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DIRECT VENT, FORCED AIR, GAS FURNACES

CSA Unit 23 - Forced Air Add-On Devices

Chapter 1 Air Filters and Cleaners for Forced-Air Furnaces

A forced-air furnace cannot operate without air filtration. The gas technician/fitter must be familiar with the various types of filters available, be able to install them correctly, and instruct customers on their maintenance to ensure safe, efficient operation of the gas furnace.

It is important for the gas technician/fitter to understand the advantages and disadvantages of media and electrostatic filters and electronic air cleaners, so they can help customers choose the air filtration system best suited to their needs.

Created
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Learning Objectives

Describe Air Cleaning Equipment

Describe three types of air cleaning equipment (media filters, electrostatic filters, and electronic air cleaners) that can be used with forced-air furnaces

Understand Media Filters

Describe the function, installation, and maintenance of media filters

Understand Electrostatic Filters

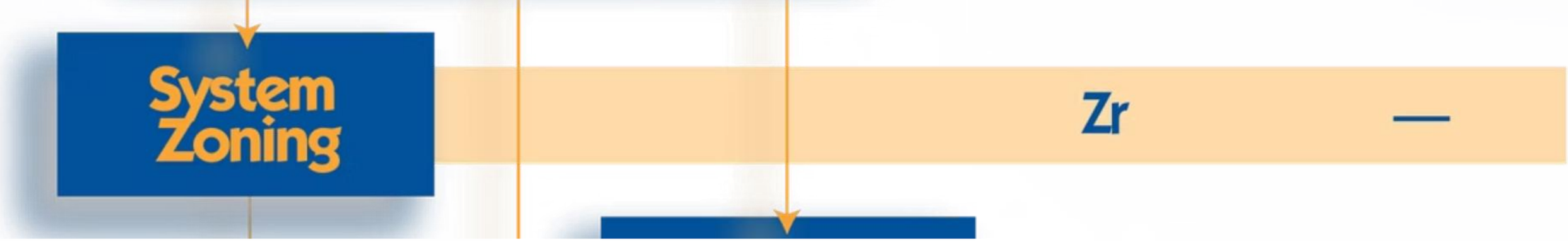
Describe the function, installation, and maintenance of electrostatic filters

Understand Electronic Air Cleaners

Describe the function, installation, and maintenance of electronic air cleaners

Understand UV Air Purifiers

Describe the function and installation of ultraviolet air purifiers



Key Terminology

Term	Abbreviation (Symbol)	Definition
Electronic air cleaner	EAC	Air cleaner that uses electrostatic charge to remove and collect particulate contaminants from the circulated air system
Electrostatic precipitator	ESP	Another name for the electronic air cleaner (EAC) that uses induced electrostatic charge
High-efficiency particulate air (arrestance) filter	HEPA	Type of air filter
Media filter		Filter that physically removes particles from the air stream
Minimum efficiency reporting value	MERV	Numerical value given to furnace filters to identify filtering ability

Red Seal Alignment

This chapter aligns with several Red Seal blocks and tasks related to gas technician training, including:

Occupational Common Skills

- Task 1: Performs safety-related functions
- Task 2: Maintains and uses tools and equipment
- Task 3: Plans and prepares for installation, service and maintenance

Systems Supply Venting and Air

- Task 7: Installs venting
- Task 8: Installs air supply system
- Task 9: Installs draft control systems

Servicing Gas-fired Systems

- Task 18: Maintains gas-fired systems
- Task 19: Repairs gas-fired systems
- Task 20: Decommissions gas-fired systems

Types of Air Filtration Systems

Media Filters

Sometimes called mechanical filters, they are the simplest form of air filtration. They are made from such media as fibreglass and positioned in the air stream.

Air is forced through the filter and particles removed. The filter media can be reusable or disposable.

Media filters of high, low, and medium efficiency are available.

Electrostatic Air Filters

These are media filters made from a material that generates a static charge in response to air flow.

The static charge attracts and holds more particles than media filters to the medium.

Electronic Air Cleaners (EAC)

They use an electrostatic charge to remove and collect particulate contaminants from the circulated air system.

An EAC uses an external power source to generate the charge that attracts particles to charged plates, rather than a media filter, to collect them.

UV Air Purifier

Use UV light to reduce biological contaminants, chemical, and odours. UV is not a filtration method, but can be incorporated into filtration systems.

Understanding MERV Ratings

What is MERV?

The minimum efficiency reporting value (MERV) is a numerical value given to furnace filters to identify the filtering ability.

The MERV rating system is now an international industry standard that helps determine a furnace filter's ability to capture and hold dirt and dust in specific size ranges.

Rating Scale

MERV ratings range from 1–20. The higher the MERV rating, the greater the filtering capability. Measurements are in microns.

Applications

High-efficiency particulate air (HEPA), MERV 17–20, or high-efficiency particulate arrestance filters, which remove a very high percentage of airborne contaminants, are often specified for various commercial, industrial, and institutional applications.

Residential Use

A MERV rating between eight and 11 is adequate for most homes. To be safe, it is best to check if the furnace manufacturer has a maximum MERV rating for the model of furnace being used.

Pressure Drop Considerations

What is Pressure Drop?

The pressure drop that the filter causes should undergo assessment for suitability with fan units prior to use to ensure maintenance of duct static pressures.

As filters become more efficient (higher MERV ratings), they typically create more resistance to airflow, which can affect system performance.

Impact on System

Too much pressure drop can cause:

- Reduced airflow through the system
- Decreased heating and cooling efficiency
- Increased energy consumption
- Potential damage to the furnace components

Finding Balance

The ideal filter provides adequate filtration while maintaining proper airflow through the system.

Always consult manufacturer specifications for maximum allowable pressure drop in the system.

Sources of Indoor Air Particles

Household Dust

Dust on floors or other surfaces that is disturbed by activity in the house

Combustion Sources

Dust generated by smoking, burning candles, cooking, doing laundry, etc.

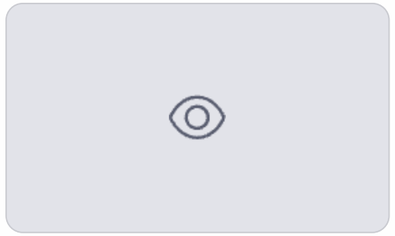
Biological Sources

Hair and skin flakes from humans or pets

Outdoor Sources

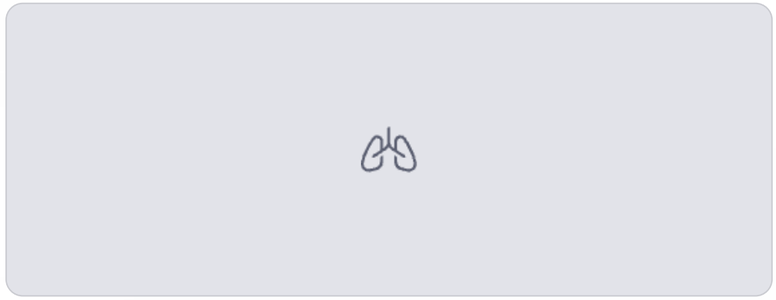
Particles from the outside air that come into the home with infiltrating air

Health Impacts of Airborne Particles



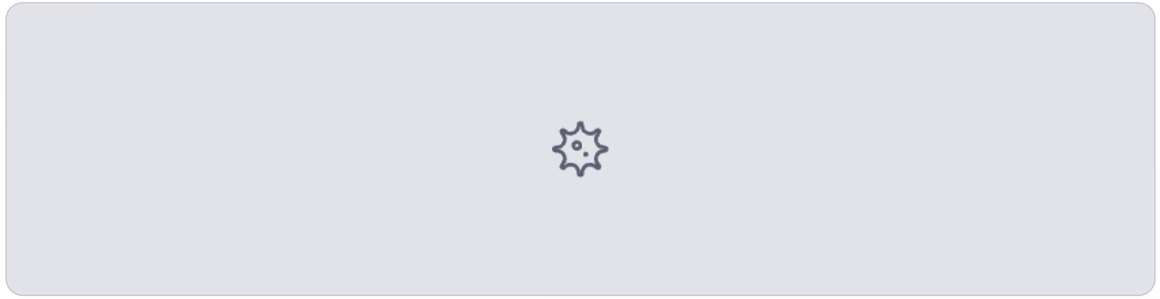
Visible Particles

Particles of dust that accumulate on a television screen, shelves, and furniture are visible to the eyes



Respirable Particles

Some particles are so small that they are inhaled and then exhaled without being trapped in the lungs



Harmful Particles

The particles most dangerous to humans are those that enter the lungs and lodge there

Although an occupant would probably like to keep visible dust out of a home, the main health risk comes from unseen/unsafe particles which include tobacco smoke, spores, bacteria, and viruses.

Choosing the Right Air Filtration System

Air Quality Requirements

Consider the degree of air cleanliness required for the specific application

Dust Conditions

Evaluate the amount and type of dust in the air to be filtered

Airflow Resistance

Consider the operating resistance to air flow (pressure drop)

Space Constraints

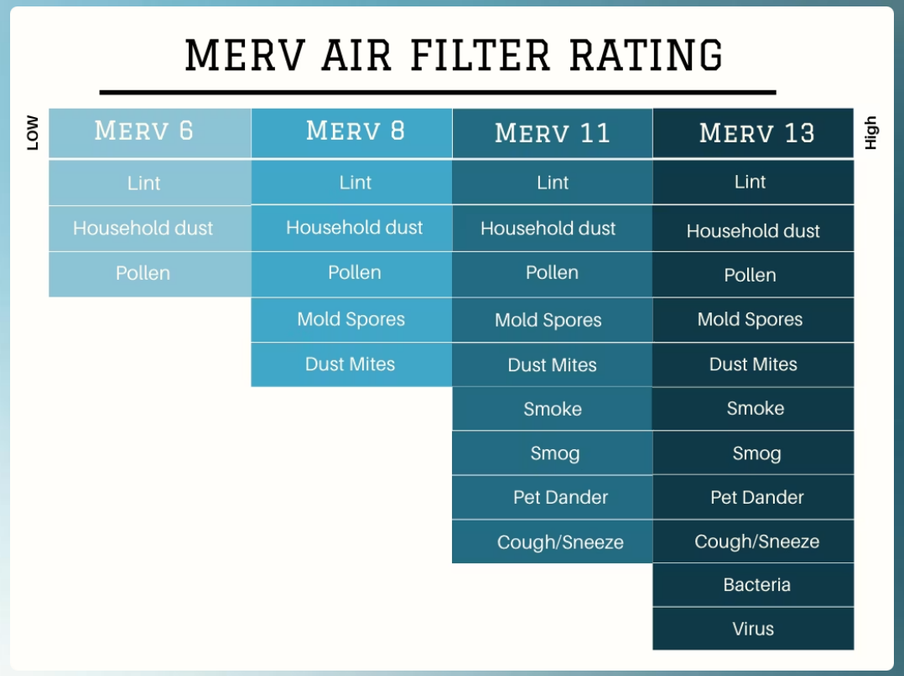
Assess the space available for filtration equipment

Cost Factors

Evaluate initial costs, ongoing maintenance costs, and operating costs

System Lifespan

Consider the predicted life and efficiency of the system



Relative Costs of Air Filter Types

Filter	Maintenance and capital costs, per year, over 15 years ($)	Amount of clean air produced (litres/second)	Cost of clean air per year ($/liters/second)
25 mm pleated	48	17	3.36
25 mm premium	100	97	1.13
Charged media	43	44	1.25
100 mm pleated	100	60	1.71
HEPA bypass	240	175	2.03
ESP	67	298	0.26

Source: Canada Mortgage and Housing Corporation (CMHC)

Types of Media Filters

Hammock Filters

Located on a frame or hammock that surrounds the fan in the forced-air furnace

If a forced-air furnace is intended to be used with a hammock filter, the filter holder will be factory installed

Slab Filters

Consist of layers of filter material, usually fibreglass, held in place by a cardboard frame

The fibres are treated with oil or a similar adhesive

Most slab filters are designed for one-time use and must be discarded when they are dirty

Pleated Filters

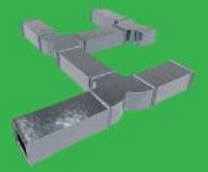
Represent the most popular type of filter choice available today

Come in a variety of sizes and thicknesses

Paper pleating increases the filter surface and improves performance

metalized PET or polyethylene. The shape of the air duct is typically round tubes. The plastic coating is durable and provides insulation to maintain the temperature of the HVAC system as it is set. This type of ductwork is easier to install than rigid air ducts. If you are low on space, it is the best choice for installing this air duct. Due to flexible structure of the ducts, they can be bent and fixed accordingly, even in tight spaces. However, the airflow may become restricted due to the flexible ducts' bends, resulting in the HVAC system's inefficiency.

2. Rigid Ductwork



As the name suggests, the other category of air duct is rigid ductwork with hard, enduring, and stiff structure. This type of air duct can be rectangular or cylindrical shaped. You can customize the vents according to the structure required. They cannot be bent like flexible ductwork. But they are least likely to be punctured or torn.

2.1. Sheet Metal Ducts

These types of air ducts are made up of aluminum or galvanized steel. Steel metal ducts are

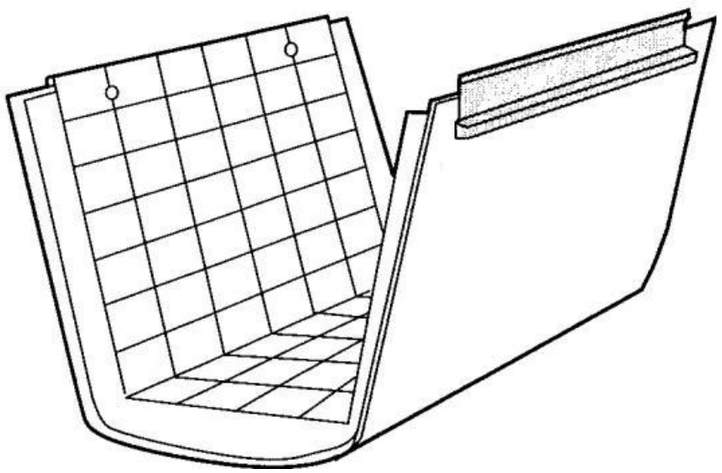
2.2. Fiberglass Ducts

Built with fiberglass strands & held by resin. The fiberglass is effective at providing insulation.

2.3. Fiberboard Ducts

Made up of compressed fiber glass & an external layer of foil is attached around the

Hammock Filter



Description

Hammock filters are located on a frame or hammock that surrounds the fan in the forced-air furnace.

The filter material is typically disposable and requires periodic replacement.

Installation

If a forced-air furnace is intended to be used with a hammock filter, the filter holder will be factory installed.

The filter material is secured to the frame with screws or clips that can be loosened for replacement.

Maintenance

Regular inspection and replacement of the filter material is necessary.

One side of the media is usually coated with oil to enhance particle collection. This coated side should be opposite the blower.

Slab and Pleated Filters

Figure 1-2
Slab filter

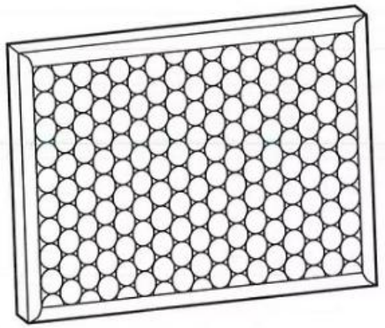
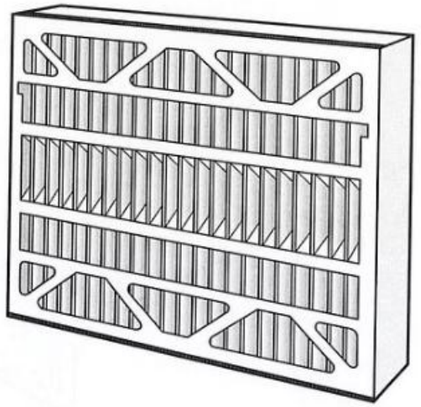


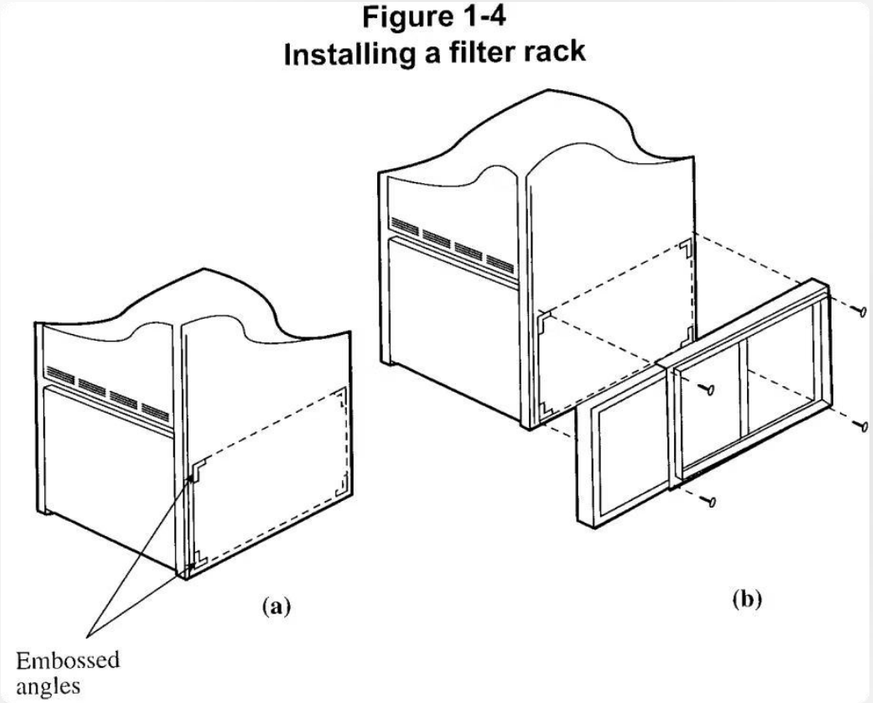
Figure 1-3
Pleated media filter



Advantages and disadvantages

Advantages	Disadvantages
• Low initial cost and upkeep • Efficient for the removal of lint	• Low efficiency on normal atmospheric dust • Decreased air flow as particles collect in

Filter Rack Installation



Locate the Installation Position

Identify the location of the racks. The side of the furnace cabinet will likely have embossed angles indicating the location.

Cut the Return Opening

Cut the return opening using the angles as guides.

Mount the Filter Rack

Mount the filter rack over the opening.

Complete Ductwork

Proceed with the ductwork installation.

Holding the filter in position requires the installation of a filter rack. The filter rack is usually located between the furnace casing and the return-air plenum.

Impact of Filters on Air Flow

Resistance to Air Flow

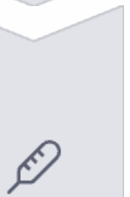
All media filters, whether mechanical or electrostatic, add resistance to air flow.

Thickness Considerations

The thickness of the filter and the specifications for the furnace must match. Adding extra filters to the filter chamber to improve indoor air quality can seriously impede furnace operation.

Primary Purpose

The main purpose of the furnace inline filter is to protect the blower fan and heat exchanger from the dust, hair, and other particles the return duct pulls in.



Operational Issues

As a filter fills with particles, the air volume flowing through the filter decreases. Restrictions in air flow can cause problems in heating cycles, causing the furnace to switch off on the high limit control and seriously limit the furnace's ability to heat the house.

Partial Bypass Air HEPA Systems

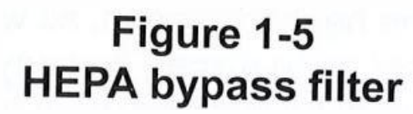


Figure 1-5
HEPA bypass filter

Why Use Bypass Systems?

HEPA filters have a tight fabric and should not be used as inline furnace filters as they are too restrictive and could stall the HVAC fan.

By using the bypass approach even if the HEPA unit was clogged, all of the air could just bypass the HEPA unit and the HVAC fan system would not be subject to higher static pressures.

How They Work

HEPA filtration systems can be stand-alone or installed as a partial bypass attached to the return side of a forced air HVAC system.

The bypass ducting diverts some of the return air through the HEPA unit. Filtered air is then rerouted back into the return air and continues through the system for heating/cooling.

HEPA Filtration Stages

Pre-filter

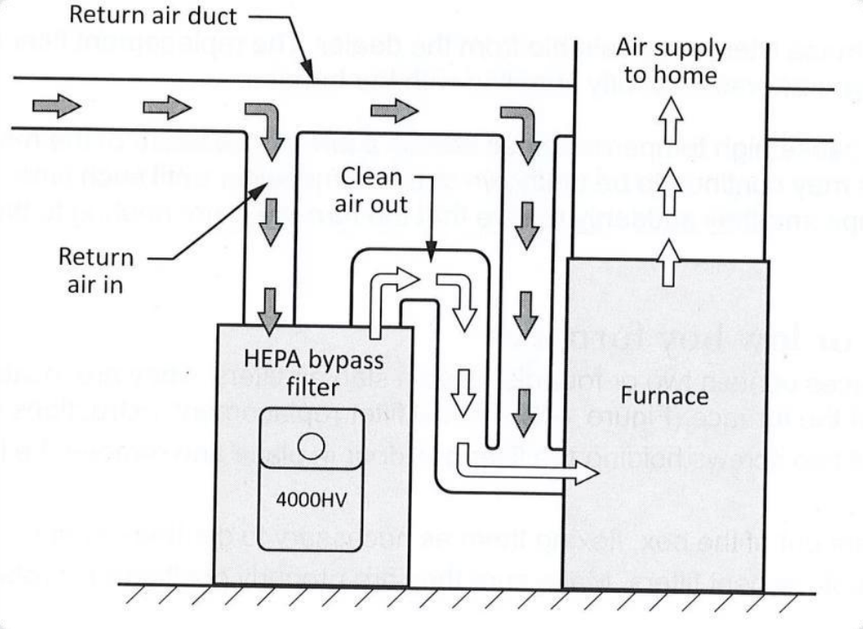
An inexpensive filter to remove larger particulates from the air. This is important to prolong the life of the HEPA filter.

HEPA Filter

Removes 99.97% of particulates 0.3 micron and larger.

Carbon Filter

For removing chemicals and odours from the air.



Importance of Regular Filter Maintenance

Performance Issues

Dirty filters are the most common cause of inadequate heating or cooling performance.

They create temperature changes that are detrimental to the operation of the furnace.

System Damage

In systems with add-on air conditioning, decreased operational air flow may cause liquid refrigerant to return to the compressor during the running cycle since there is insufficient air flow to vaporize the refrigerant. This condition is called floodback and may damage the compressor.

Energy Costs

Dirty filters cost money since excessive accumulation can block the air flow, forcing the unit to work harder and use more energy.

Maintenance Schedule

Filter cleaning must be on a regular and frequent basis — more frequently than service calls are required.

Customer Education on Filter Maintenance

1 Locate the Filter

It is the responsibility of the gas technician/fitter to point out the filter's location to the user.

2 Establish Maintenance Schedule

The technician should establish a filter change or cleaning schedule with the customer.

3 Explain Replacement Procedure

The gas technician/fitter must be sure the customer understands the installation procedure for new filters.

4 Identify Correct Filter Type

Ensure the customer knows what size and type of filter is required for their system.

Caution! Never operate a forced-air furnace without a filter installed. Dust and lint will build up on the furnace's internal parts, resulting in loss of efficiency, equipment damage, and possible fire.

Filter Replacement Schedule

Monthly Inspection

Filters require monthly inspection in the heating season.

Regular Cleaning

Clean or replace filters at least twice a year.

As Needed

Replace any time filters become clogged.

Follow Instructions

Always follow manufacturer's instructions for cleaning or replacement.

A dirty filter can cause high temperature rise across a furnace because of the restrictive nature of the air flow. This may continue to be unknown to the homeowner until such time as the outdoor temperature drops and they suddenly realize that the furnace is not heating to the set temperature.

Down-flow Furnace Filter Replacement

Remove Filter Box Door

Remove the two screws holding the filter box door in place and remove the filter box door assembly.

Remove Old Filters

Pull the filters out of the box, flexing them as necessary to get them past the flue pipe.

Insert New Filters

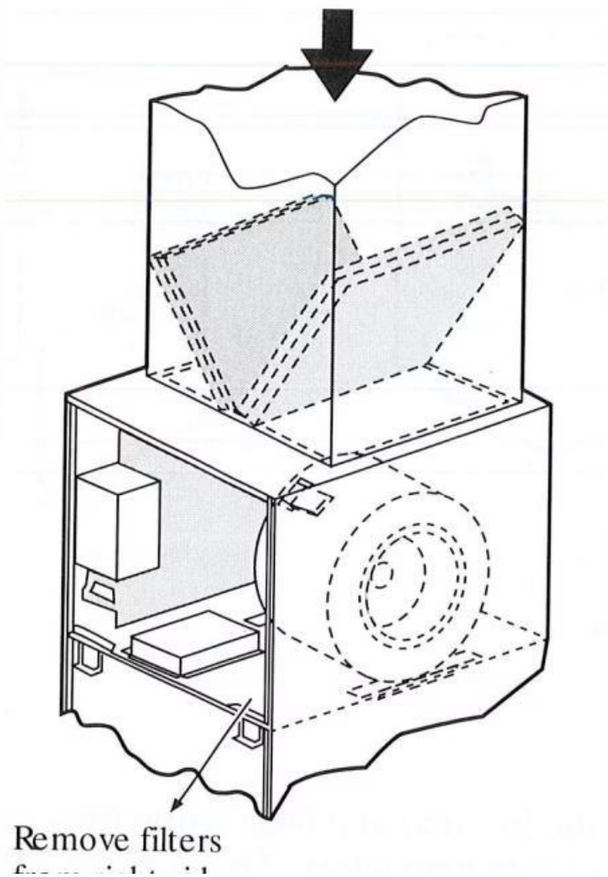
Insert the replacement filters. Make sure they are properly positioned in retaining clips on the back panel.

Reinstall Door

Re-install the filter box door assembly and secure it with the two screws.

Down-flow furnaces contain two or four disposable slab air filters. They are located in a filter cabinet on top of the furnace.

Down-flow Furnace Filter Location



Filter Cabinet Position

In down-flow or low boy furnaces, the filter cabinet is typically located on top of the furnace.

This position allows the filters to capture particles before the air enters the furnace's internal components.

Filter Arrangement

The filters are arranged to cover the entire return air opening.

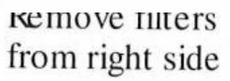
Multiple filters may be used side by side to ensure complete coverage of the return air path.

Access Considerations

The filter cabinet is designed with a removable door for easy access during maintenance.

Ensure there is adequate clearance above the furnace for filter removal and replacement.

Up-flow Furnace Filter Replacement



Disconnect Power

Disconnect power to the unit before removing blower door.

Remove Access Door

Remove the blower access door.

Loosen Retaining Wire

Loosen the filter retaining wire at the front of the unit.

