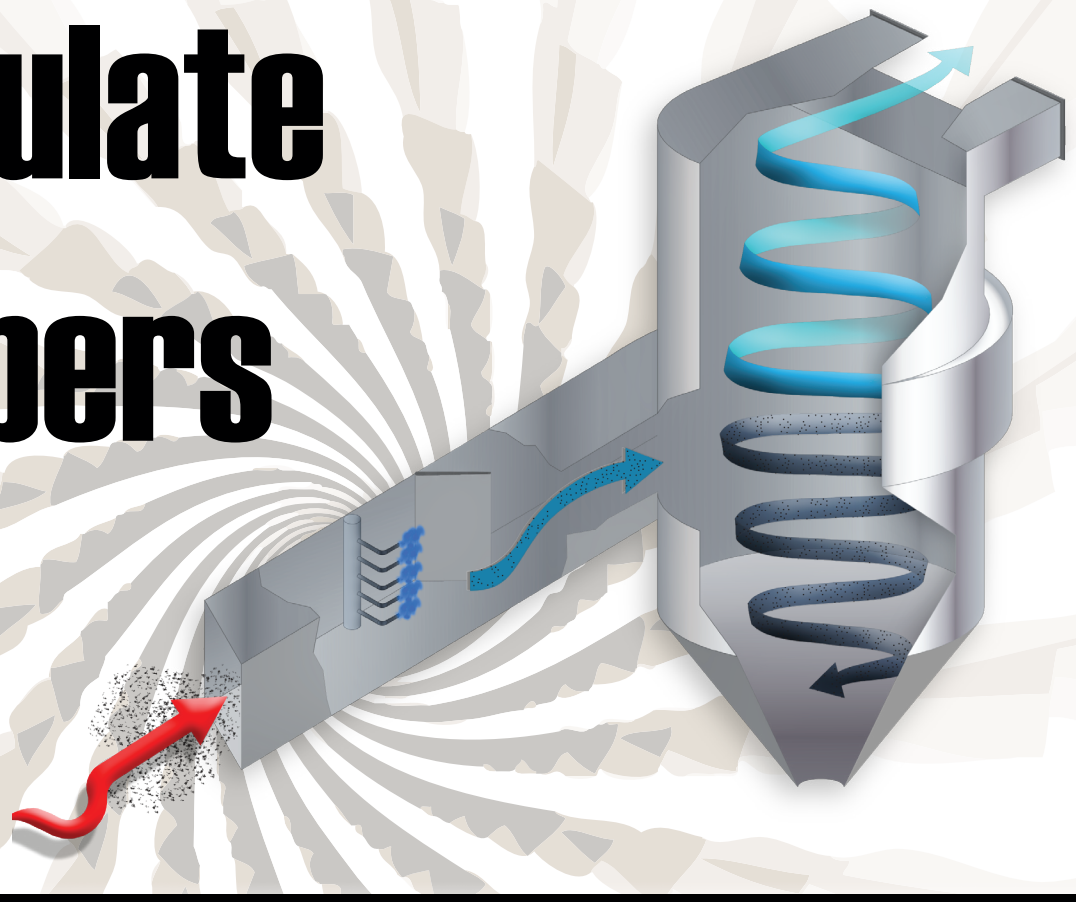
HEUMANN ENVIRONMENTAL

Phone: 812-280-1854
www.heumannenviro.com

Particulate Scrubbers



ENGINEERED FOR PERFORMANCE, OPTIMIZED FOR EFFICIENCY

Particulate scrubbers are simple in concept, but rely on technical expertise in their design to function optimally. Over 100 years of combined experience in the design, engineering, and supply of custom scrubber systems enable us to select the solution that best fits your requirements.

Performance That's Guaranteed

Our advanced performance prediction models are used to accurately determine what is required to meet your specific emission limitations and enable us with complete confidence to guarantee the efficiency of our scrubbers over a specified range of process conditions. Additionally, our understanding of the intricacies of scrubber design means we can ensure that capital and operating costs are minimized without sacrificing the quality or performance you expect.

Custom Engineered for You

Almost every scrubber system is designed one at a time. Does it make sense to pay for custom work without getting a 'custom' level of integration and performance? Our team has the knowledge and experience to ensure that the right scrubber is selected at the optimum balance of features, performance and cost.

