a McGill AirClean™ product

Fabric Filter Systems

Providing compliance level control for difficult applications

McGill AirClean LLC

An enterprise of United McGill Corporation –
Family owned and operated since 1951

McGill supplied this spray-dry scrubber and an eight-module fabric filter system to control HCl, SO_2, and particulate on a manure-fired BFB boiler.

History and Capabilities

McGill AirClean has over 40 years of experience solving air pollution control problems for industrial applications such as:

- pulp and paper
- waste incineration
- electrical power and steam generation
- wood products
- chemical
- pharmaceutical
- food
- automotive
- metals
- petrochemical
- glass manufacturing
- and many more

Our products include:

- fabric filter systems
- dry and wet electrostatic precipitators
- regenerative thermal oxidizers
- acid gas control systems
- deNO_x reactors (for selective catalytic reduction)

An eight-module fabric filter controls emissions from a rotary kiln incinerator that burns hazardous waste.

McGill Fabric Filter Systems

McGill AirClean is a leading manufacturer of fabric filter systems for controlling emissions from solid fuel-fired combustion sources. Our fabric filter systems have a proven track record providing compliance level control for difficult applications such as solid waste incinerators and circulating fluidized-bed boilers. We have fabric filter systems operating successfully with all types of combustion devices.

Applications

- spreader stoker
- bubbling fluidized-bed
- underfeed stoker
- atomized slurry
- chain grate stoker
- cyclone
- pulverized fuel
- rotary kiln
- circulating fluidized-bed
- incineration
- gasification

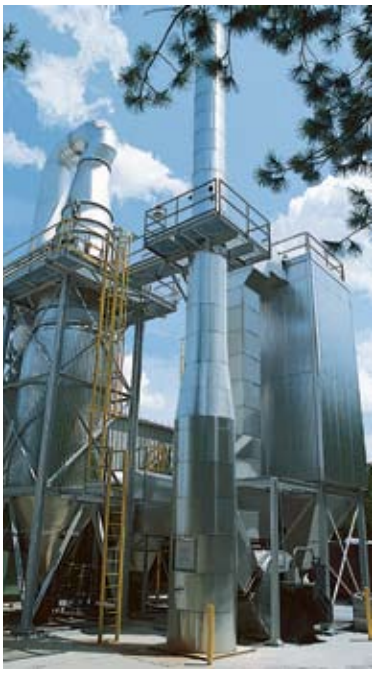
Fuels

- coal
- coke
- salt-laden hogged fuel
- culm
- solid waste
- pitch
- biomass
- refuse-derived fuel (RDF)
- oil refuse
- tire-derived fuel (TDF)
- manure
- paint sludge
- lignite
- wood waste
- hazardous waste
- medical waste
- municipal solid waste (MSW)

Features

A fully integrated system design that includes:

- modular construction
- single-point, removable top lids with integral pulsing system
- wide bag spacing



This turnkey system uses evaporative cooling, dry reagent injection, and a fabric filter to control acid gas and particulate emissions from a medical waste incinerator.

A pair of spray-dry scrubbers, each with its own three-module fabric filter, control HCl, SO_2, and particulate from two 100-tons per day municipal solid waste incinerators.

A sixteen-module fabric filter system controls particulate from a 650,000 lb/hr circulating fluidized-bed boiler that burns anthracite culm.

Two six-module fabric filters control the emissions from a coal-fired, circulating fluidized-bed boiler.

Modular Construction

McGill's use of modular components simplifies and reduces erection time resulting in lower construction costs. It can also speed up major repairs or rebuilds by having to replace only the affected components. The photo sequence below, from left, clockwise, depicts McGill's modular concept.

A fabric filter module delivered to the jobsite and ready to be rigged for lifting.

With the foundation work completed, and the structural steel erected, the last of the modules for this fabric filter system is lifted into place.

The completed system, comprised of two spray-dry scrubbers and two fabric filters, controls SO_2, HCl, Hg, and particulate from four coal-fired boilers.

Once the modules, hoppers, scrubbing tower, and manifolds have been erected, insulation is applied prior to the installation of the exterior sheathing.

