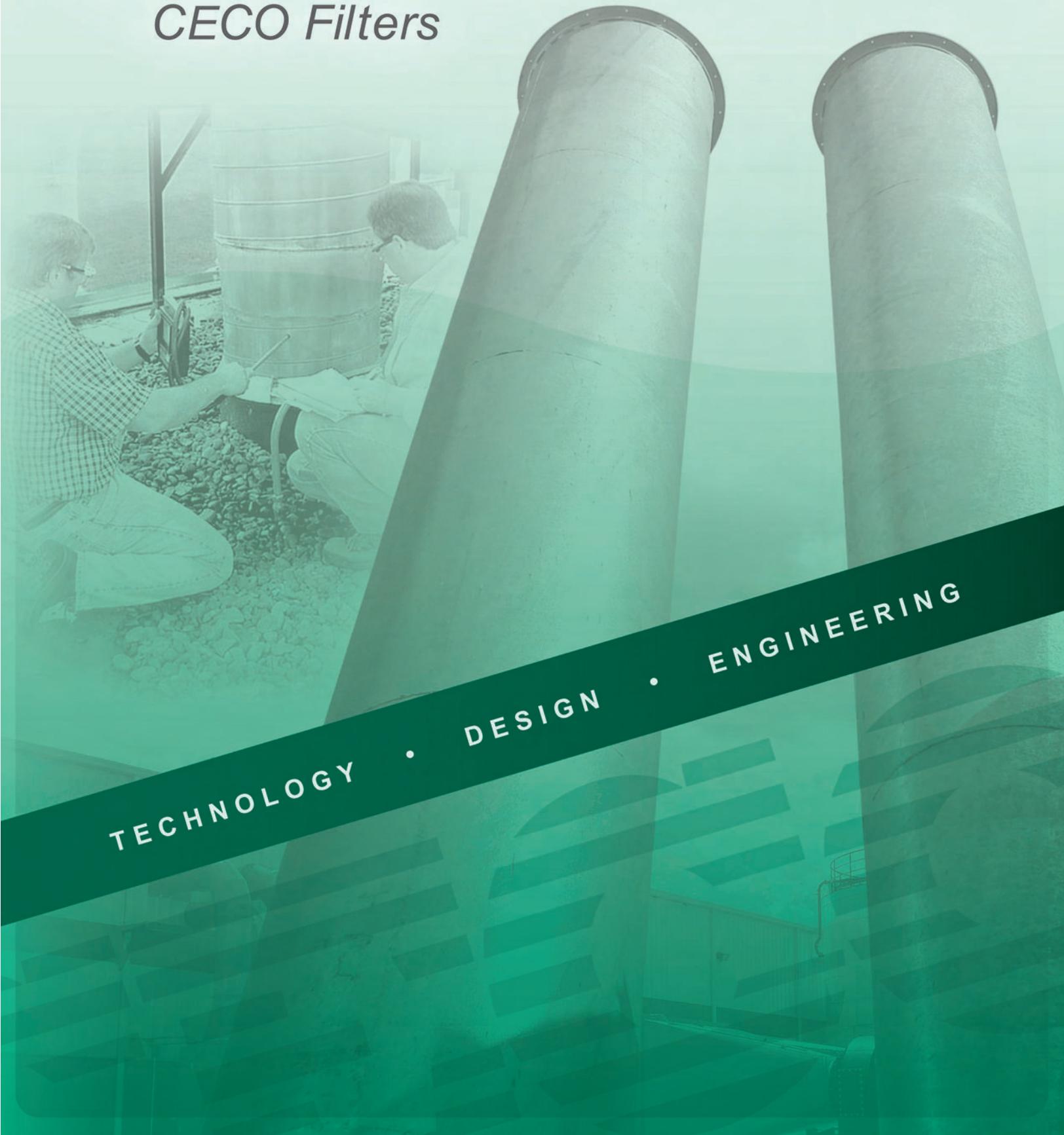


CECO Filters



TECHNOLOGY • DESIGN • ENGINEERING



CECO Filters



CECO Filters, Inc.

CECO Filters' focus on unsurpassed customer service and innovative filter designs and has earned us a reputation as an industry leader, providing cutting edge technology solutions for the past five decades. CECO Filters designs and builds fiber bed mist eliminators and air pollution control systems to create cleaner and safer working environments inside, and cleaner and safer emissions released outside.



