White Paper

April 2011

Successfully Deploying

FAAST™ Fire Alarm Aspiration Sensing Technology
In Duct Applications

SYSTEM SENSOR®

Introduction

The FAAST™ Fire Alarm Aspiration Sensing Technology 8100 smoke detector is an extremely flexible combustion particulate sensor. It is suitable for a variety of fire protection applications, ranging from high-sensitivity, open-air protection of data centers to HVAC duct protection of theaters. The 8100 is the first aspirating smoke detector (ASD) designed to specifically discriminate dust from smoke particulate. Using its unique dual vision sensing technology, the detector is better able to discern threat from nuisance, limiting false alarms and keeping your facility operational 24/7.

Duct Sampling – Not So Trivial

One of the many popular uses of ASDs is in air-handling duct applications. Unlike traditional duct smoke detectors, ASDs usually offer higher sensitivity and active sampling.

However, with the benefits of active sampling come additional challenges. ASDs are required to monitor and maintain a minimum airflow volume. When operating inside ductwork, this can present a significant test of the ASDs capabilities. Not only will air speeds vary from duct to duct, but air speeds will often vary significantly within a duct. These variable air speeds are due to air handling units turning on and off or variable frequency drives, which provide more precise flow adjustments. The consequences to an ASD of variable air speeds can be as inconvenient as a flow fault or as dangerous as a reduction in sensitivity.

High-Sensitivity Duct Detection

In order to mitigate flow faults while maintaining adequate sensitivity, care must be taken when using an ASD in a duct application. System Sensor has tested the FAAST 8100 in a number of duct configurations. Analysis of test results and industry best practices has lead System Sensor to make the recommendations throughout the remainder of this whitepaper.

Small Ducts

For ducts less than 3 feet wide, the sampling pipe should be inserted into the duct at a height equal to half of the duct height (Figure 1).

Figure 1:

Small Diameter Duct

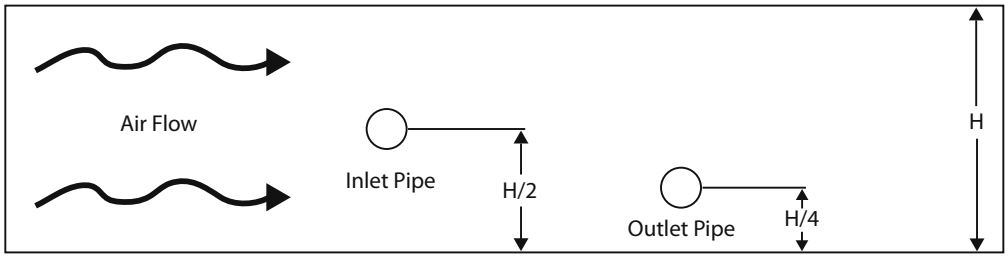


Table 1: Sampling Pipe Hole Size (Small Diameter Duct)

DUCT WIDTH	NO. OF HOLES	HOLE SIZE	NOMINAL PIPE FLOW RATE (CFM)
12 in. (300 mm)	2	1/4 in. (6.5 mm)	1.84 cfm (52.0 L/min)
20 in. (500 mm)	3	1/4 in. (6.5 mm)	1.83 cfm (51.9 L/min)
28 in. (700 mm)	4	11/64 in. (4.5 mm)	1.70 cfm (48.1 L/min)
36 in. (900 mm)	5	5/32 in. (4 mm)	1.81 cfm (51.2 L/min)

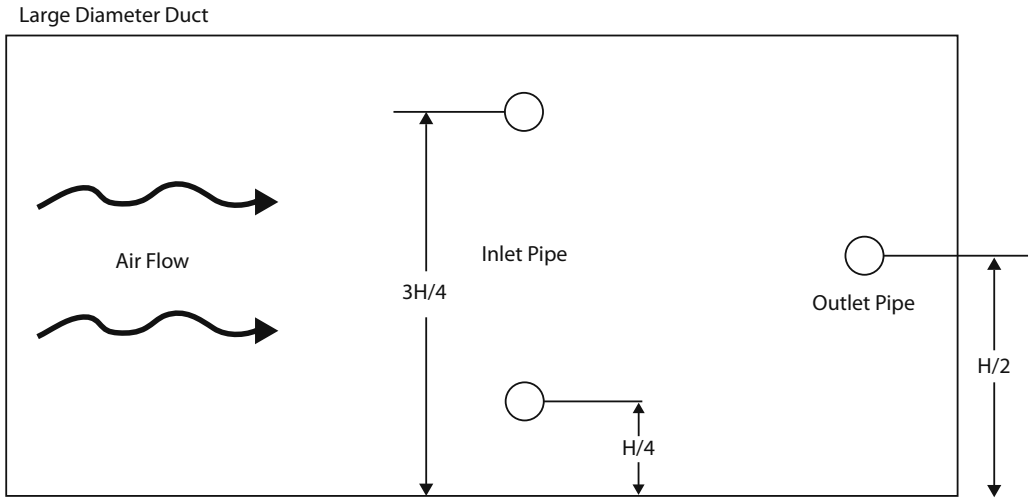
Always consult local fire codes for hole size and spacing requirements.