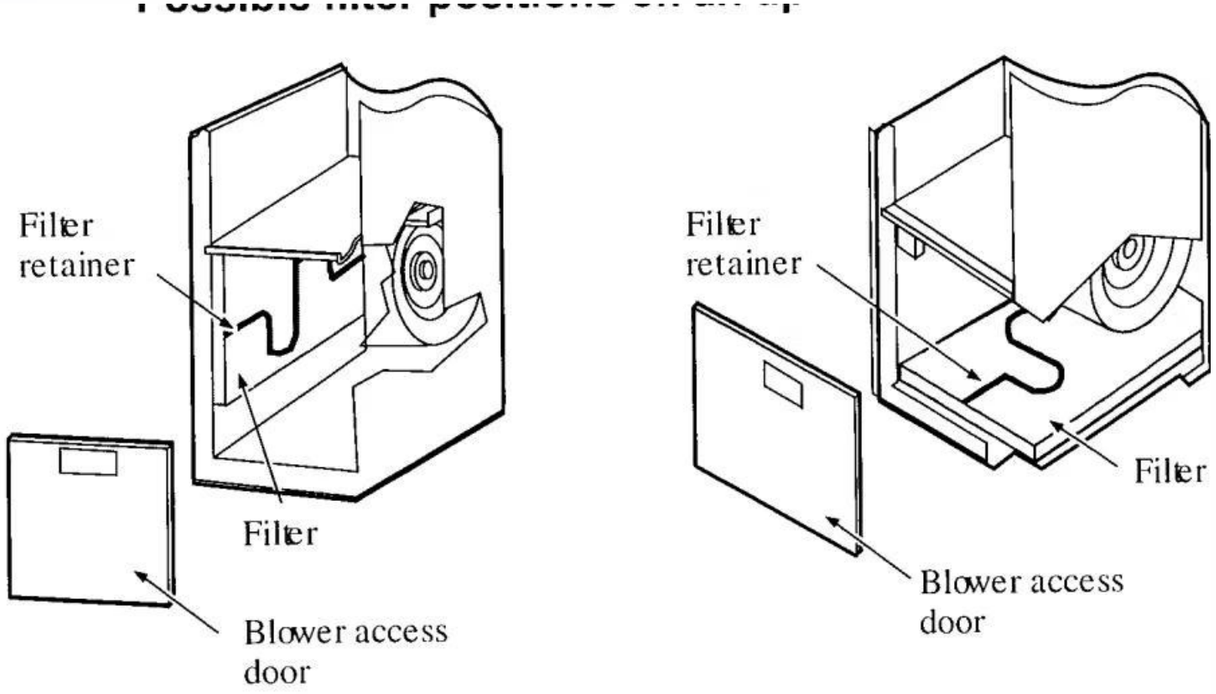
Replace Filter

When replacing the cleaned filter, make sure the filter retaining wire is secured in place at both the front and back of the unit.

Restore Power

Replace the blower access door and restore the power.

Up-flow Furnace Filter Positions



Filter Location Options

Up-flow furnaces may contain a cleanable, reusable hammock filter within the furnace blower compartment in a bottom or side (left or right) return air inlet.

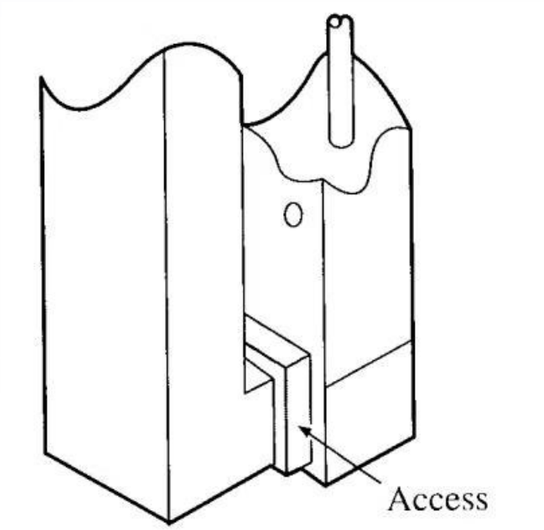
Bottom Return

When the return air enters from the bottom of the furnace, the filter is typically installed horizontally below the blower compartment.

Side Return

With side return configurations, the filter is installed vertically in the return air opening on either the left or right side of the furnace cabinet.

External Filter Frames



Location

Filters may be located outside the furnace in a filter frame.

These frames are typically installed in the return air duct near the furnace.

Design

The filters in a filter frame should slide out easily for replacement (if disposable) or cleaning (if reusable).

Filter frames are designed to provide a secure fit for the filter while allowing easy access for maintenance.

Advantages

External filter frames offer easier access for maintenance compared to filters located inside the furnace cabinet.

They can often accommodate larger or thicker filters than might fit inside the furnace.

Hammock Filter Replacement

Prepare the Area

Before you remove the filter unit, place a floor covering material on the floor.

Remove the Filter

Slide the entire filter out of the unit.

Loosen the screws that hold the media to the rack.

Remove the media.

Dispose of Old Media

Wrap the old media in newspaper and discard it.

Prepare New Media

Unroll new media and cut it to the correct size.

Attach the media to the rack.

Reinstall Filter

Slide the filter back into the blower compartment.

One side of the media is usually coated with oil to enhance particle collection. This coated side should be opposite the blower. (In an up-flow unit, the coated side will face the return air duct work.)

Reusable Slab Filter Maintenance

Remove Filter

Remove the filter from the unit.

Remove the media from the filter frame.

Clean Media

Wash or vacuum the media.

Use hot water and detergent for washing.

Dry Media

Squeeze water from the media and return it to the frame.

Apply Filter Spray

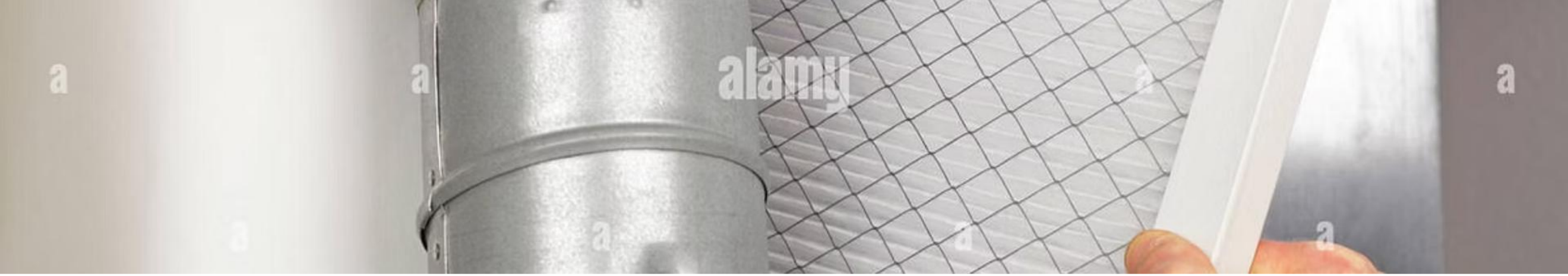
Coat the downstream or leaving side of the media with a tackified filter spray to enhance particle collection.

The filter spray must be applied before the filter is repositioned in the furnace.

Reinstall Filter

Reposition the filter in the unit.

Important: Do not re-oil the filter in place. If re-oiling is done while the filter is in position, oil will be sprayed on the blower assembly and heat exchange surfaces.



Disposable Slab Filter Replacement

Remove Old Filter

Remove the filter from the unit.

Dispose of Filter

Discard old filter with regular household garbage.

Install New Filter

Place new filter in unit.

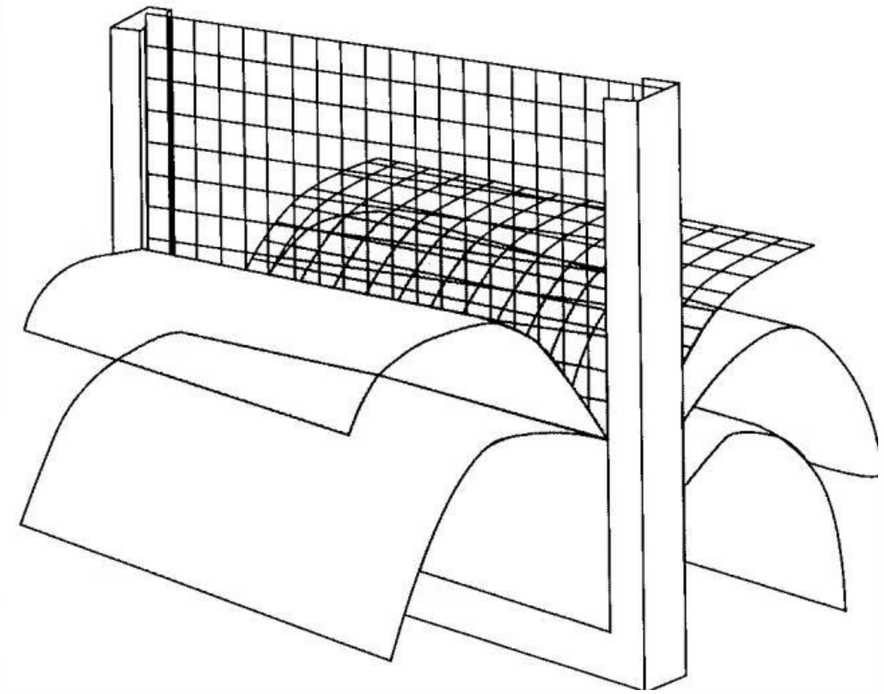
The new filter must be of the same size.

If there are arrows on the filter frame, place them to match the system air flow.

Caution! Disposable filters must be discarded, not reused. Reused filters will not remove particles effectively.

Do not vacuum disposable filters. Vacuuming will remove mineral oils along with the dirt, and the filters will no longer work.

Electrostatic Filters: Introduction



What Are Electrostatic Filters?

Electrostatic filters may replace standard media filters if more filtration is necessary.

They use a combination of static electricity and filtering media to remove particles from the air.

Construction

The filter media is usually made of layers of nylon or woven polyethylene fibre encased in a frame.

In appearance, a filter of this type is similar to a disposable slab filter.

Maintenance

Most electrostatic air filters are washable and reusable.

Regular cleaning is necessary to maintain optimal performance.

How Electrostatic Filters Work

Airflow

As air flows through the filter, it creates friction with the filter material.

Static Charge Generation

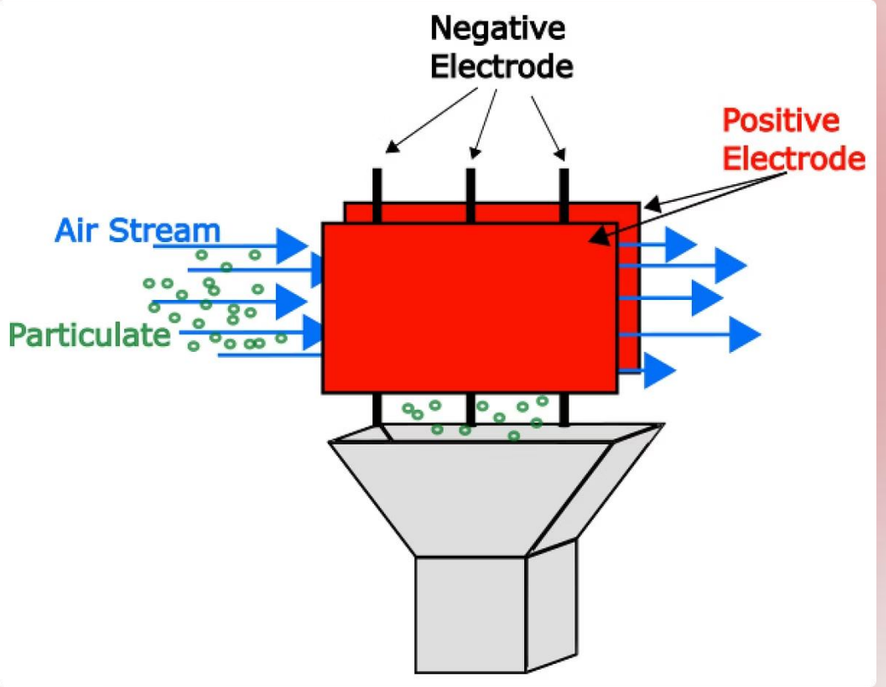
In an electrostatic air filter, static electricity is generated as the air stream travels through the filter.

Particle Attraction

The static charge causes dust particles to become electrically charged. These charged particles are then more likely to cling to the filter medium.

Particle Collection

The charged particles adhere to the filter material, removing them from the air stream.



Electrostatic Filter Advantages and Disadvantages

Advantages

- No electricity required
- More efficient than media filters without electrostatic charge
- Typically washable and reusable
- Lower long-term cost compared to disposable filters
- Environmentally friendly due to reusability

Disadvantages

- Less efficient than electronic air cleaners
- Requires regular washing to maintain effectiveness
- Higher initial cost than basic media filters
- May lose charge over time, reducing effectiveness
- Can create more air resistance than some basic filters

Electrostatic Filter Installation

Select Proper Size

Ensure the electrostatic filter is the correct size for your furnace's filter rack.

Check Airflow Direction

Note the airflow direction arrows on the filter frame and install accordingly.

Insert Filter

Slide the filter into the filter rack, ensuring it fits securely.

Secure Filter

If the filter rack has clips or fasteners, ensure they are properly engaged to hold the filter in place.

Electrostatic filters can typically be installed in the same location as standard media filters, making them an easy upgrade for improved filtration.

Electrostatic Filter Maintenance

Inspect

Check the filter monthly during heating season for dust accumulation

Remove

Take the filter out of the furnace when it appears dirty

Clean

Wash with warm water and mild detergent to remove trapped particles

Dry

Allow filter to dry completely before reinstallation

Regular cleaning is essential to maintain the electrostatic filter's efficiency. Unlike disposable filters, electrostatic filters can be washed and reused many times, providing long-term value.

Electronic Air Cleaners: Introduction

What Are Electronic Air Cleaners?

Electronic air cleaners (EACs), also known as electrostatic precipitators (ESPs), are advanced air filtration devices that use an electrostatic charge to remove and collect particulate contaminants from the circulated air system.

Key Difference

Unlike electrostatic filters that generate a static charge through air movement, EACs use an external power source to generate the charge that attracts particles to charged plates, rather than a media filter, to collect them.

Applications

EACs are suitable for residential and commercial HVAC systems where high-efficiency air filtration is desired.

They are particularly beneficial in environments with high levels of airborne particles or for individuals with respiratory sensitivities.

How Electronic Air Cleaners Work

Pre-Filtering

Air first passes through a pre-filter that captures larger particles

Ionization

Particles pass through an ionization section where they receive an electrical charge

Collection

Charged particles are attracted to collector plates with an opposite charge

Clean Air Output

Cleaned air exits the unit and returns to the living space

Electronic Air Cleaner Components

Pre-Filter

Captures larger particles before they enter the ionizing section

Protects the internal components from excessive dust buildup

Usually washable and reusable

Ionizing Section

Contains charged wires that create an electrical field

Imparts an electrical charge to particles passing through

Operates at high voltage (typically 6,000-12,000 volts)

Collector Plates

Series of parallel plates with alternating charges

Attracts and holds the charged particles

Made of aluminum or other conductive material

Power Supply

Converts household current to the high voltage needed for ionization

Includes safety features to prevent electrical hazards

May include indicator lights to show operational status

Electronic Air Cleaner Advantages

High Efficiency

Can remove up to 95% of airborne particles as small as 0.3 microns

Cost-Effective Long Term

No filter replacement costs, only periodic cleaning required

Low Air Resistance

Creates less restriction to airflow than high-MERV media filters

Environmentally Friendly

Reusable components reduce waste compared to disposable filters

Health Benefits

Removes allergens, bacteria, and other harmful particles from the air

Electronic Air Cleaner Disadvantages

Higher Initial Cost

More expensive to purchase and install than conventional filters

Electricity Required

Needs electrical connection to operate, adding to energy consumption

Regular Maintenance

Requires periodic cleaning of collector plates and pre-filters

Ozone Production

Some models may produce small amounts of ozone as a byproduct

Potential Noise

May produce crackling sounds if extremely dirty or if arcing occurs

Electronic Air Cleaner Installation

Select Location

Install in the return air duct, typically between the return air drop and the furnace

Prepare Ductwork

Cut and modify ductwork as needed to accommodate the air cleaner cabinet

Mount Cabinet

Secure the air cleaner cabinet to the ductwork using sheet metal screws

Electrical Connection

Connect to power supply according to manufacturer's instructions and local electrical codes

Install Components

Insert pre-filter, ionizing section, and collector plates into the cabinet

Always follow the manufacturer's specific installation instructions and ensure compliance with local building and electrical codes.

Electronic Air Cleaner Maintenance

Monthly Inspection

Check indicator lights to ensure proper operation

Listen for unusual sounds that might indicate problems

Regular Cleaning (Every 1-3 Months)

Remove and clean pre-filter

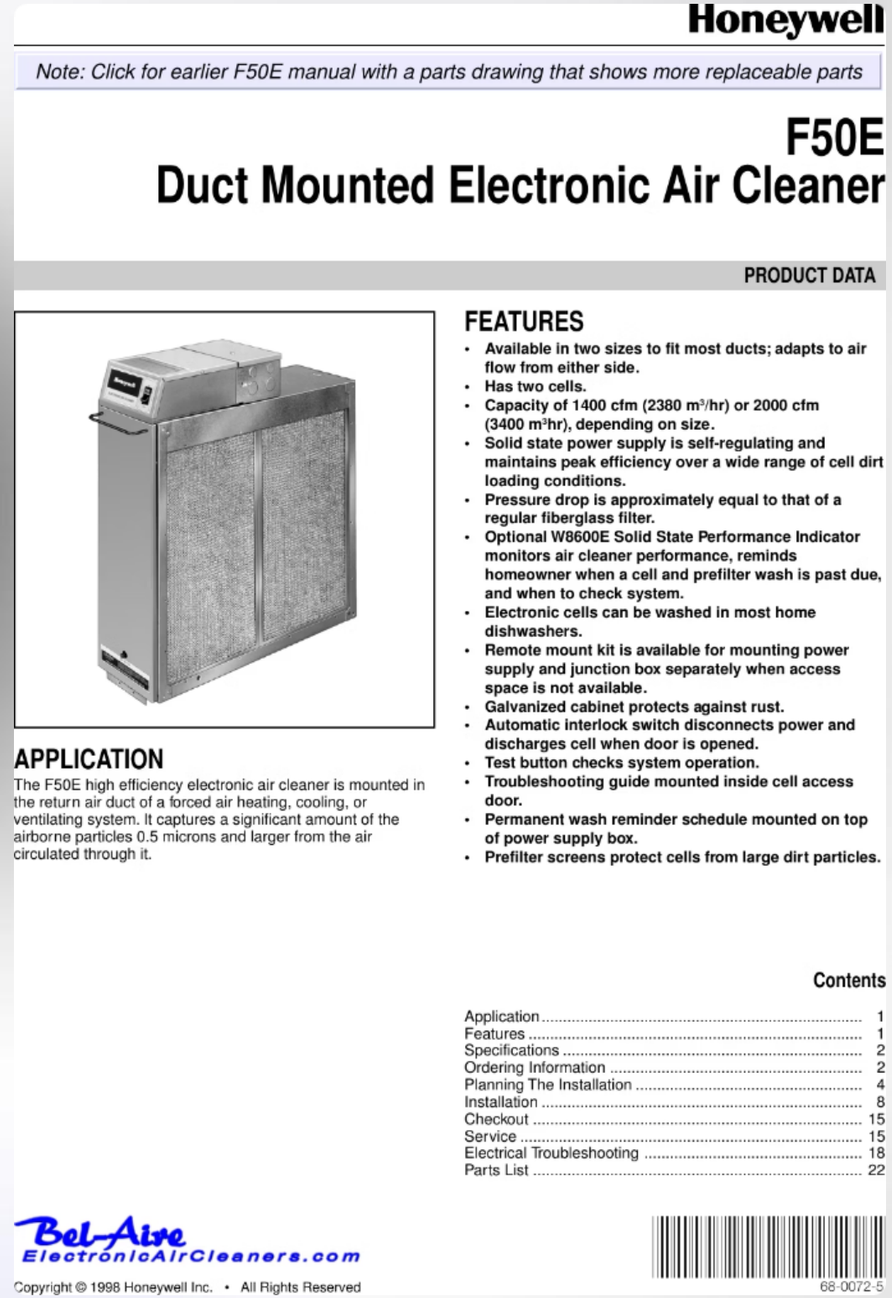
Remove and clean collector plates and ionizing section

Annual Service

Inspect electrical connections

Check for wear on components

Verify proper operation of safety features



Honeywell

Note: Click for earlier F50E manual with a parts drawing that shows more replaceable parts

F50E
Duct Mounted Electronic Air Cleaner

PRODUCT DATA

FEATURES

- Available in two sizes to fit most ducts; adapts to air flow from either side.
- Has two cells.
- Capacity of 1400 cfm (2380 m^3/hr) or 2000 cfm (3400 m^3hr), depending on size.
- Solid state power supply is self-regulating and maintains peak efficiency over a wide range of cell dirt loading conditions.
- Pressure drop is approximately equal to that of a regular fiberglass filter.
- Optional W8600E Solid State Performance Indicator monitors air cleaner performance, reminds homeowner when a cell and prefilter wash is past due, and when to check system.
- Electronic cells can be washed in most home dishwashers.
- Remote mount kit is available for mounting power supply and junction box separately when access space is not available.
- Galvanized cabinet protects against rust.
- Automatic interlock switch disconnects power and discharges cell when door is opened.
- Test button checks system operation.
- Troubleshooting guide mounted inside cell access door.
- Permanent wash reminder schedule mounted on top of power supply box.
- Prefilter screens protect cells from large dirt particles.

APPLICATION

The F50E high efficiency electronic air cleaner is mounted in the return air duct of a forced air heating, cooling, or ventilating system. It captures a significant amount of the airborne particles 0.5 microns and larger from the air circulated through it.

Contents

Bel-Aire ElectronicAirCleaners.com

68-0072-5

Cleaning Electronic Air Cleaner Components

Turn Off Power

Disconnect power to the air cleaner before servicing

Remove Components

Take out pre-filter, ionizing section, and collector plates

Clean Components

Wash in hot, soapy water or run through dishwasher if manufacturer permits

Use only recommended cleaning solutions to avoid damage

Dry Thoroughly

Allow components to dry completely before reinstallation

Moisture can cause electrical arcing and damage

Reinstall

Return components to their proper positions in the cabinet

Restore power to the unit

Ultraviolet Air Purifiers: Introduction

What Are UV Air Purifiers?

Ultraviolet (UV) air purifiers use UV-C light to reduce biological contaminants, chemicals, and odors in the air.

UV is not a filtration method but can be incorporated into filtration systems to enhance air quality.

How They Work

UV-C light damages the DNA and RNA of microorganisms, preventing them from reproducing and effectively neutralizing them.

The UV light is typically installed in the ductwork or near the cooling coil where microorganisms are likely to grow.

Applications

UV air purifiers are particularly effective against mold, bacteria, viruses, and other biological contaminants.

They are often used in conjunction with traditional filters for comprehensive air cleaning.

Types of UV Air Purification Systems

Coil Sterilization Systems

UV lamps installed near the cooling coil to prevent mold and bacteria growth

Helps maintain system efficiency by keeping coils clean

Operates continuously to prevent biofilm formation

Air Sterilization Systems

UV lamps installed in the ductwork to treat air as it passes through

Designed to maximize exposure time of moving air to UV light

May include reflective surfaces to increase UV effectiveness

Combination Systems

Incorporate both coil and air sterilization functions

May include additional filtration components

Provide comprehensive air treatment approach

UV Air Purifier Installation

Select Installation Location

Identify optimal placement for maximum effectiveness (typically near cooling coil or in return air duct)

Prepare Mounting Surface

Create access opening if necessary and prepare mounting brackets

Install UV Lamp Assembly

Mount the UV lamp fixture according to manufacturer's instructions

Connect Electrical Supply

Wire the UV system to appropriate power source following electrical codes

Install Safety Features

Ensure safety switches and warning labels are properly installed

Caution: UV light can cause eye and skin damage. Always follow safety precautions during installation and maintenance.

UV Air Purifier Maintenance

Regular Lamp Inspection

Check UV lamps periodically to ensure they are functioning properly

Lamp Replacement

Replace UV lamps according to manufacturer's schedule (typically annually)

UV lamps continue to emit light but lose effectiveness over time

Lamp Cleaning

If recommended by manufacturer, clean lamp surfaces to remove dust

Always disconnect power before cleaning

System Verification

Periodically verify that safety interlocks and warning systems are functioning

UV Air Purifier Advantages and Disadvantages

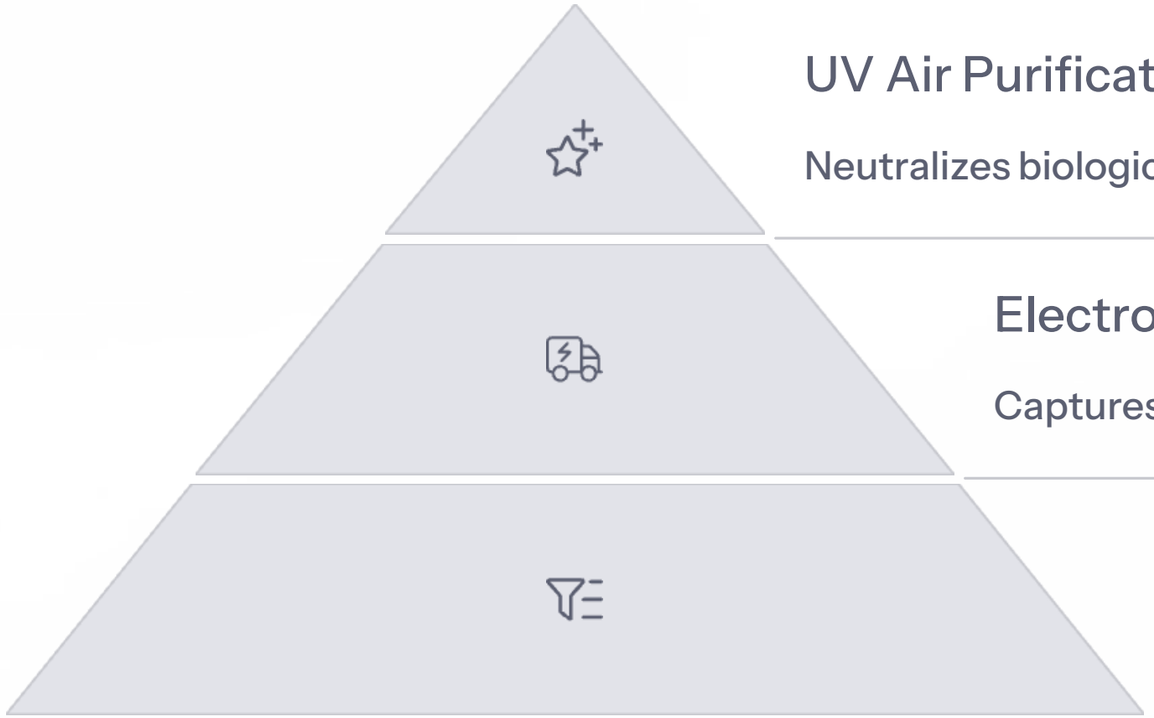
Advantages

- Effectively neutralizes biological contaminants
- Helps prevent mold growth on cooling coils
- Reduces system maintenance by keeping components cleaner
- No resistance to airflow
- Can help reduce odors

Disadvantages

- Does not remove particles from the air (needs to be used with filters)
- Requires periodic lamp replacement
- Consumes electricity continuously
- Potential safety concerns if improperly installed
- Some models may produce small amounts of ozone

Combining Filtration Technologies



UV Air Purification

Neutralizes biological contaminants

Electronic Air Cleaning

Captures very small particles

Media Filtration

Removes larger particles

For optimal indoor air quality, a comprehensive approach combining multiple technologies may be most effective. A basic media filter can remove larger particles, while electronic air cleaning captures smaller particles, and UV purification addresses biological contaminants. This layered approach provides more complete air cleaning than any single technology alone.

