replacement packing (by keeping the same cylinder assembly)

Materials of Construction
Special fibers can be selected based on different applications and required efficiency. Cage material depends on the corrosive applications and is manufactured from the following materials:
- Carbon steel, stainless steel
- Special alloys
- Polypropylene and fiber reinforced plastic
- PTFE, PVDF

GT-FiberBed Mist Eliminators Applications
- Sulfuric acid plants - drying tower, IAT, FAT
- Nitric acid plants
- Phosphoric acid plants
- Chlorine plants - dry, wet chlorine, NaOH, hydrogen stream
- Ammonium nitrate plants
- Lubricating oil vent systems
- Paper and pulp industry
- Ammonia scrubbers
- Plastic processing plants - blue smoke
- Metal working plants - blue smoke or haze
- Pollution and odor controller in various industry due to solvents, oil mists
- Other applications - asphalt production, fabric treating and coating
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GTC Technology is a global licensor of process technologies and mass transfer solutions with the mission of creating value for our clients. Refining, petrochemical and chemical companies around the world rely on GTC’s advanced processes to optimize production capacity and efficiency. With insightful industry expertise, research capabilities and innovative thinking, GTC solves complex processing problems and has earned a reputation of excellence in designing and delivering high-quality, strategic solutions for clients worldwide. We’re engineered to innovate.