



NAFA[®]
National Air
Filtration
Association

BEST PRACTICE GUIDELINES



Filtration for
Indoor Cannabis
Growing





Table of Contents

Contributor Acknowledgement	3
About NAFA	4
NAFA Certifications	5
Purpose, Scope & Background	6
NAFA Best Practices Recommendations	7
Installation, Operation and Maintenance	9
COVID Special Section	12
Glossary	13
Copyright & Usage	14

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Filtration for Indoor Cannabis Growing

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

The purpose of this publication is to provide air quality product guidance and recommendations specific to the indoor cannabis growing industry for the HVAC contractor, air filter company and cannabis cultivation director. This guideline is directed at fully enclosed cultivation facilities using HVAC systems. Greenhouse or outdoor growers will not be able to utilize all of the recommendations below.

2 SCOPE

This publication will address the filtration practices associated with indoor cannabis growing facilities. Recommendations will address the particulate capture of recirculated air, exhaust air and outside make up air. In addition, this publication will address:

- Odor control within the cultivation facility and on exhaust applications.
- Air disinfection for powdery mildew, Botrytis and other microorganisms commonly found within the cultivation facility.
- Operating and maintenance of filtration systems.

Finally, this document will address issues related to COVID-19, utilizing rapidly evolving knowledge provided by available research and government guidelines.

3 BACKGROUND

Indoor cannabis growers face a myriad of indoor air quality issues most commercial facilities do not. Cannabis cultivators commonly utilize negative pressure inside a building versus positive pressure for the purpose of controlling odor, carbon dioxide (CO₂), temperature, and humidity issues. However, from a cross-contamination standpoint, a positive pressure grow room is preferred, but only a few new construction facilities are able to achieve this without leaking cannabis odors outdoors. Secondly, Cannabis growers routinely have 1,000 watt grow lamps per 6 plants, which generate a substantial amount of heat. LED grow lights are becoming more accepted, but still not mandated. Air exchanges within a facility are on average 20 - 40 per hour. Wall mounted fans are placed every 10 to 15 feet to help blow on the plants to strengthen the stalks and to help with transpiration. Transpiration is the release of excess moisture through the plants' leaves which increase humidity within the room, thus resulting in a mandatory use of dehumidifiers. Third, CO₂ is usually preferred at a rate of 1,500 ppm, providing a faster rate of growth for the plant. Finally, odor mitigation on any exhaust ducting is mandatory, due to city ordinance and regulations.

NAFA Best Practice Recommendations

1

AIR FILTRATION

A fully enclosed cannabis cultivator has a choice of air handler units that range from rooftop mounted, slab mounted, inside the room, or installed in the hallways outside of the cultivation rooms. The majority of the air handlers will have filtration, but there are a few growers that will use a ductless or mini-split system that offers very little, if any, filtration. For those applications, it is strongly recommended that portable, or stand-alone air filtration systems be added to the room. For air handler systems that incorporate filtration, a minimum of MERV 13 is recommended.

Particulates such as potting soil, dirt, debris, fungus and mold are easily recirculated through the cultivation rooms and need to be captured quickly and as efficiently as possible. Where possible, NAFA recommends to have a MERV 8 pre filter and a minimum MERV 13 final filter. If two stage filtration is not available, standalone or portable air cleaning units should come equipped with MERV 13 to HEPA filtration and be combined with UVGI for airstream disinfection. your filter supplier for proper maintenance and change out times depending on your facility.

Standalone or portable air cleaning units should come equipped with MERV 13 or higher filtration and be combined with UVGI for airstream disinfection.



2

ODOR MITIGATION

Terpene odors associated with cannabis plants are offensive to local buildings, adjacent properties, homeowners, and schools. Most cities and states have enacted fines for terpene odors being released outdoors without proper odor oxidation or capture technology applied to the odors.

There are two odor control applications methods for use within fully enclosed or greenhouse cultivators:

1) Capturing odor within the cultivation room. The NAFA recommended approach is to utilize a gas phase filter within the HVAC system or within a stand-alone fan powered air cleaner.