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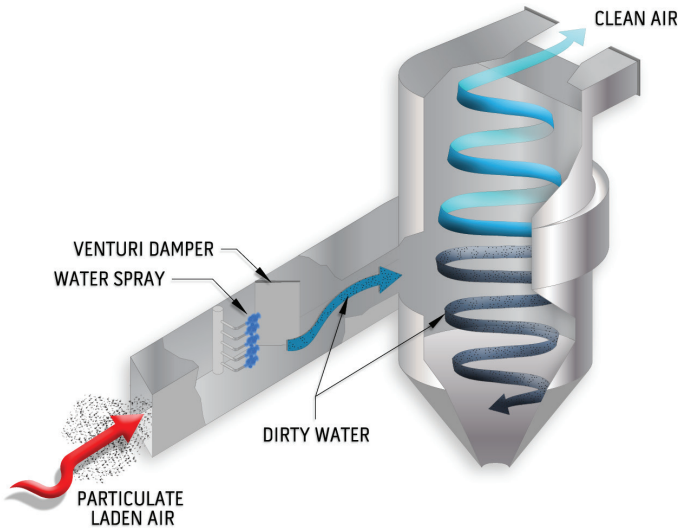
Available Options

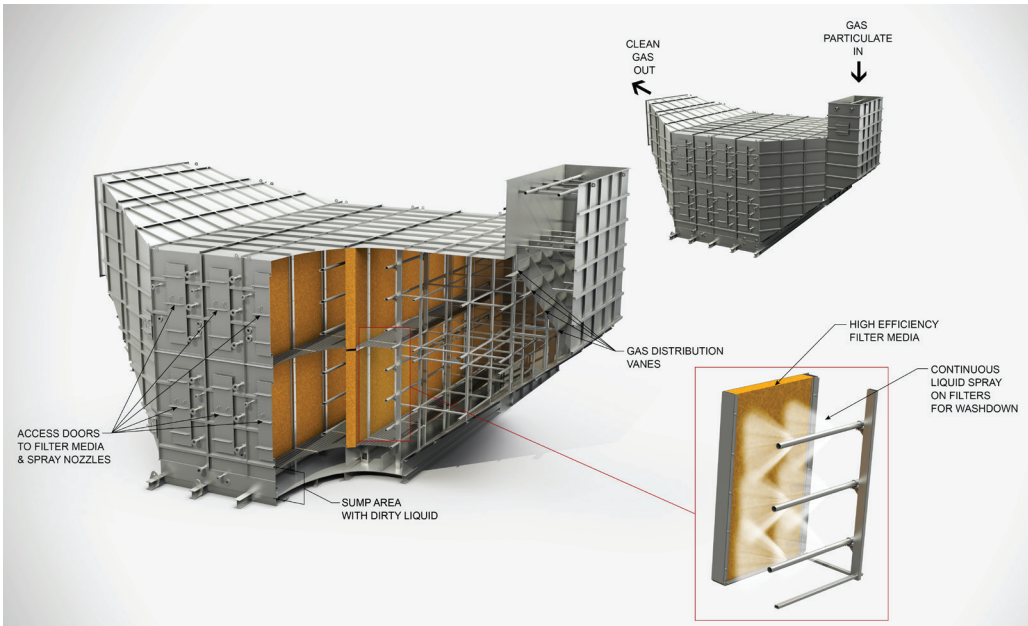
- Gas inlet for vertical or horizontal duct layouts
- Inlet quench for high temperature processes
- Specialized design to handle high dissolved solid concentrations
- Skid mounting
- Construction options including carbon steel, stainless, nickel alloy, or FRP (Fiberglass Reinforced Plastic)
- Recirculation tanks (external or integral)
- ASME Code stamp for high pressure design
- Multiple water injection and throat designs
- Venturi damper operators (manual or automatic) to accommodate varying gas flows
- Turn-key systems (including piping, fans, tanks, instrumentation, pumps, stack and controls)
- Dual purpose gas absorption and particulate collection
- Performance guarantee (including warranty)



Industries Served

Petrochemical	Chemical Processing
Wood Products	Mining & Ore Processing
Power Generation	Food Products
Pharmaceutical	Waste Incineration
Cement & Rock Products	Fertilizers
Steel	Gasification
Pulp & Paper	Wastewater Treatment
Polysilicon	Biomass
Activated Carbon	Pneumatic Conveying
Drying & Cooling Processes	Bulk Material Handling
Industrial Ventilation	Calcining & Roasting

Figure 3



Interceptor Series

Utilizing interception, HEC's Interceptor Series cross flow scrubbers provide superior collection of soluble particulate at low power consumption with one or more stages of Kimre® media arranged perpendicular to the gas flow.