Selecting the Right Air Filtration System for Customers

Assess Needs

Determine customer's air quality concerns and health requirements

Evaluate Environment

Consider home conditions, pets, allergies, and local air quality

System Compatibility

Ensure selected filtration works with existing HVAC equipment

Budget Considerations

Balance initial costs with long-term operational expenses

Customer Education on Air Filtration

Explain System Operation

Ensure customers understand how their air filtration system works

Establish Maintenance Schedule

Create a clear timeline for filter replacement or cleaning

Demonstrate Maintenance Procedures

Show customers how to properly maintain their specific system

Highlight Warning Signs

Teach customers to recognize when their system needs attention

Impact of Dirty Filters on System Performance

Filter Becomes Clogged

Dust and particles accumulate in the filter material

Airflow Decreases

Restricted airflow reduces system efficiency

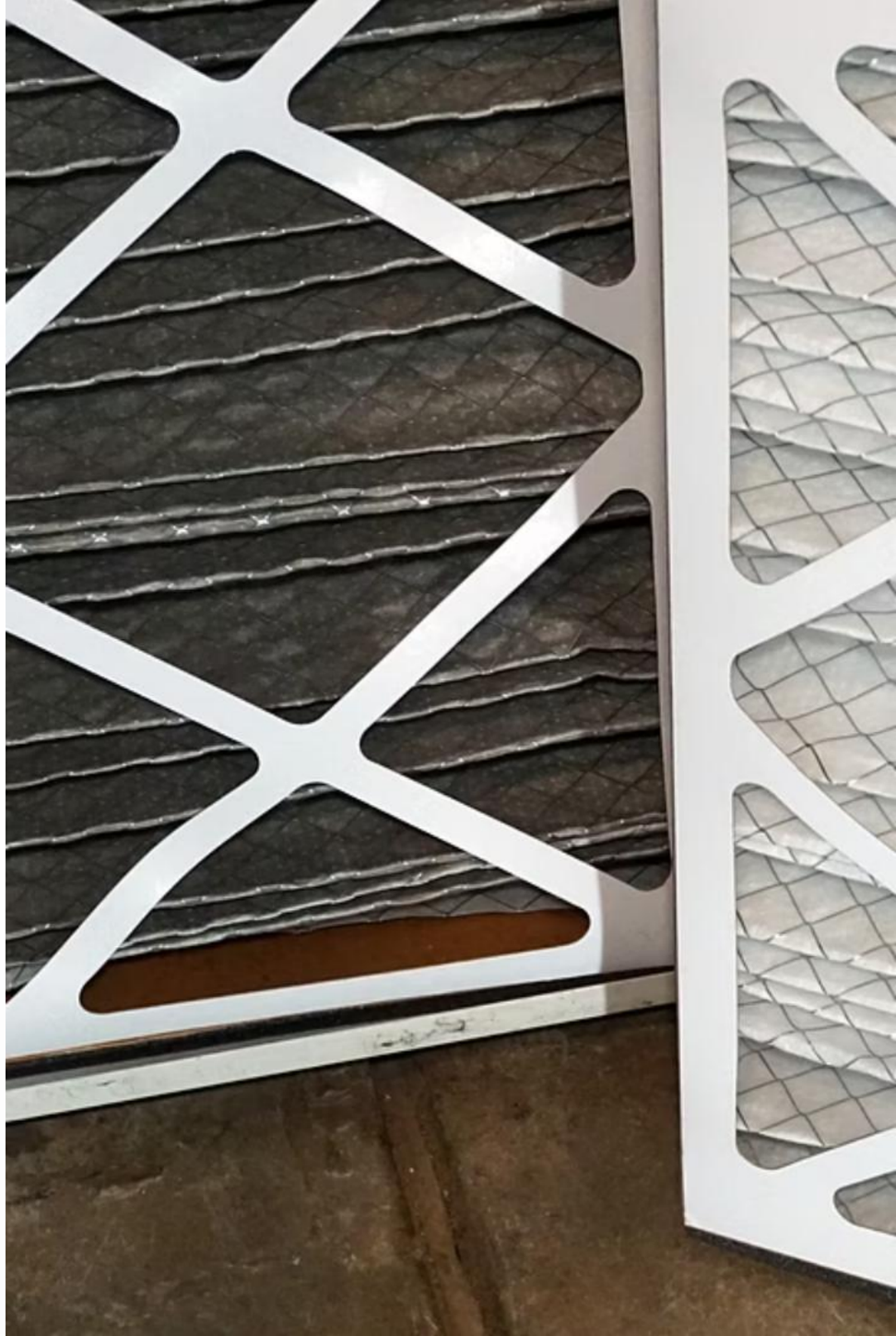
System Works Harder

Blower motor strains to move air through the restriction

Temperature Issues

Furnace may overheat and trigger high-limit switch

Air conditioning coils may freeze due to insufficient airflow



Importance of Proper Filter Sizing

Dimensions Matter

Filters must be the exact size specified for the system to ensure proper fit and function.

Even small gaps around a filter can allow unfiltered air to bypass the filter, reducing effectiveness.

Thickness Considerations

The thickness of the filter affects both filtration capacity and airflow resistance.

Thicker filters generally provide better filtration and longer life but may create more resistance.

System Compatibility

Not all systems can accommodate all filter thicknesses.

Always check manufacturer specifications for compatible filter dimensions.

Filter Replacement Best Practices

Check Direction

Install filters with the arrow pointing in the direction of airflow (toward the furnace).

Incorrect orientation reduces efficiency and can damage the filter.

Secure Properly

Ensure the filter is properly seated in its rack or frame.

Use any clips or fasteners provided to hold the filter securely in place.

Replace, Don't Clean (Disposables)

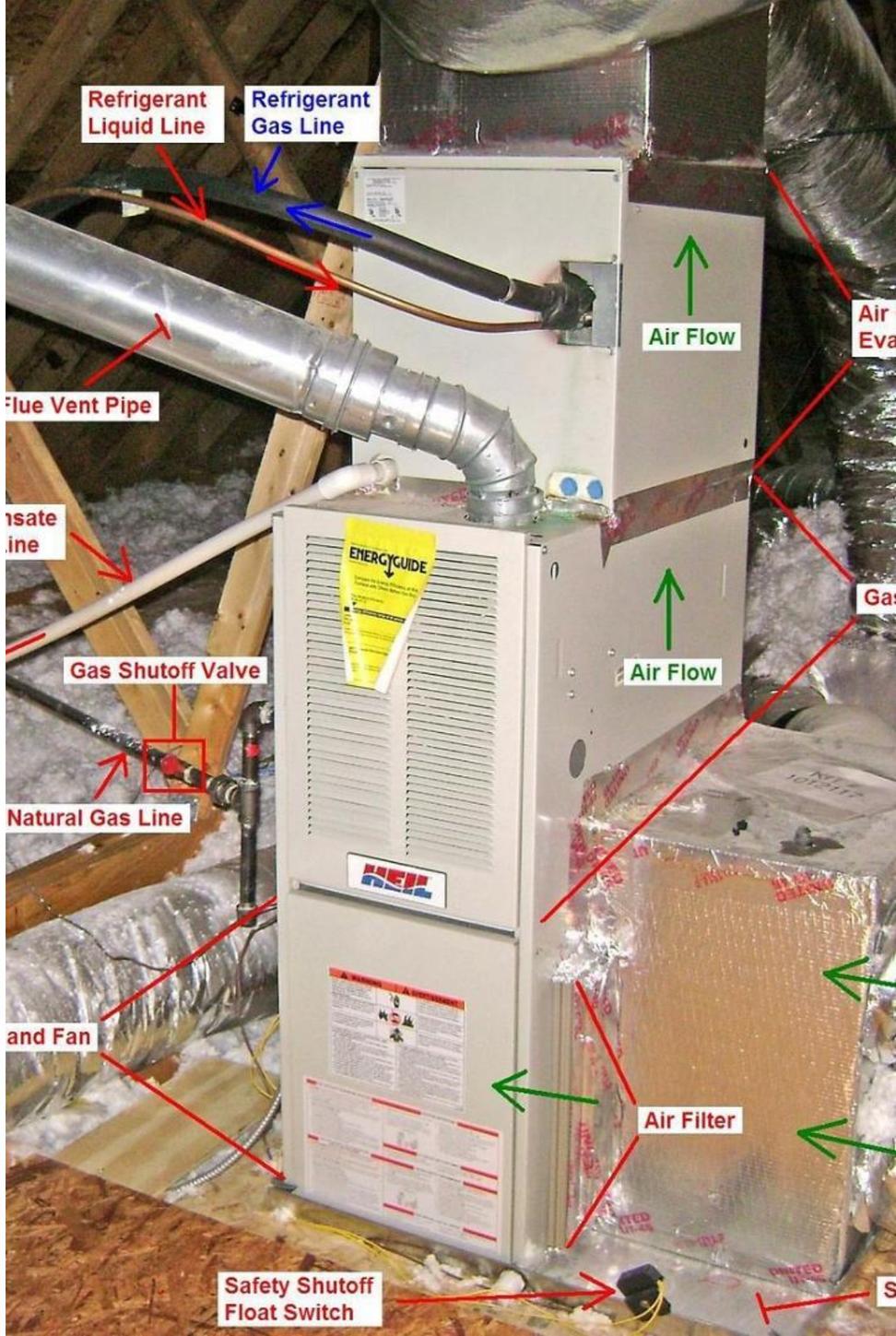
Never attempt to clean disposable filters.

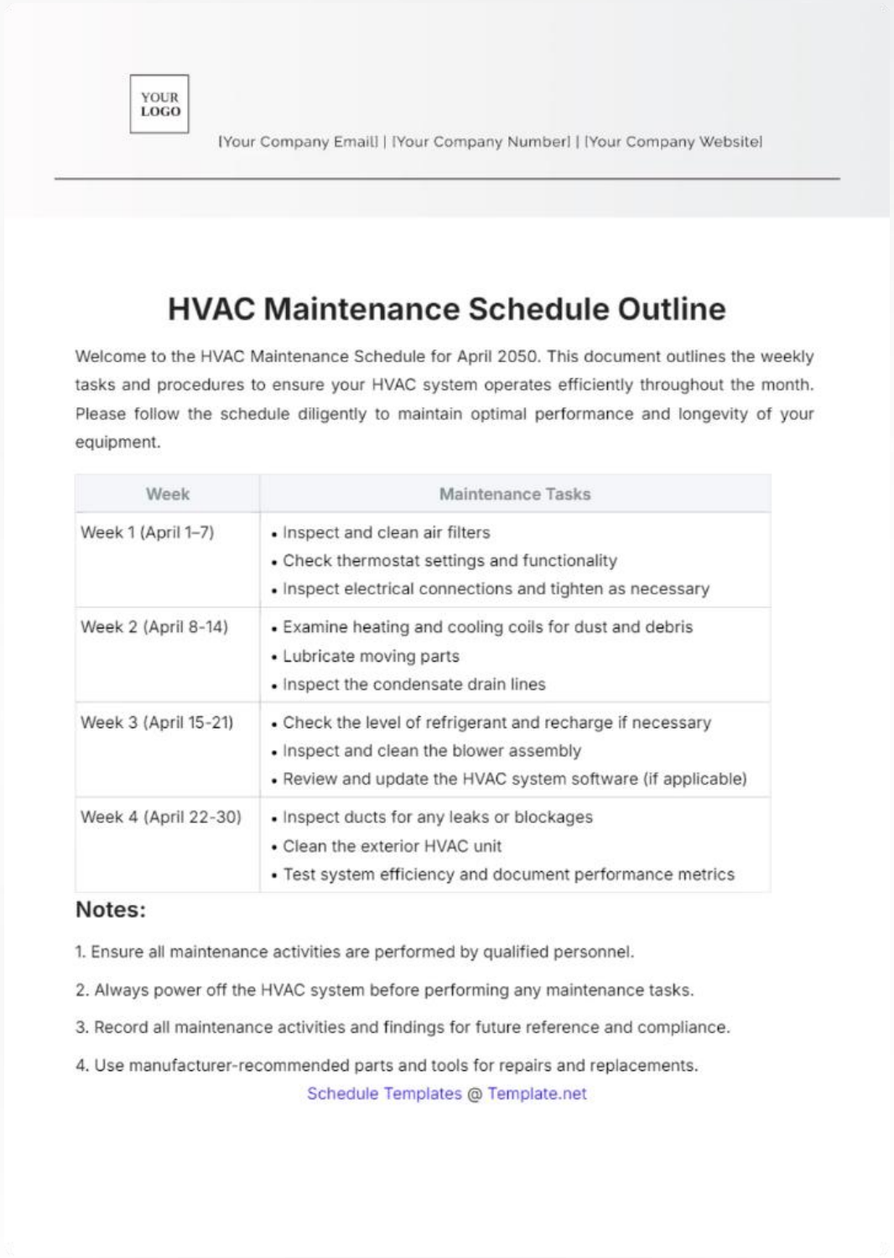
Cleaning damages the filter media and reduces effectiveness.

Follow Schedule

Replace filters according to the recommended schedule, even if they don't appear dirty.

Many harmful particles are not visible to the naked eye.





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HVAC Maintenance Schedule Outline

Welcome to the HVAC Maintenance Schedule for April 2050. This document outlines the weekly tasks and procedures to ensure your HVAC system operates efficiently throughout the month. Please follow the schedule diligently to maintain optimal performance and longevity of your equipment.

Week	Maintenance Tasks
Week 1 (April 1–7)	• Inspect and clean air filters • Check thermostat settings and functionality • Inspect electrical connections and tighten as necessary
Week 2 (April 8-14)	• Examine heating and cooling coils for dust and debris • Lubricate moving parts • Inspect the condensate drain lines
Week 3 (April 15-21)	• Check the level of refrigerant and recharge if necessary • Inspect and clean the blower assembly • Review and update the HVAC system software (if applicable)
Week 4 (April 22-30)	• Inspect ducts for any leaks or blockages • Clean the exterior HVAC unit • Test system efficiency and document performance metrics

Notes:

1. Ensure all maintenance activities are performed by qualified personnel.
2. Always power off the HVAC system before performing any maintenance tasks.
3. Record all maintenance activities and findings for future reference and compliance.
4. Use manufacturer-recommended parts and tools for repairs and replacements.

Schedule Templates @ Template.net

Seasonal Filter Maintenance Considerations

Winter

Check filters monthly during heavy heating use

Consider higher MERV rating if home is sealed tightly

Spring

Replace filters before allergy season

Consider more frequent changes during high pollen periods

Summer

Monitor filters during heavy AC use

Check more frequently if wildfire smoke is present

Fall

Replace filters before heating season begins

Consider higher efficiency during fall allergy season

Indoor Air Quality Considerations

99.97%

HEPA Filtration Efficiency

Percentage of particles 0.3 microns or larger removed by HEPA filters

8-11

Recommended MERV Rating

Optimal MERV range for most residential applications

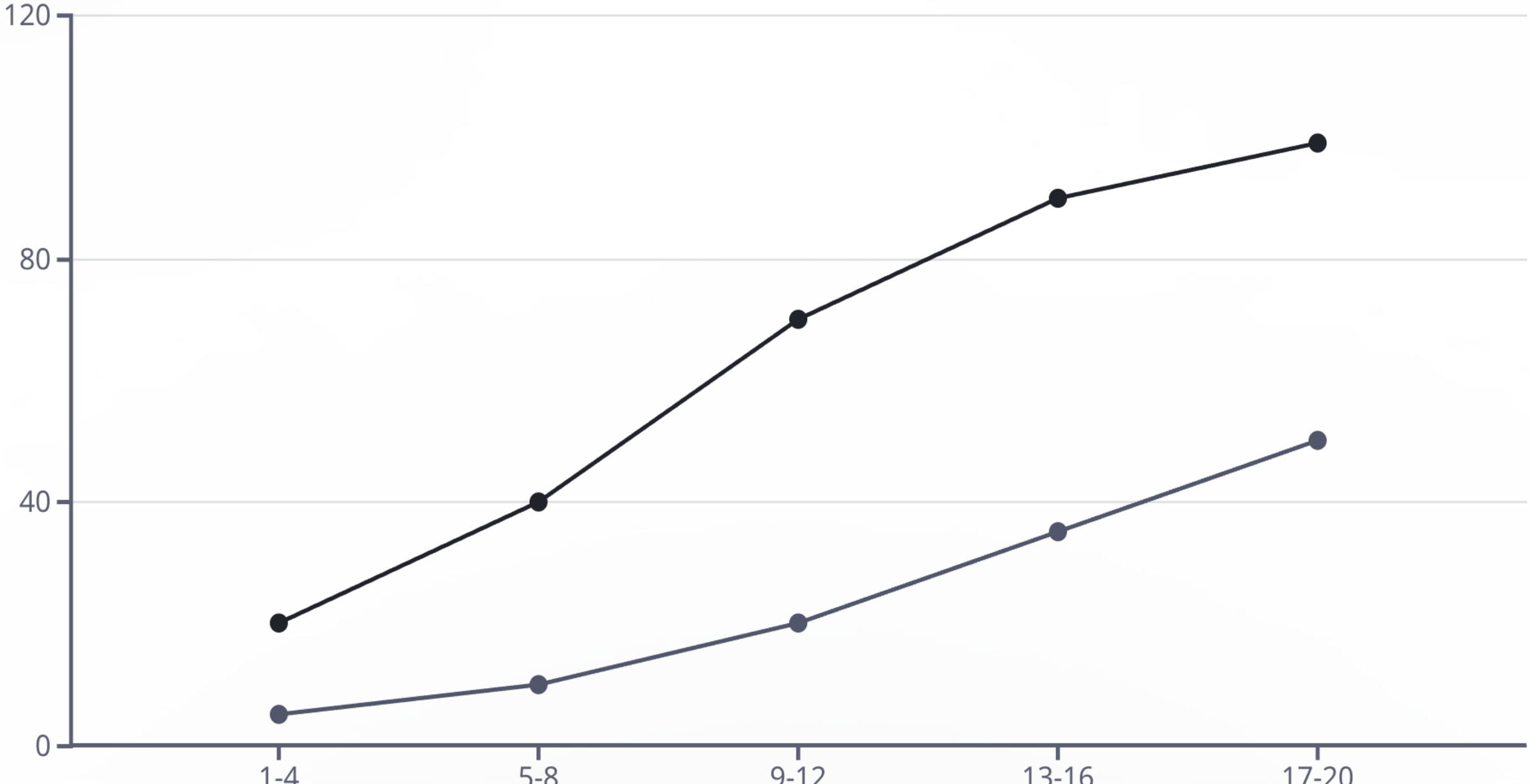
1-3

Monthly Filter Changes

Typical frequency for checking and replacing filters during peak seasons

Indoor air quality is a critical consideration for health and comfort. The EPA estimates that indoor air can be 2-5 times more polluted than outdoor air, making effective filtration an essential component of a healthy home environment.

Filter Efficiency vs. Airflow Balance



Common Air Filtration Problems and Solutions

Problem	Possible Causes	Solutions
Reduced Airflow	Clogged filter, filter too restrictive	Replace filter, consider lower MERV rating
Short Filter Life	High dust levels, incorrect size	More frequent changes, address dust sources
Bypass Air	Poor filter fit, damaged rack	Ensure proper sizing, repair filter rack
System Cycling Off	High limit tripping due to restricted airflow	Replace filter, check for other blockages
Coil Freezing	Insufficient airflow across cooling coil	Replace filter, ensure proper airflow

Air Filter Environmental Impact

Disposable Filters

Disposable filters contribute to landfill waste, with millions discarded annually. The environmental impact includes:

- Manufacturing resources (paper, cardboard, synthetic materials)
- Transportation emissions
- Landfill space
- Non-biodegradable components

Reusable Filters

Reusable filters offer environmental benefits but have their own considerations:

- Reduced waste generation
- Water and detergent usage for cleaning
- Energy for manufacturing durable materials
- Longer lifespan (typically 3-5 years)

Energy Considerations

The energy efficiency impact of filters is also important:

- Clean filters reduce HVAC energy consumption
- Proper filtration extends equipment life
- Balanced approach saves resources long-term

Electrostatic Filter Installation

Installation Locations

Because electrostatic filters are a form of slab filter, they are installed in the same position and way as slab filters, either:

- inside the plenum; or
- in a filter frame.

Consult the manufacturer's specifications for installation instructions.

Proper installation of electrostatic filters is essential for optimal performance. Always

Electrostatic Filter Cleaning Instructions

Vacuuming

If the filter is lightly soiled, vacuuming will be sufficient to remove the particles.

Vacuum first the upstream side of the filter, followed by the downstream side. You can also vacuum some electrostatic filters in place.

Consult the manufacturer's instructions for specifics.

Flushing with clean water

From time-to-time, flush the filter thoroughly with clean water using either a hose or shower nozzle.

Drying the filter before returning it to position is not necessary, but you should shake excess water from it to prevent it from dripping into the ductwork.

Washing with detergent

If the filter is greasy, wash it with detergent, possibly in a bathtub. However, take care not to scratch the tub with the filter frame.

Rinse the filter with clear water before you return it.

Electrostatic Filter Maintenance

Regular Inspection

The gas technician/fitter should inspect the electrostatic air filter during the inspection of the furnace and replace damaged filters.

Customer Education

Ensure customers understand the cleaning requirements and maintenance schedule for their electrostatic air filter.

Performance Monitoring

Check filter efficiency periodically to ensure it continues to provide adequate air filtration for the system.

Electronic Air Cleaners Overview

What Are EACs?

An electronic air cleaner (EAC) may be free-standing or designed to be installed into central heating and cooling systems. The basic operation is the same. In this chapter, references to EACs are those designed to be installed into the heating and cooling system.

Electronic Air Cleaner Components

Pre-filter

The pre-filter screens large particles before they enter the electrostatic field. This section may be composed of fine wire mesh, expanded aluminum, or foam.

The large particles removed by the pre-filter might cause excessive arcing (and excess ozone production) if they could enter the high-voltage section of the air cleaner cell. Note: The pre-filter serves the same purpose as the slab or hammock filters in the furnace blower compartment, so when an EAC is installed, remove any existing slab or hammock filter.

Charging Section

The charging section (cell) consists of a band of small-diameter wire filaments or ionizer wires.

They are supplied with high DC voltage (between 6 and 25 kV DC) from the power pack. The wires are suspended equidistant between grounded plates. The high voltage on the wires creates an electrostatic field, also called an ionizing field.

The positive ions create flow across the airstream. As airborne particles pass through the field, they become positively or negatively charged.

Collecting Section

The collector cell contains a series of parallel plates.

Alternate plates are charged with a positive direct current voltage of 4 to 10 kV DC. Plates that are not charged are at ground potential. The charged particles passing into this section are attracted to the plates by the electric field on the charges they carry. These capture and hold contaminated particles of the opposite charge.

Oils or adhesives on the plates may augment retention.

Power Pack

The power pack consists of: a step-up transformer, which increases incoming 120 V AC current to 3000 - 3500 V at the collector cells; and a rectifier circuit (also called a voltage doubler), which converts the previously mentioned current to 7500 -- 8500 V DC at the charging cells.

Electronic Air Cleaner Operation

Air Flow

Air enters the EAC through the return duct

Pre-filtering

Large particles are captured by the pre-filter

Charging

Particles receive an electrical charge

Collection

Charged particles are attracted to collector plates

Clean Air

Filtered air continues through the HVAC system

EAC Control Systems

System Switch

The air cleaner comes with a manual system switch.

Air Proving Switch

The air proving switch ensures that the EAC is functioning only when the furnace blower is in operation.

Indicator Lights

Many EACs include indicator lights to show when the unit is operating and when maintenance is required.

EAC Advantages and Disadvantages

Advantages

- Unchanging system resistance as particles are collected
- Removal of fine particulate matter, such as cigarette smoke and pollen
- Collection of particles does not impair system operation
- Highly efficient on 5 and and differen

Disadvantages

- Removal of odours of vapours such as tobacco smoke are not removed (To reduce these odours, you may add an activated carbon filter downstream of the EAC to filter out odours)
- High initial cost
- Production of ozone gas with a noticeable odour created by an electrical arc
- More complicated customer-performed maintenance and cleaning than for media filters

As a result of some of these disadvantages, EACs are not as popular today as they once were. EACs produce ozone levels in the house air but not greater than the safe concentrations recommended by health guidelines.

EAC Installation Locations

Return Air Plenum

EACs are typically installed in the return air plenum.

Near Blower Compartment

They may be installed in the return air duct close to the blower compartment.

Between Components

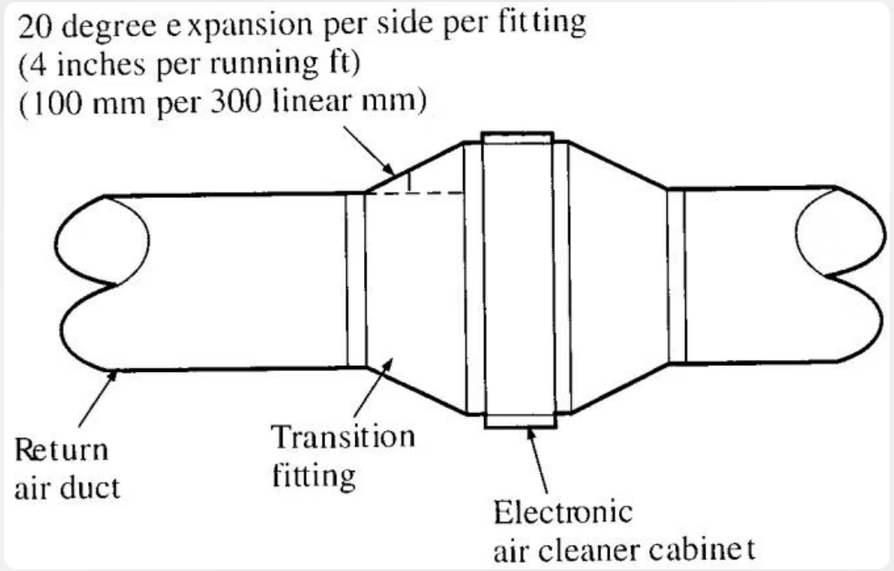
They may be installed between the plenum and the blower.

Additional Locations

You can also install air cleaners in the outdoor-air intake ducts of buildings and residences or in the recirculation and bypass air ducts.

Always place air cleaners ahead of heating or cooling coils and other air-conditioning equipment in the system to protect other equipment from dust and to increase its efficiency.