Design Process and Considerations

McGill's sales and design engineers will review your specific process conditions and recommend the optimal fabric filter system to meet your emission control requirements. Their critical design analysis will include such considerations as:

- particulate removal requirements
- ash/dust characteristics
- flue gas chemistry
- operating temperature
- acid gas control requirements (if any)

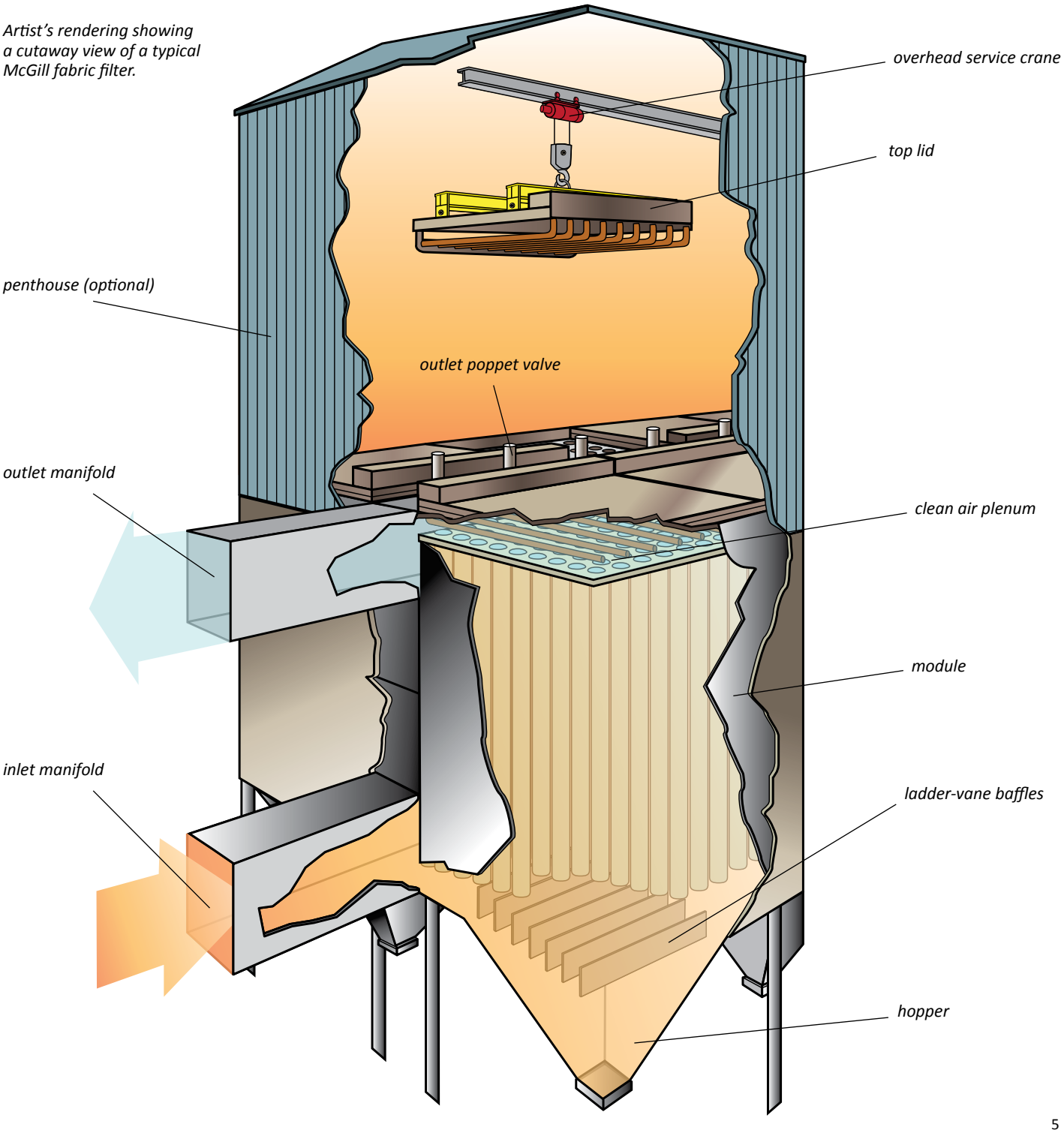
With our turnkey capabilities we are able to offer a single-source performance guarantee and equipment warranty for all of our systems. In addition to designing and manufacturing our own equipment, we also provide all auxiliary equipment for your complete installed solution. We offer maintenance services that include off-site monitoring, inspection, repair, rebuilds, and parts. Our product and service offering allows us to provide our customers with the best possible control technology in a cost-effective and turnkey manner.

