



# Coffee Break Training - Fire Protection Series

## Fire Alarms & Detection: Smoke Detection in Duct Systems: Part 1

No. FP-2012-30 July 24, 2012

**Learning Objective:** The student shall be able to explain installation limitations for smoke detection in duct systems.

Smoke detection is installed in heating, ventilating, and air conditioning (HVAC) duct networks to prevent smoke from migrating through a structure's air handling system.

Circulating, closed-air handling systems often use the terms "supply" and "return." Supply air is that air which has been conditioned (heated or cooled) and is being supplied to an occupied space such as a classroom, bedroom, kitchen, etc. Return air is taken from the space and is returned to the air handling system for conditioning. Generally, those air handling systems where the return air volume equals or exceeds 2,000 cubic feet per minute (56,700 Lpm) require smoke detector shutdown and local mechanical codes or National Fire Protection Association (NFPA) 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems* to provide specific requirements.

NFPA 72, *National Fire Alarm and Signaling Code* recommends the use of wall- or ceiling-mounted open area detectors for smoke control in buildings because of the chance that smoke in the HVAC systems will be diluted by the air movement. Detectors may be ionization type, photoelectric, or both.

Smoke detectors listed for duct detection should not be substituted for open area protection (see "Coffee Break Training" 2010-34 for an explanation of listing limits) because smoke from open areas may not be drawn into the HVAC system when the air handling equipment is shut down for repair, maintenance, or simply not being used.

There are two primary methods of detector mounting: locating the detector inside the duct, or mounting the detector in a housing on the duct's exterior with its sensing element, sampling tubes, or projected beam inserted into the air stream. In-duct installations must be accompanied by a service access panel, so a technician can inspect, calibrate, and repair the smoke detector.

Detectors must be specifically listed for use in air handling systems and be compatible with the air velocity (in feet or liters per minute) through the HVAC system. (Note the difference between air **volume** that is measured in **cubic feet** or liters per minute, and air **velocity** that is measured simply in **feet** or meters per minute.) The range of acceptable velocities for a duct detector can be found on its manufacturers' specification sheet (catalog cut-sheet) or in the Underwriters Laboratories (UL) *Fire Protection Equipment Directory*. In all cases, the manufacturers' installation and testing instructions must be followed.

The velocity range for duct smoke detectors is critical to their successful operation. If the air flow is too little, the detector may not successfully detect products of combustion in the air stream. If the velocity is too high, the air flow may bypass the detector at such a rate that the detector cannot sense any fire products.

Air flow is measured with a manometer. The HVAC technician who installed the air handling system should have this device to "balance" the building's air delivery system. The fire alarm installer and HVAC contractor may have to coordinate their installations, so the fire inspector can witness proper tests.



This smoke detector assembly is mounted on the outside of a duct system and employs sampling tubes in the air stream to collect smoke particulates and carry them to the detector's sensing mechanism.



Eligible for Continuing Education Units (CEUs)  
at [www.usfa.fema.gov/nfaonline](http://www.usfa.fema.gov/nfaonline)

For archived downloads, go to:  
[www.usfa.fema.gov/nfa/coffee-break/](http://www.usfa.fema.gov/nfa/coffee-break/)