Features:

1. High efficiency down to sub-micron particles sizes.
2. Low pressure drop.
3. Open structure reduces maintenance.
4. Durable media provide long life and low operating costs.

Inertia

There are two primary methods for contacting liquid droplets with particles. The first method uses a device that takes advantage of inertial impaction. These devices are typically spray towers or chambers, wet cyclones, or venturis (in order of increasing effectiveness). All of these devices utilize acceleration of the flow stream to cause inertial impaction and follow the power-contacting theory. The power-contacting theory in simple terms states that the amount of power utilized in contacting the particles is proportional to the contact efficiency.

In (Figure 2) we show a diagram of a conventional venturi contacting device. In the contraction portion of the device, the gas and droplet mixture accelerate as the cross sectional area is reduced. In this section the fine dust particles accelerate more rapidly than the larger water droplets creating a relative velocity between the two. In the throat section, the the particles and liquid droplets are further mixed and allowed to reach a maximum velocity. In the expansion or divergence section, the larger particles remain at a high velocity while the small un-collected dust particles slow with the gas flow as the cross sectional area increases.

Interception

The second method for scrubbing particulate uses interception as the mechanism by passing the particle laden gas pass through a structure or media that is wetted with the scrubbing liquid. While not as common as venturi and wet wall cyclones, these devices can be particularly effective for the high efficiency collection of soluble particulate with low power consumption. (Figure 3) shows a cross flow Interceptor Series Scrubber. When utilizing interception as the primary mechanism for scrubbing, the amount of surface area of liquid film, as well as the gas path, affects the collection efficiency. Collection efficiency can be increased by increasing the number of interception sites and/or the surface area of liquid film available for contact.

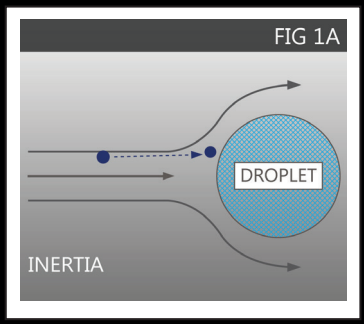
Interception devices are rarely utilized for insoluble particulate due to the probability of plugging or fouling within the media.

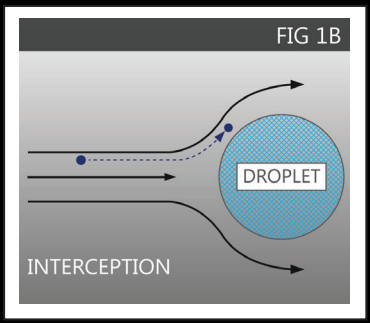
Impactor Series

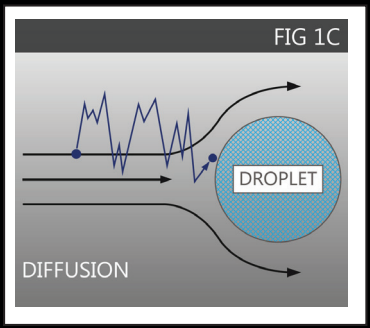
Utilizing inertial impaction, the Impactor Series of HEC Scrubbers include our fixed and adjustable inlet venturi scrubbers and cyclonic separators.

Features:

1. Blind Injection: Problems often occur in scrubbers at the point at which the particle laden gas stream comes in contact with wet surfaces. This is called the wet/dry zone. In this area, solids may build up because they are damp and sticky but there is not enough liquid flow to wash them away. HEC's "blind injection" virtually eliminates the wet/dry zone and prevents solids build up.
2. Injection Tubes: Water may be introduced into a scrubber in a number of ways. Conventional spray nozzles typically provide the easiest and least expensive method of liquid distribution but often result in maintenance problems due to nozzle plugging and erosion. Utilizing HEC's unique understanding of how droplets are generated our engineers are able to provide low pressure liquid injection utilizing simple injection tubes (or pipe) without any loss in collection efficiency. By utilizing low pressure injection tubes we achieve the following benefits:
    - Reduced pump pressure which means lower pump cost, less pump horsepower, and more reliable pump operation.
    - No nozzles to plug or erode away. One of the most common causes of a loss of collection efficiency in scrubbers is poor liquid distribution to the contactor as a result of nozzle pluggage or nozzle erosion. HEC eliminates this problem with its injection tube option.
    - Higher solids recirculation means lower bleed rates and reduced operating costs. By using low pressure, large diameter injection tubes, we can run our liquid recirculation systems at higher solids concentrations than our competitors. This means more concentrated and less liquid volume for secondary waste treatment.
3. Enhanced Cyclonic Separator design: HEC cyclonic separators provide the lowest liquid carry over, often exceeding 99.99% droplet removal.