CECO Filters offers numerous styles of mist collectors based on state-of-the-art Fiber Bed Technology to capture and collect liquid mists, in particular sub-micron aerosol particles that cause exhaust stack opacity and blue haze. With our wide array of products and know-how we have the ability to provide the most economical and cost effective clean air solutions for your emissions problem.

CECO Filter provides many standard systems or we can custom design a complete system with various ancillary components to suit your needs.

Available Add-on Options:

- Exhaust Fan
- Exhaust Stack
- Exhaust Cooling System
- Prefilters
- Drain Systems
- Pilot Unit for demonstration purposes
- CECO N-SERT® and X-SERT® Prefilters

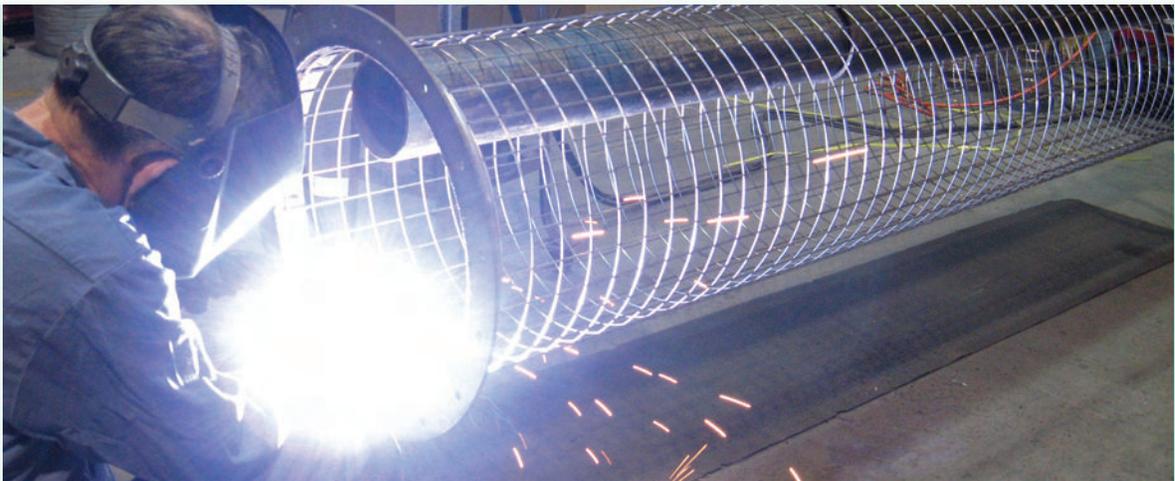


CECO Fiber Bed Filters

CECO offers a complete line of fiber bed mist eliminators and systems to abate liquid mist and aerosol emissions. Our fiber bed mist eliminators, also referred to as fiber bed filters or candle filters, are optimal for removing sub-micron liquid aerosols from gas and air streams. CECO Filters designs and manufactures fiber bed coalescing filters for use in a wide range of industries and application facilities where abatement of stack emissions is critical to regulatory compliance.

Fiber bed filters capture and remove liquid and soluble particulate from gas streams. Collection efficiencies as high as 99.9% can be achieved. In addition to abating process exhaust air streams by removing hazardous contaminants for pollution control, fiber bed filters can reclaim valuable materials from process air streams and exhausts, even in heavy liquid loading situations.

CECO fiber bed filters are available in standard or customized configurations and can be designed into new installations or retrofitted into existing systems as replacement media solutions. Often this results in simplified and less costly maintenance due to the long operating life of our fiber bed coalescing filter elements.





Fiber Bed Filter Construction

For Organics Applications (such as are common in the Asphalt, Textiles, Plasticizers industries) CECO's cylindrical Fiber Bed Filters, are typically from 2 ft. to 20 ft. tall, and are constructed around a rolled carbon steel screen which forms the inner cage structure and a similarly constructed outer cage.

The filter material, selected from a wide range of media, is placed between the inner and outer cylindrical screens to form the fiber bed. The required operating parameters of the filter (such as pressure drop, collection efficiency, and gas through-put) determines the diameter of the fibers, fiber materials of construction and the material's packing density. Plates and flanges are attached to the ends to permit a variety of attachment and draining methods.

