High Flow Filter Systems

for amine processing environments

Upset amine system? You’re not alone.
Prevent upsetting problems from getting worse

Most amine plants have a purification system consisting of hydrocarbon removing separators such as flash tanks, scrubbers and granulated activated carbon (GAC) beds. They also have particle filters such as the 3M™ High Flow Filter Cartridge to remove solids. The purifying system components are not entirely independent. Upstream components must work properly to maximize the performance of the downstream purifying equipment.

For instance, the scrubber removes oily liquids that would prematurely blind the particle filters. The particle filters remove contaminants that could plug the GAC. Each purification component works best when supported by the others. Together, they work in harmony to optimize the total amine unit.

Upsets are a fact of life in amine systems, whether they are in refineries, gas plants or ammonia plants. Unfortunately, that means operational crises, downtime and extraordinary costs.

Now there’s help. The 3M™ High Flow Filter System. With the 3M high flow filter system, you can maintain a healthy amine purification system to minimize upsets such as amine foaming, sour gas and poor heat exchange. That means you save time and money.

The 3M system consists of 3M™ High Flow Filter Cartridges housed in 3M™ High Flow Filter Vessels. The system’s cartridges or particle filters catch more contaminate than competing filters. They last longer and filter more amine. The filter vessels are easy and quick to install or change. Combined with a well-maintained coalescer or granulated activated carbon (GAC) the high flow filter cartridges and vessels add up to an ideal purification system for maintaining peak amine sweetening efficiency and a trouble-free operation.

The 3M™ High Flow Filter Cartridge uses meltblown polypropylene microfibers to achieve very high particle removal efficiencies.

The radial pleat packs up to 200 square feet of filter media in each 7 inch x 40 inch cartridge.

The redundant O-rings provide a high performance seal that reduces the chance of by-pass. The O-rings are available in five different materials for broad chemical compatibility.
The secret is in the radial pleat

The 3M™ High Flow Filter Cartridges are made with a patented radial pleat that permits a larger surface area design than competitive pleated cartridges. A larger diameter permits more filter surface area. The radial design eliminates the wedge-like voids between pleats commonly found in vertically pleated cartridges. The 3M filter can pack up to 200 square feet of media in a single cartridge. You pay less per square foot of media because you are buying fewer cores, sleeves and endcaps.

More surface area means:
- more places to catch contaminates and therefore more contaminate holding capacity — up to 22 pounds per cartridge
- more time between change-outs and therefore lower labor costs and downtime
- higher flow rates per cartridge minimizing the number of cartridges needed

Made with polypropylene meltblown microfiber filter media, the high flow filter cartridge provides high filtering efficiency at low micron ranges. The 3M model number 746B which is rated at 99% efficiency at 15 micron, for example, is most often used for amine filtration to obtain an ideal total suspended solids level of less than 10 ppm. Other micron ratings are available to meet your specific needs.

The patented radial pleat design allows greater packing of usable filter media into each cartridge.
The 3M™ High Flow Filter Vessels have been designed to maximize productivity and minimize problems. The vessels are available in standard vertical and horizontal designs to hold from 1 to 29 cartridges in a single housing.

For maximum ease-of-use, the horizontal vessel design is recommended for amine service. This configuration allows an operator to change out filters from ground level. Heavily loaded cartridges slide out easily and can be dropped into a waste container without undo strain.

All housings have perforated guide tubes for easy and quick cartridge installation. There are no loose parts, such as spring and seal assemblies or v-posts to take out and reinstall. The 3M cartridges are designed with a redundant O-ring seal that reduces the chance of bypass. No need to worry about seating the cartridges properly because closing and tightening the lid automatically seals the cartridges in the receptacle.

Although it often takes several hours to change many competitive filter systems, one operator can typically change 3M high flow filter cartridges in 3M high flow filter vessels in only 30 minutes. And with the 3M system, the frequency of change-outs is reduced, as well. This increases worker safety by minimizing their exposure to harmful gasses and chemicals such as hydrogen sulfide.
With 3M filters cleaning your amine, you can look forward to fewer problems. You can expect:

- Reduced contamination of heat exchangers and contactor trays
- Less erosion and corrosion of piping
- Reduced amine foaming
- Reduced use of foam inhibitors
- Longer carbon life
- Less downtime
- Less upset recovery time
- Fewer cartridges to dispose
- Less worker exposure

With a well-maintained purification system that uses 3M high flow filter cartridges, you will have lower overall filtration costs including labor and disposal costs.

