INTERPROJEKT
ENGINEERING GmbH

Interprojekt Engineering

CERAMIC CATALYTIC FILTER SYSTEMS

Licensed product by McGill AirClean™

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Dry scrubber, twelve-module catalytic filter, and SCR system to control NOx, SO_2 , and particulate on a float glass furnace.

Interprojekt is an owner-managed engineering company founded in 1990 in Essen. With a competent team of engineers we provide all engineering services including consulting, planning, detail engineering, manufacturing, assembly and assembly supervision as well as commissioning and after-sales service. All services are provided by a single source in connection with our sister company DAS in the Czech Republic and our long-term partner for the electrical equipment the ELKA from Krefeld. We supply components and turnkey plants for exhaust gas purification and waste heat recovery. With our long-term partner and licensor for candle filters McGill AirClean, we have had catalytic candle filters in our portfolio since 2021.

Our portfolio:

- Dry Electrostatic Precipitator
- Catalytic Candle Filter, Licensed product by McGill AirClean™
- Wet Electrostatic Precipitator
- Precipitation of SOx. HCl and HF
- Precipitation of NOx (SCR / DeNOx, Catalytic Candle Filter)
- Batch Preheating
- Frozen Cullet system (Defrosting and heating of cullets)
- Hot water boiler / Electricity generation from waste gas heat

How Catalytic Filter System Works

The Process

Before entering the catalytic filter, the flue gas, laden with particulate, acid gases, and NOx is treated with a dry alkaline reagent, for acid gas reduction, and an ammonia reagent, for NOx reduction.

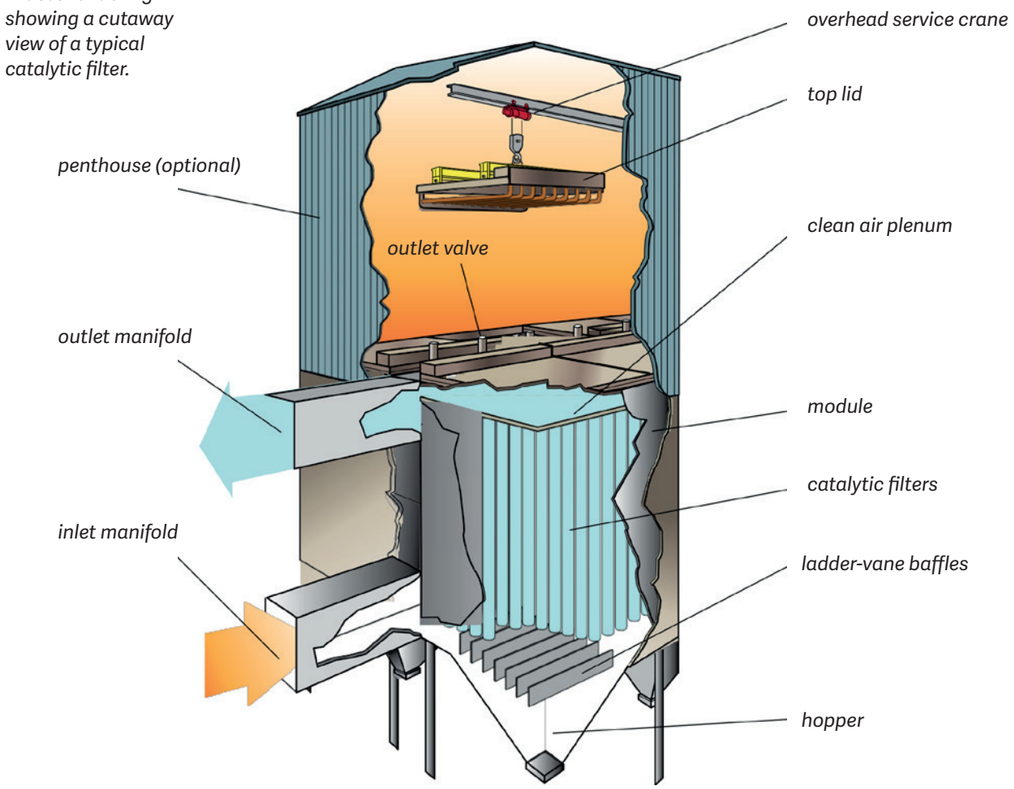
Dry alkaline reagent is pneumatically injected in the flue gas duct, up-stream of the catalytic filter, where acid gases react with the alkali to form solid particulate salts. The reacted salts and un-reacted alkali will be collected on the exterior surface of the catalytic filters and form a dust cake. The dust cake, on the filters, provides a secondary reaction site for the unreacted alkali to react with the acid gases.