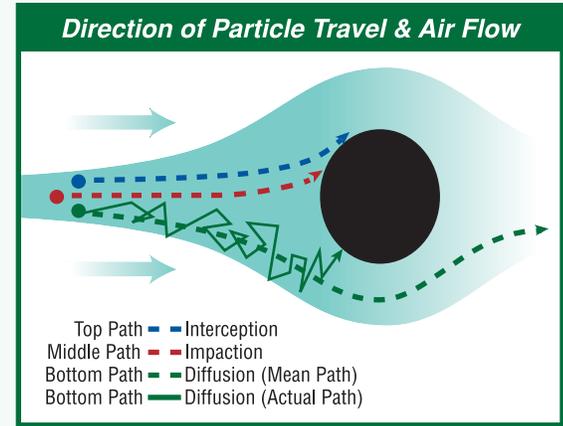
CECO Fiber Bed Coalescing Filters Offer:

- High Removal Efficiency Filter Performance
- Long Filter Life
- Increased Surface Area
- Low Operating Costs
- Low Maintenance Costs
- Filter re-packing services, either on-site or at CECO's facilities
- Custom Designed filters for any new or existing systems



Filter Process

Mist laden gas passes in a radial, horizontal direction perpendicular to one side of the filter bed and cleaned gas exits from the opposite side. Gas flow through a fiber bed filter can be either from outside to inside or from inside of the filter to its exterior. The aerosol particles are captured and collected by the fibers. The collected liquid particles coalesce into larger droplets on the surface of the fibers and, as the droplets increase in mass and begin to flow, they drain from the filter by gravity.



Particles are collected by a combination of mechanisms: impaction, interception and Brownian Diffusion. Collection of particles less than 2 microns is primarily due to Brownian diffusion; a collection mechanism somewhat unique to the fiber bed filter.

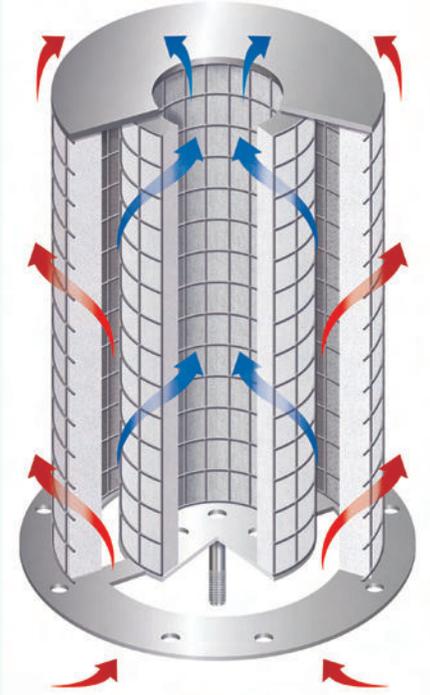
It is necessary to review the Impaction and Brownian Diffusion collection methods to fully appreciate these phenomena. Larger droplets, 2 microns in diameter and greater, move along with the gas stream until the particle's trajectory causes it to collide with an obstacle such as a fiber in the filter media. The gas stream flows around the fiber and the large diameter particle, controlled by its momentum, continues on its original path and "impacts" onto the fiber.

Sub-micron mist droplets have very little mass, and thus do not have any significant momentum, so the mean path of these sub-micron mist droplets follows the gas stream around the fiber. However the sub-micron particle movement actually mimics the random movement of a gas molecule, moving with the gas stream causing deviations away from the mean path. With a given fiber diameter, residence time, bed depth, and packing density, these deviations cause the submicron particle to impact and be collected on one of the nearby fibers.

Patented TWIN-PAK® Nested Filters

In 1990 CECO developed and patented the innovative TWIN-PAK® nested design of a filter-inside-a-filter. By taking advantage of the unused space inside a standard filter element, we are able to increase the surface area of the fiber bed element to up to 60%. For new installations this can allow the vessel housing to be much smaller, thus saving capital dollars. In the case of a process expansion, the existing unit can be retrofitted to accommodate up to 60% more gas flow with the same mist eliminator vessel.

De-bottlenecking existing filter systems can be difficult and expensive if the filter vessel must be modified to accept taller filters or a greater number of filters. CECO Filters' Patented TWIN-PAK® has been used to retrofit existing systems and competitors filter systems, thereby increasing throughput and decreasing system pressure drop, without modification of the filter vessels.



