

Venturi scrubbers

Technology
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Venturi scrubbers are used for particulate removal from flue gases and process vents, providing efficient removal of particulates as small as 0.2µm (micron). The scrubbers are suitable for mechanically generated (large) and chemically generated (small) particulates with typical particulate size in the range 0.5 to 10µm. Material loading, density, and solubility are all factored into ERG's design.

Venturi operating principle

The flue or process vent gas stream enters the top of the venturi where the scrubbing liquid (usually recirculated) is sprayed into the gas stream. In the venturi throat, the gas accelerates and mixes intimately with the scrubbing liquid due to the intense eddies present in the turbulent flow. The change in momentum allows the particulate to be entrained in the liquid droplets, effectively removing the solids from the gas stream. The droplets then recombine as the gas slows and expands at the venturi outlet, agglomerating in the cyclone separator and draining into the sump tank ready for recirculation through the venturi throat. A final mist elimination stage removes any residual droplets.

Venturi selection

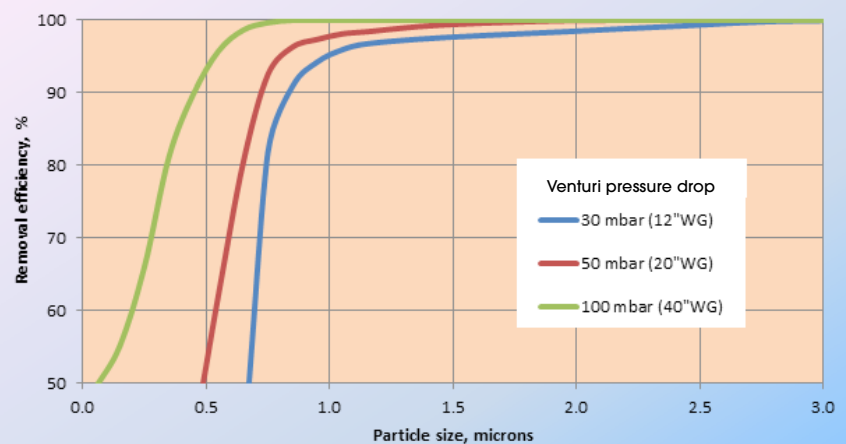
The gas pressure drop determines the particulate removal efficiency. The smaller the particulate, the larger the pressure drop required.

Fixed throat venturis have no internal moving parts and so are simple to operate and maintain. If the gas flow rate is variable, the pressure drop across the throat varies as will the particulate removal efficiency. Higher flow rates result in greater particulate removal efficiency.

Variable throat venturis include adjustable blades in the throat. For variable gas flows these can be automatically modulated to achieve a constant pressure drop ensuring high particulate removal efficiency is maintained independent of flowrate. The mechanism that adjusts the position of the blades is located outside the gas flow and is highly reliable.



Illustrative particle removal efficiency for ERG Venturi scrubber



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System configuration options

Side stream settler and/or press - used with insoluble particulate to remove the captured solids from the liquor circuit as a slurry or a dry cake.

Separate sump tank - used to allow on-line inspection of the scrubbing liquor, especially when the particulate is prone to float on the liquid surface.

Integrated quench and venturi vessel - used when hot flue gas is being treated. The gas is quenched to the adiabatic saturation temperature in the upper part of the venturi and then accelerated in the throat below.

High pressure fans - to provide the motive force through the system extraction ducts, venturi vessel and any additional scrubbing stages. Treated gas is discharged to the client's process or to atmosphere. Typical fan duties range from 25 to 100 mbar depending on the application.

Recirculation pumps - vertical seal-less or horizontal pumps with suitable seal plan can provide the required flow rate and pressure at the venturi throat. Enhanced system reliability and availability is achieved by using a duty/standby arrangement.

Down-stream scrubbing is frequently required to remove soluble acidic (e.g. HCl, Cl₂, HF, HBr, SO₂) or alkaline (e.g. NH₃) contamination. Our patented V-tex[®], packed or tray scrubbers can be used to achieve the required emission limits.

Construction materials

Depending on the operating temperature, gas composition and contaminant type, ERG can provide the venturi and cyclone in carbon or stainless (304, 316) steels, duplex, Hastelloy (C22 or C276), Inconel, or PVC/GRP, PP/GRP or chemically resistant GRP (Crystic or Derakane resins).

Indicative venturi selection table

gas flowrate m ³ /hr	liquid recirc flow m ³ /hr	venturi diameter m	cyclone diameter m	cyclone length m
1,000	3	0.25	0.6	1.5
2,500	7	0.35	0.9	2.1
4,400	12	0.5	1.2	2.7
6,800	18	0.6	1.5	3.3
9,700	26	0.75	1.8	3.9
13,500	38	0.9	2.1	4.5
17,500	50	1.0	2.4	5.2
22,500	65	1.1	2.7	5.8
27,500	80	1.2	3.0	6.4
33,500	95	1.4	3.3	7.0
40,000	110	1.5	3.6	7.7