Sheet Metal Modifications for EAC Installation



Gradual Transitions

If the duct is a different size from the air cleaner cabinet, gradual transitions are recommended to reduce air turbulence and increase efficiency.

Expansion Limits

The expansion should be no more than 20 degrees, or 4 inches per running ft (100 mm per 300 linear mm) on each side.

Air Distribution

In the duct adjacent to the unit, install turning vanes to ensure good air distribution across the face of the electronic cells.

System Benefits

This will help to keep the blower and evaporator coil clean and ensure the unit functions efficiently.

EAC Installation Requirements

Complete Filtration

EACs must filter the entire return air stream.

Proper Air Flow

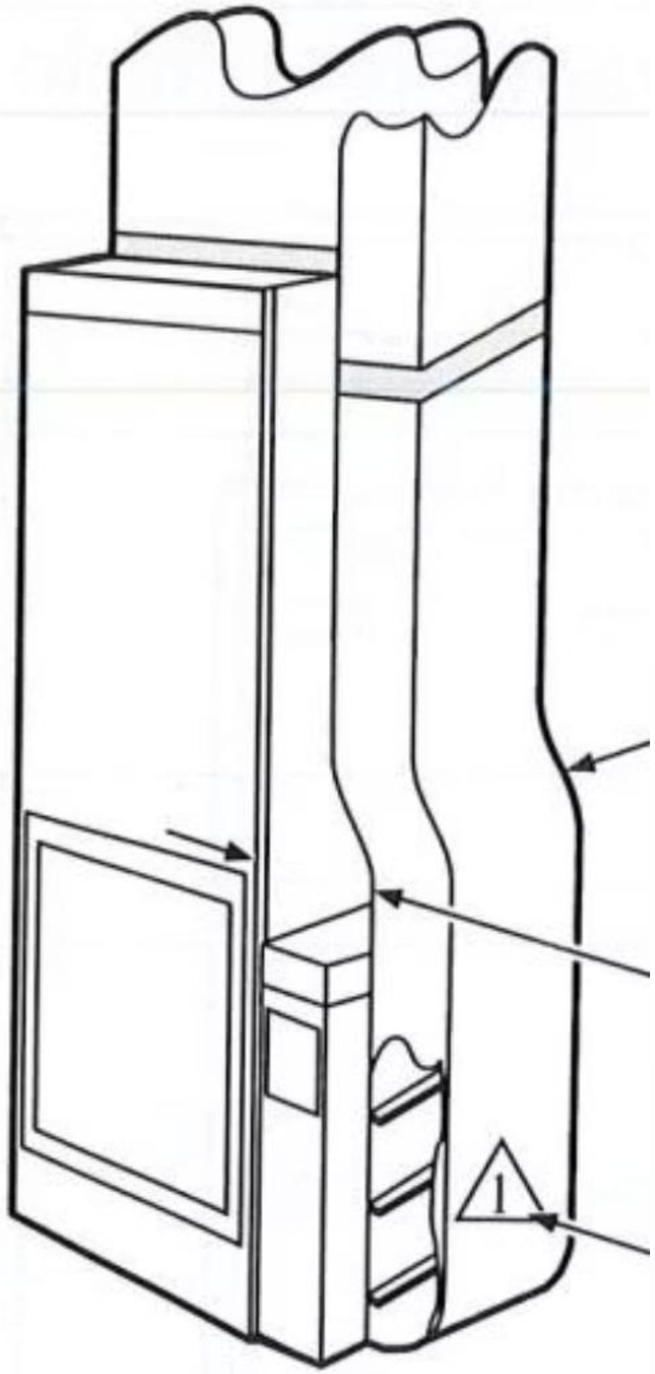
EACs must not exceed acceptable restrictions to air flow.

Adequate Clearance

EACs must be installed with clearances that match manufacturer's specifications and allow for service access. If necessary, a duct offset can be used to provide space for an EAC.

Humidifier Considerations

EACs should be installed upstream from the humidifier, if possible. Moisture from the humidifier will cause mineral and salt buildup in the EAC. If the EAC must be installed downstream from the humidifier, the distance between the two units should be as great as possible.



Duct Offset for EAC Installation

Measure Required Space

Determine the dimensions needed for the EAC installation.

Create Offset Design

Design the duct offset to accommodate the EAC while maintaining proper airflow.

Fabricate Transition Pieces

Create the necessary ductwork components for the offset installation.

Install Offset and EAC

Mount the offset ductwork and install the EAC according to manufacturer specifications.

EAC Installation Step 1: Preparation

Clean Blower Compartment

Remove as much dust as possible from the heating system before installing the EAC.

Remove Furnace Filter

Remove and discard the furnace filter.

Vacuum Ductwork

Power vacuum the ductwork to remove accumulated dust in an existing home, or construction dust in a new home.

Clean Fan Blades

Clean the furnace fan blades as required. Since the EAC removes particles only from circulating air, it cannot remove dust that has settled in the blower compartment or distribution ducts.

EAC Installation Step 2: Attach Cabinet to Furnace

Remove Components

Remove and set aside the access door, electronic cell(s), and pre-filters.

Note: Electronic cells and ionizing wires are very delicate. You must handle them with caution. The power door requires accurate and secure replacement.

Align Cabinet

Align the cabinet with the return air opening.

Create Opening

Create an opening in the furnace to match air cleaner cabinet opening.

Install Transition

Install a transition when furnace and air cleaner openings are different sizes.

Level and Support

Be sure the unit is firmly supported and level. Place blocks under the cabinet if necessary.

Secure Cabinet

Attach the cabinet securely to the furnace. Either attach the cabinet directly or use a starting collar fitted in the furnace opening. Either drill holes and fasten with sheet metal screws or rivets, or use slip joints.

EAC Installation Step 3: Install Turning Vanes

When To Install

Install turning vanes if the EAC must be located close to a turn in the ductwork.

Purpose

The vanes ensure even air flow over the face of the unit.

Installation Method

Follow manufacturer guidelines for proper installation of turning vanes to optimize airflow.

Performance Impact

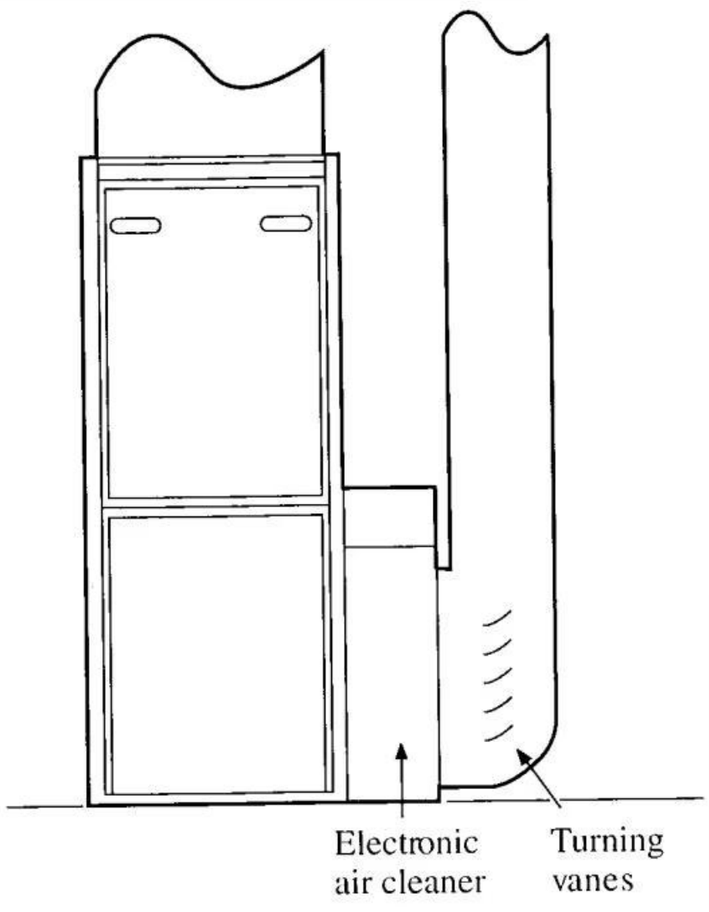
Properly installed turning vanes improve EAC efficiency and reduce system resistance.

Figure 1-13
Turning vanes distribute air flow evenly

EAC Installation Steps 4-5: Ductwork and Wiring

Step 4: Fasten Cabinet to Ductwork

Install a transition when the opening on the air cleaner and the opening on the duct are different sizes.



Step 5: Wiring

EACs function only when the blower is operating and air is in motion. When properly installed, the EAC electrically or mechanically interlocks with the furnace or cooling system blower circuit and can only operate when the furnace blower is energized.

For an interlock:

1. Install a sail switch in the return air duct. When the blower is energized, the air movement causes a fin on the sail switch to move, closing a set of electrical contacts to the EAC and energizing it.
2. Follow all electrical and building codes in conjunction with manufactures instructions.

Ozone Production in EACs

Normal Operation

A properly functioning EAC produces a small amount of ozone, the odour of which may be noticeable. The gas technician/fitter should explain this odour to the building occupants.

Excessive Ozone

A strong noticeable odour indicates continuous arcing and brush discharge in the EAC and indicates a need for service.

Odor Reduction

An activated carbon filter can reduce the odour of ozone. Install the activated carbon downstream from the air cleaner.

Safety Note

Since some activated charcoal filters are combustible, it is important that particles from the air filter are not able to fall into the EAC.

Note: High ozone odours can occur if there is too little air flow through the filter.

Customer Instructions for EAC Maintenance

Cleaning Frequency

EACs require cleaning every one to six months, depending on household conditions.

Household Factors

A home with several people and pets, where residents smoke tobacco, and have hobbies such as woodworking, will need frequent EAC cleaning.

Lower Maintenance Homes

A smaller household with no smokers, pets, or individuals with dusty hobbies, will need less frequent EAC cleaning.

Professional Service

Since cleaning must be frequent, while other services are rarer, the customer must know how to clean the EAC. Some customers may also be happy to replace broken ionizing wires themselves. A trained gas technician/fitter should do all other servicing.

Technician Responsibilities for Customer Education

Show Power Switch

The gas technician/fitter must show the customer the location of the power switch (and test switch, if the EAC includes one).

Demonstrate Cleaning

The gas technician/fitter must ensure that the customer knows how to remove and clean filters and cells, according to the manufacturer's instructions for the unit.

Explain Maintenance Schedule

Most EACs come with a wash reminder schedule, which should be posted in a convenient place for customer reference.

Explain Indicator Lights

Some EACs have an indicator light that comes on to indicate that the cells are dirty and air cleaning efficiency is diminished. Ideally, the cells should be washed frequently enough that this light never comes on.

Caution! Turn off the power to the EAC before cleaning the cells to discharge the electronic cells. Sometimes, it takes a few minutes for the charge on the cells to dissipate. Pressing the test button after the unit is turned off will dissipate the charge to ground.

Cleaning EAC Cells: Basic Procedure

Remove Cells

Slide cells out of cabinet. Be careful as cells may have sharp edges.

Wash Cells

Wash the cells either by soaking them at a coin-operated do-it-yourself car wash or in an automatic dishwasher. Take care not to damage the ionizing wires, no matter which method is used. Detergent is usually used for cleaning. Follow the manufacturer's specific instructions for cleaning materials.

Inspect Cells

After washing, inspect the cells for dirt or residue. Repeat the washing process if necessary.

Clean Pre-filter

Before reassembling the EAC, clean the pre-filter. You may wash the pre-filter screen with detergent, or you may vacuum them, whichever is more convenient. Do not wash the pre-filter in the dishwasher or a car wash. Since the pre-filter contains lint that can become caught in cells, do not soak it at the same time as the cells.

Inspect Wires

Before reassembling the EAC inspect the ionizing wires and replace any that are broken.

Reassemble

Reassemble the EAC. If the EAC has a drying unit, engage it.

Restore Power

Turn power on at main disconnect.

Note: Some EACs will not operate until they are completely dry. Others will operate, but wet cells and pre-filters may cause arcing. If the unit comes with a Check LED, the light may come on when cells and pre-filters are wet in the unit. Wait for two or three hours until the cells and pre-filter are completely dry to avoid these problems.

Dishwasher Method for Cleaning EAC Cells

Check Compatibility

Before washing the cells in the dishwasher, check the dishwasher manual. Some manufacturers of dishwashers do not recommend using them to wash electronic cells.

Position Cells

Place cells on the bottom rack with the air flow arrows pointing up, being sure to place in such a way as to allow good water circulation. Do not place anything else in the dishwasher with the cells.

Add Detergent

Use regular dishwashing detergent.

Run Wash Cycle

Run them through a complete wash cycle. Do not allow the dishwasher to run through the dry cycle. The dry cycle will bake on any contaminants that remain on the cells and impair air cleaner efficiency.

Cool and Drain

Allow the cells to cool completely in the dishwasher or wear protective gloves to avoid burns when removing the cells. Hot water may accumulate in the tubs supporting the collector plates. Tip the cells to drain these tubes.

Clean Wires

Wipe the ionizer wires and contact board on the end of the cell gently using a small damp cloth.

Clean Dishwasher

If dirt or residue remains in the dishwasher, run the dishwasher again, empty, to clean it.

Soaking Method for Cleaning EAC Cells

Prepare Container

Do not soak cells in a bathtub since their sharp edges can scratch the tub finish. Fill a container large enough to immerse one or both cells with very hot water.

Add Detergent

Dissolve 3/4 cup of regular automatic dishwashing detergent per cell. If the detergent does not dissolve readily or forms a scum on the water, use softened water or try another brand.

Soak Cells

After the detergent is completely dissolved, lower the cell(s) into the container and soak each cell for 15 - 20 minutes.

Agitate and Remove

Lift the cells up and down a few times, then remove them.

Rinse and Soak Again

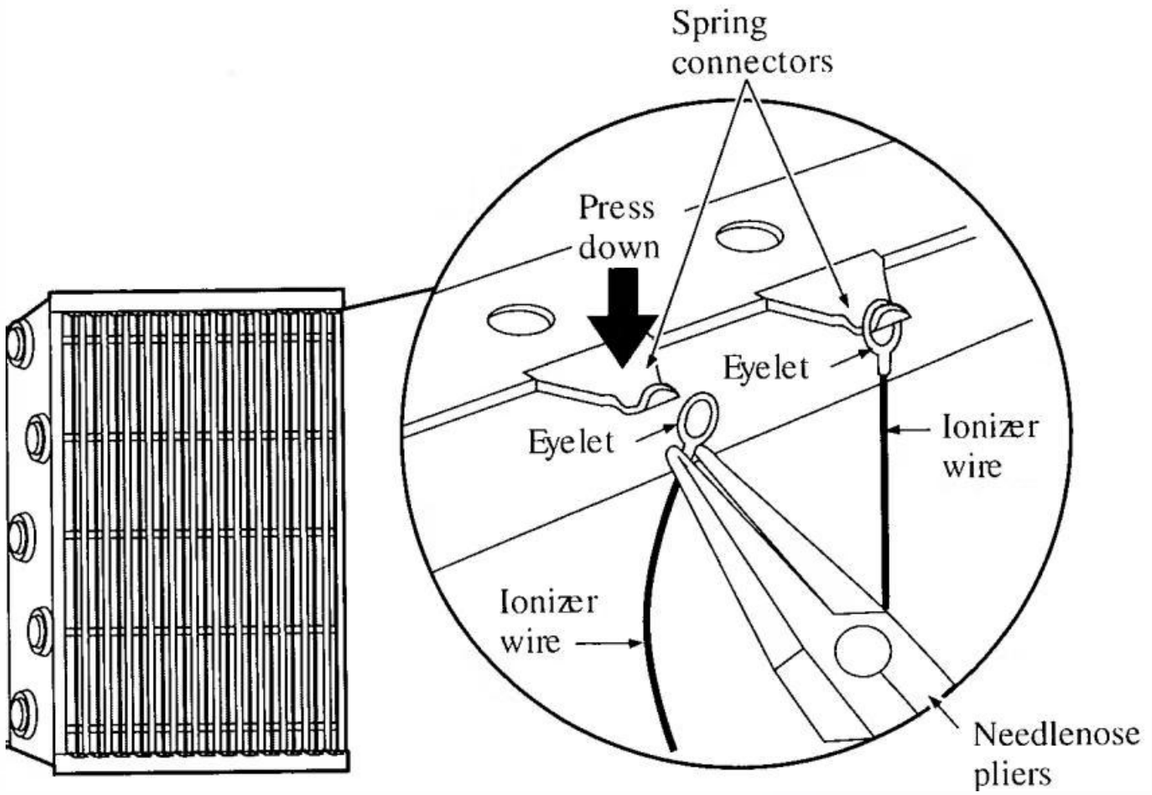
Rinse the cells with a fine spray and soak again in hot clean water for 5 - 15 minutes.

Drain

Stand the cells upright to drain.

Checking and Replacing Ionization Wires

Figure 1-14
Replacing ionization wires
Courtesy of Honeywell Limited



Inspect Wires

The fine tungsten wires in the charging section of the electronic cell are brittle and can easily break or become damaged. Show the customer how to inspect the cell from the upstream side to ensure no wires are broken or out of position.

Identify Issues

Broken wires can cause visible arcing or sparking. They require replacement.

Replacement Parts

EAC Maintenance and Service

Customer Maintenance

The customer can clean cells and replacement ionizing wires, but a trained gas technician/fitter must perform other maintenance and service.

Basic Maintenance

Before the beginning of the heating and cooling seasons, inspect the solid-state components and ionizing wires of the EAC. The exact procedure for checking the unit will vary depending on the manufacturer, so refer to the manufacturer's instructions.

Component Checks

Checking the components at the beginning of the heating and cooling seasons is basic preventive maintenance for the EAC. Checking the components requires a voltmeter or multimeter.

Professional Service

Regular professional maintenance ensures optimal performance and extends the life of the EAC.

Checking EAC Components

Power Check

Be sure the power from the main disconnect to the EAC is in the ON position.

Sail Switch Test

To check the operation of the sail switch (or electrical blower interlock), energize the furnace blower. If the EAC does not operate, the sail switch may be faulty.

Indicator Light Check

Check to see that the voltage indicator light is on. If the light is not on, but the unit operates, the light is faulty.

Test Button Check

Push the Test Button on the front of the EAC access door. Pushing the button shorts the hot side of the collector section to ground and should produce one or more loud snapping sounds in the section. This indicates that the EAC is working properly. The test button discharges the cells.

Power Pack Voltage Check

Remove the access door. With the voltmeter or multimeter set to AC, check the voltage to the power pack. It should read 120 V AC. If the power pack is not working, you can replace the solid-state power supply within the power supply box.

Collecting Section Voltage Check

With the voltmeter or multimeter set to DC, check the voltage to the collecting section plates (3000 - 3500 V DC).

Charging Section Voltage Check

With the voltmeter or multimeter set to DC, check the voltage to charging ionization wires. It should read 7500 - 8500 V DC.

Caution! EACs operate at high voltage to charge particles. Follow manufacturer's instructions carefully when servicing them to avoid a hazard.

EAC Troubleshooting

If	Then
There is visible arcing or sparking.	Check the cell for short circuits using an ohmmeter. Make sure power to the EAC is off and cells are discharged. Check the resistance between the frame of the cell and the ionizer, and the frame of the cell and the collector contacts. In each case, the resistance should be infinite.
A cell is sparking continuously in one place.	The plates need to be repositioned. Consult the manufacturer's instructions for correct positioning of plates.
The customer complains of an ozone odour.	Make sure the air cleaner shuts off when the furnace blower is not active. Make sure there is adequate air flow through the unit.

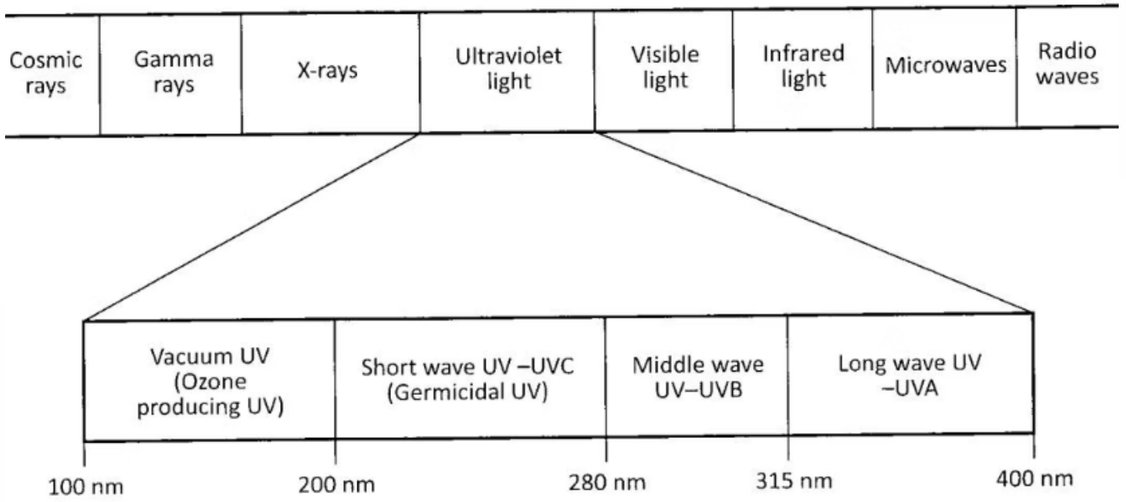
UV Air Purifiers Introduction

What is UV Light?

Ultraviolet (UV) light rays lie in the spectrum of light that is invisible to most humans. UV lights are designed to create a specific wavelength range within the electromagnetic spectrum of UV radiation.

The following are the common UV lamps used in air purification systems:

- The UVC range is germicidal and is therefore commonly used for air sterilization UVC lamps effectively destroy microorganisms that pass by the bulb, including germs, viruses, bacteria, and fungi (such as mould).
- Vacuum UV (VUV) lights can help reduce gaseous contaminants and odours such as volatile organic compounds (VOC).
- UVA combined with a catalyst reduce odours and chemicals.



UVC light is like looking at the sun. Looking at the blue light can result in significant eye damage and exposure to it can result in skin damage.

Ensure no plastic parts or wire insulation are exposed to UV light.

Figure 1-15
The electromagnetic spectrum

UV Light Spectrum

UVA (315-400 nm)

When combined with a catalyst, UVA light can help reduce odors and chemicals in the air.

UVB (280-315 nm)

This range has limited applications in air purification systems.

UVC (200-280 nm)

The germicidal range that effectively destroys microorganisms including germs, viruses, bacteria, and fungi.

Vacuum UV (100-200 nm)

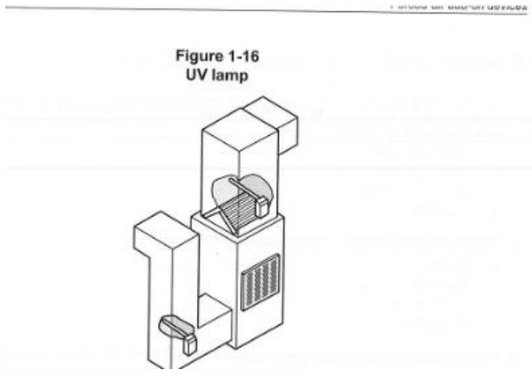
Can help reduce gaseous contaminants and odors such as volatile organic compounds (VOCs).

Germicidal UV Lamp

Basic Function

The basic UVC lamp device is designed to fit into a wide variety of locations in the supply or return air duct. Installing the device near the cooling coil to reduce mould and bacteria in the coil fins, drain pans, and surrounding surface.

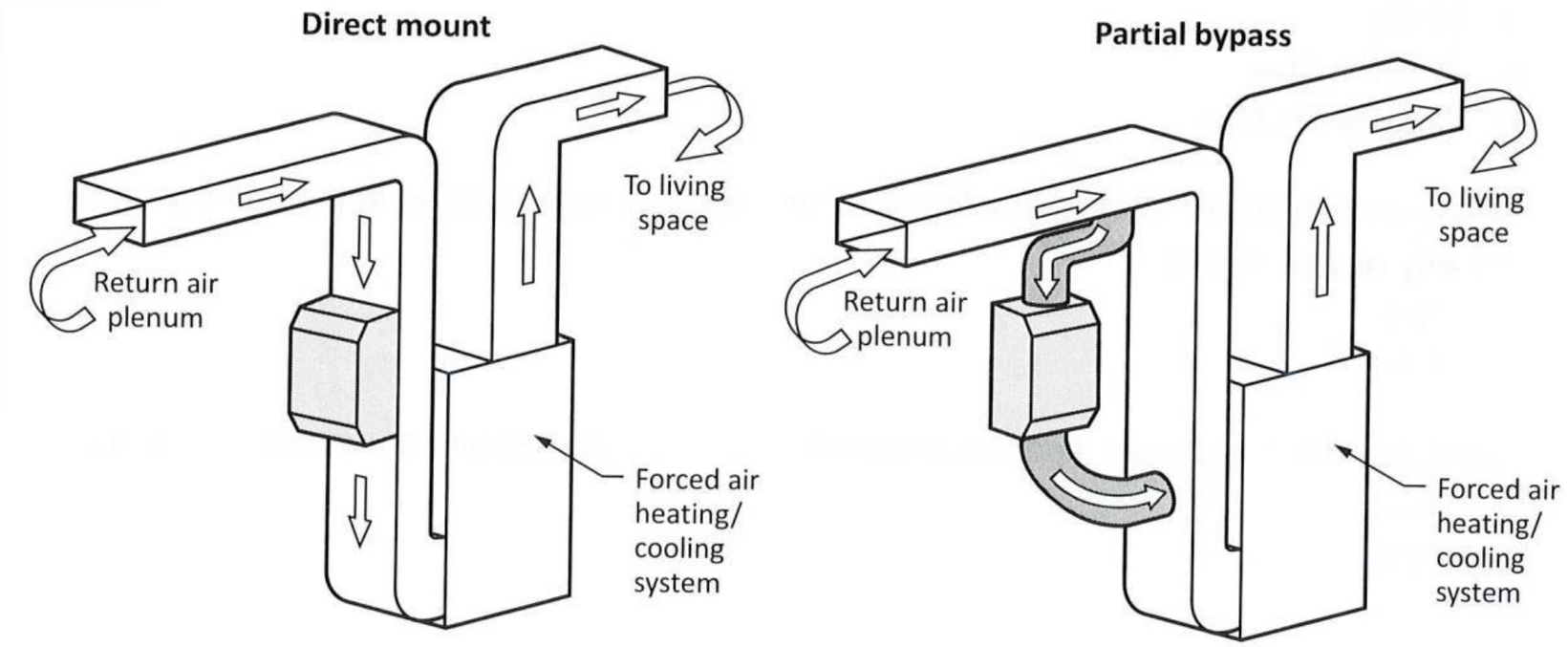
Continuous operation of the air handler motor and UVC germicidal lamp allows maximum exposure of airborne contaminants to the UVC light.



Advantages and Disadvantages

Advantage	Disadvantage
Can destroy micro-organisms, such as germs, viruses, bacteria, and fungi (including mould)	No effect on particulates including most allergens
Helps prevent illness and disease	No effect on chemical fumes, gases, or cigarette smoke
Does not produce ozone	

UV Air Treatment Systems



Integrated Systems

UV lamps have been incorporated into systems that can both purify and filter the air. These systems can include different filters options including HEPA and charcoal.