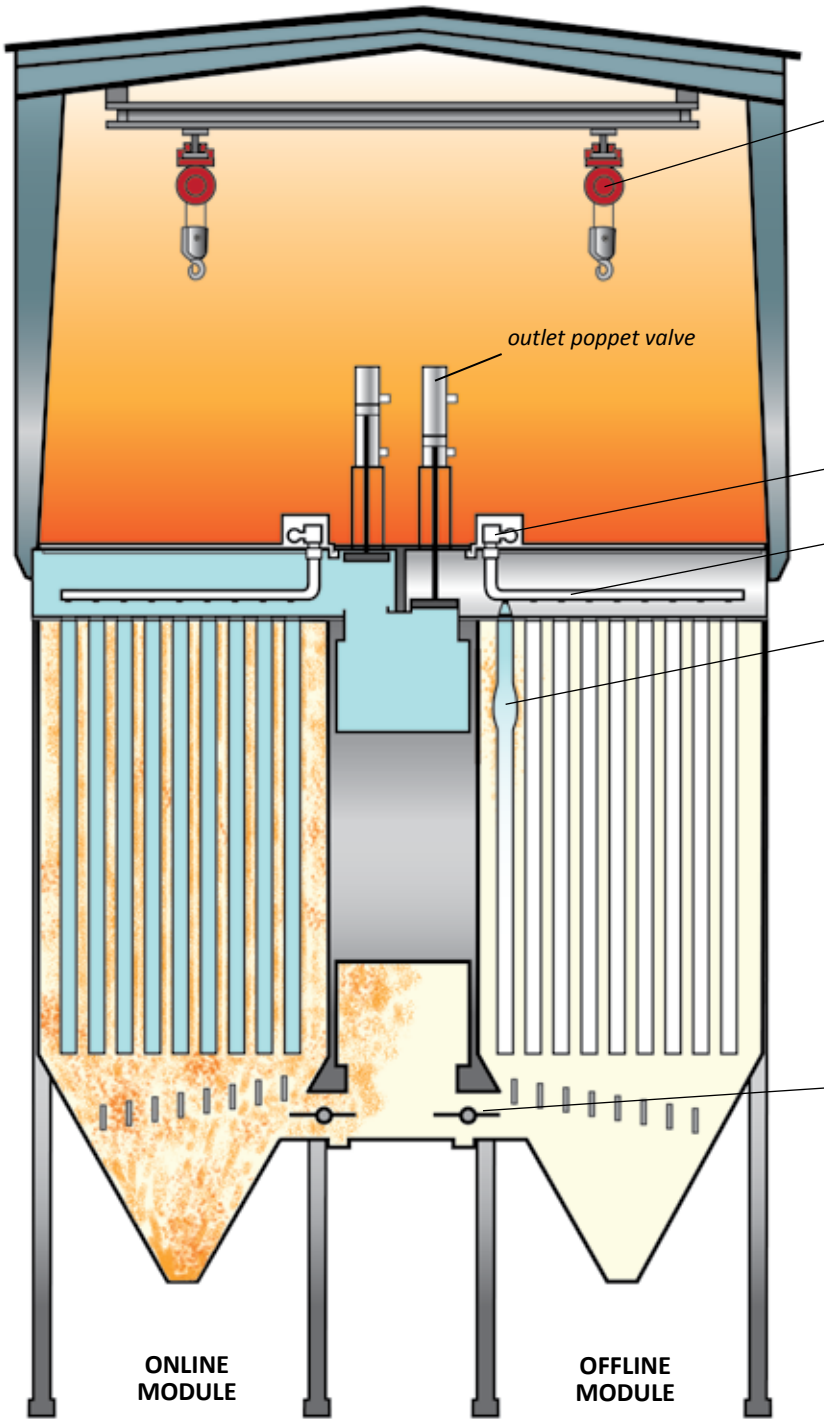
How McGill Fabric Filters Work

Collection Process

The collection process begins as dust and ash-laden flue gas enters the McGill fabric filter through an inlet manifold and is distributed to individual modules by passing through an inlet valve that remains open except during maintenance. Once inside the module the flue gas strikes ladder-vane baffles causing the largest particulate to fall into the collection hopper. The baffles then distribute the flue gas evenly throughout the cross section of the module. As the flue gas flows from the outside into the inside of the bag, particulate is collected on the outside surface of the bag. Inside each bag is a rigid wire cage that keeps the bag from collapsing. The cleaned flue gas then flows out the top of the bag through an opening in the tube sheet. Upon exiting the bags, the cleaned flue gas enters a clean air plenum and passes from the module through an outlet poppet valve. This valve can be closed as needed to isolate modules for maintenance or bag cleaning. An outlet manifold system then directs the cleaned flue gas from the modules to a common discharge point.