### Capacities for Standard 3M™ High Flow Filter Vessels

<table>
<thead>
<tr>
<th>Number of Cartridges</th>
<th>Vessel Diameter (inches)</th>
<th>Total Flow Recommended (gpm)</th>
<th>Total Surface Area (sq. ft.)</th>
<th>Total Dirt Holding Capacity (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>40</td>
<td>200</td>
<td>22</td>
</tr>
<tr>
<td>2</td>
<td>8 ea.</td>
<td>80</td>
<td>400</td>
<td>44</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>160</td>
<td>800</td>
<td>88</td>
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<tr>
<td>5</td>
<td>20</td>
<td>200</td>
<td>1000</td>
<td>110</td>
</tr>
<tr>
<td>7</td>
<td>24</td>
<td>280</td>
<td>1400</td>
<td>154</td>
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<tr>
<td>11</td>
<td>30</td>
<td>440</td>
<td>2200</td>
<td>242</td>
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<tr>
<td>18</td>
<td>36</td>
<td>720</td>
<td>3600</td>
<td>396</td>
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<tr>
<td>21</td>
<td>42</td>
<td>840</td>
<td>4200</td>
<td>462</td>
</tr>
<tr>
<td>29</td>
<td>48</td>
<td>1160</td>
<td>5800</td>
<td>638</td>
</tr>
</tbody>
</table>

The specially designed 3M™ High Flow Filter Vessels are available in standard sizes to hold up to 29 cartridges. The chart above displays typical flow rates and dirt-holding capacities of the system.

This graph shows the weight of cartridges required to remove 100 pounds of contaminant. Less weight means lower disposal costs.
**Better... Faster... Cheaper...**

**High performance filtration.** Extremely high dirt holding capacity. Quick and easy filter change-outs. Higher volume throughput in a given space. All of these features result in a filter system with very low operating costs and excellent filter economy.

**Comparing the 3M™ High Flow Filter System Against Conventional Cartridge Systems**

![Comparison Diagram](image)

**Comparison Facts: 3M vs. the Competition**

<table>
<thead>
<tr>
<th>Comparative Measure</th>
<th>Typical Filter Cartridges Rated at 5 microns</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3M™ High Flow Filter System</td>
</tr>
<tr>
<td>Typical number of cartridges to handle 550 gpm</td>
<td>11 each x 40 in. length</td>
</tr>
<tr>
<td>Total filtering surface area</td>
<td>2200 sq. ft.</td>
</tr>
<tr>
<td>Expected dirt holding capacity</td>
<td>242 lbs.</td>
</tr>
<tr>
<td>Typical total cost of cartridges per filled vessel</td>
<td>$4,037</td>
</tr>
<tr>
<td>Cost per pound of dirt captured</td>
<td>$16.68</td>
</tr>
<tr>
<td>Typical time/labor needed for change-out</td>
<td>0.5 operator hour</td>
</tr>
</tbody>
</table>
Use full flow through the filter because...

Consider the recirculating fluid system (diagram) which has a continuous stream of contaminant added to it at a 10 ppm level. If the recirculating fluid is clean initially, a filter system that removes particles with 100% efficiency and has the full stream of fluid going through the filter will have 10 ppm of dirt at point A and 0 ppm of dirt at point B.

On the other hand, a 100% efficiency filter that has only 10% of the fluid going through it and 90% going through the bypass loop will have 10 ppm of dirt at point A and 9 ppm of dirt at point B on the first pass. On the next turnover of the system, an additional 10 ppm is added to the remaining 9 ppm in the system. That means the dirt concentration is now 19 ppm at point A. Of that 19 ppm 10% (1.9 ppm) gets filtered and 90% (17 ppm) bypasses. Particle concentration increases until eventually it reaches equilibrium where the upstream concentration is 100 ppm, the filter removes 10 ppm and 90 ppm bypasses (see table). This model assumes components in the main process do not remove particles.

