

I. Contributors

Paul Keller, Jr., April Yungen, Zachary Ortwine, Randy Jackson

II. Introduction

Open air plenums can be found in all types of buildings as well as aviation, marine and transportation applications. The plenums within these buildings can often be contaminated with particulate ranging from simple nuisance dust to other hazards. Soiled open air plenums can adversely impact the conditioned space and this paper provides guidance for the inspection and cleaning of these areas.

III. Disclaimer

Although the following information reflects methods for inspecting and cleaning open air plenums, readers should recognize that new developments regularly occur and should familiarize themselves with the most current information when determining the appropriate steps to take.

NADCA recognizes that differences in opinion will exist as to how to manage open air plenums. NADCA also recognizes that industry professionals will decide whether or not various inspection and cleaning processes are appropriate for a given open air plenum, based on the unique circumstances surrounding that plenum.

This document was written in the United States of America and is intended primarily for use in this country. This material may also prove useful for industry professionals and others operating outside of the USA. All users of this document are encouraged to refer to applicable federal, state/provincial, and/or local authorities having jurisdiction over the subjects addressed within this document.

IV. Definition and Function

An open air plenum consists of intended non-ducted air pathways formed in building cavities, voids, and spaces outside of the occupied zone of the building. By design, it facilitates airflow between the HVAC equipment and the occupied space of a building.

Types and Identification of Open Air Plenums:

Supply plenum (positive) – Used in specific applications by design such as raised floor air distribution systems for data centers, certain clean rooms and other similar spaces.

Return/exhaust plenum (negative) – Used in specific applications by design such as ceiling/attic plenums, voids between walls, closets, raised floor and pipe chases. In a ceiling plenum with tiles, the removal of ceiling tiles will disrupt airflow patterns. It is particularly important to maintain the integrity of the ceiling and adjacent walls in areas that are designed to be exhausted, such as supply closets, bathrooms, and chemical storage areas. The presence of a transfer duct, transfer grilles, fire dampers, and/or louvered doors may indicate an open air return plenum.

Accidental air plenum – Leaky or disconnected ducts can create an unintentional open air supply or return plenum.

V. Need for Inspection, Cleaning and Restoration

According to ACR, The NADCA Standard, it is recommended that cleaning of HVAC system components be performed when a proper HVAC cleanliness inspection indicates that one or more of the following conditions exist. These conditions may also exist in open air plenums, prompting the need for cleaning and restoration:

- The HVAC system components are contaminated with an accumulation of particulate;
- The HVAC system components' performance is compromised due to contamination build-up;
- The HVAC system components have been determined to be a source of unacceptable odors;
- The HVAC system components are discharging visible dirt or debris into the conditioned space;
- The HVAC system components have been contaminated as a result of fire, smoke, and/or water damage;
- The HVAC system components have been infested with birds, rodents, insects, or their byproducts;
- The HVAC system components have been determined to be at risk for fire hazard;
- The HVAC system components have become contaminated with construction particulate or debris;
- Mold contamination conditions have reached either Condition 2 or Condition 3;
- Deterioration of fibrous glass duct liner, duct board, or other porous components;
- As part of an HVAC maintenance program as defined in ANSI/ASHRAE/ACCA Standard 180;
- As part of the HVAC equipment manufacturers *recommended* maintenance practices;
- As part of a proactive energy management program;
- As part of a proactive indoor air quality management program;
- As a component to achieve LEED Certification;
- When a newly installed component or duct has been contaminated with construction and/or other dust and debris.

Open air plenums should be inspected and cleaned periodically in order to reduce these conditions. Airflow throughout these spaces can create an increased risk of contamination, odors, condensation, microbial growth, and other conditions that may require attention and cleaning.

Unlike sealed ductwork, open air plenums can be used for purposes other than to facilitate a pathway for air circulation. They often contain a large number of items unrelated to the HVAC system. Examples of these items are light fixtures, fire suppression systems, extensive data cabling, wiring, plumbing, insulation, and other construction materials. In older buildings, these plenums could also contain asbestos and other hazardous materials. Since plenums are not completely sealed, infiltration of conditions such as humidity and unconditioned outside air can occur. Similarly, animal and/or insect infiltration can occur and lead to degradation of the conditions within the air plenum.

The air moving through an open air plenum is generally unfiltered. As such, dust and dirt fall out of the air stream and are deposited throughout the plenum over time. These contaminants accumulate on items inside the plenum, potentially posing health risks to the occupants of the building or creating fire hazards. Airborne contaminants from the plenum could also cause issues within clean areas of occupied spaces.

VI. Risk Management

Open air plenums often contain building elements such as mechanical (HVAC), electrical, plumbing, gas piping, fire protection, sewer, and telecommunications systems that are essential to the operation of the building. Technicians performing the cleaning of an open air plenum shall follow all necessary risk-reduction protocols, keeping occupant safety in mind. It is recommended that a Risk Management Plan (RMP) or Job Hazard Analysis (JHA) be developed and followed.

It should communicate:

- Each risk item associated with working near essential building systems;
- Risk assessment of the likelihood and severity of a risk-event to occur;
- Risk-reduction actions to be performed by technicians working in open air plenum spaces;
- Emergency-response actions to be performed in the event of an emergency or accident;
- Emergency contact for the technician to notify in the event of an emergency or accident.

VII. Safety Considerations

Contaminants found in open air plenums include but are not limited to:

- dust, dirt, and soot;
- combustible dust and/or byproducts;
- debris;
- fiberglass;
- water;
- microbial contamination;
- asbestos;
- lead;
- hazardous chemicals or pesticides;
- hazardous materials;
- bacteria;
- viruses;
- animal and insect byproducts.

Personal Protective Equipment (PPE) and job site safety shall be evaluated before entering an open air plenum. PPE considerations include but are not limited to:

- safety glasses;
- gloves;
- respirators;
- N95 masks;
- protective earwear;
- safety shoes;
- and coveralls.

Additional safety training may be required prior to entering an open air plenum. Training considerations include but are not limited to:

- confined space;
- air monitoring;
- rig to rescue/rope training;
- ladder safety;
- fall protection;
- combustible dust.

Engineering controls such as containment shall be used in accordance with ACR, The NADCA Standard, to prevent cross-contamination and are dependent on the type of conditioned space and nature of contaminants present. A consultation with an Indoor Environmental Professional (IEP) may be necessary for identifying contaminants and developing a scope of work.

VIII. Methods of Cleaning/Cleaning Techniques

Methods for cleaning open air plenums may include the following as referenced in ACR, The NADCA Standard:

Type 1 (Dry Cleaning) Methods:

- dry surface dusting, brushing, wiping, agitating, blasting or compressed air washing under negative air;
- HEPA-filtered contact vacuuming.

Type 2 (Wet Cleaning) Methods:

- wet wiping;
- water washing;
- pressure washing;
- steam cleaning;
- chemical cleaning.

IX. Cleanliness Verification

Open air plenums shall be cleaned, at minimum, to the level of visibly clean or the level of cleanliness agreed to in the scope of work. Other forms of cleanliness verification may be considered if specified.

References

ACR, The NADCA Standard for Assessment, Cleaning and Restoration of HVAC Systems