Best Practice Guidelines

Filtration for Schools

This NAFA Guideline has been provided, courtesy of:

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Filtration for Schools

NAFA guidelines provide advice on achieving the cleanest air possible based on the design limits of existing HVAC equipment and with consideration of the impact on energy and the environment. Our guidelines are created and updated to collect and supplement existing information. However, we go beyond the "bare minimum," publishing best practices based on the experience and expertise of our membership, as well as current mandates and research provided by governmental and scientific communities.

For a more complete explanation of principles and techniques found in this guideline, visit www.nafahq.org to purchase the *NAFA Guide to Air Filtration*. If you have any questions or comments about this publication, please contact NAFA Headquarters.

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About Us

Our Mission:
The National Air Filtration Association (NAFA) mission is to be the global source for expertise, education & best practices in air filtration.

What can NAFA membership do for you?
NAFA brings together air filter and component manufacturers, sales and service companies, and HVAC and indoor air quality companies. By becoming a member, you can:

- Meet with industry thought leaders
- Strengthen your network
- Share best practices
- Receive up to date industry information
- Access professional development, certification and education

Be a part of something bigger
As a NAFA member, you are a part of a support system that shares the common goals of supporting industry growth and creating healthier communities. Following the coronavirus pandemic, we are more aware than ever of the important role that our members play in a well society. We know that our work is important to maintaining healthy, happy communities.

Benefits of Membership

As a member of NAFA, you'll have access to a host of benefits that offer networking, learning, and advertising opportunities. Here are just a few of our most popular benefits:

- Annual conferences and webinars
- Professional development programs (CAFS and NCT Level I & II certification)
- Air Media magazine
- Best practices guidelines
- Clean Air Award recognition program
- Library of resources, manuals, seminars, and training.
- NAFA advertising and sponsorship programs
- Exposure through NAFA social media and a listing on the NAFA website
- NAFA volunteer and leadership opportunities

...and more!

Click here to become a member today!

CAFS & NCT Certifications

Educate your team
Attract new customers
Be known as a leader in your industry

Now more than ever, customers seek professionals with the credentials for quality assurance and knowledge to ensure that their complex needs will be met. Addressing this concern, NAFA offers two certification programs to increase the level of education and professionalism in the industry.

The NAFA Certified Air Filter Specialist (CAFS) program
CAFS is the first education and certification program offering an extensive examination on the principles, methods and applications of air filtration. It differentiates professionals who have demonstrated a high level of professionalism and a thorough, up-to-date understanding of air filtration technology. The CAFS exam is pass/fail, and is based on the NAFA Guide to Air Filtration.

NAFA Certified Technician (NCT) Program
This open-book exam is based on the NAFA Installation, Operation, and Maintenance of Air Filtration Systems manual. This program was designed to increase the knowledge of technicians, facility managers, and building owners.

Both certifications are renewable on an annual basis pending successful completion of continued education requirements. While the exams are open to members and nonmembers alike, test fees are dramatically reduced for members. To find out more about the cost, study aids, test dates/locations, and requirements, visit the weblinks below.

CAFS information page

NCT information page

About This Publication

1 PURPOSE

This NAFA guideline provides filtration best practices for the removal of particulate for the improvement of indoor air quality, and the protection of HVAC equipment in K-12 schools. It serves to provide the facility operators with the necessary tools to make measurable differences to the operation of the HVAC systems with air filtration.

2 SCOPE

This guideline identifies air quality issues associated with typical schools K-12. It establishes design criteria and performance specifications for new construction, as well as existing HVAC systems. This shall include methodology for contaminant removal by filtration and associated system maintenance.

3 BACKGROUND

School districts are some of the most frequently used high traffic buildings in our society. They hold some of our most important resources, our students and faculty. School districts are always under financial constraints to achieve high quality education on a limited budget. This may result in neglect to their facilities and HVAC equipment due to understaffing, lack of knowledge and operational costs. New research has shown the benefits of cleaner environments on learning. We all can agree that our students and faculty should have the cleanest air possible to breathe.

Sneezing, coughing, talking, and singing add condensate nuclei particles to air and increase the possibility of transmission of disease. Most public schools are funded based on student attendance, and as such, excessive absenteeism, potentially caused by IAQ issues, may ultimately result in school districts losing funding.