It is not recommended to use PCO, ionization, ozone, plasma, H2O2 or any off-gassing technology within the cultivation room. The reactions with high humidity, CO2, or silica can create acidic environments which oxidize terpenes on the plant. There should be nothing that emits from the odor control system that will potentially damage the plants and terpenes. NAFA strongly recommends the use of a gas phase filter properly designed for the capture of terpene odors. Consult with a NAFA CAFS for assistance in the design and operation of the gas phase system.

NAFA Best Practice Recommendations (continued)

ODOR MITIGATION (CONTINUED)

2) Eliminate terpene odors within the exhaust duct before the air is released outdoors. NAFA recommends utilizing a gas phase filter designed for thiol or terpene odors, or utilizing UV-V wavelength (187nm) in the exhaust ducting to eliminate any exhausted odors.

When using UV-V, remember:

- Proper sizing in relation to exhaust duct dimensions and CFM are required for optimum performance.
- UV-V lamps are recommended to be changed annually.
- Gas phase filtration has multiple lifespans, depending on the quantity of media, amount of odors, and airflow.

It is important to confirm with the manufacturer recommended change out intervals based on the facility design and operation.



3

UVC DISINFECTION

Powdery mildew, Botrytis, gray mold, and other fungus associated with cannabis plant health have been a central topic for cannabis cultivators. Many growers have tried to utilize fungicides to control microorganisms, however many fungicides are not strong enough or are time consuming to apply (taking up valuable employee time). The use of UV-C (254nm) for airstream disinfection has quickly become an alternative to using fungicides for contaminant control. This method has several advantages over the use of chemicals such as:

- Low maintenance of changing lamps, every 1 to 2 years, depending on UV manufacturer
- Non-corrosive
- Reduces labor of applying chemicals
- Healthier for the plant

NAFA recommends the use of an in-duct UV-C system designed for airflow disinfection or stand-alone/portable units be utilized within the Mother room, Vegetative room, Flower room, trim and dry rooms to help control any potential powdery mildew, gray mold, Botrytis, fungus or any other microorganism that could damage the plants or reduce yield.

When sizing a UV-C system for air treatment, the system should be sized based on supply duct dimensions, CFM and the contaminant to be disinfected. The manufacturer should provide a report showing a minimum disinfection of 95% per hour of operation or higher at the end of lamp life, not upon installation on day one. Several case studies on the benefits utilizing UV-C have shown UV-C to be effective and safe.



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 or gaps in and 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 medias, 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 assumed to be contaminated with viable organisms, possibly hazardous in nature, and need to be disposed of in a careful and safe manner. Dispose of spent filter products in a safe manner protecting the HVAC equipment, building occupants, and especially, the technicians performing the work. 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.

You care about the environment and your community.

You care about the fiscal health of your organization.

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. Consider increasing air handling fan runtime as longer operating hours can provide better particle removal effectiveness. Provide clean ventilated air to flush occupied spaces before and after occupancy.
- 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 $\geq 85\%$ 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 final filters may cause unacceptable pressure drop. It is not 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. Bag and dispose of spent filters immediately.

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

AHU: Air Handler Unit

HVAC: Heating, Ventilation, Air Conditioning

CFM: Cubic feet per minute

PCO: Photocatalytic Oxidation

H2O2: Hydrogen peroxide (dry hydrogen peroxide)

Plasma: Another name for ionization or ozone

CO2: Carbon dioxide

Powdery Mildew: A fungus that attacks cannabis plants

Botrytis: A fungus that attacks the roots of cannabis plants

ppm – Parts per million

nm - Nanometer

Copyright & Usage

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.

These guidelines were created through the hard work and care of experts in the industry...your peers. By reading these guidelines you agree not to reproduce, broadcast, or otherwise distribute the information within these guidelines for commercial purposes without the prior written consent of NAFA. If such permissions are granted, you also agree to include in any printed/electronic uses the phrase, "Used with permission of The National Air Filtration Association®."

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