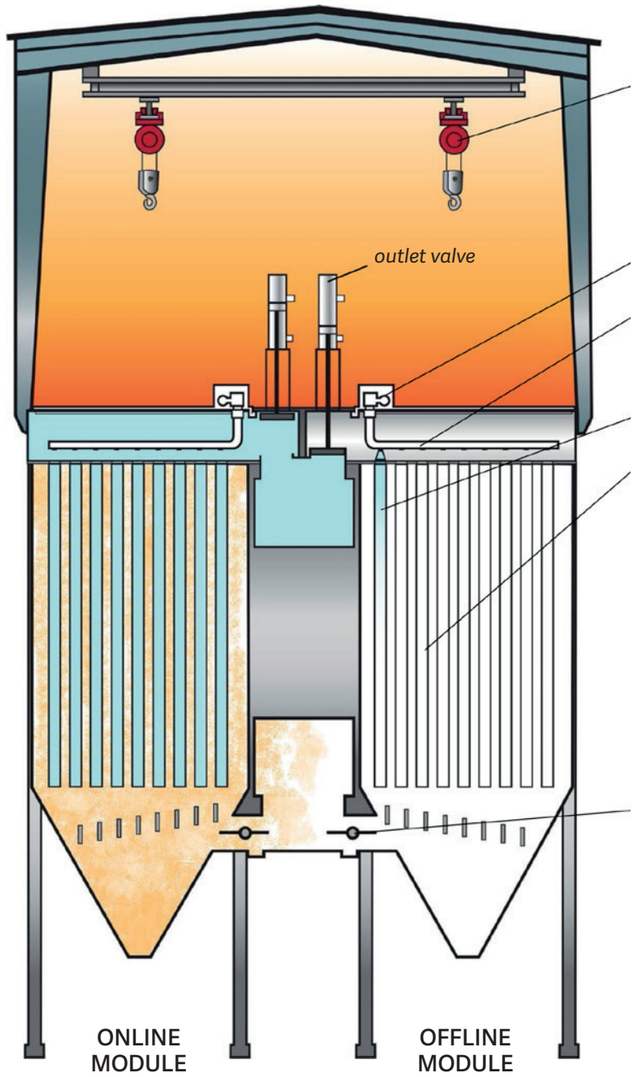
Ammonia or urea is also injected in the flue gas duct up- stream of the catalytic filter. The catalyst present in the ceramic filters drives the reaction between the ammonia or urea reagent and NOx to form diatomic nitrogen (N_2) and water (H_2O) vapor.

The collection process begins as dust, acid gases, and NOx laden flue gas enters the Interprojekt catalytic filter through an inlet manifold and is distributed to individual modules by passing through an inlet valve that remains open except during maintenance.

Once the flue gas enters the catalytic filter 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 filters, particulate is collected on the outside surface of the ceramic filter. The cleaned flue gas then flows out the top of the filters through an opening in the tube sheet. Upon exiting the filters, the cleaned flue gas enters a clean air plenum and passes from the module through an outlet valve. This valve can be closed as needed to isolate modules for maintenance or filter 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 catalytic filter.





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

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

Cleaning Process

The catalytic filter's control system automatically begins the cleaning sequence when the buildup of particulate on the filters 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 valve. The filters 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 filters causing the particulate to dislodge from the outer surface of the filters.

The particulate drops into a hopper and is collected for removal. After all the filters 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 online, 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 catalytic 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 filter cleaning, high abrasion, and high particulate re-entrainment can cause premature filter failure. We consider both flue gas distribution and can velocity when designing a catalytic 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 filters far enough apart (75 mm or more), we reduce the gas velocity around the filters to an acceptable level. These design features prolong filter life making the system less expensive and simpler to maintain.

A view from inside the penthouse atop the system.

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

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

Easy Maintenance

Filter inspection and replacement are the most critical and time-consuming maintenance operations performed on a catalytic filter system. To inspect and service the filters properly, the module design must provide easy access to the filters and a safe work environment for maintenance personnel. Our catalytic 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 filters 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 filters. Piping and valves can be electrically isolated and disconnected quickly and easily.

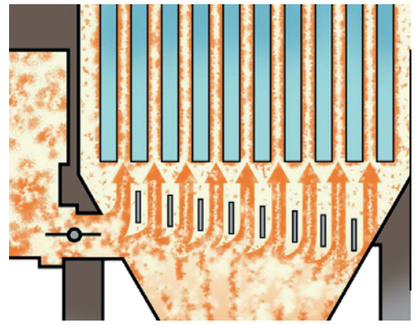


Figure 1 – Can Velocity

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

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

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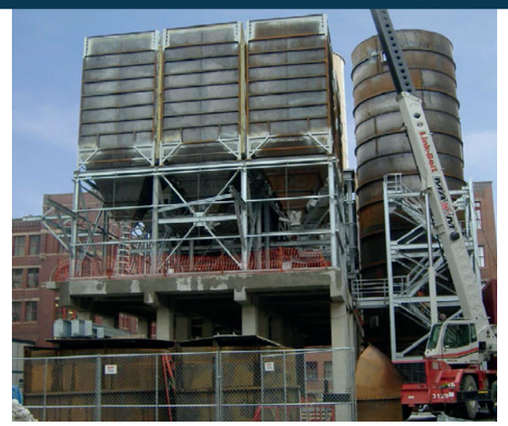
5 Module Catalytic Filter System, controlling particulate, SOx and NOx on a container glass furnace.

Modular Construction

With 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 on the right depicts the modular concept.

A catalytic 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 catalytic filter system is lifted into place.

Once the modules, hoppers, scrubbing tower, and mani- folds have been erected, insulation is applied prior to the installation of the exterior siding.

The completed system.

4 Module Catalytic Filter System, controlling particulate and NOx on a container glass furnace.

Design Process and Considerations

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

- Particulate removal requirements
- NOx removal requirements
- Acid gas removal requirements
- Dust characteristics
- Flue gas chemistry
- Operating temperature

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 turn-key manner.

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www.interprojekt.org

Interprojekt Engineering GmbH Nienhausenstraße 50 D - 45883 Gelsenkirchen
Phone: +49 201 830 26 0 Fax: +49 201 830 26 50 Email: interprojekt@interprojekt.org