While reducing costs for air filtration products may show an immediate savings on the budget, keeping up with proper preventative maintenance with scheduled air filter changes will have a more sustainable impact in the long run. Without filtration maintenance, key components of HVAC systems will deteriorate, resulting in costly repairs, possible replacement, and increased operating costs.

SCHOOL HVAC SYSTEMS

Most school districts were designed with commercial grade HVAC systems using single stage filtration. Many of these systems are out-dated with a very low minimum efficiency reporting value (MERV) filter. When implementing a new filter system it is essential to clean evaporator coils, fans, and all other major components of the HVAC system. Cleaning the system and installing higher efficiency/low pressure drop filters may achieve lower pressure in the system, increased airflow, and higher levels of particle removal resulting in cleaner air.

FILTER EFFICIENCY

The higher the air filter efficiency, the better the protection for the equipment and the occupants. It has been estimated that a 30% increase in static pressure across a coil results in a $200 (electric cost) per 10,000 cfm of air movement (at 7 cents per KWH). This does not include the added cost of cleaning dirty heating or cooling coils, drain pans, or air ducts. Designers should consider specifying a lower efficiency (MERV 6-8) pre-filter upstream of secondary filters. The pre-filters are less expensive to change and will capture a significant amount of particulate mass, thereby extending the service life of the more expensive secondary filters.

While the EPA's "Tools for Schools" program recommends all HVAC applications have a minimum filtration efficiency of MERV 8, NAFA recommends MERV 13 efficiency.

The key to this efficiency is:

- The protection of the HVAC components from particles that promote biofilm and particulate fouling.
- Microbial contamination in the HVAC equipment.
- Reducing the respirable (0.3 to 3 microns) concentration of pollutants for students and faculty (ASHRAE Guideline 10).

It is recognized that some induction units and other room specific heating or cooling equipment may be incapable of MERV 13 filtration due to space limitations or fan capacity. In these applications, selection of filtration products should be made with the highest MERV in mind. NAFA also recommends designing more filter surface area into these ventilation systems. This has two distinct advantages:

1. Reducing the number of filter changes each year as well as the cost of labor for maintenance.

2. Static pressure loss is lower, reducing the amount of power needed to operate fans and blowers, further increasing savings.

According to the EPA Tools for Schools Program, "...Since different filter media are approximately proportional in their efficiency/pressure drop ratio, the most effective method for reducing pressure drop is to design more filter surface area into the filter system. This can be done by the specification of a filter with larger amounts of surface area, such as a pleated filter or bag filter. The next method is to increase the number and/or size of the filters in the airstream, for example, by mounting the filter slots in a "V" pattern, rather than a filter rack that is simply flat and perpendicular to the airstream."

NAFA Best Practice Recommendations (continued)

FILTER EFFICIENCY (CONTINUED)

Once the filter is selected a change out frequency should be established. This change out frequency can vary from unit to unit within a building and should be established based on the following criteria:

1. The specified or allowable pressure drop.
2. Filter manufacturers' recommended final pressure drop.
3. Technical experience.
4. Value determined by life cycle cost analysis.

For more information about selecting the proper change out frequency, please refer to Chapter 11 of the NAFA Installation, Operations, and Maintenance of Air Filtration Systems manual.

SPECIAL APPLICATIONS

There are certain areas in schools that require more specific attention beyond general HVAC filtration.

Molecular Filtration

Use of molecular filtration is recommended in the following areas:

- Locker rooms
- Chemistry and biology labs
- Swimming pool areas
- Metal working (welding fumes)

* For additional information refer to NAFA Guidelines on Molecular Filtration and Welding Fumes.

Dust Collection

Use of specialized filtration equipment such as dust collection systems are recommended in woodworking areas. In these special applications a NAFA Certified Air Filter Specialist (CAFS) should be contacted to determine the proper filter and/or filtration system required to remove the contaminants associated with these areas.

Installation, Operation & Maintenance

The following identifies some of the more important factors to consider when installing, operating and maintaining an HVAC Filtration system. As a supplement to manufacturers' guidelines, see NAFA's Installation, Operation and Maintenance of Air Filtration Systems manual or consult a NAFA CAFS.

