Aspirating Smoke Detection for Duct Monitoring
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Ducts present a challenge for many traditional fire detectors due to environmental factors like high airflow and pressure fluctuations, creating the need for very early warning fire detection and uncompromising accuracy.

Ease of installation and ongoing maintenance is also a key concern when monitoring ducts, creating the need for a flexible, user-friendly system that can reduce downtime and ongoing costs.

Applications

Advanced next-generation FAAST™ aspirating smoke detection can be used in all duct applications including:

- Heating Ventilation and Air conditioning (HVAC) systems in:
  - Datacenter cooling systems
  - Floor voids
  - Transformer cooling systems
  - Applications with overpressure, e.g. surgery rooms, clean rooms and laboratories
- Industrial / manufacturing extraction systems

Key Criteria

FAAST™ provides the earliest and most accurate detection down to invisible smoke concentrations, allowing more time to implement counter measures and prevent full scale evacuations.

The detector can be located in an easy to access location, whilst the pipe network draws air directly to the detection chamber via sampling points. Advanced airflow monitoring, combined with intelligent dual optical detection ensures accuracy and reliability even in fluctuating environments.

Features & Benefits

- Class Leading accuracy and performance
- Low-level full system test capability (single operator), with no need for additional equipment or facility downtime
- Reduced maintenance needs resulting in considerable operational cost efficiencies
- Acclimate Mode manages fluctuating environmental factors to ensure reliable detection 24/7
- Remote monitoring with flexible status updates via email/smart phone/mobile
- Optimal detection 24/7 with no downtime
Duct monitoring is an essential aspect of any building’s fire protection; HVAC and extraction systems allow rapid transportation of smoke during fire events that can cause panic as well as delays in the intervention.

FAAST™ offers state-of-the-art sensitivity combined with the reliability demanded by these challenging applications:

- The ability to monitor fast airflows and overcome fluctuating environmental conditions
- Accurate detection of tiny amounts of smoke
- False alarm resistant
- Flexible installation testing and maintenance to overcome access issues
- Safe and timely evacuations achieved by the earliest, most accurate warning of an issue

Installation

When designing an ASD system for use in these environments, a system certified for Class B applications is recommended.

FAAST™ is being installed in a growing number of ducts, due to its industry-leading accuracy and earliest fire warning capability - up to 0.00095% obs/m.

The system can be easily installed by mounting a sample pipe inside the duct, whilst the unit is located in a separate, easy-to-access location.

Accurate detection and maximised system uptime can be achieved by considering the following guidance when installing a duct sampling point:

- Where to locate the pipe and the sampling points
- How to achieve pressure equalisation
- How to ensure minimised ongoing maintenance that can be carried out by a single operator

Please see Figure 1. below for pipe configuration details.

Application Challenges

Figure 1.
Location of Sample Pipes

Sampling pipe location is critical to total system stability and performance; incorrect positioning can result in air turbulence, increasing dust and particulate deposits and compromising HVAC efficiency.

Achieving Laminar air flow

To allow the airflow to become laminar (air moving at the same speed and in the same direction), the correct location of the sampling pipes is important.

The sampling pipe should be located 6-10 times the duct width from the bends or branch connections. It should also be placed centrally in the duct, with the exhaust offset by 1/4 of the total height (see Figure 2, right, showing a longitudinal cut through air duct).

Monitoring Large Ducts

Multiple rows of sampling pipes can be used for the detection of large ducts (see Figure 3, to the right, showing a longitudinal cut through air duct).

Please refer to your local standards and guidelines for further information.

Accommodating HVAC Filtration

To ensure benchmark sensitivity and accuracy, monitoring should be carried out before the HEPA filtration (High Efficiency Particle Arrester). This prevents any dilution of the sample, as smoke particles may also be removed by the filter.

Figure 2.

Figure 3.
Sample Holes

Sample points should be positioned offset at a 20-45° angle in relation to the air flow. Mark the position of the sampling holes on the outside of the air duct to be able to identify the angle (see marking example in Figure 5. below).

Please refer to the table shown below in Figure 4. for information on the number and size of sampling holes to be used, depending on duct width.

<table>
<thead>
<tr>
<th>Duct Width</th>
<th>No. of Sampling Holes Per Pipe</th>
<th>Hole Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>300mm</td>
<td>2</td>
<td>6.5mm</td>
</tr>
<tr>
<td>500mm</td>
<td>3</td>
<td>6.5mm</td>
</tr>
<tr>
<td>700mm</td>
<td>4</td>
<td>4.5mm</td>
</tr>
<tr>
<td>900mm</td>
<td>5</td>
<td>4mm</td>
</tr>
<tr>
<td>1m</td>
<td>6</td>
<td>3.5mm</td>
</tr>
<tr>
<td>1.5m</td>
<td>8</td>
<td>3mm</td>
</tr>
<tr>
<td>2m</td>
<td>10</td>
<td>3mm</td>
</tr>
</tbody>
</table>

Pressure Equalisation

To maintain the pressurisation balance, the exhaust should be returned to the duct downstream of the monitoring sample pipe.

The exhaust pipe should be located 0.5m downstream from the inlet pipe and the exhaust pipe can be set up in two different configurations:

- A short pipe that protrudes 50 -75mm into the duct (no end cap). This method promotes better overall airflow through the detector, but may be more prone to faults caused by duct airflow fluctuations
- A pipe with four holes that is the same length as the sampling pipe. This configuration has less air passing through the detector, but is less prone to faults. When employing this configuration position the exhaust holes directly away from the airflow

Please see Figure 5. below for further information.
Tuning the Airflow

Adjusting the sampling pipe position in relation to airflow can be achieved by undertaking the following steps:

With the air handling units off, power up the ASD and set the configuration using the design software PipeIQ. After the start-up sequence, allow 5 minutes for the ASD to adjust to the pipe network.

Set the air handling units to the highest velocity and observe the flow pendulum on the FAAST unit: if the flow is low, carefully adjust the sampling pipe so that the holes are facing the oncoming airflow. If the flow is high, adjust the pipe so the holes are facing away from the airflow. A few degrees of rotation may have a significant impact.

Wait at least 1 min for the airflow to stabilise and adjust until the airflow data remains in the desired range. Shut off the air handling units and observe the airflow data. It should remain at or near the desired airflow.

Mark the angle of rotation on the duct, sealing and securing the sampling tube and then perform the relevant smoke test.

Please see Figure 7. bottom left for additional information.

Maintenance and Accessibility

A key benefit of using FAAST is its simplified ongoing maintenance and testing capability, helping to prevent downtime and reduce costs.

Test point

A single operator can perform simplified system testing by extending the sample pipe so it protrudes from the opposite side of the duct. The extended pipe should be fitted with a removable blank end cap.

The use of a union socket (as shown in Figure 6. above), is recommended to allow for maintenance. It's also useful for the selection of the final orientation during system commissioning.

The sampling pipe should also be installed close to inspection hatches, where possible.

Due to the dilution of the smoke particles created by high air flows, a minimum sensitivity of class B is recommended (please consider regional standards and guidelines).