For sampling pipe holes, use Table 1 to drill evenly spaced holes into the sampling pipe along the same line. The hole drilling line should be marked with permanent ink and should be visible from outside the duct.

Large Ducts

For ducts larger than 3 feet wide, a branch configuration employing two sampling pipes should be used. One pipe should be inserted into the duct at a height equal to $^{3}/_{4}$ of the duct height. The other pipe should be inserted into the duct at a height equal to $^{1}/_{4}$ of the duct height (Figure 2).

Figure 2:



For sampling pipe holes, use Table 2 to drill evenly spaced holes into the sampling pipe along the same line. The hole drilling line should be marked with permanent ink and should be visible from outside the duct.

Table 2: Sampling Pipe Hole Size (Large Diameter Duct)

DUCT WIDTH	NO. OF HOLES	HOLE SIZE	NOMINAL PIPE FLOW RATE (CFM)
3 ft. 4 in. (1 m)	6	9/64 in. (3.5 mm)	1.77 cfm (50.2 L/min)
5 ft. (1.5 m)	8	1/8 in. (3 mm)	1.80 cfm (50.9 L/min)
6 ft. 6 in. (2 m)	10	1/8 in. (3 mm)	2.10 cfm (59.6 L/min)

Always consult local fire codes for hole size and spacing requirements.

Exhaust Pipe

The exhaust pipe should be located approximately 18 inches downstream from the sampling pipe(s). The exhaust pipe should be inserted into the duct at a height equal to $^1/_4$ of the duct height.

The exhaust pipe may be set up in two different configurations. The first option consists of a pipe of the same length as the sampling pipe with four $^3/_8$ -inch holes. Traditionally, fitting the exhaust pipe with holes has been the way to install ASDs in ducts. This configuration promotes somewhat more stability to the airflow passing through the detector with less overall sampling volume as a tradeoff. When employing this configuration, System Sensor recommends orienting the exhaust holes directly away from the airflow.

A second option is a short pipe that protrudes 2 to 3 inches into the duct and is not fitted with an end cap. This is a simpler method and promotes better overall airflow through the detector. However, this arrangement may be more prone to faults caused by duct airflow fluctuations. System Sensor recommends trying this configuration first and reverting to the traditional method if stabilizing the airflow pendulum proves difficult.

Installation

After determining the proper number and sizes of sampling pipes and sampling holes, all pipe should be cut to the proper length and holes added. The FAAST 8100 should be mounted to a nearby adjacent location and additional pipe run to the duct.

As a rule of thumb, duct sampling pipes should be located a distance of at least six duct widths from any disturbances to the duct airflow caused by sharp bends or branch connections. Holes should be cut into the ductwork at the appropriate location in the manner described above.

With all pieces assembled, insert the sampling and exhaust pipes into the duct but do not seal or cement. Using the line marked on the sampling pipe, orient the holes such that they are facing into the airflow and directed upwards at approximately 45 degrees.

Tuning the System

With the air handling units off, power up the 8100 and connect to it using the PipeIQ™ software. Using the PipeIQ, set the desired configuration parameters and reconfigure the device. Upon receiving a new configuration, the 8100 will automatically power down and reset. After a brief startup sequence, allow 5 minutes for the 8100 to adjust to the new pipe network.

Once 5 minutes have elapsed, turn on the air handling units, preferably at the highest velocity. Observe the behavior of the green airflow pendulum on the front of the 8100. If the pendulum begins to swing to the left, not enough air is entering the aspirating detector. Using the mark on the sampling pipe for reference, carefully adjust the sampling pipe so that the holes are facing slightly more towards the oncoming airflow. A few degrees of rotation may have a significant impact. After making the adjustment, wait at least 20 to 30 seconds for the airflow to stabilize and the pendulum to update.

If the pendulum swings to the right, too much air is entering the ASD. Using the mark on the sampling pipe for reference, carefully adjust the sampling pipe so that that the holes are facing slightly more away from the airflow. After making the adjustment, wait for the airflow to stabilize and the pendulum to update. Continue adjusting as necessary until the pendulum remains fixed directly in the middle position.

When satisfied with the position of the sampling tube, shut off the air handling units and observe the airflow pendulum. It should remain at or near the middle position. Mark the angle of rotation on the duct and complete the installation by sealing and securing the sampling tube as appropriate. Perform smoke testing as prescribed by the authority having jurisdiction.

Summary

Deploying aspirating smoke detectors inside ductwork requires planning and patience. By following the recommendations in this document and carefully tuning the angle of the sampling pipe, you will be able to successfully install a FAAST ASD in high-velocity air ducts while minimizing the occurrence of flow faults. With the flow issue resolved, facility operators will be able to enjoy the superior dust rejection and numerous other innovations that make the 8100 the new standard in Very Early Warning Fire Detection.

For more information on the
FAAST™ Fire Alarm Aspiration Sensing Technology,
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