Artist's rendering showing a cutaway view of a typical McGill fabric filter.





During offline cleaning a module is isolated by closing its outlet poppet valve.

An artist's cross-sectional view of a McGill fabric filter system depicting on-line and off-line modules.

Cleaning Process

The fabric filter's control system automatically begins the cleaning sequence when the buildup of particulate on the bags causes the pressure differential to reach a preset level (a timed override is also provided). For off-line cleaning, a module is isolated by closing its outlet poppet valve. The bags in the isolated module are then pulsed one row at a time. Solenoid-piloted diaphragm valves provide bursts of compressed air that travel the length of the bags causing them to flex outward. The corresponding snap of the bag back on the cage dislodges particulate from the outer surface of the bags, which drops into a hopper and is collected for removal. After all the bags within the module have been cleaned, there is a null period to allow dislodged particulate to settle into the hopper. Once the null period is over, the module is brought back on-line and the next module is isolated for cleaning. Cleaning can also be performed on-line without isolating a module. This is especially beneficial in certain circumstances, such as when there is a high concentration of acid in the flue gas to be removed.

Gas Velocity and Distribution

Many fabric filter manufacturers size their systems strictly on the basis of the "air-to-cloth" ratio, overlooking the importance of the system's flue gas distribution and "can" velocity (see Figure 1). When gas distribution is uneven or internal velocities are too high, frequent bag cleaning, high abrasion, and high particulate re-entrainment can cause premature bag failure.

McGill considers both flue gas distribution and can velocity when designing a fabric filter system. We equip each module with ladder-vane baffles rather than the conventional strike plates or diffusers that many manufacturers use. In addition to removing large particulate, the baffles distribute the flue gas evenly throughout the module. By spacing the bags far enough apart (3 inches or more), we reduce the gas velocity around the bags to an acceptable level. Those design features prolong bag life and allow us to use bags up to 22 feet long, making the system less expensive and simpler to manufacture and maintain.

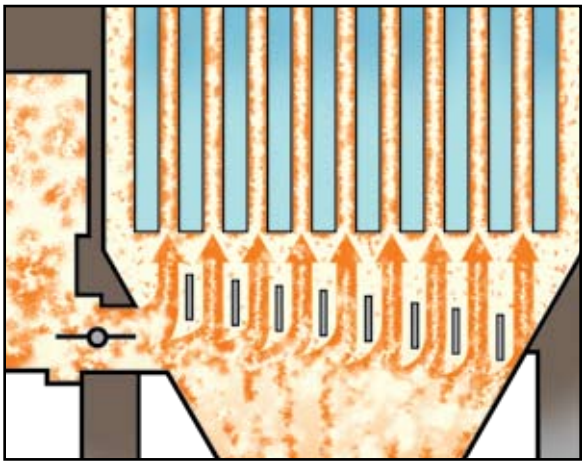


Figure 1 — Can Velocity

Can velocity is the velocity of the flue gas as it passes the bottom of the bags (maximum abrasive velocity), as shown in this illustration. It can be determined by using the following equation.

$$\text{Can Velocity} = \frac{\text{Gas Volume Flow per Module (net conditions)}}{\text{(Module Cross-Section Area)} - \text{(Bag Bottom Area)}}$$

Easy Maintenance

Bag inspection and replacement are the most critical and time-consuming maintenance operations performed on a fabric filter system. To inspect and service the bags properly, the module design must provide easy access to the bags and a safe work environment for maintenance personnel. McGill fabric filters are designed so maintenance work can be done from the outside of the module, free from exposure to particulate and flue gas. Maintenance personnel have easy access to the bags from atop a roomy platform the size of the width and length of the module rather than from a confining walk-in plenum that most other designs have. For large systems, a 3-ton crane is provided to remove the top lid of each module. Pulse piping and valves are removed with this lid, allowing safe and immediate access to the bags. Piping and valves can be electrically isolated and disconnected quickly and easily.

A view from inside the penthouse atop the fabric filter system.

An overhead crane is used to remove the top lids from the fabric filter's modules to provide easy access to the collection bags.

With the top lid removed, bag maintenance can be performed in a safe, ambient air environment.

Products depicted in this brochure were current at the time of publication. As a quality-conscious manufacturer, McGill AirClean is continually seeking ways to improve its products to better serve its customers. Therefore all designs, specifications, and product features are subject to change without notice.

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