CECO Graded Bed™ Filters

For applications requiring a high removal efficiency for a given pressure drop or for high inlet loadings, CECO Filters Graded Bed™ Filters provide superior performance with higher sub-micron particle collection efficiency and deeper loading into the media bed for extended element life. This combined with the patented TWIN-PAK® nested filter design, allows CECO Filters to bring fiber bed technology to a new level of efficiency, performance and element longevity.

When challenged with sub-micron aerosol particle collection from effluent applications such as asphalt coaters and saturators, textile production and plasticizer processes, where particles may range between 0.2 and 1 micron, the CECO Graded Bed™ filter has proven to provide higher collection efficiencies at lower pressure drop while eliminating the problem of premature filter blinding.

Industry-wide focus on eliminating visible plumes has resulted in a requirement for increased monitoring of stack discharge to control opacity. Often, visible plumes are caused by a slight sag, slump or “worm hole” in the fiber bed media which can create a path for the sub-micron mist particle to “float” through the media uncollected.

A Graded Bed™ filter consists of a media bed that is constructed of multiple layers of different types of media, each with a specific quality. In the CECO Filters Graded Bed™ filter we employ two to three types of media per bed. Of course, we employ the time tested rope wound media for high collection efficiency of the sub-micron droplets. What sets CECO Filters' Graded Bed™ apart is that we employ a first layer of a blanket media for uniform gas distribution and solid particle depth loading, and we are able to apply the rope media with a much higher density because it is applied behind the blanket media.

Fiber Bed Principles & Performance

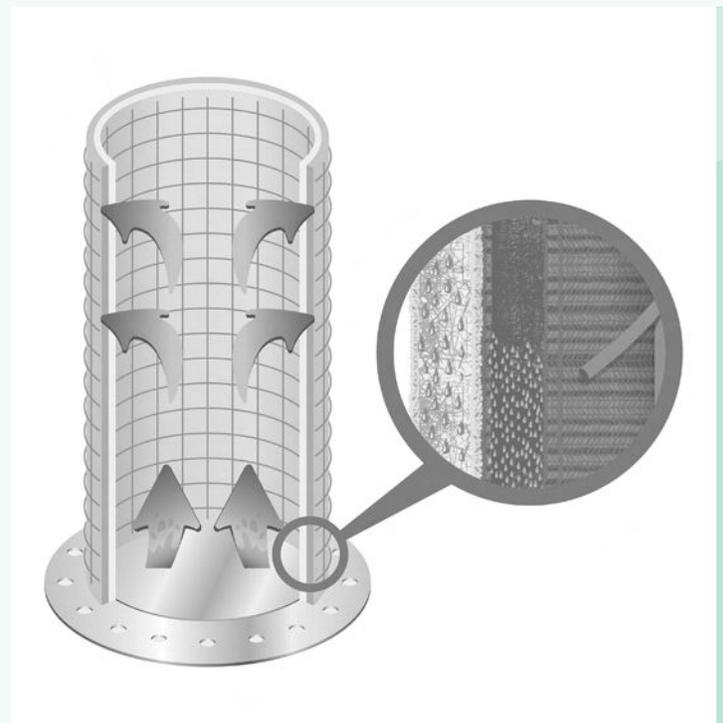
The filter media in a fiber bed often incorporates blanket material which is uniquely designed for even gas flow distribution. The blanket material is a continuous mat material built of millions of fiberglass fibers combined together and needle punched to insure even density, distribution, and media thickness. Needled blanket can be made out of many different materials and fiber diameters.

Since the needled blanket material is manufactured separately to strict specifications, the thickness, density and fiber diameter are tightly controlled through the needling step. The tight specifications on these features of the blanket material lend the media an extremely uniform gas flow distribution and pressure drop profile across the entire surface area of the element.

Furthermore, the blanket media is a one-piece mat material, generally ¼-1" thick. The fibers can be made of a variety of materials including fiberglass, Polyester, Teflon and Polypropylene, and in numerous fiber diameters. Note that the material is continuous for the full length of the candle, leaving only one vertical seam. This seam is then overlapped with the next layer of blanket media, forming a virtually seamless construction. This seamless construction insures no gas bypassing or short-circuiting through any seams, or holes.