Some of the common process reasons for using scrubbers for particulate separation are:

- Scrubbers are simple to build and operate. They can be engineered easily for very severe and/or variable operating conditions.
- The most efficient way to cool high temperature process gases for treatment is by quenching with water. Once this is done, scrubbing with water for particulate removal is often the most economical and operable method for particulate separation.
- Wet scrubbers may be more compact than other dry devices.
- Gaseous and particulate contaminants may be collected in the same device.
- Wet scrubbing may be the safest way of handling potentially explosive, pyrophoric, or combustible dusts.
- Wet scrubbers can operate reliably on sticky and/or highly hygroscopic materials.

How Particulate Scrubbers Work

The primary function of a scrubber is to cause dust particles to attach to liquid droplets or film, and then remove the liquid containing the particulate from the gas stream.

While many particles will grow in mass by absorption of water, the most significant mechanism for particle growth is contact between dust particles and water droplets or a liquid film. This contact occurs by the following basic mechanisms:

1. **Inertial Impaction (Fig 1a)**- This is the primary mechanism that wet scrubbers for particulate removal using venturis and other "power-contacting theory" devices utilize. Inertial impaction occurs when there is relative velocity between objects. As a faster particle entrained in the gas flow tries to go around a slower or stationary object (e.g. water droplet), it may break out of the flow stream due to its inertia and impact the slower object. This is inertial impaction.
2. **Interception (Fig 1b)-** If the inertia of the faster particle is not great enough to directly impact it upon the slower one it still may contact it if the flow stream that the particle is traveling within passes close enough to the slower particle. This is Interception.
3. **Diffusion (Fig. 1c)**- Largely an effect of Brownian motion of very small particles (less than .3 micron with SG=1), this mechanism provides higher collection than would otherwise be expected due to the Inertial Impaction and Interception. Diffusion causes these very small particles to contact larger water droplets.
4. **Condensation**- When condensation occurs, it first does so using any available dust particles as nuclei of condensation. Although, not exactly a "contacting" method, Condensation can be used to form water droplets around the dust particles. While droplets formed by condensation are relatively small, they are larger than the particles that form their nucleus.

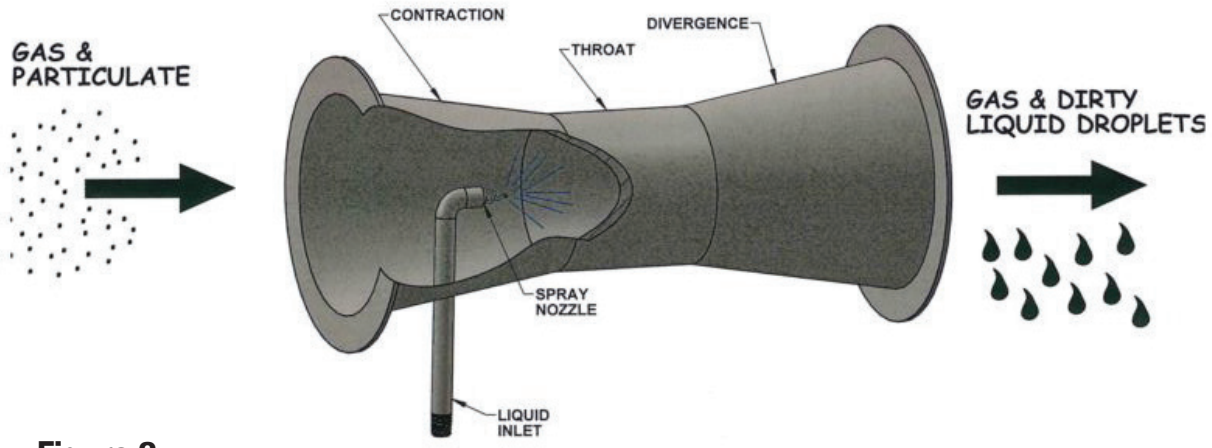


Figure 2

VENTURI CONTACTING DEVICE