Installation of Filters & System Integrity

Maintaining integrity of the filter system is vital for the efficacy of the HVAC system and imperative for air filtration performance as unfiltered air by-pass is a key contributor to poor IAQ.

A positively sealed filtration system will prevent unfiltered air bypass, maintain system pressure, and provide consistent filtration system efficiency. After each filter installation, the system must be checked to ensure that there are no possible leaks ord around the filters. This includes filter frames, fastening devices, caulking and gaskets.

NAFA recommends having a NAFA Certified Air Filtration Specialist (CAFS) inspect the installation for system integrity at least annually.

When changing or modifying the model or design of a filter system consult the manufacturer's specifications of the air handling system. Consideration must be given for:

- Size
- Fit
- Media area
- Airflow rate
- Initial and final pressure drop of the new filter system

Maintenance

A preventive maintenance program should include a monthly inspection of the filtration system. Use the following checklist as a starting point:

____ Filters
____ Filter hardware
____ Fastening devices
____ Caulking
____ Gaskets
____ Ductwork

Removing and replacing damaged or defective filters, filter hardware, gaskets, and duct insulation will keep unfiltered air from bypassing the filter system. Keeping the coils and blower clean and free from dirt and debris will improve airflow, increase system efficiency, reduce electrical consumption, and maintain overall design performance. Scheduled filter maintenance will keep the HVAC system working efficiently with clean, conditioned air and a reduction in contaminant levels.

Additional information regarding maintenance of HVAC and filter systems may be found in the ANSI/ASHRAE/ACCA Standard 180, "Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems."

Installation, Operation & Maintenance (continued)

Monitoring of Airflow and Pressure Drop

As a filter loads with contaminants the resistance to air flow through the filter increases. This increase is referred to as "pressure drop" or "differential pressure."

As an example, in a draw-through system, as the filters load and the resistance increases, the fan pressure is lower on the downstream side. Hence the pressure "drop" downstream of the filters.

This drop or differential can be measured with a pressure sensing device such as a manometer or magnehelic gauge. All HVAC units should have a pressure-sensing device installed to accurately monitor the pressure drop across the filter bank. In extreme temperature conditions, a magnehelic gauge is recommended over a manometer. When a filter has exceeded its useful life based on pressure drop or Life Cycle Costing, it should be replaced. Leaving a filter in service after this point may increase operational and energy costs and could damage the HVAC system.

Most molecular filters, over time, will not increase in pressure drop. Some particulate media, when impregnated with sorbent, could increase in pressure drop. This is not indicative of the service life of the sorbent. Service life of a molecular filter is a function of types and concentration of contaminants and filter design. Most manufacturers offer testing services to determine remaining filter service life. It is important to note that as the media life decreases, so does the efficiency of the molecular filter. Molecular filters are often recommended for change out before media is 100% spent.

Filter Service

The servicing of filtration products is a dirty business. It is best practice that service technicians have a safe work environment and use the correct personal protective equipment (PPE). Outer layer clothing should be weather appropriate in line with the climatic conditions. PPE includes:

- Eye protection
- Masks
- Gloves
- Coveralls
- Safety Boots
- Hearing Protection
- Hard Hat

In addition, service technicians should have a good working knowledge of:

- HVAC systems
- Ladder safety
- Confined space entry
- Risk management
- Shut down procedures
- Lock-out procedures

The use of specialized procurement devices (pictured above) should be used for safely adding, and removing product from difficult access points, such as a roof.

Installation, Operation & Maintenance (continued)

Training

The servicing of air filtration products is becoming more technical and requires specialized skills. It is for this reason that NAFA introduced the Certified Technician (NCT) Program in 1999 to increase expertise and professionalism to the air filtration industry. The NCT enables facility managers and building owners the opportunity to certify their employees on all aspects of filtration service and Indoor Air Quality.

For additional information visit the NAFA website: www.nafahq.org or contact a local NAFA member.

Disposal

Particulate filters should be disposed of in a careful and safe manner. Spent carbon in molecular filters may sometimes be returned to the manufacturer for reactivation. NAFA recommends that technicians performing the work be certified to NAFA Certified Technicians (NCT) standards.

