Hot Gas Filtration

With increasing regulations world-wide on industries generating flue and process gas containing particulate matter and other pollutants, many companies face the challenge of how to reduce these emissions. Macrotec’s Hot Gas Filters can be used in incineration to biomass boilers in the removal of particulate to below 5 mg/m³, with our dry gas scrubbing removing acid gasses, dioxins and heavy metals.

Typical Uses

Our hot gas filtration plants are used in multiple applications and industries such as:
- Incineration
- Cremation
- Gasification & Pyrolysis
- Biomass Combustion
- Nuclear Waste Processing
- Mineral Processing and Smelting
- Coal Drying
- Cement Production
- Foundry Processes
- Waste-to-Energy

What is Hot Gas Filtration?

Multiple industrial processes produce emissions, containing products which are hazardous to your health and pollute the environment. Most countries have instituted regulations that limit these emissions, requiring these gasses to be filtered. Since these gasses often reach several hundred degrees, conventional bag-type filters will fail quickly due to the high temperatures, leaving ceramic hot gas filtration as the only long term reliable option.

Particulate Matter often consists of fine particles (PM 2.5), which are extremely harmful to people. PM 2.5 is unfortunately able to pass through many conventional filters, with ceramic hot gas filtration offering the only reliable method of capturing. Dry gas scrubbers are used in conjunction with ceramic filters to either adsorb or neutralise other harmful products such as hydrogen chloride (HCl), sulphur dioxide (SO₂), hydrogen fluoride (HF), lead (Pb), mercury (Hg) and dioxins.

Why choose Macrotec?

Macrotec’s extensive experience with combating all types of emissions has given us a unique perspective in hot gas filtration and filtration technologies. In order to strengthen our product offering and expertise, we have teamed up with Glosfume, a UK company who are the world leaders in hot gas filtration.

Together we have the experience, expertise and product offerings for a wide array of industry applications.
**Typical Emissions**

Below are the typical emissions of our Filters working with Macrotec Dry Gas Scrubbing:

<table>
<thead>
<tr>
<th>EMISSION</th>
<th>MACROCERAMIC</th>
<th>GLOSFUME</th>
<th>TYPICAL EMISSION LIMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particle Matter</td>
<td>&lt; 8</td>
<td>&lt; 3</td>
<td>10</td>
</tr>
<tr>
<td>CO</td>
<td>&lt; 35</td>
<td>&lt; 5</td>
<td>50</td>
</tr>
<tr>
<td>HCl</td>
<td>&lt; 5</td>
<td>&lt; 5</td>
<td>10</td>
</tr>
<tr>
<td>SO</td>
<td>&lt; 10</td>
<td>&lt; 5</td>
<td>50</td>
</tr>
<tr>
<td>No</td>
<td>&lt; 100</td>
<td>&lt; 55</td>
<td>200</td>
</tr>
<tr>
<td>HF</td>
<td>&lt; 0.15</td>
<td>&lt; 0.05</td>
<td>1</td>
</tr>
<tr>
<td>Heavy Metals</td>
<td>&lt; 0.05</td>
<td>&lt; 0.1</td>
<td>0.05</td>
</tr>
<tr>
<td>Dioxins</td>
<td>&lt; 0.1</td>
<td>&lt; 0.1</td>
<td>0.1</td>
</tr>
</tbody>
</table>

*All measurements are in mg/m³ (11% O₂, STP), except dioxins, which are ng/m³.

**How does Ceramic Hot Gas Filtration work?**

Our ceramic filtration units work by drawing the flue gas through hollow ceramic filter elements, capturing particles on the filter wall. The structure of the filter elements is so fine, even PM 2.5 is captured. The filter unit is split into “dirty” and “clean” compartments, with the flue gas entering on the “dirty” side and particulate matter being captured on that side of the filter element. Clean air then passes from the filter element into the “clean side” and out to the stack.

The filter elements are periodically cleaned down with reverse pulse cleaning using compressed air, discharging the built-up particles to a collection bin.
**Our Ceramic Filter Elements**

An important element to Macrotec’s filters are our ceramic filter elements, which are designed and manufactured by Glosfume. These elements are able to operate at temperatures of up to 1,000°C, at a 99.99% efficiency and are able to remove sub-micron particles. For optimum performance and reliability, all Glosfume ceramic filter elements are formed from engineered fibres using a fully automated process. During manufacture, forming times and pressures are strictly maintained to achieve stable pressure drop and bulk density. Every tenth element manufactured is tested and recorded, then packed in barcoded packaging to ensure complete traceability.

For the best possible performance, each element is fully machined to high tolerances. A specially formed surface allows dust to form a conditioned layer that assists the removal of submicron particles. Gas flow is improved, and more evenly distributed by the unique tapered profile of each element. The taper makes it easier to clean the filter element.

**Dry Gas Scrubbing**

Our hot gas filters are designed with gas scrubbing in mind, with our filters able to easily incorporate sodium bicarbonate and activated carbon scrubbing. These are used to neutralise acid gasses such as HCL, HF, SO₂ and adsorb dioxins and heavy metals such as mercury and lead.

Our hot gas filtration units are also designed for optimal performance of sodium bicarbonate for its effective range of 140°C to 450°C, while operating at higher velocities and thus there is no requirement for reaction towers or other ancillary equipment for effective dry scrubbing. Filters are modelled using CFD software to ensure even distribution and retention of the scrubber for optimal reaction. An additional benefit of dry gas scrubbing at temperatures above 400° is that reformation of dioxins are prevented. This cannot be achieved by bag filters, which operate between 140°C to 260°C due to ignition risk of the media.

**Our Filter Options**

Macrotec provides three different filtration systems; our high temperature MacroCeramic filters for up to 900°C, Glosfume filters for up to 450°C for the lowest emissions and Glosfume biomass filters. Standard filter pods go from 3500 to 9800 Am³, but with all filters being modular units which can be linked for extremely large processes. The modular units also allow for easier installation, lower transport costs, flexible installation footprint, high redundancy, and easy maintenance.

**Advantages of Ceramic Filtration**

- Ceramic elements can withstand temperatures of up to 1,000°C, compared to 140°C to 260°C for bag filters.
- Non-flammable.
- Totally resistant to acids and alkalis.
- Operating temperature of up to 450°C (Glosfume units) and 900°C (MacroCeramic), allowing for scrubbing at the most efficient temperatures and during almost all processes.
- No need for reaction towers or cyclones.
- Lowest emission level achieved with constant and reliable performance.