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Smoke Detector for Common Supply and Return Air Systems

Code: 2018 Mechanical Code **Date:** October 15, 2019
Section: 606.2.2

Question:
If two or more air-handling systems serve a common space and one or more of these systems serve additional spaces and the aggregate capacity of the combined systems exceeds 2,000 cfm (no single system exceeds 2000 cfm), **BUT there are no shared supply, return, or plenums**, what are the requirements for smoke detectors per Section 606.2.2?

Answer:
Before we can correctly answer this question, the definition of a **plenum** must be read in Chapter 2. It is reprinted here for convenience:

> PLENUM. An enclosed portion of the building structure, **other than an *occupiable space* being conditioned**, that is designed to allow air movement, and thereby serve as part of an air distribution system.

Therefore, by definition, an occupiable space is not considered a plenum. Now the question can be fully answered.

In the above scenario, there is no requirement for a duct detector under NCMC Section 606.2.2 because there is no shared supply or return ductwork, no plenums shared, and the room itself is not considered a plenum. An example of this would be a set of several fully-ducted systems that all are 2000 cfm or less, but in aggregate add up to over 2000 cfm.

Follow-up Question #1
If two or more air-handling systems serve a common space and one or more of these systems serve additional spaces and the aggregate capacity of the combined systems exceeds 2,000 cfm, **AND they share a supply, return, or plenum**, what are the requirements for smoke detectors per Section 606.2.2?

Answer:
Section 606.2.2 requires that when two or more air systems serve **common supply or return ducts** or **plenums** with a combined design capacity greater than 2000 cfm, the return system shall be provided with smoked detectors[i].

Follow-up Question #2
What is an example of a system that exceeds 2000 cfm but is incapable of spreading smoke beyond the enclosing walls, floors, and ceiling of the room or space in which the smoke is generated?

Answer:
An example of this would be a very large rooftop unit serving a big-box store where there is only a small stubbed-out supply and/or return into the open shopping space. Even if the unit is over 2,000 cfm, no duct detector is required. If several of the rooftop units were ducted together, but they still just supply and return air to the same big open space (no branch runs to another space), the exception to 606.2.1 still applies. It is not uncommon to see design professionals require one, but it is not required by minimum code.

Follow-up Question #3:
Does NC enforce the requirements of NFPA 90A[ii], which may require the use of duct detectors in additional places on larger air handler systems?

Answer:
No, not by minimum code.
Various organizations and industries may choose to follow the requirements of NFPA 90A for various reasons, but that is a design choice and not minimum code. If there is a building, and the design professional does not require the NFPA 90A requirements for duct detector placement, there is no code path in the NC Mechanical Code or NC Fire Prevention Code to require the following of NFPA 90A in regard to smoke duct detector placement. Refer to NC Mechanical Code section 606.2.3 for placement of duct detectors in return air risers.

Follow-up Question #4:
If there is a 100% outside air makeup air or ventilation unit, and it is over 2,000 cfm, is a smoke duct detector required?

Answer:
No.
The minimum code requirements are for return air systems, and a 100% outside air system has no return. Occasionally the design professional will specify a duct detector on a makeup air unit due to concerns from smoke being generated outside of the building and pulled into the building by the unit, but that is the prerogative of the design professional and the owner, and minimum code does not require it.

Follow-up Question #5:
Does the 2018 NC Mechanical Code require the installation of duct detectors in the supply air ducts of air handlers over 15,000cfm?

Answer:
No.
The 1996 NC Mechanical Code[iii] did require a duct detector in the supply air stream downstream of the filters for air handlers with a capacity greater than 15,000 cfm. That was to alarm in the scenario where the fire was within the air handler itself. However, this has not been a code requirement since the adoption of the 2002 NC Mechanical Code and all subsequent code cycles to 2018.

Keywords:

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[i] Refer to the Exception to 606.2.1 for a possible exception due to full coverage of area smoke detectors.
[ii] www.nfpa.org

[iii] NCMC [1996] Section 406.6: An air handling unit exceeding 15,000 CFM shall automatically shut down on detection of smoke by a duct type detector located downstream of the filters. This detector is in addition to the detector required in return air of units serving more than one space as required by NCMC [1996] 406.3.