In the Graded Bed™ filter design the depth loading has a secondary beneficial effect in that the blanket media acts to unload the high efficiency media by first collecting the larger droplets, and facilitating the drainage of these larger droplets. This allows the second media, the high efficiency rope media, to work specifically and directly on the sub-micron mist. The lighter mist load on the rope media results in even higher collection efficiency.

The higher collection efficiency can be explained by several factors working together. The blanket media is pre-filtering and coalescing the larger droplets, thus acting to unload the rope media and boosting efficiency. Secondly, the final rope wound bed layer is wound to a very high density, allowing this layer to act as a polishing stage, working specifically on only sub-micron mist. Coalescing and drainage are improved leading to higher collection efficiency on the sub-micron droplets. This rope layer thickness and density can be adjusted to achieve the desired efficiency.





Replacement Filters

CECO designs and manufactures replacement fiber bed filter elements for a wide range of processing applications to reduce and eliminate liquid mist, aerosol and fume emissions. CECO Fiber Bed Filters are available in standard or custom-designed configurations specifically designed as replacement media solutions for existing installations. Our fiber bed coalescing filter elements offer long filter life and simplified maintenance. Both conventional and the TWIN-PAK® nested filters can be provided as replacements for existing spent or non-performing filter systems. In almost all cases existing non-performing filters can be replaced with CECO replacement filters with little or no system or vessel modifications.



Asphalt Emissions:

Asphalt is typically derived from petroleum. It is a complex mixture containing approximately 80% by weight of Carbon, 10% Hydrogen, up to 6% Sulfur, along with small amounts of Oxygen and Nitrogen and trace amounts of metals such as Iron, Nickel, and Vanadium.

In order to keep asphalt from solidifying during transport, storage and use, it must be kept at temperatures between 400° and 550°F. These elevated temperatures drive off the light-ends of the hydrocarbons as odorous vapors, most of which quickly condense when the organic vapor / air mixture cools by contacting the surrounding ambient air.

This condensed vapor creates extremely fine aerosol particles which results in a visible plume often referred to as 'blue haze' or 'blue smoke.' This condensed aerosol is hazardous when inhaled, coats nearby equipment and machinery, can create a fire hazard and often has an unpleasant odor.

This phenomenon occurs in several asphalt production, storage and transport applications including tank and tanker loading and unloading, blending and processing tanks and asphalt roofing products (shingles, tarpaper, etc.) coaters and saturators.

CECO Filters offers a complete line of fiberbed filter systems to control emissions from all asphalt applications.

For low gas volumetric flow rate applications like tank venting (500-2,000 ACFM) CECO offers a single filter element DLM system with an easy access prefilter. For higher flow rate applications such as for coater and saturator lines CECO offers a larger CMC system (2000 – 35,000 ACFM) as shown below. The pre-filters are track mounted and are easily installed and removed. Main filter access is via a sidewall access door. Main filters are attached to the filter tubesheet utilizing quick connect clamps. Main filter change-out is accomplished simply by accessing the clean side of the filter chamber, releasing the quick connect clamps, lifting the filter elements out of the vessel and replacing them with new filter elements, replacing the quick-connect clamps, and closing the access door. A single maintenance worker can accomplish filter change-outs unassisted. The only tool necessary is a socket and ratchet set. No lifting equipment is necessary to change out filters.

Both DLM and CMC systems are designed to draw in dilution air, or can be fitted with cooling coils, or evaporative cooling to condense the organic vapors so they can be collected with the fiberbed filter. These systems also use the quick access prefilters. This can become very important when the process includes the addition of talc, or aggregates. In addition the main filters can be installed with integral CECO N-SERT prefilters to further extend the life of the main filter.

Systems can be supplied preassembled for the client to install themselves, or CECO can offer a full turn-key installation package. The installation is done by industrial mechanical installers all from within the CECO Environmental family of companies with technicians fully qualified and experienced in the asphalt process.

CECO Filters provides custom designed, cost-effective mist elimination systems that meet and exceed the increasingly tight EPA standards for organic, sub micron mist, and organic vapor removal.





Plasticizer/Textile Emissions:

Plasticizer-based organic vapor emissions are typically produced by many vinyl-based, polymer and rubber processing operations.

This condensed vapor creates extremely fine aerosol particles which results in a visible plume, often referred to as 'blue haze', hydrocarbon haze' or 'blue smoke'.