Installation Options

They may be installed to operate as a standalone system, as a partial bypass arrangement or an insert unit, in either case they do not remove the inline HVAC filter necessary to protect then fan.

UV Light Types

UV air treatment systems may use different types of UV lights depending on the type of air treatment being performed. Do not assume that all UV systems have germicidal capabilities.

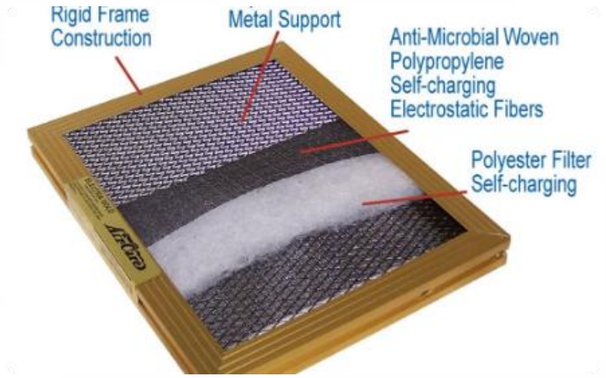
Ozone Production

Some UV lights are designed to produce both UVC and VUV light. A VUV light unit will produce small amount of ozone. This ozone odour may be noticeable.

Electrostatic Filter Installation Best Practices

Proper Positioning

Electrostatic filters must be installed in the correct orientation to ensure proper airflow and filtration efficiency. Always check for airflow direction indicators on the filter frame.



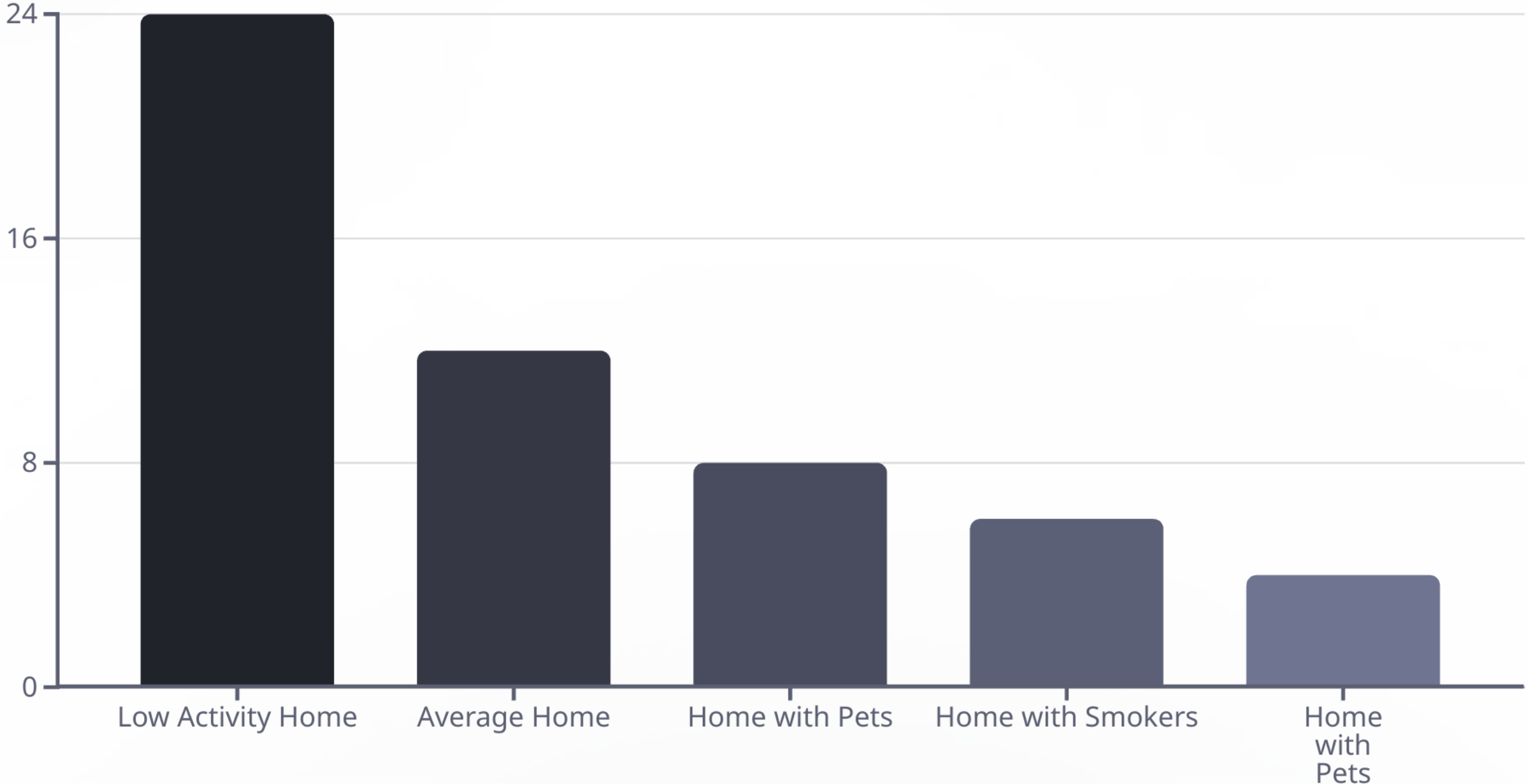
Secure Mounting

The filter frame must be securely mounted to prevent air bypass around the edges of the filter. Any gaps will significantly reduce filtration effectiveness.

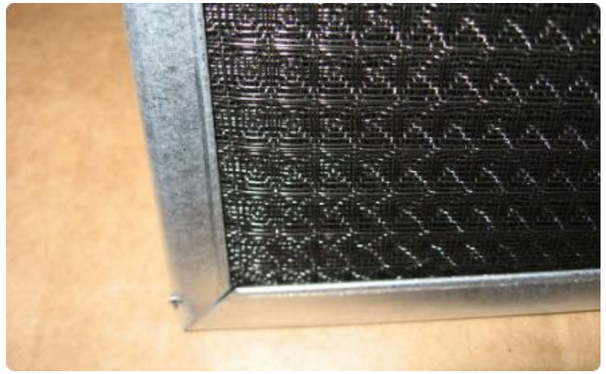
Proper Sealing

Use appropriate gaskets or sealing materials to ensure an airtight fit between the filter frame and the ductwork or plenum. This prevents unfiltered air from bypassing the filter.

Electrostatic Filter Cleaning Frequency

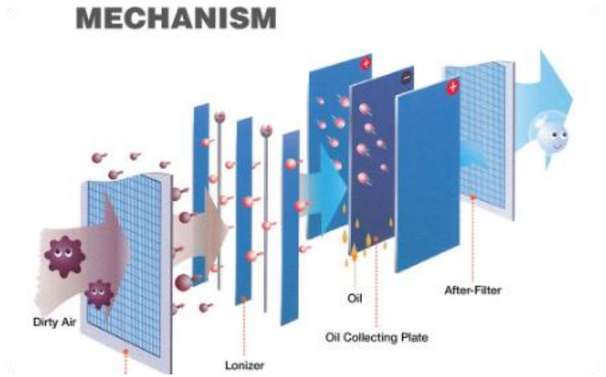


Electronic Air Cleaner Components



Pre-filter

The pre-filter screens large particles before they enter the electrostatic field. This prevents excessive arcing and ozone production in the high-voltage section of the air cleaner cell.



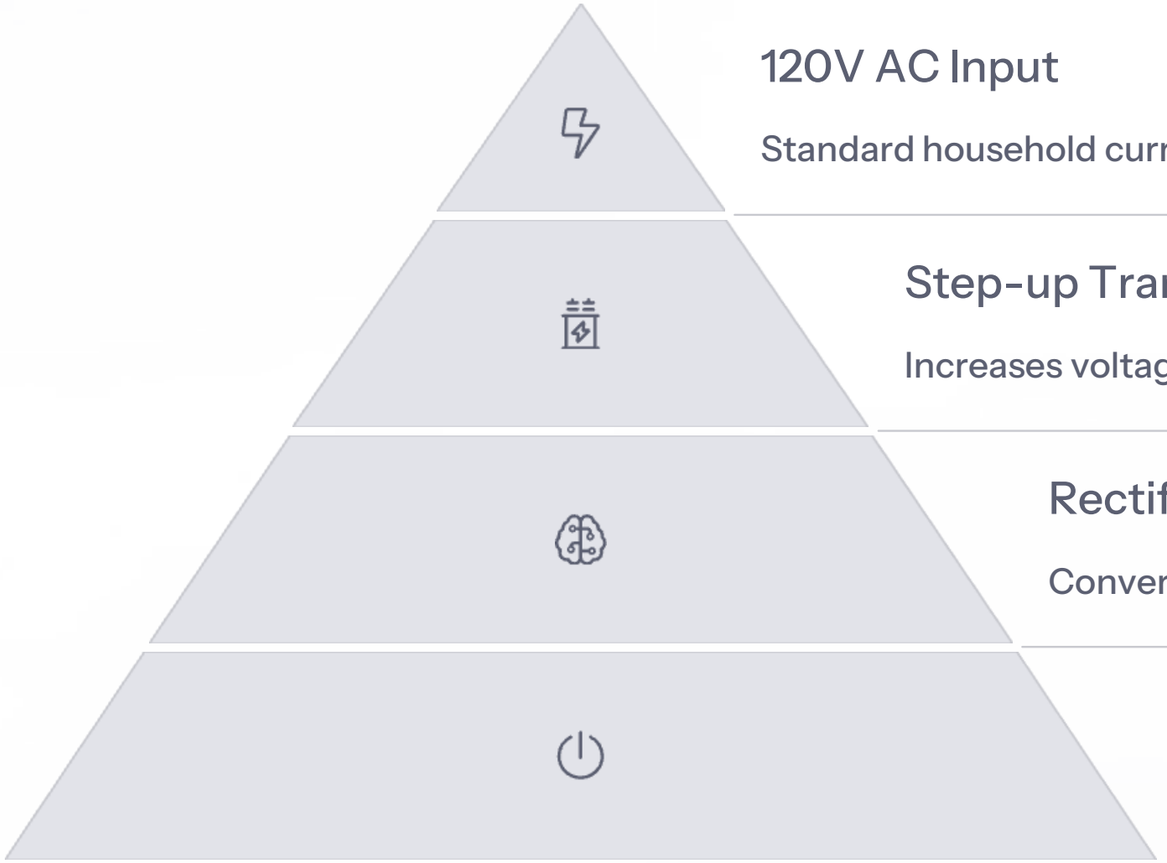
Charging Section

The charging section consists of ionizer wires supplied with high DC voltage that create an electrostatic field. As airborne particles pass through this field, they become positively or negatively charged.

Collecting Section

The collector cell contains a series of parallel plates with alternating charges that attract and capture the charged particles as they pass through the section.

Electronic Air Cleaner Power Supply



120V AC Input

Standard household current

Step-up Transformer

Increases voltage to 3000-3500V

Rectifier Circuit

Converts to 7500-8500V DC

Power Distribution

Supplies voltage to charging and collecting sections

The power pack is a critical component of the electronic air cleaner system. It converts standard household current into the high-voltage DC current required for the charging and collecting sections. The step-up transformer increases the incoming 120V AC to 3000-3500V, and the rectifier circuit (also called a voltage doubler) further converts this to 7500-8500V DC for the charging cells.

EAC Installation Location Considerations

Air Flow Direction

Ensure the EAC is installed with the correct airflow direction as indicated on the unit

Duct Transitions

Use gradual transitions when connecting to different sized ductwork

Clearance Requirements

Provide adequate clearance for maintenance access and service

Humidifier Placement

Install upstream from humidifiers when possible to prevent mineral buildup

EAC Installation Preparation Steps

1

System Cleaning

Remove dust from the entire HVAC system before installation

2

Ductwork Preparation

Ensure proper transitions and turning vanes are ready

3

Electrical Planning

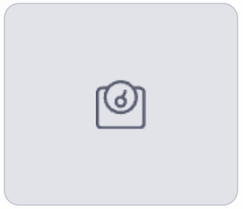
Verify power requirements and interlock connections

4

Component Inspection

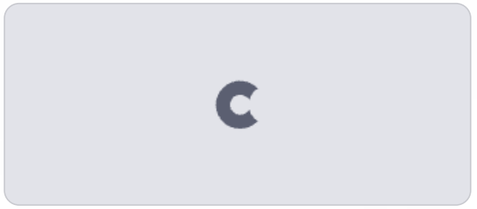
Check all EAC components for damage before installation

EAC Turning Vane Installation



Measure duct dimensions

Determine the exact size of the duct where vanes will be installed



Cut vanes to size

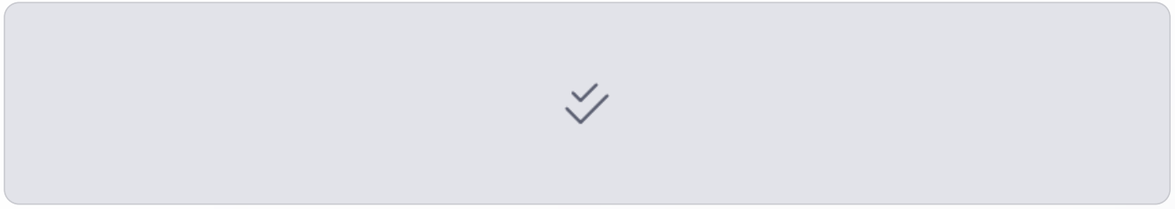
Prepare turning vanes according to duct dimensions

Install vane rails

Secure the vane rails to the duct walls

Insert vanes

Place vanes into rails at proper spacing



Verify installation

Ensure vanes are secure and properly aligned

EAC Electrical Interlock Options

Sail Switch

A mechanical switch activated by air movement in the duct. When the blower is energized, the air movement causes a fin on the sail switch to move, closing a set of electrical contacts to the EAC and energizing it.

Current Sensing Relay

Monitors the current draw of the blower motor and activates the EAC when the blower is running.

Pressure Differential Switch

Detects the pressure difference created by the blower operation and closes the circuit to the EAC when sufficient pressure is detected.

Direct Wiring

Connects the EAC directly to the blower circuit so that it operates whenever the blower is energized.

EAC Cleaning Methods Comparison

Dishwasher Method

- Place cells on bottom rack with airflow arrows pointing up
- Use regular dishwashing detergent
- Run through complete wash cycle (no dry cycle)
- Allow cells to cool completely before handling
- Wipe ionizer wires and contact board gently
- Run empty dishwasher cycle if residue remains

Soaking Method

- Use container large enough for complete immersion
- Fill with hot water and 3/4 cup dishwashing detergent per cell
- Soak cells for 15-20 minutes
- Lift cells up and down before removing
- Rinse with fine spray
- Soak in clean hot water for 5-15 minutes
- Stand cells upright to drain

Note: Do not soak cells in a bathtub since their sharp edges can scratch the tub finish. If using the dishwasher method, check the dishwasher manual first as some manufacturers do not recommend using them to wash electronic cells.

Ionizing Wire Replacement Procedure

Safety First

Ensure power to the EAC is completely off and cells are discharged before beginning any work.

Remove Broken Wire

Carefully remove all parts of the broken wire, being careful not to damage the spring connector.

Prepare New Wire

Obtain the correct replacement wire with eyelets on both ends.

Attach First End

Hook the eyelet of the new ionization wire over the spring connector on one end of the cell.

Stretch Wire

Hold the opposite eyelet with needlenose pliers and stretch the wire the length of the cell.

Secure Second End

Depress the opposite spring connector and hook the eyelet over it.

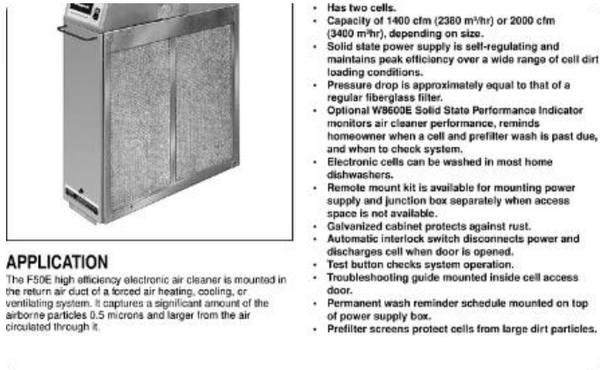
Verify Installation

Check that the wire is properly tensioned and securely attached at both ends.

EAC Voltage Testing Points

Power Supply Input

With the voltmeter set to AC, check the voltage to the power pack. It should read 120V AC. If no voltage is present, check the power source, interlock, and wiring connections.



APPLICATION

The F50E high efficiency electronic air cleaner is mounted in the return air duct of a forced air heating, cooling, or ventilating system. It captures a significant amount of the airborne particles 0.5 microns and larger from the air circulated through it.

- Has two cells.
- Capacity of 1400 cfm (2380 m³/hr) or 2000 cfm (3400 m³/hr), depending on size.
- Solid state power supply is self-regulating and maintains peak efficiency over a wide range of cell dirt loading conditions.
- Pressure drop is approximately equal to that of a regular fiberglass filter.
- Optional W9600E Solid State Performance Indicator monitors air cleaner performance, reminds homeowner when a cell and prefilter wash is past due, and when to check system.
- Electronic cells can be washed in most home dishwashers.
- Remote mount kit is available for mounting power supply and junction box separately when access space is not available.
- Galvanized cabinet protects against rust.
- Automatic interlock switch disconnects power and discharges cell when door is opened.
- Test button checks system operation.
- Troubleshooting guide mounted inside cell access door.
- Permanent wash reminder schedule mounted on top of power supply box.
- Prefilter screens protect cells from large dirt particles.

Collector Section

With the voltmeter set to DC, check the voltage to the collecting section plates. It should read 3000-3500V DC. Lower voltage may indicate a problem with the power supply or a short in the collector section.

Ionizer Section

With the voltmeter set to DC, check the voltage to the charging ionization wires. It should read 7500-8500V DC. Incorrect voltage may indicate a problem with the power supply or damaged ionizer wires.

Common EAC Problems and Solutions

Problem	Possible Causes	Solutions
No power to unit	Blown fuse, tripped breaker, faulty interlock	Check power source, replace fuse, reset breaker, check interlock
Arcing or sparking	Dirty cells, broken wires, misaligned plates	Clean cells, replace broken wires, realign plates
Strong ozone odor	Excessive arcing, inadequate airflow	Clean cells, check for airflow restrictions, verify blower operation
Poor air cleaning	Dirty cells, low voltage, air bypass	Clean cells, check voltage, seal any gaps around filter
Indicator light on	Dirty cells, system fault	Clean cells, check system components

UV Light Safety Precautions

Eye Protection

UVC light is like looking at the sun. Looking at the blue light can result in significant eye damage. Always wear appropriate eye protection when working with UV systems.

Skin Protection

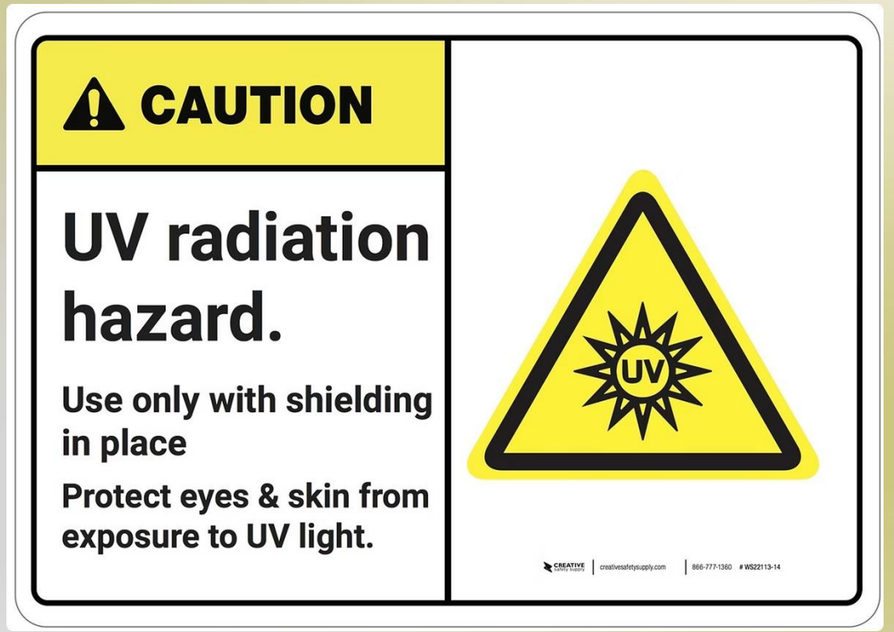
Exposure to UVC light can result in skin damage similar to severe sunburn. Cover all skin when working with active UV systems.

Power Disconnection

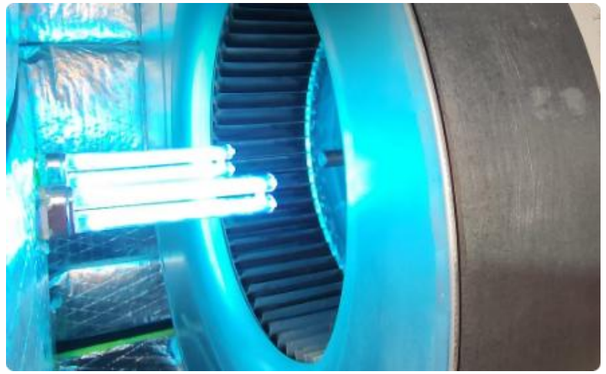
Always disconnect power to UV systems before servicing to prevent accidental exposure to UV radiation.

Material Protection

Ensure no plastic parts or wire insulation are exposed to UV light as they can degrade over time.



UV Air Purifier Applications



Cooling Coil Treatment

Installing UV lamps near the cooling coil helps reduce mold and bacteria growth in the coil fins, drain pans, and surrounding surfaces, improving system efficiency and indoor air quality.

Return Air Treatment

Placing UV systems in the return air duct helps neutralize airborne pathogens before they enter the HVAC system, providing whole-house air purification.

Standalone Systems

Portable or wall-mounted UV air purifiers can provide targeted air treatment in specific rooms or areas without modifying the central HVAC system.

Types of UV Air Treatment Systems

UVC Germicidal Systems

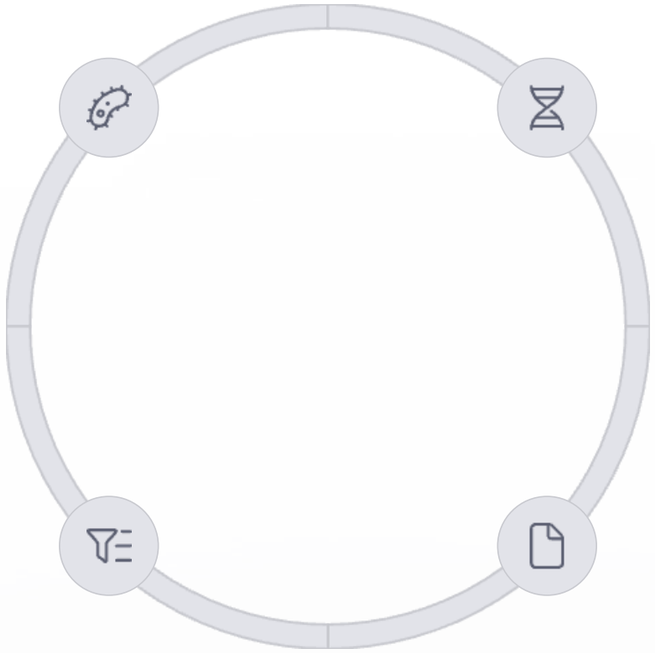
Uses UVC light (200-280 nm) to destroy microorganisms

- Effective against bacteria, viruses, and mold
- Does not produce ozone
- No effect on particulates or chemicals

Combination Systems

Integrates UV with other filtration technologies

- HEPA filtration for particulates
- Activated carbon for odors
- UV light for microorganisms



VUV Odor Control Systems

Uses Vacuum UV light (100-200 nm) to reduce odors

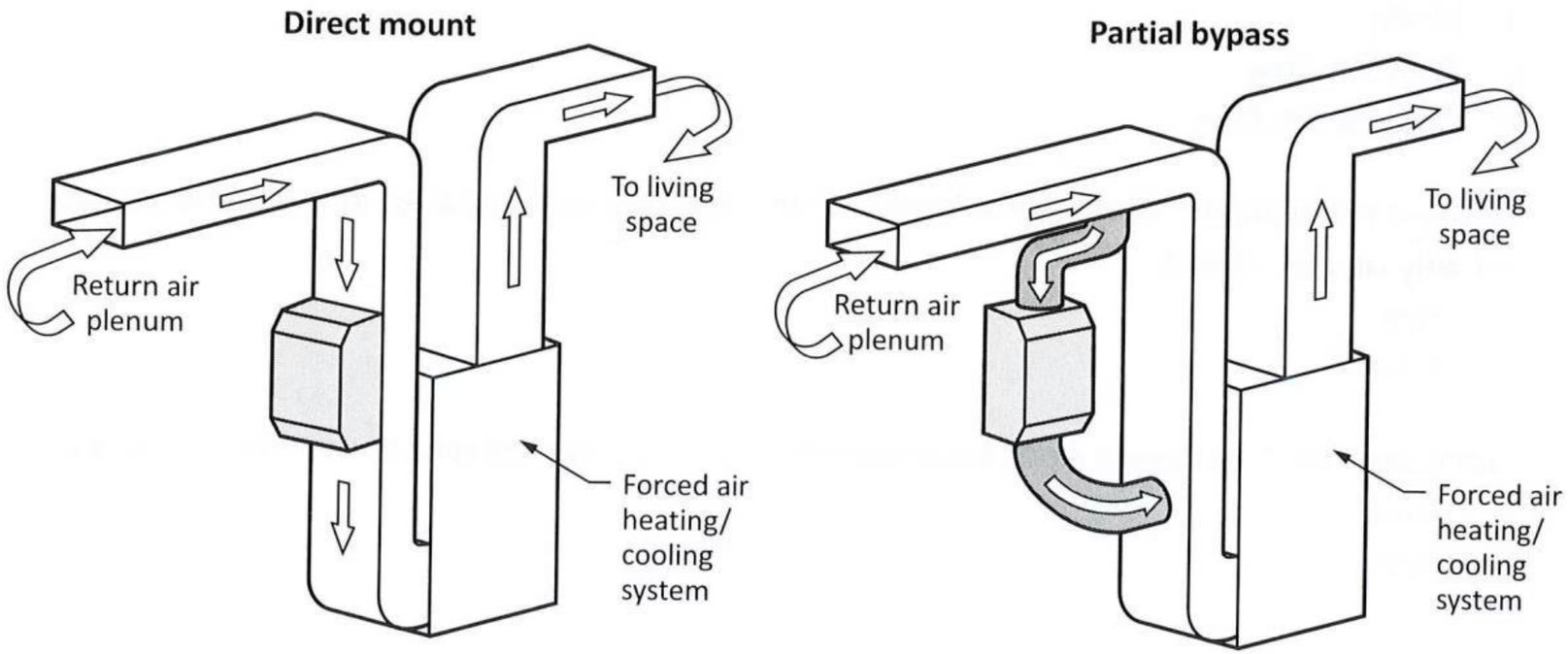
- Helps reduce gaseous contaminants
- Effective against volatile organic compounds
- Produces small amounts of ozone