In both cases the filter ultimately removes 10 ppm of contaminant. In the first case the main process sees no dirt and in the second case the system quickly builds up to 90 ppm of contaminant in constant circulation to the main process. In an actual recirculating amine system, the heat exchangers, contactor trays, reboiler, etc., becomes an additional filter removing some of the 90 ppm of dirt in the loop. Where do you prefer to remove the contaminates — in the particle filters or in the heat exchanger?

Particle Concentration vs. Turnovers in a Filter System with a 90% Bypass Loop

<table>
<thead>
<tr>
<th>Turnover</th>
<th>Concentration Point A (ppm)</th>
<th>Concentration Removed by Filter (ppm)</th>
<th>Concentration Point B (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.0</td>
<td>1.0</td>
<td>9.0</td>
</tr>
<tr>
<td>2</td>
<td>19.0</td>
<td>1.9</td>
<td>17.1</td>
</tr>
<tr>
<td>3</td>
<td>27.1</td>
<td>2.7</td>
<td>24.4</td>
</tr>
<tr>
<td>4</td>
<td>34.4</td>
<td>3.4</td>
<td>31.0</td>
</tr>
<tr>
<td>5</td>
<td>41.0</td>
<td>4.1</td>
<td>36.9</td>
</tr>
<tr>
<td>6</td>
<td>46.9</td>
<td>4.7</td>
<td>42.2</td>
</tr>
<tr>
<td>∞</td>
<td>100.0</td>
<td>10.0</td>
<td>90.0</td>
</tr>
</tbody>
</table>
Optimize with a 3M full flow system

Particle Concentration vs. Turnovers

With conventional 2.7-inch diameter cartridge systems, it is often cost prohibitive to filter your entire amine stream. The new 3M® High Flow Filter System is the first system that allows you to filter your entire amine stream cost effectively and productively. Why filter the full amine stream? Consider the following:

- **Optimize total system efficiency and energy**
  By only filtering a portion of your amine stream, you are allowing particles to deposit themselves in other parts of your system. For example, filtering a 25% sidestream means that 75% of the remaining dirt continues to recirculate, increasing the probability that some of this dirt will be deposited in critical parts of your system such as the tower, reboiler or flash tank. This can compromise total system efficiency and energy.

- **Reduce the number of costly turnarounds**
  Since dirt build up in the amine unit will be minimized with full flow filtration, the number of times that the total system must be shut-down for clean-up will decline.

- **Reduce recovery time from days to hours**
  Full stream filtration can lessen the severity of inevitable upsets leading to much quicker recovery time. This is because the amount of “free” dirt in the system that needs to be captured to resolve the upset is much reduced.

- **Reduce the costs associated with upsets**
  The high dirt holding capacity of the 3M high flow filter system can dramatically decrease or even eliminate costly and time-consuming filter change-outs during an upset period.

*Using less than full stream filtration allows some particles to remain in the system at unacceptable levels as the above chart shows. In this example, the data from the table on page 7 is plotted as the “10% Filtered” curve. Bypass loops of 75%, 50% and no bypass are also shown.*
Should I run my system with a filter bypass loop or full flow through the filter?
When it comes to filtering amine, you’re never alone. Our amine technical specialists stand ready to help. Let us assist you in all aspects of your amine filtration. If you want to streamline your amine filtration system or initiate greater flow rates in your filtration process, for example, we can help you design a system to meet your needs. We’ve successfully converted operations like yours to the 3M amine filtration system and saved them thousands of dollars a month in the process. We are also trouble-shooters and a technical resource.

For amine filtration advice, product information, or a sales representative call 1-800-648-3550.

Typical Amine System

IMPORTANT NOTICE: User is responsible for determining whether this product is fit for a particular purpose and suitable for user's method of application.

Filters used with hazardous materials may retain the same hazardous properties as the filtered liquid or gas. Always wear appropriate respiratory equipment and protective clothing when handling filters used with hazardous materials. Dispose of only in accordance with federal, state, and local laws and regulations.

LIMITATION OF REMEDIES AND LIABILITY: If the 3M product is proved to be defective, the exclusive remedy, at 3M’s option, shall be to refund the purchase price of or to repair or replace the defective 3M product. 3M shall not otherwise be liable for loss or damages, whether direct, indirect, special, incidental, or consequential (including, but not limited to, loss of profits, investment, goodwill or business opportunity), regardless of the legal theory asserted, including negligence, contract, warranty, or strict liability.

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