This phenomenon occurs in thermal applications that include extrusion, curing ovens, calendaring, or any basic plastics processing operation which involves high temperatures to form plastics and elastomers into finished shapes. In many of these processes fine aerosol mist emissions can occur due to the high vapor pressure of plasticizer components.

In the textile industry fabrics and garments are often coated with organic oils as finishing agents or fire retardants. The coated fabrics are then cured in ovens, dryers or a tenter frame which both dries fabrics and eliminates bow distortions in the fabric – a natural occurrence when subjecting fabrics to heat. A frequent result of applying heat to fabrics is the release of a blue haze emanating from the finishing oils and chemicals used in the finishing process. This haze results in visible smoke discharge at the exhaust stack. Another fine aerosol emission can occur in the yarn spinning process when organic oils are applied as lubricants.

In these applications CECO Filters Brownian Diffusion Fiber Bed Filters are specifically designed to capture the submicron mist particles from the exhaust stream thus eliminating visible stack emissions .

CECO offers a variety of fiber bed mist collection systems for these applications starting at 500 ACFM and up. In many systems pre-filter options are available which can become very important when the process includes the addition of waxes, resins, and solids. CECO N-SERT® and X-SERT® Pre Filters are used as an integral part of the main filter.



The access to the main filter elements is typically via a sidewall access door. Main filters elements are attached to the filter tubesheet utilizing quick-connect clamps. Main filter change-out is accomplished simply by accessing the clean side of the filter chamber, releasing the quick-connect clamps, lifting the filter elements out of the vessel and replacing them with new filter elements, then replacing the quick connect clamps and closing the access door. A single maintenance worker can accomplish filter change-outs unassisted. The only tool necessary is a socket and ratchet set. No lifting equipment is necessary to change out filters.

The systems can also be designed to draw in outside air, or can be designed with cooling coils or evaporative cooling to condense the organic vapors so they can be collected with the fiberbed filter.

Systems can be purchased on an equipment supply-only basis or as part of a turn-key solution. The execution of turn-key systems is accomplished by fully qualified and experienced technicians employed by companies specializing in industrial mechanical installation, all from within the CECO Environmental family of companies.

CECO Filters provides custom designed, and cost-effective mist elimination systems that meet and exceed the increasingly tight EPA regulatory standards for organic submicron mist, and organic vapor removal.

OIL MIST

CECO Filters provides systems based on fiber bed filter technologies to control a number of hazardous conditions and emissions resulting from industrial oil mists.

Many metal-working processes use coolants, both oil and water-based, for lubrication of the metal-working tools used in operations including milling, drilling, braking, bending and temper mills (gauge thickness modification). As the tools heat up these coolants are volatilized and create mist, smoke and 'blue haze' which can deposit onto surfaces throughout the interior of the plant. As the coolants are heated by the mechanical forces of the metal-working tools, the liquid is atomized and/or vaporized (and later condenses) into submicron droplets which are very difficult to collect due their minute particle size. This can produce hazardous working conditions for plant personnel and diminished indoor air quality which can often result in OSHA compliance issues and worker health problems.

Lube Oil Emissions are created from rotating equipment such as compressors, turbines, vacuum pumps and other high speed rotating equipment which require lubrication to control temperatures. The sub-micron mist or blue haze which results from injection of recirculated lubrication oils into seals and bearings can also cause hazardous conditions in manufacturing plants.

CECO Filters Mist Collection systems are ideal for abatement of these oil mist conditions. CECO Filters offers many different styles of mist collectors to meet our customer's specific individual needs. Our systems can be supplied as a point of use system (one unit dedicated to each production machine) or as a single centralized system servicing multiple machines. CECO systems are designed to be compact, with a minimal foot print or can also be installed overhead to save valuable floor space in the plant.

CECO's Brownian Diffusion fiber bed filter technology indoor air quality control systems exceed stringent OSHA standards and are so effective the cleaned air can be recirculated back into the plant without increasing overall interior air contaminant concentrations. Our filters have been known to provide as much as 15 years of filter life in these applications. Unlike other filtration methods CECO Filters fiber bed technology require less frequent change-outs and thereby results in less down time for system maintenance.



***Excellence in Pollution Control Technology
Service and Support the World Over.***

CECO Filters is a member of the CECO Environmental family of companies.



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