PCO Systems

Photocatalytic Oxidation combines UVA with a catalyst

- Reduces odors and chemicals
- Breaks down complex molecules
- Minimal ozone production

HEPA/UV Air Purifier System



Air Intake

Draws in room air for filtration

Pre-filtration

Captures large particles

HEPA Filtration

Removes 99.97% of particles

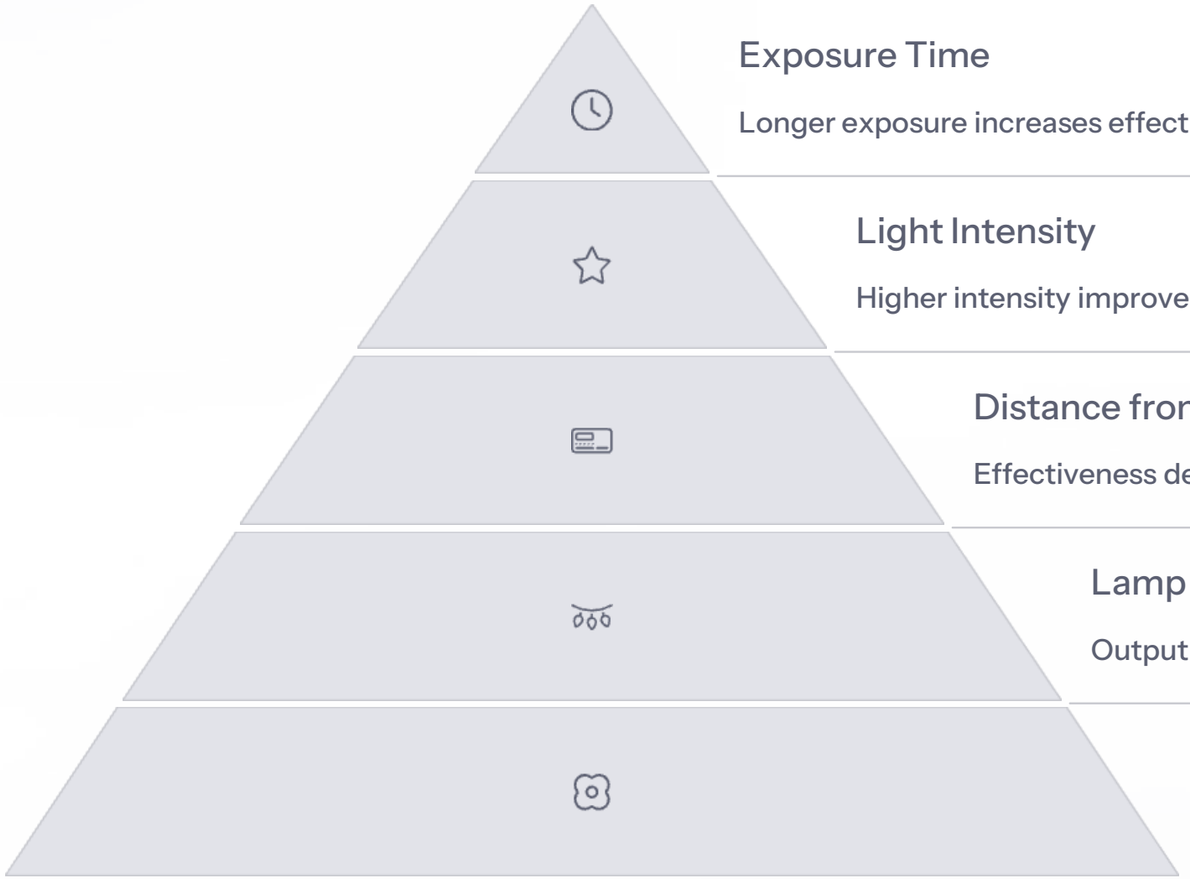
UV Treatment

Neutralizes microorganisms

Carbon Filtration

Absorbs odors and VOCs

UV Light Effectiveness Factors



Exposure Time

Longer exposure increases effectiveness

Light Intensity

Higher intensity improves germicidal action

Distance from Source

Effectiveness decreases with distance

Lamp Age and Condition

Output diminishes over time

Air Flow Rate

Proper balance needed for treatment

The effectiveness of UV air purification systems depends on multiple factors working together. The most critical factor is exposure time - microorganisms must be exposed to the UV light long enough for inactivation to occur. Light intensity directly impacts how quickly pathogens are neutralized, while the distance from the UV source affects the intensity reaching the target organisms. Lamp condition deteriorates over time, with most UV lamps requiring replacement every 9-12 months to maintain optimal performance. Finally, air flow rate must be carefully balanced - too fast and organisms won't receive sufficient exposure, too slow and system efficiency decreases.

UV Lamp Maintenance Requirements

Monthly Inspection

Visually check that UV lamps are operating (blue glow visible through viewport if equipped)

Quarterly Cleaning

Gently clean lamp surface with alcohol wipe to remove dust (with power off)

Semi-Annual Testing

Verify UV intensity with appropriate meter if available

Annual Replacement

Replace UV lamps according to manufacturer's schedule (typically 9-12 months)

Air Filtration Efficiency Comparison

Integrated Air Quality Solutions

Particulate Filtration

Removes dust, pollen, pet dander, and other airborne particles using mechanical or electronic filtration.

Microbial Control

Neutralizes bacteria, viruses, and mold spores using UV germicidal irradiation technology.

Chemical Filtration

Absorbs odors, volatile organic compounds, and gaseous pollutants using activated carbon or other adsorbent media.

Humidity Control

Maintains optimal humidity levels to discourage microbial growth and enhance comfort.

A comprehensive approach to indoor air quality combines multiple technologies to address different types of air contaminants. While electrostatic filters and electronic air cleaners excel at removing particulates, UV systems target microorganisms, and activated carbon addresses chemical pollutants and odors. When properly integrated, these systems work together to provide complete air purification for residential and commercial environments.

Air Cleaner Installation Checklist

System Assessment

Evaluate the existing HVAC system for compatibility with the air cleaner

Measurements

Verify dimensions and clearances for proper installation

System Cleaning

Clean the existing system components before installation

Ductwork Modifications

Make necessary transitions and install turning vanes if required

Air Cleaner Mounting

Securely install the air cleaner cabinet according to manufacturer specifications

Electrical Connections

Wire the air cleaner with proper interlocks to the blower circuit

System Testing

Verify proper operation of all components

Customer Education

Provide maintenance instructions and documentation

YOUR LOGO GOES HERE

Organisation: Template Library
Project: Example Template Project
Team: Example Team

Template ID: DP-PEA-0040
Template Version: 2 **Form Version:** 2
Form created: Friday, 26 April 2019, 11:11:42 am

Preventative Maintenance Checklist for HVAC

Automated Form Number	Template Library-Example Template Project-Example Team-DP-PEA-0040-0
Building or Area being Inspected	Pines Apartment Blocks
Name of Inspector/Auditor	Dave Hodgson
Date and Time of Inspection	Friday, 26 April 2019

HVAC

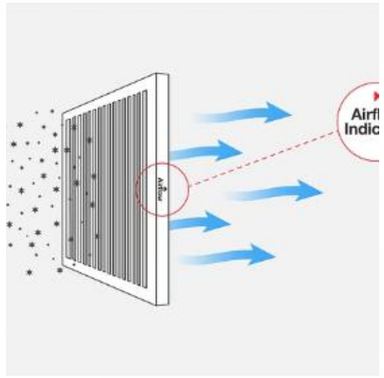
Inspect at least twice a year, with seasonal start-up and run inspections

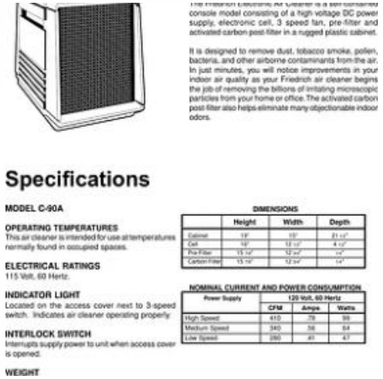
Checkbox	Do screws, latches, gaskets, or missing screws need replacements?	No	
Checkbox	Recharge P-traps or U-bend water traps for condensate drain pans	Yes	
Checkbox	Has a qualified mechanical contractor provide seasonal PM of chillers and boilers services?	Yes	
Checkbox	For cooling towers, disassemble screens and access panels for inspection	Yes	
Checkbox	Inspect the cooling tower fill, support structure, sump and spray nozzles	Yes	
Checkbox	Fill valve, gear box, drive coupling, fan blades, and motor bearings	Yes	
Checkbox	Clean starter and cabinet	Yes	
Checkbox	Inspect wiring; check motor starter contacts for wear and proper operation; megger test the motor and log readings	Yes	**Readings:** See attached for log readings
Checkbox	Check the condition of the sump heater and contactor, and log observations	Yes	**Observations:** No observations, sump heater in good condition
Checkbox	Has bearing lubrication for pump been completed at least annually? Inspect couplings and check for leaks. Investigate unusual noises	Yes	
Checkbox	Has cleaning or replacing air filters of air handling unit been completed at least once a month (some may only need to be changed every 3-6 months)?	No	

Air Cleaner Maintenance Schedule

Component	Maintenance Task	Frequency	Performed By
Electrostatic Filter	Cleaning	1-3 months	Homeowner
EAC Pre-filter	Cleaning	1-3 months	Homeowner
EAC Cells	Cleaning	1-6 months	Homeowner
EAC Ionizing Wires	Inspection/Replacement	6-12 months	Homeowner/Technician
EAC Components	Voltage Testing	Annually	Technician
UV Lamps	Replacement	9-12 months	Technician
Complete System	Inspection	Annually	Technician

Customer Education Materials





Specifications

MODEL C-90A

OPERATING TEMPERATURES
This air cleaner is intended for use at temperatures normally found in occupied spaces.

ELECTRICAL RATINGS
115 Volt, 60 Hertz.

INDICATOR LIGHT
Located on the access cover next to 3-speed switch. Indicates air cleaner operating properly.

INTERLOCK SWITCH
Interrupts supply power to unit when access cover is opened.

WEIGHT

DIMENSIONS

	Height	Width	Depth
Cabinet	19"	15"	21 ½"
Cell	19"	13 ½"	4 ½"
Pre-Filter	15 ¼"	12 ¼"	¼"
Carbon Filter	15 ¼"	12 ¼"	¼"

NOMINAL CURRENT AND POWER CONSUMPTION

Power Supply	120 Volt, 60 Hertz		
	CFM	Amps	Watts
High Speed	410	.78	99
Medium Speed	340	.56	64
Low Speed	280	.40	47

Providing comprehensive educational materials to customers is essential for ensuring proper maintenance and operation of air cleaning systems. These materials should include clear instructions for routine maintenance tasks, safety information, maintenance schedules, and contact information for professional service. Well-informed customers are more likely to properly maintain their systems, resulting in better air quality and longer equipment life.

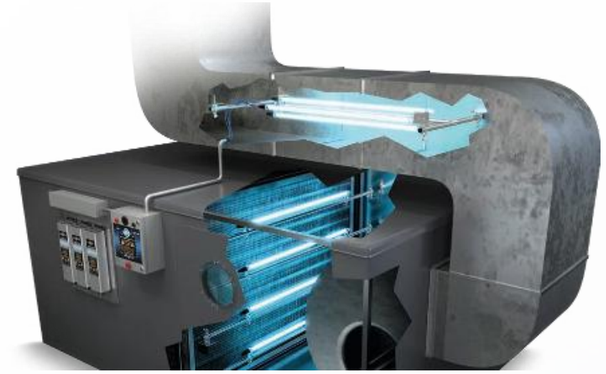
Air Cleaning Technology Selection Guide

Electrostatic Filters

Best for: Homes with standard HVAC systems seeking moderate filtration with low maintenance costs. These washable filters provide good particle removal without creating significant airflow restriction. Ideal for households with average air quality concerns and those looking to reduce disposable filter waste.

Electronic Air Cleaners

Best for: Homes with occupants who have respiratory sensitivities or allergies. EACs provide superior filtration of fine particles including pollen, dust, and smoke. They're ideal for households willing to perform regular maintenance in exchange for excellent air quality. Not recommended for homes where ozone sensitivity is a concern.



UV Air Purifiers

Best for: Homes with concerns about biological contaminants such as mold, bacteria, and viruses. UV systems are excellent supplements to other filtration methods but shouldn't be the only air cleaning technology. They're particularly valuable in humid climates where microbial growth is a concern or in homes with immunocompromised occupants.

CSA Unit 23

Chapter 2
Humidifiers: Installation, Operation, and Service

Since the comfort of building occupants depends on both air temperature and relative humidity, the gas technician/fitter should understand humidification. There are many types of humidifiers. The gas technician/fitter must install them carefully so they do not damage the heating and cooling equipment.

Objectives

Describe Functions

Describe the function of different types of humidifiers and their control

Installation Procedures

Describe installation procedures for humidifiers

Operation & Service

Describe operation requirements and service procedures for various types of humidifiers

Key Terminology

Term	Abbreviation (Symbol)	Definition
Hard water		Water that contains a high mineral content
Humidifier		Unit that increases the air's humidity level
Humidistat		The basic control for a humidifier
Psychrometer		Tests the relative humidity of a conditioned space
Relative humidity	RH%	Measurement of the percentage amount of water vapour contained in the air compared to the amount that can be contained (100%) when the air is saturated at the same temperature

Basic Concept of Central Humidifiers

Water Supply

A small water line connected to household plumbing carries water to the humidifying unit

Evaporation

Inside the humidifying unit, water evaporates into the passing air

Distribution

The moistened air increases the humidity level throughout the home

Where central humidifiers differ is in how the evaporation is accomplished, what happens to any excess water, and what controls are available to regulate the humidification.

Understanding Relative Humidity

Definition

Relative humidity (RH%) is a measurement of the percentage amount of water vapour contained in the air compared to the amount that can be contained (100%) when the air is saturated at the same temperature.

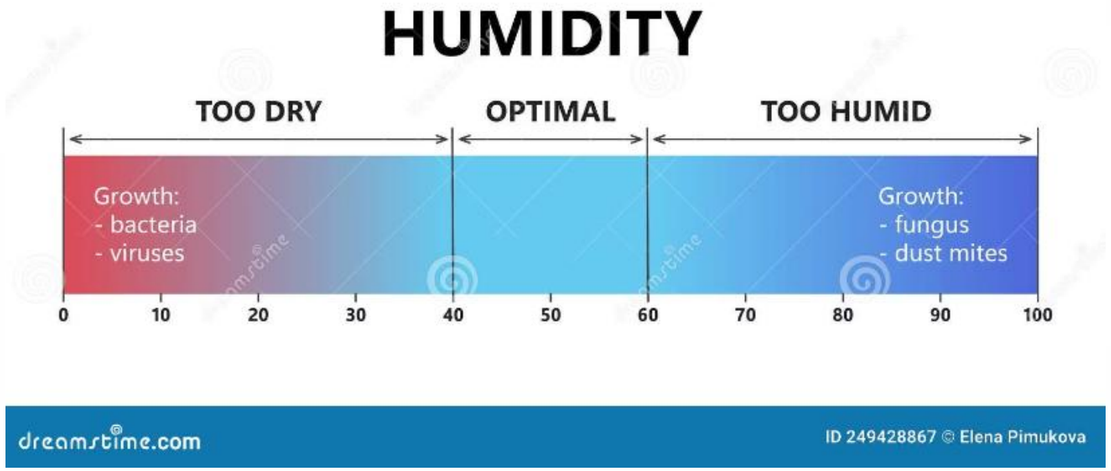
Key Characteristics

- Changes with temperature as warm air can hold more water than cold air
- Is always low in warm desert climates (such as Arizona)
- Is low inside in the winter (when the temperature is low outside) in cold climates, such as in much of Canada

Comfort and Relative Humidity

Effects of Low Humidity

- The room may feel colder than its actual temperature
- There may be high levels of static electricity
- Building occupants may be more susceptible to colds and other airborne viruses since excessive dryness reduces the effectiveness of the nasal membranes



A humidifier adds moisture to the air, increasing the relative humidity and the comfort level. In most cases, a relative humidity of 30-50% is most comfortable for building occupants.

Condensation Concerns

Condensation of water on inside windows in the form of fogging or frost is usually an indication of excessive relative humidity. This condensation can take place in other areas of the building with the possibility of damage from staining, rotting, and mould.

Outside air temperature - Celsius	Desirable maximum inside RH%
-7	40%
-12	35%
-18	30%
-24	25%
-29	20%

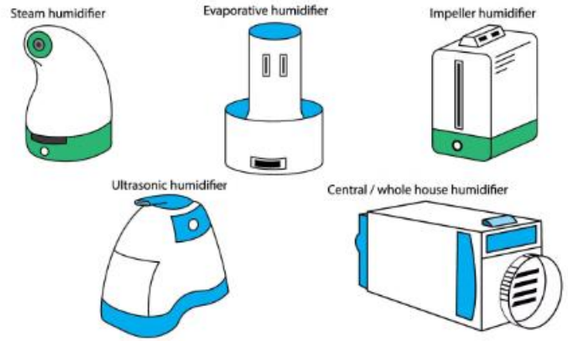
Types of Humidifiers

By Installation Type

- Stand-alone devices
- Integrated part of the building's heating and cooling system

By Location

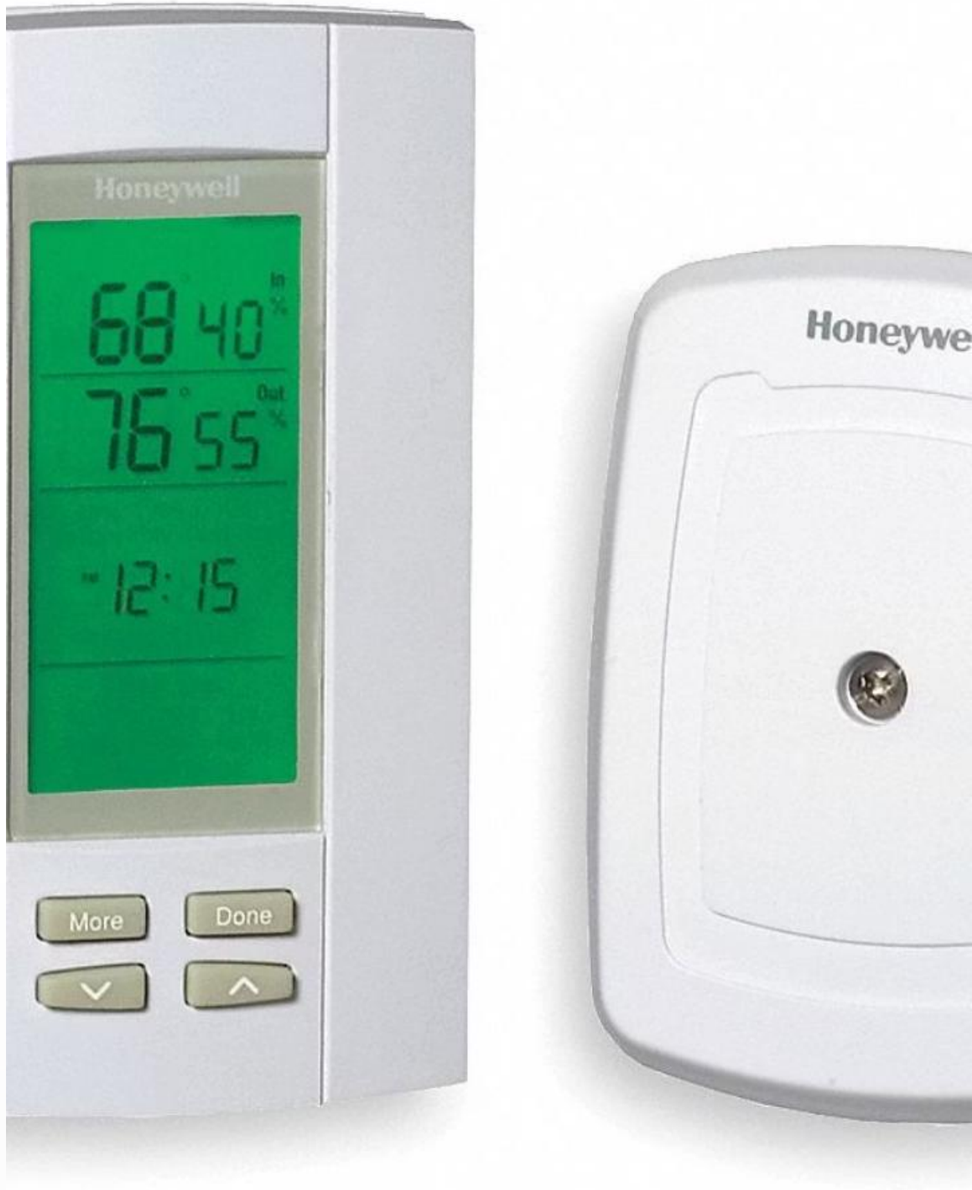
- Installed in the furnace plenum
- Installed in duct
- Attached to the plenum or duct to introduce water vapor into the air stream



Humidistat Control

Humidistats installed either in the living area or in the cold air return control most humidifiers. The basic control for humidifiers is a humidistat which turns the humidifier on or off according to the humidity level. This is different from a common household thermostat which controls temperature.

If the humidifier is connected to a forced-air furnace, it will only work when the furnace blower is operating. However, there may be times when the humidifier should be on, but the furnace is off.



Independent Humidifier Operation

Fan-Equipped Humidifiers

Humidifiers that contain their own fans can independently (and thus better) regulate the humidity level.

Furnace Fan Control

You can run the furnace fan constantly in dry periods by adjusting the thermostat fan auto/on switch to the on position.

Advanced Humidistats

Humidistats are also available with fan contacts to actuate the fan of a furnace when humidification is required. They may also be able to activate the cooling system for dehumidification.

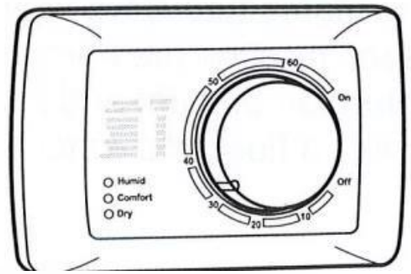
Types of Humidistat Controls

Mechanically Controlled

- Contains a strip of moisture-sensitive plastic film that elongates as humidity rises
- When humidity reaches the preset level, the strip triggers a switch that turns the humidifier off
- When humidity falls, the strip shrinks and starts the humidifier
- The dial face will often have a scale showing the recommended setting based on outdoor air temperature

Electronically Controlled

- Contains electrical sensors that vary in resistance as the relative humidity changes
- Will have connections for an outdoor temperature sensor
- Can detect very small changes in relative humidity



Humidistat Positioning

Importance of Position

If the humidistat is not in the right place, the relative humidity will not be measured correctly, and the building may be less comfortable.

Recommended Location

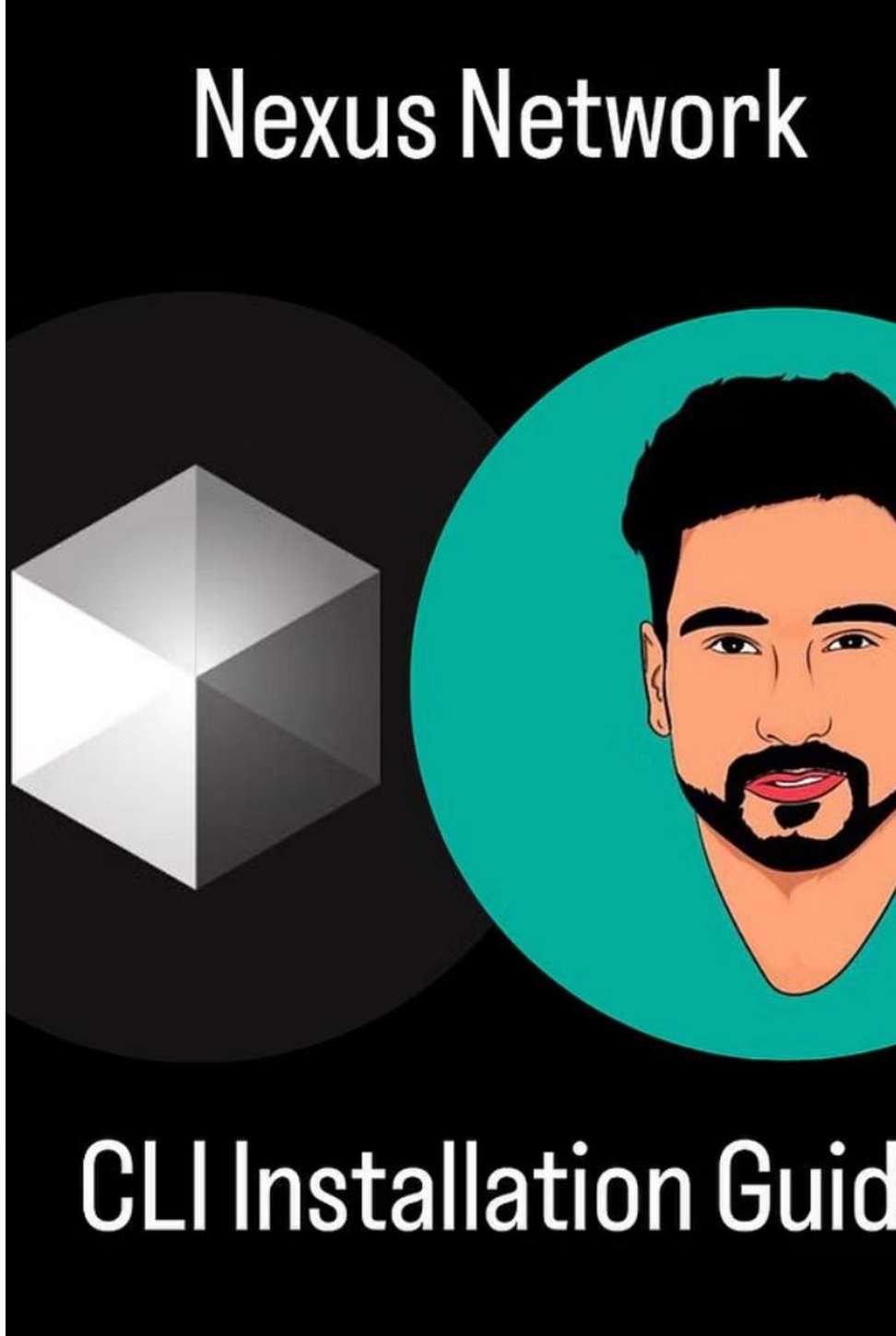
The humidistat is normally mounted in the return air duct or an area where air is being controlled. Select a location clear of drafts or excessive humidity.

Locations to Avoid

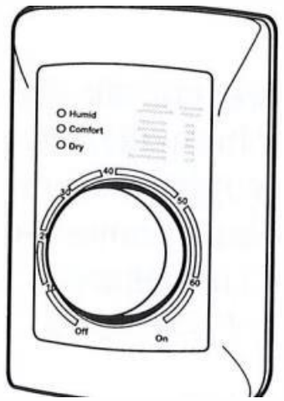
Avoid mounting near doors or windows, or in bathrooms and kitchens.