You care about your employees and your students.
You care about the environment and your community.
You care about the fiscal health of your institution.
Indoor air quality matters.

COSTS OF POOR AIR QUALITY
Lost productivity
Decreased Health
Increased absenteeism
Increased Equipment Maintenance/Replacement
Increased Energy

BENEFITS OF IMPROVED AIR QUALITY
Reduced absenteeism
Increased productivity
Improved health, wellness and satisfaction

KEY RECOMMENDATIONS FOR YOUR HVAC SYSTEM

- Run the HVAC whenever the space is occupied.
- Direct the clean/cleaned air into the breathing zone in each occupied space.
- Return air vents should pull air from the room and not directly from the clean air inlet.
- Maintain temperature and humidity design set points.
- Set the HVAC system to bring in as much outside ventilation air as possible.

KEY RECOMMENDATIONS FOR FILTER MAINTENANCE

- To achieve the recommended MERV 13-equivalent or better levels of performance (which removes ≥85%of 1-3 μm particles), a combination of filters/air cleaners can be used.
- Use only air cleaners for which evidence of effectiveness and safety is clear.
- When upgrading filters, carefully monitor to ensure your current system can handle the upgrade (e.g. pressure drop).
- Upgrading both pre-filters and filters may cause unacceptable pressure drop. It may not be necessary to upgrade both.
- Consider using the AHAM Clean Air Delivery Rate (CADR) for sizing air-cleaners for your space.
- Confirm filters are sealed in their frames, preferably with gaskets to prevent filter bypass.
- Personnel changing filters should wear PPE. Dispose of spent filters immediately and in a safe manner.

DID YOU KNOW?

Studies with SARS CoV-1 have shown that toilet flushing can generate airborne droplets and aerosols that could contribute to transmission of pathogens. Remember to:

- Keep toilet room doors closed, even when not in use.
- Encourage putting the toilet seat lid down, if there is one, before flushing.
- Keep bathroom fans running continuously and vent separately, where possible.

Glossary

Air Filter/Air Cleaning: A device used for the removal of particulate or gaseous impurities from the air.

ANSI: American National Standards Institute. As the voice of the U.S. standards and conformity assessment system, ANSI empowers its members and constituents to strengthen the U.S. marketplace position in the global economy while helping to assure the safety and health of consumers and the protection of the environment.

ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers. ASHRAE is an international organization that sets standards and guidelines for the heating, ventilating, air conditioning, and refrigeration industry.

CAFS: Certified Air Filter Specialist accreditation granted by NAFA® to those who pass the national exam on air filtration.

cfm: Cubic feet per minute; a volumetric measurement used to size fans and ductwork. HVAC: Heating, Ventilating & Air Conditioning.

IAQ: Indoor air quality describes the quality of air supplied to an interior space. The goal of IAQ is to provide air that is clean and healthy to building occupants.

Life Cycle Costing (LCC): The investigation and valuation of the environmental impacts of air filters.

MERV: Minimum Efficiency Reporting Value refers to the lowest efficiency of a filter when tested in accordance with ANSI/ASHRAE Standard 52.2 2012.

NAFA®: Registered acronym for the National Air Filtration Association, the trade association for air filter manufacturers and distributors, worldwide.

Pressure Drop: Describes the drop in static pressure of the air from the upstream side of a filter to the downstream side.

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ASHRAE Position Document on Airborne Infectious Diseases, 2009

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As a global source for expertise, education & best practices in air filtration, we provide these guidelines with one important goal in mind: **To support best practices and ensure the cleanest air possible for our employees, our customers, and our community.** While the information provided is the property of NAFA and is protected by copyright and intellectual property laws, we strongly encourage the use and dissemination of this information - in print or electronically - to those within our industry.

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Disclaimer

The information contained in this guideline is intended for reference purposes only. NAFA has used its best efforts to assure the accuracy of information and industry practices. NAFA encourages the user to work with a NAFA Certified Air Filter Specialist (CAFS), to ensure that these guidelines address user specific equipment and facility needs. Issues regarding health information, including COVID- 19, may be superseded by new developments in the field of industrial hygiene or by new information revealed by experts in science/ medicine. Users are therefore advised to regard these recommendations as general guidelines and to determine whether new information is available.

Send questions to: nafa@nafahq.org