Convenient Placement

A location near the thermostat is convenient for building occupants.



Manual Humidistat



Features of Mechanical Humidistat

The mechanical humidistat will only have one setting, for relative humidity, and the building occupants set the humidistat to the desired relative humidity.

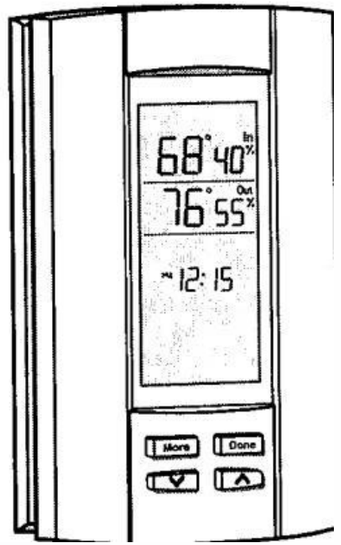
This simple control allows users to manually adjust the humidity level based on comfort needs and outdoor temperature conditions.

Digital Humidistat Control

Electronic Humidistat Settings

The electronically controlled humidistat will typically have a manual and automatic setting:

- When on manual setting, it will give the owner direct control of their RH%, the same as a mechanical humidistat
- When in automatic mode, if installed with outdoor sensor, the control will automatically adjust RH% to help prevent window condensation



Wetted-Element Humidifiers

All wetted-element humidifiers operate on the same principle. An open textured medium, the evaporating surface, is wetted, and the water it contains evaporates into the air.

Medium Types

The medium may be a fixed pad wetted by a spray or fed by gravity, or it may be dipped into a water reservoir on an electrically-powered paddle, drum, or rotating belt.

Control

Humidistats control wetted-element humidifiers, turning them on when humidity falls below the set point.

Drum Humidifiers

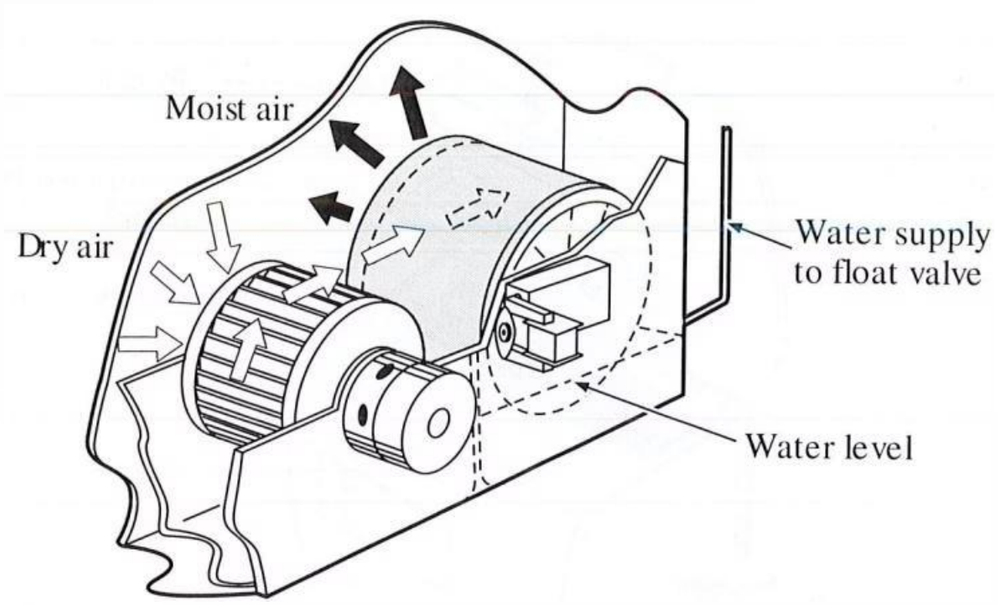
Operation

Duct-mounted drum humidifiers contain a 24 V AC motor and a wheel or drum covered with foam. When the humidistat calls for humidity, the drum rotates through a water reservoir. This saturates the foam on the drum, which then evaporates into the air passing through the humidifier.

The moistened air enters the return air plenum and is distributed throughout the home by the furnace blower. The reservoir contains a float and water valve to automatically control water level and prevent overflows.

Figure 2-3
Drum humidifier for in-duct installation

Drum Humidifier Components



Motor

24V AC motor that rotates the drum

Foam Drum

Absorbs water from reservoir

Float Valve

Controls water level

Water Reservoir

Holds water for evaporation

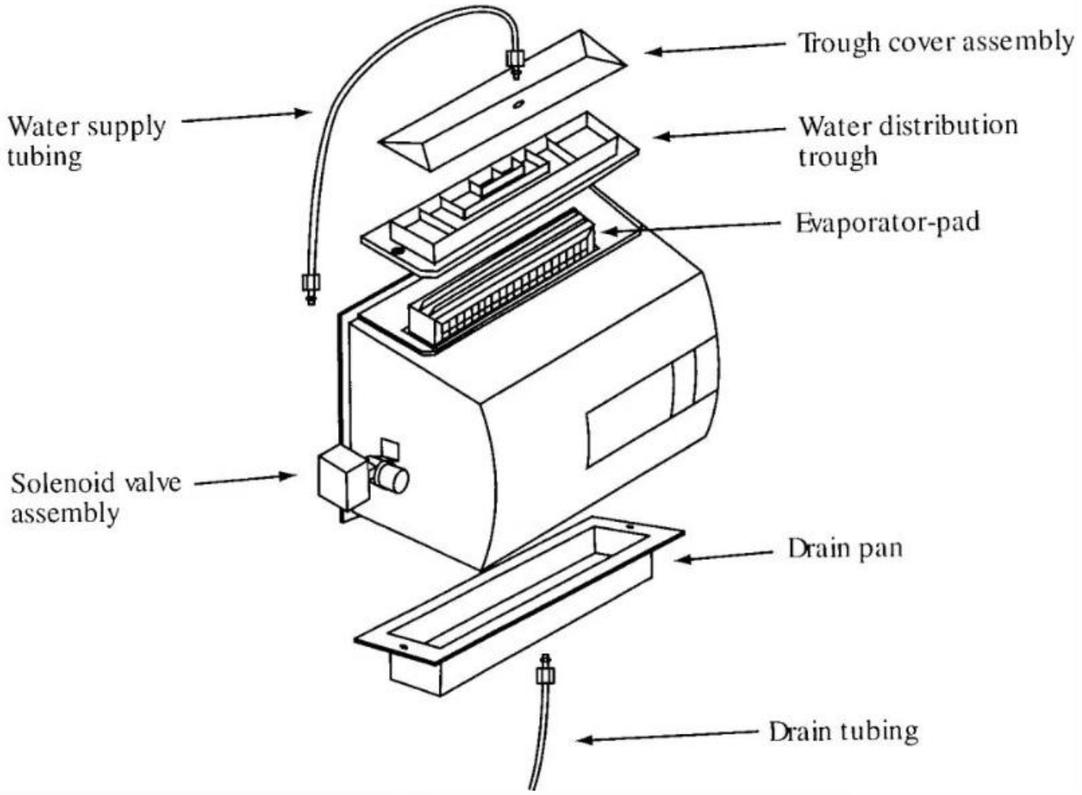
Evaporator-Pad Humidifier

Operation Principle

Similar to the drum humidifier, the evaporator-pad humidifier is duct-mounted and is connected between the warm-air supply plenum and the return air supply (also referred to as by-pass type).

Air flows from the warm-air supply plenum through a moisture-laden evaporator pad, picking up moisture and returning moist air to the return air supply of the furnace.

Figure 2-4
Evaporator-pad humidifier



Evaporator-Pad Humidifier Features

Water Distribution

The pad is "wetted" by water controlled through a solenoid valve and distributed over the pad by a distributor trough at the top of the humidifier.

Mounting Requirements

It is important to mount the humidifier level to ensure that the trough delivers water uniformly over the entire top surface of the humidifier pad.

Water Management

Water that does not evaporate drains from the bottom of the humidifier.

Powered Models

Powered models have a built-in fan which allows the unit to circulate humidified air even when the heating system is not in operation.

Spray Humidifiers

Humidity Call

When the humidistat calls for humidity, a solenoid is energized and opens a water valve

Water Flow

Water flows through the 24 V AC solenoid valve and open valve

Spray Action

Water is sprayed on the humidifier medium

4 Evaporation

From this point, the operation is the same as a drum humidifier

Atomizing Humidifiers

Atomizing humidifiers introduce small droplets of water directly into either the duct air stream or the conditioned space.

Atomization Methods

- Centrifugal force
- Spray nozzle
- Ultrasonic vibrations

Important Note

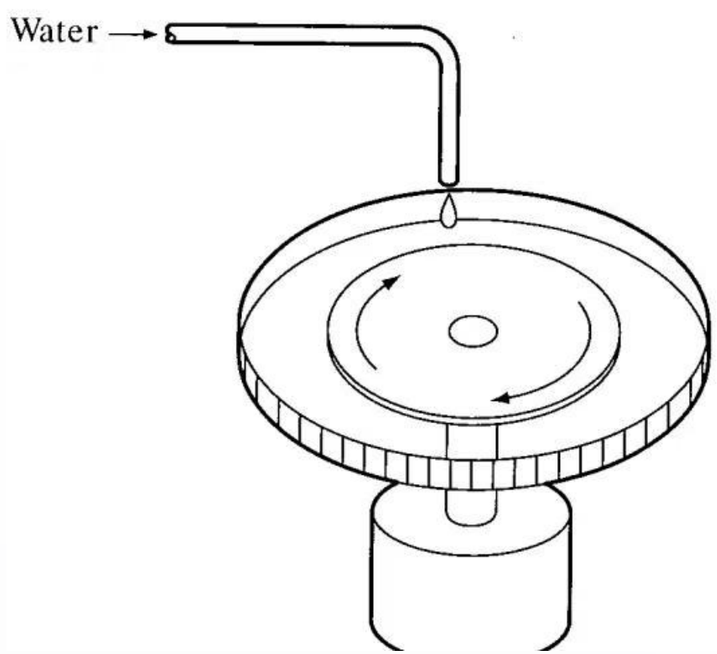
Do not use atomizing humidifiers with hard water. The minerals contained in hard water leave the evaporating water vapour as dust that will be distributed through the building.

Centrifugal Atomizing Humidifiers

Operating Principle

Centrifugal atomizing humidifiers contain a spinning disc or cone that breaks the water into a mist, or a rotating disc which slings water into the air from a reservoir.

This method creates very fine water droplets that can be easily absorbed into the air stream, providing efficient humidification.



Spray-Nozzle Atomizing Humidifiers

Operation

Spray-nozzle atomizing humidifiers have a fine spray nozzle that creates fine droplets and sends them into the duct airstream. The nozzle may use water pressure alone or a mixture of air and water.

Installation Types

Atomizing humidifiers are often portable or console-type units, but you can also mount them so that the water will be directed into a ducted central system.

Important Caution

If they are connected to the ducts, do not use them when the furnace is not operating. If the fan is not running, the moisture they introduce can accumulate and cause corrosion, mildew, and other moisture problems.

Steam Humidifiers

Since steam is water vapour at high temperature, introducing steam into the airstream is an efficient way to add water vapour to the air.

Self-Contained Type

- Converts tap water to steam by electrical energy
- Can either be free-standing and unconnected to the duct system or inject steam into the duct system

Inject Type

- Inject steam from a boiler into either the space or duct system
- Must be placed where the air can absorb the vapour to ensure that condensation does not occur in the ducts

Benefits

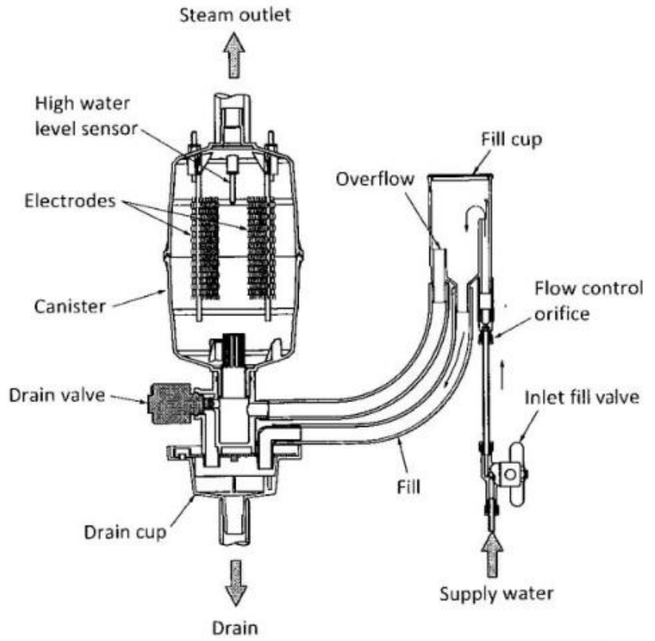
- Can deliver significant amount of humidification for large homes or arid climates
- Use less water than other types of units

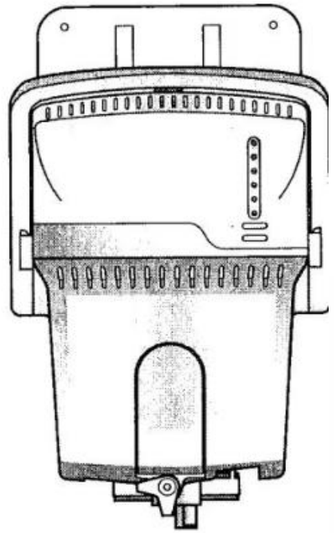
Self-Contained Steam Humidifier

Operation

The self-contained unit generates steam by energizing two electrodes that extend into a canister of water. The current flowing between these electrodes causes the water to boil. The steam then flows from the outlet hose and is injected into the moving air stream through a dispersion tube mounted in the ductwork.

You can use a separate fan pack for homes without ductwork.





Steam Humidifier Dispersion Tube

Design Features

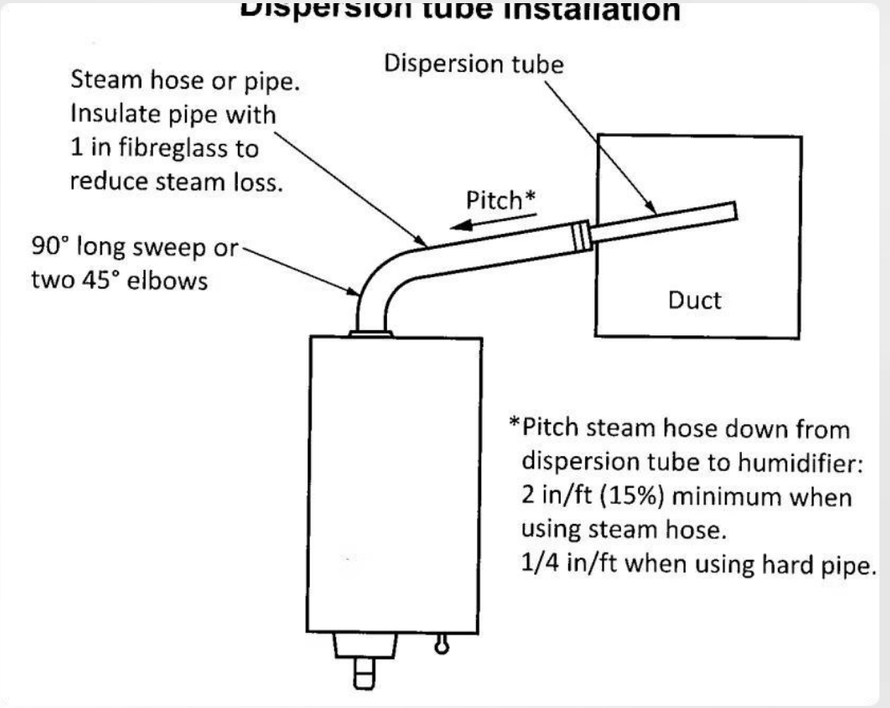
The design of the dispersion tube incorporates vertical tubelets that distribute the steam over the entire area of the duct and allow any condensed moisture back into the steam hose to drain back to the steam canister.

Installation Requirements

You must mount the dispersion tube on the vertical dust surface. The mounting plate will angle the tube upward. The dispersion tube should be higher than the humidifier so the steam hose can be sloped to drain back to the unit.

Condensation Management

Any condensation that forms on the outer walls of the tubelet is directed back to the system, preventing moisture accumulation in the ducts.



Humidifier Installation Overview

Follow Manufacturer's Instructions

Because there are so many types of humidifiers, detailed descriptions of humidifier installation are not provided. Follow the manufacturer's instructions for the specific model and type of humidifier to be installed.

Consider Size

Determine the correct size before a humidifier is installed to ensure proper humidification for the space.

Correct Location

Position the humidifier according to manufacturer specifications and best practices for the specific type.

Humidifier Sizing Factors

Area Size

Size of the area to be humidified (in ft^3)

Building Construction

The construction or "tightness" of the building

Code Requirements

Code requirements for air changes per hour

Climate Factors

Lowest outdoor temperature in the area

Desired Humidity

Level of relative humidity desired

Consult the manufacturers' specifications to ensure that the unit chosen is appropriate for the space to be humidified.

Humidifier Installation Locations

In a bypass duct

You can use wetted-element, or steam humidifiers, here. The bypass duct is a loop that forms a bypass from supply air plenum and return air plenum of the main heating system.

In the supply or return-air plenum

You can install wetted-element or atomizing humidifiers here.

Under the supply duct

You can mount steam or wetted-element humidifiers to an opening on the underside of a supply duct. It is best to choose the supply duct that serves the largest area in the building.

In the supply duct

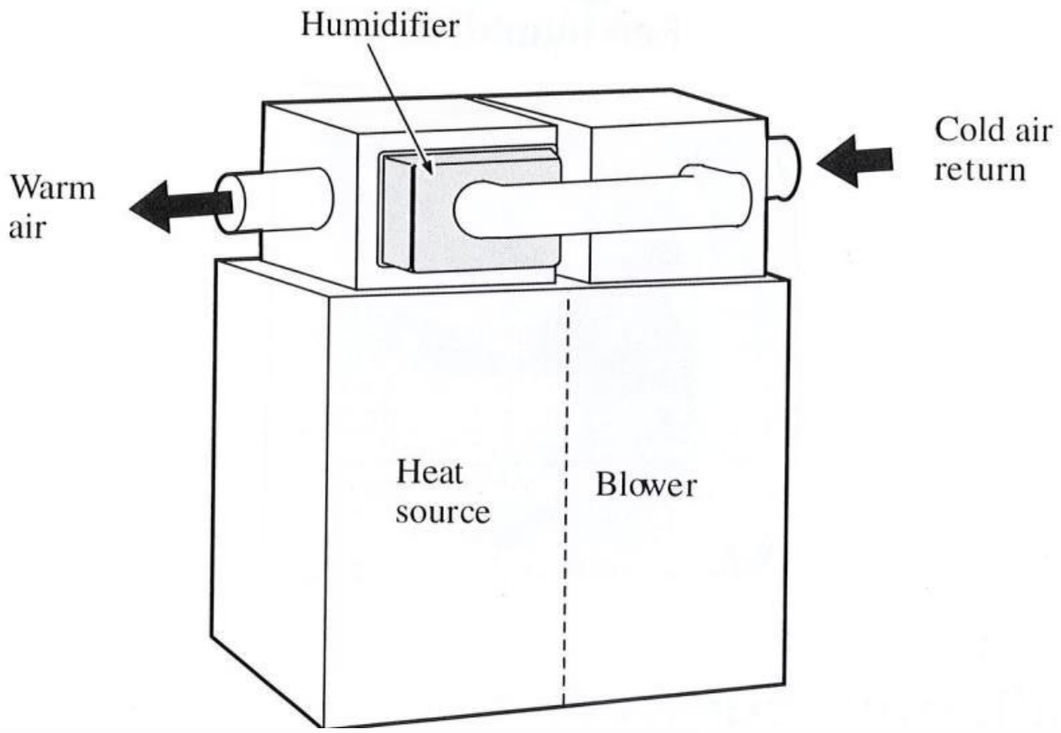
You can use wetted-element or atomizing humidifiers. Atomizing humidifiers must have wiring to operate only when the furnace fan is operating.

Bypass Humidifier Installation

Bypass Humidifier Function

Humidifiers installed in a bypass location are passive - they do not contain a fan or other method of moving air. Air circulates through the units because of differences in pressure between the warm and cool side of the furnace.

You may mount the bypass humidifier on either the supply plenum or duct or the cold air return plenum or duct. The bypass duct must connect the return and supply-side plenum or ducts, wherever you mount the humidifier.



Installation Restrictions

Never Exhaust Onto

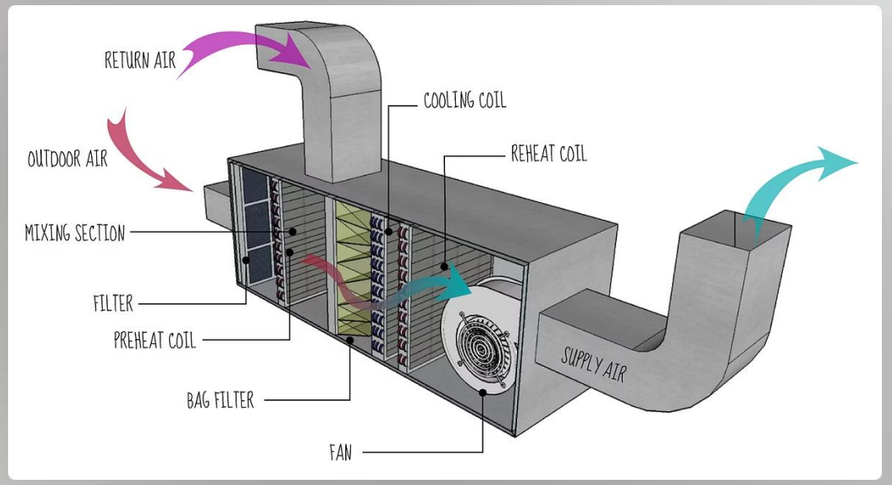
- Air conditioning coils
- Air filters
- Electronic air cleaners (EACs)
- Blowers
- Turns in a duct

Never Install In

- The furnace casing
- Above a heat exchanger

Important Considerations

- Humidifiers should be positioned so if water spills, it will not spill onto electrical components
- The humidifier location must allow access for service and maintenance
- If a humidifier is used with an EAC, it must be located downstream from the latter to avoid damage to the cleaner



Bypass Humidifier Positioning

Figure 2-9
Bypass wetted-element humidifier

Positioning Procedure

1. Select a location for the bypass on the opposite plenum
2. Select a location that cannot damage the air conditioner A-coil during installation
3. Select a location where the duct provided is adequate to connect the humidifier to the bypass

The sidewalls of humidifiers are interchangeable to allow bypass duct mounting on either side of the humidifier.

Humidifier Positioning Guidelines

1. ## Avoid Furnace Body

   Do not locate the humidifier or bypass on a furnace body

2. ## Allow Clearance

   Allow adequate clearance in front of and above the humidifier so you can easily remove the cover to perform routine maintenance

3. ## Maintain Height

   Mount the humidifier at least 3 inches (78 mm) above the furnace body to allow adequate space for the solenoid valve and drain line

4. ## Prevent Freezing

   Mount the humidifier in a conditioned space to prevent freezing

Humidistat Location Selection

Select Location

Select a location for the humidistat on the return plenum or on the wall in the living space

Consider Ease of Installation

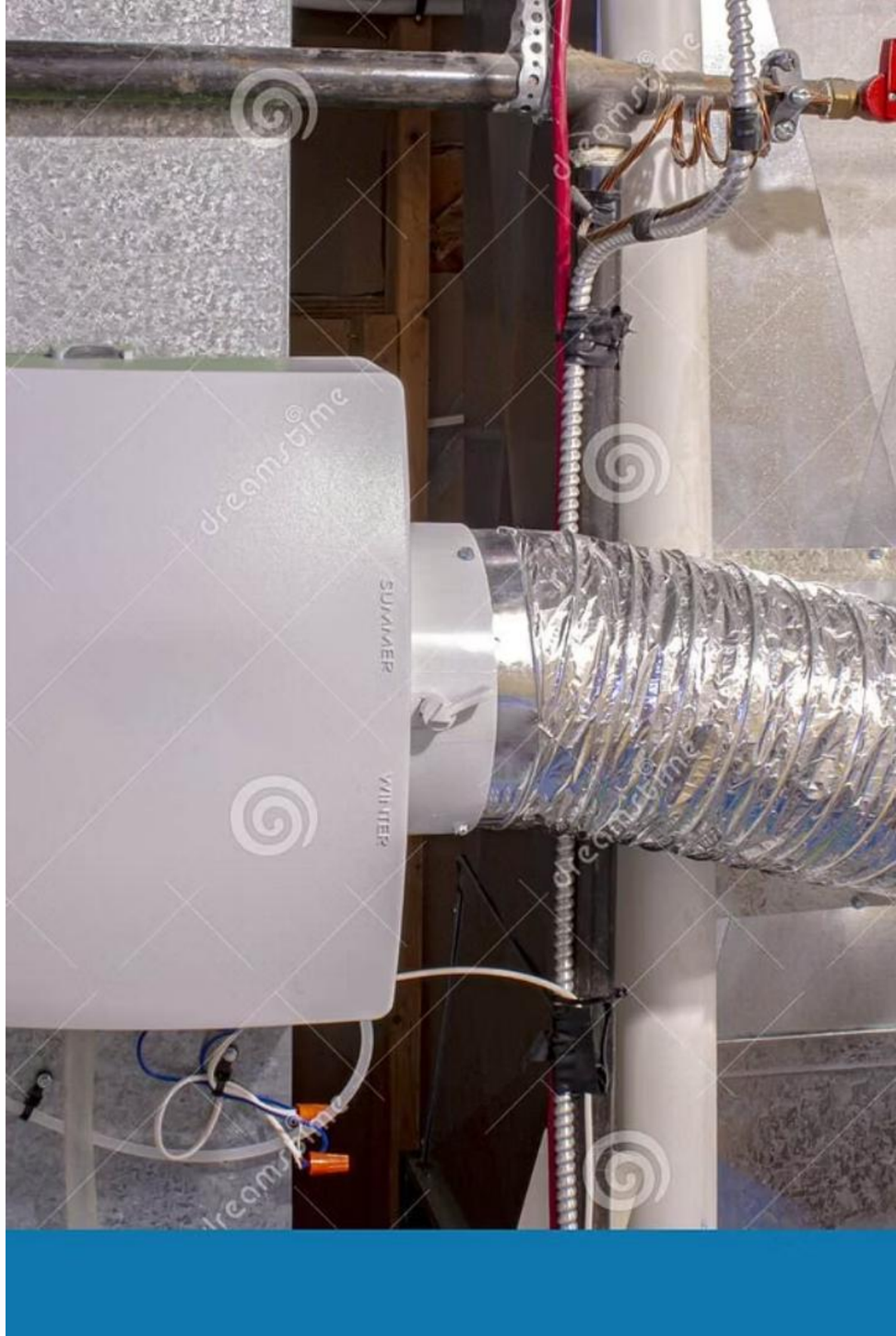
Mounting on the return plenum is the easiest installation for the control wiring circuit

Ensure Proper Sensing

For return duct mount, place the humidistat upstream from the humidifier or bypass so that it can properly sense the relative humidity of the living space

Maintain Distance

Locate the control at least 8 inches (203 mm) upstream from the humidifier in the return air duct



Fan Humidifiers

Fan Humidifier Features

Fan humidifiers, also known as powered or flow-through, use the fan inside the humidifier to pull duct air through the humidifier.

Access to only the supply or the return is required, making installation more flexible than bypass models that require connections to both supply and return.

Water Supply Considerations

Hard Water Problems

Hard water -- water that contains a high mineral content -- can cause various problems in humidifiers:

- Nozzles, tubes, and evaporative elements may collect precipitated solids and become clogged
- Mineral solids that enter the air stream can leave a layer of white dust on furniture and floors throughout the home

Solutions

- You can soften the water supply to the humidifier
  - This process usually adds sodium to the water
  - Since the sodium itself precipitates out in humidifier reservoirs over an extended period, make a provision for the reservoir to be flushed out on an ongoing or periodic basis
- You can add chemicals that prevent scaling (the precipitation of minerals) to the humidifier pan

Consult the manufacturer's literature before adding any chemicals to the humidifier.

Water Supply Connection Methods

Saddle Valve

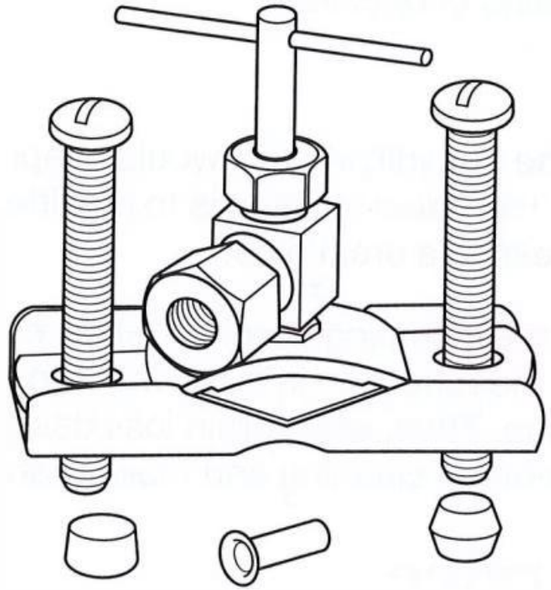
For copper water tubing systems, a saddle valve often comes with various manufacturers of humidifiers installation packages. Though they are considered "easy to install", this type of connection should not be recommended. The saddle valve is prone to failure and can cause enormous property damage.

Note: In Ontario, the Ontario Building Code states that a saddle valve "shall not be installed".

Recommended Method

Install a full-size tee fitting and approved valve on the water line. This provides a more reliable and code-compliant connection.

Figure 2-11
Saddle valve



Furnace-Humidifier Electrical Connection

Atomizing Humidifier Requirements

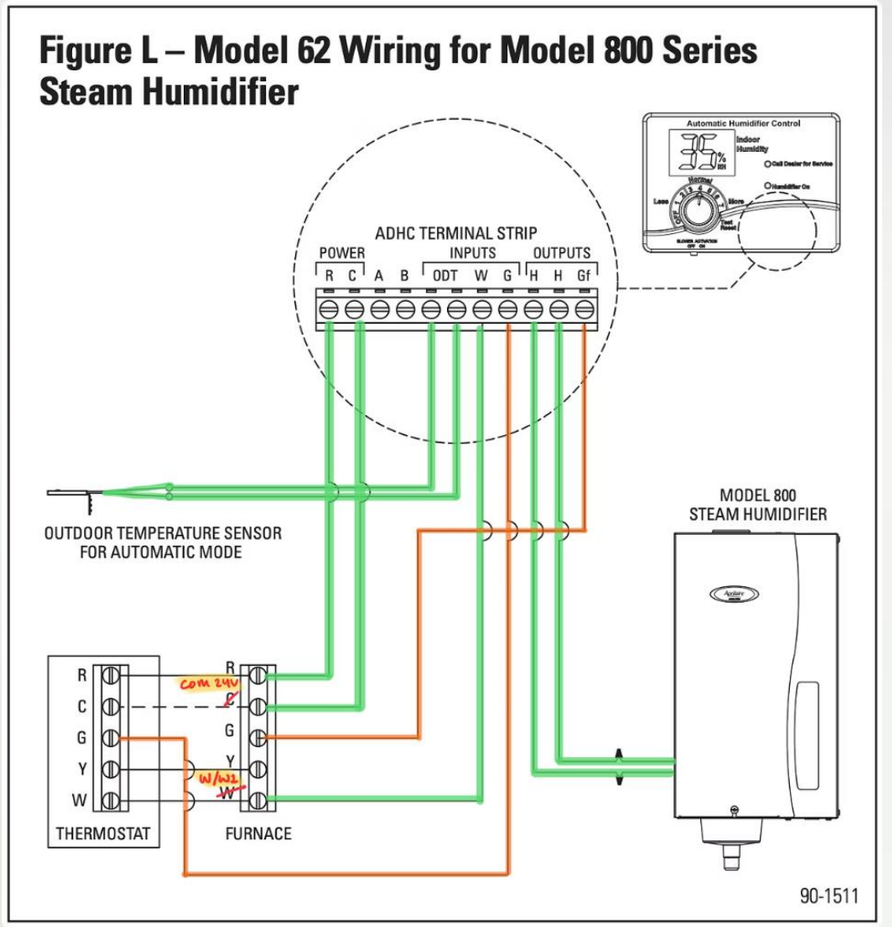
Atomizing humidifiers installed in a duct or plenum must operate only when the furnace blower is operating. If the air is not moving, the drops will fall on the duct surface, causing moisture accumulation, which can encourage mildew growth and cause corrosion.

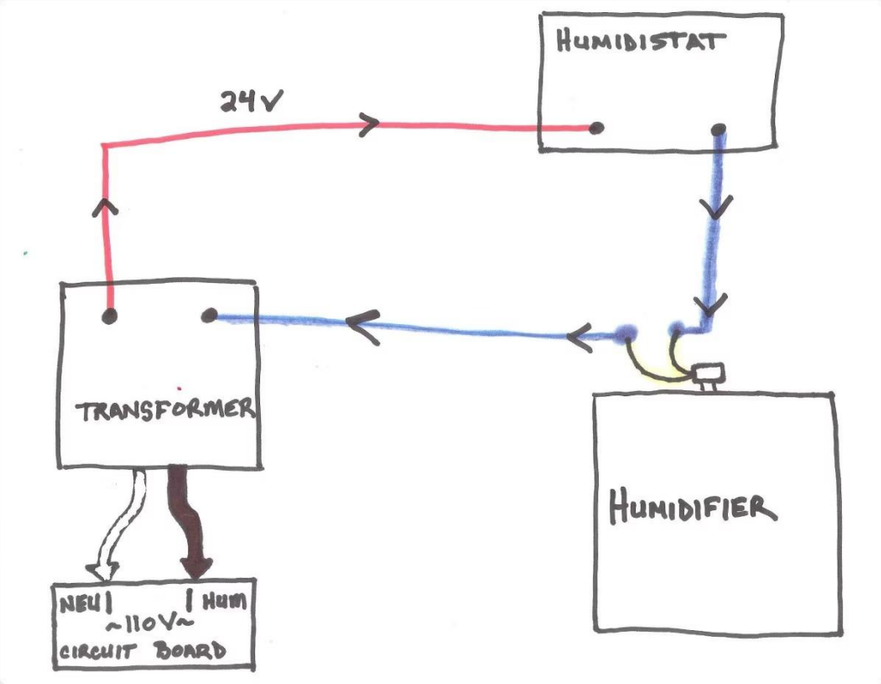
Electrical Interlock

To ensure the atomizing humidifier works only when the blower is operating, an electrical interlock is required. This is accomplished by installing a sail switch in the return air duct that closes electrical contacts when air is moving.

Evaporative Humidifiers

Evaporative humidifiers (wetted-element) may operate independently of the furnace, so no interlock is required.





Transformer Wiring Guidelines

Separate Transformer

The humidifier must not be connected to the transformer on the furnace, if there is one, since this could overload the furnace transformer.

Avoid Thermostat Circuit

The humidifier transformer should not be wired into the thermostat circuit. If it is, the thermostat would receive a different current draw depending on whether the humidistat was calling for moisture.

Direct Drive Motor Protection

If a humidifier transformer is installed on a furnace with a direct drive motor, the wiring and control system must prevent the humidifier transformer from overvoltage created by the motor's idle windings.

Follow Diagrams

Follow all manufacturer's wiring diagrams for proper installation.

Sheet Metal and Drain Considerations

Sheet Metal Modifications

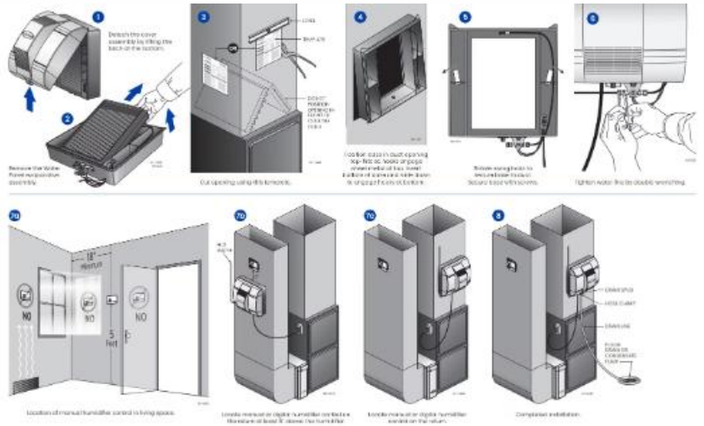
When a humidifier is installed in or under a duct, in a plenum, or in a bypass duct, make modifications to the sheet metal.

Follow the manufacturer's instructions for the specific humidifier concerning the size of the openings required and proper sealing of openings.

Drain Requirements

Ideally, all the water flowing into the humidifying unit would evaporate, but in reality, most systems end up with leftover water. The usual solution is to provide a drain tube, but this means that the humidifier must have access to a drain pipe.

Some designs retain and recycle the incoming water until it all evaporates, but the trade-off for this approach is that you can't use the reduction in fresh water to carry away any mineral deposits that prevent potential mould buildup.



Operation and Service Overview

Seasonal Inspection

Check the operation of the humidifier when inspecting the forced-air furnace prior to the start of the heating season.

Cleaning Importance

It is especially important to be sure that the humidifier is clean before the heating season starts.

Health Concerns

If water remains in a humidifier for an extended period (for example, over the summer), it may become a breeding environment for fungi, bacteria, algae, and viruses. If the reservoir is not cleaned before the furnace blower is turned on, these contaminants can be distributed throughout the house, lowering indoor air quality.

Common Operation Requirements

Check factors such as water level, mechanical operation, and humidistat function. The guidelines for operation given here are general. Check the manufacturer's specifications for specific operation requirements.

Factor	Description
Water level correct	If the water level in the reservoir is too high, water can overflow into ducts, ultimately causing corrosion and/or development of mildew. The water level must be set to the manufacturer's specifications.
Float valve assembly operating	The float valve assembly must be working and adjusted properly to maintain the correct water level.
Humidistat working	To check the operation of the humidistat, having an independent measure of the relative humidity in the building is necessary. A sling psychrometer can provide this confirmation.
Clean overflow/drain line and reservoir pan	You may need to remove the hose for cleaning. Check to be sure the drain is not blocked. Clean the reservoir pan at the beginning and end of the heating season, or more frequently if the pan seems slimy. Ensure that the customer understands how to clean the humidifier according to manufacturer's instructions.

Service Guidelines for Different Humidifier Types

Wetted-Element Humidifiers

- If the wetted element is mounted on a drum or paddle, the drum or paddle must turn for the humidifier to operate correctly
- Clean or replace the media in wetted-element humidifiers at the beginning of every season
- You must keep the humidifier pad clean to permit proper absorption and evaporation of water
  - If the media is a cleanable type, you can wash it with detergent
  - You can scrape mineral (scale) deposits loose, lightly with a putty knife, if necessary
- Replace the humidifier pad if it will no longer conform to the drum properly after cleaning

Other Humidifier Types

- Atomizing humidifiers: The nozzle must be spraying freely or the drum turning
- Steam humidifiers:
  - Steam generation must be occurring, and the nozzle must not be blocked
  - Inspect steam hose to ensure it has no low spots and has constant upward slope from humidifier to dispersion tube
  - If dispersion tube is mounted below the humidifier, inspect the drip tee drain and trap
  - Check for loose electrical connections on the canister

Servicing Wetted-Element Spray Humidifiers

Turn Off Humidistat

Begin by turning the humidistat off

Clean or Replace Media

If replacing, install the media diagonally into the cabinet so you can see the nozzle from the front opening

Prepare for Testing

Turn on the water supply, open the damper to the humidifier, and turn on the furnace blower

Test Operation

Set the humidistat so it calls for humidity - the solenoid water valve should open

Check Spray Pattern

Check the nozzle spray - if the spray is uneven or irregular, replace the nozzle

Complete Service

Replace the filter medium in the normal position

Servicing Drum-Type Humidifiers

Clean Clutch Assembly

Clean mineral deposits from the clutch assembly using detergent or by scraping scale (mineral deposits) using a putty knife

Clean Components

Clean the drain pan and the orifice between the water source and the float valve

Test Operation

Turn on the furnace blower and set the humidistat so it calls for humidity - the motor should rotate

Adjust Water Level

Adjust water level screw to manufacturer specifications

Customer Maintenance Instructions

Season	Maintenance
Fall	▪ If the humidifier contains a media pad, clean it before the heating season begins ▪ If there is a reservoir, clean it with vinegar and water ▪ If the humidifier is a bypass type, open the bypass duct damper ▪ Check the float level and adjust it as necessary ▪ Set the humidistat to the desired relative humidity, approximately 40%
Winter	▪ Check the windows of the building for condensation, a sign of excess humidity, and adjust the humidifier as necessary ▪ Check the level of water in the humidifier periodically
Summer	▪ Drain the humidifier reservoir ▪ Close a bypass duct damper, if there is one

Troubleshooting Humidity Issues

When Customer Reports Lack of Humidity

- Check the relative humidity in the conditioned space using a sling psychrometer
- Troubleshoot the humidifier, especially the:
  - Humidistat
  - Water supply
  - Electrical system

Important Note

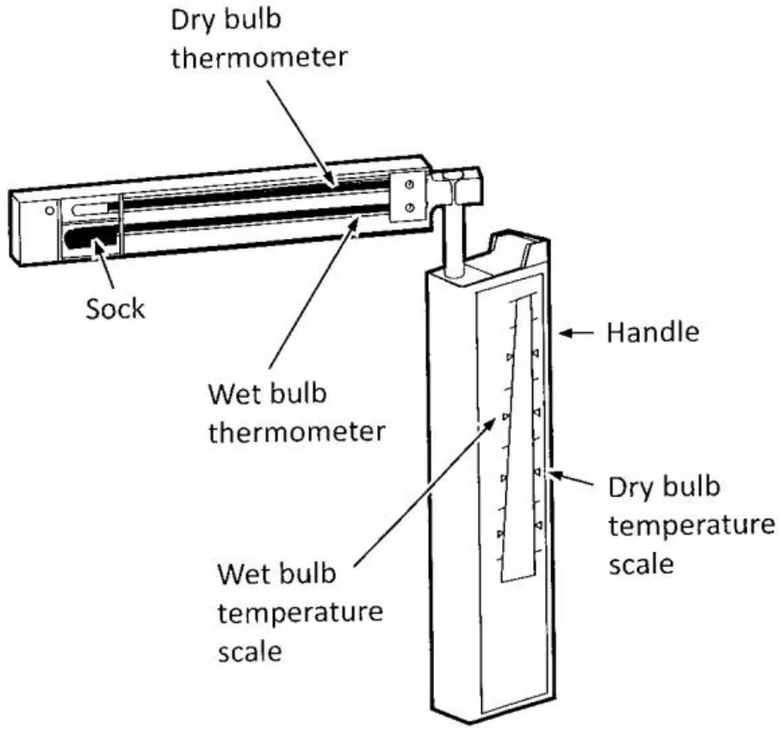
In extreme weather conditions, few humidifiers can provide the desired humidity level.

Testing Relative Humidity

Sling Psychrometer

The sling psychrometer measures air temperature using two thermometers, a wet bulb, and a dry bulb mounted on a base. The apparatus has a handle that allows it to rotate rapidly in the air.

As the psychrometer moves, air flows over the thermometers. Moisture evaporates from the wet bulb. When the temperature stabilizes on the two thermometers, readings are taken and compared to tables provided with the device to find the relative humidity based on the two temperatures.



Modern Humidity Measurement Devices

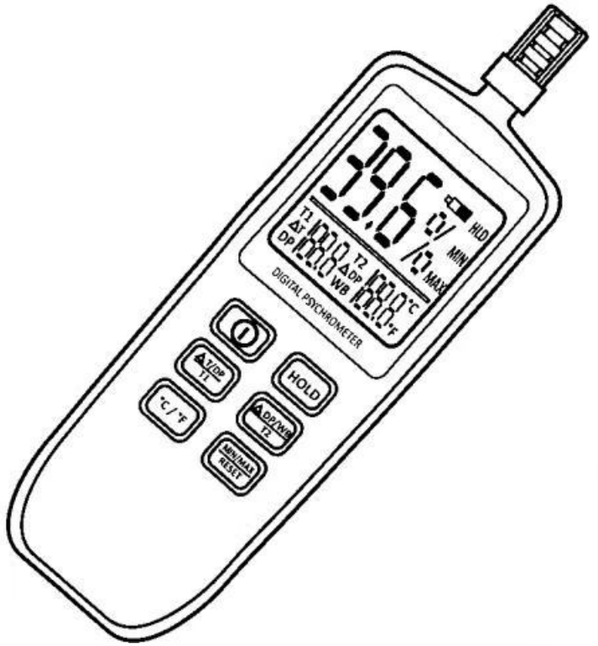
Electronic Humidity Measurement

Modern electronic devices use the following to measure humidity changes, allowing a gas technician/fitter to measure relative humidity without a sling action:

- Temperature of condensation
- Changes in electrical resistance
- Changes in electrical capacitance

Digital Psychrometer

A digital psychrometer is an example of modern electronic device that is now available for quick and accurate humidity measurements.



Troubleshooting the Humidistat

Testing Response

When testing relative humidity, set the humidistat for a higher level to see if it activates.

Calibration Issues

If the humidistat is functioning and the relative humidity in the conditioned space is not what it is calling for, the humidistat may be incorrectly calibrated. It may be possible to recalibrate the humidistat, or it may need replacement.

Outdoor Sensor Problems

If the outdoor temperature reading is not accurate:

- Check the connection to the outdoor temperature sensor
- Check the location and mounting of the sensor
- Check the resistance of the sensor and compare to the manufacturer's temperature/resistance table

Troubleshooting Water Supply Issues

Supply Line

Make sure the supply line has not become plugged and that the float valve is adjusted properly, so an optimum level of water is maintained in the reservoir.

Float Valve

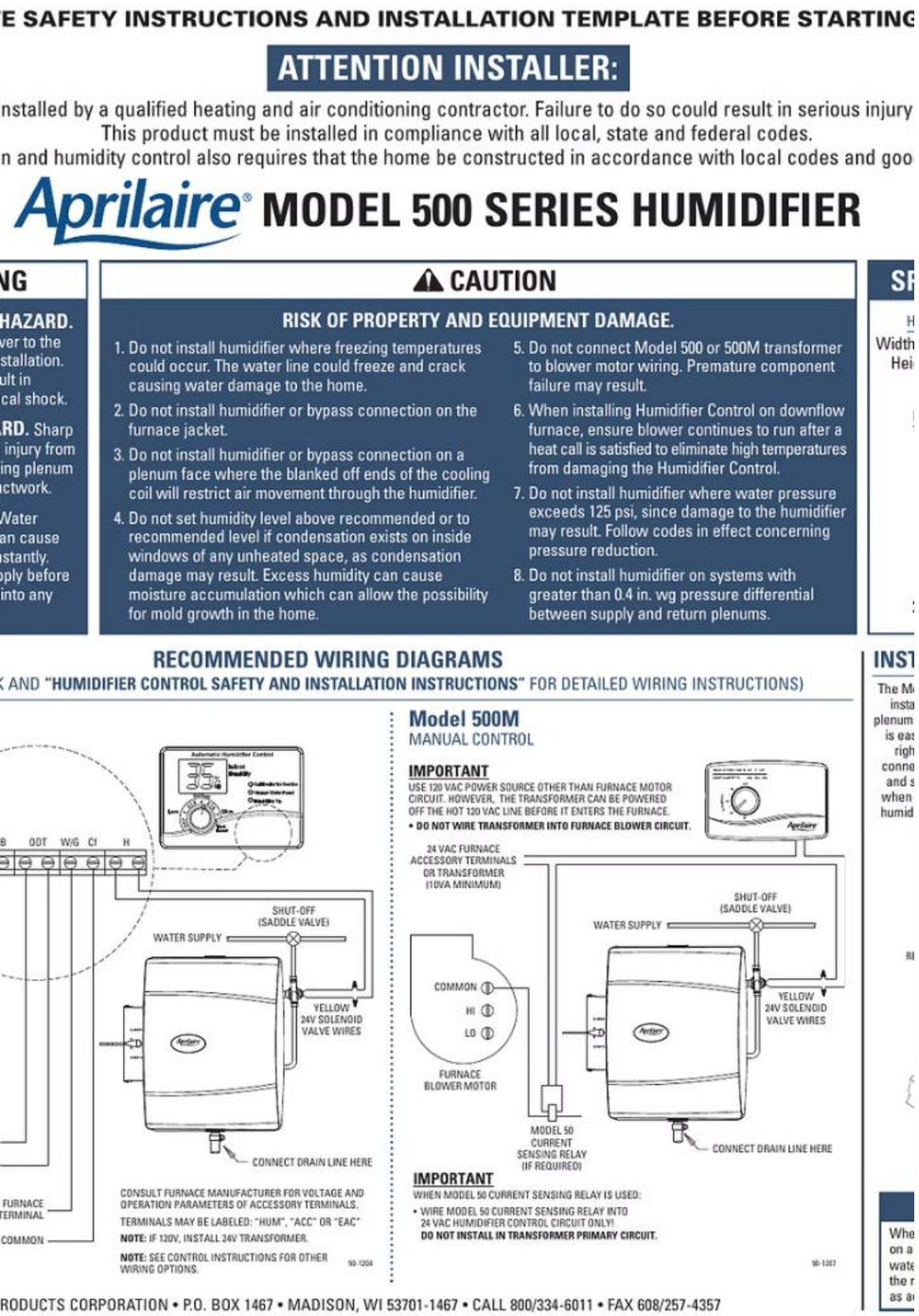
If the float is damaged, you can replace it. If the humidifier overflows, and the level/float setting is correct, the seat on the entire float assembly may need replacement.

Wetted Element

If the humidifier is based on a wetted element, make sure the medium is not clogged, dirty, or saturated with mineral deposits. Clean or replace it if necessary.

Atomizing Components

In an atomizing humidifier, make sure the drum is turning properly and the spray nozzle is not blocked.



E SAFETY INSTRUCTIONS AND INSTALLATION TEMPLATE BEFORE STARTING

ATTENTION INSTALLER:

nstalled by a qualified heating and air conditioning contractor. Failure to do so could result in serious injury
This product must be installed in compliance with all local, state and federal codes.
n and humidity control also requires that the home be constructed in accordance with local codes and goo

Aprilaire® MODEL 500 SERIES HUMIDIFIER

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⚠ CAUTION

RISK OF PROPERTY AND EQUIPMENT DAMAGE.

1. Do not install humidifier where freezing temperatures could occur. The water line could freeze and crack causing water damage to the home.
2. Do not install humidifier or bypass connection on the furnace jacket.
3. Do not install humidifier or bypass connection on a plenum face where the blanked off ends of the cooling coil will restrict air movement through the humidifier.
4. Do not set humidity level above recommended or to recommended level if condensation exists on inside windows of any unheated space, as condensation damage may result. Excess humidity can cause moisture accumulation which can allow the possibility for mold growth in the home.
5. Do not connect Model 500 or 500M transformer to blower motor wiring. Premature component failure may result.
6. When installing Humidifier Control on downflow furnace, ensure blower continues to run after a heat call is satisfied to eliminate high temperatures from damaging the Humidifier Control.
7. Do not install humidifier where water pressure exceeds 125 psi, since damage to the humidifier may result. Follow codes in effect concerning pressure reduction.
8. Do not install humidifier on systems with greater than 0.4 in. wg pressure differential between supply and return plenums.

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RECOMMENDED WIRING DIAGRAMS

K AND "HUMIDIFIER CONTROL SAFETY AND INSTALLATION INSTRUCTIONS" FOR DETAILED WIRING INSTRUCTIONS)

B ODT W/G C1 H

SHUT-OFF (SADDLE VALVE)
WATER SUPPLY
YELLOW 24V SOLENOID VALVE WIRES
CONNECT DRAIN LINE HERE

FURNACE TERMINAL
COMMON

CONSULT FURNACE MANUFACTURER FOR VOLTAGE AND OPERATION PARAMETERS OF ACCESSORY TERMINALS.
TERMINALS MAY BE LABELED: "HUM", "ACC" OR "EAC"
NOTE: IF 120V, INSTALL 24V TRANSFORMER.
NOTE: SEE CONTROL INSTRUCTIONS FOR OTHER WIRING OPTIONS.

Model 500M
MANUAL CONTROL

IMPORTANT
USE 120 VAC POWER SOURCE OTHER THAN FURNACE MOTOR CIRCUIT. HOWEVER, THE TRANSFORMER CAN BE POWERED OFF THE HOT 120 VAC LINE BEFORE IT ENTERS THE FURNACE.
• DO NOT WIRE TRANSFORMER INTO FURNACE BLOWER CIRCUIT.

24 VAC FURNACE ACCESSORY TERMINALS OR TRANSFORMER (10VA MINIMUM)
SHUT-OFF (SADDLE VALVE)
WATER SUPPLY
COMMON
HI
LO
FURNACE BLOWER MOTOR
YELLOW 24V SOLENOID VALVE WIRES
MODEL 50 CURRENT SENSING RELAY (IF REQUIRED)
CONNECT DRAIN LINE HERE

IMPORTANT
WHEN MODEL 50 CURRENT SENSING RELAY IS USED:
• WIRE MODEL 50 CURRENT SENSING RELAY INTO 24 VAC HUMIDIFIER CONTROL CIRCUIT ONLY!
DO NOT INSTALL IN TRANSFORMER PRIMARY CIRCUIT.

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Troubleshooting Electrical Connections

No Function

If the humidifier is not functioning at all, the problem may be electrical. Check circuit breakers, the humidistat, and low-voltage controls if there are any.

Motor Issues

If the humidifier has a motor— as some atomizing and wetted element types do - check it to see if it is burned out.

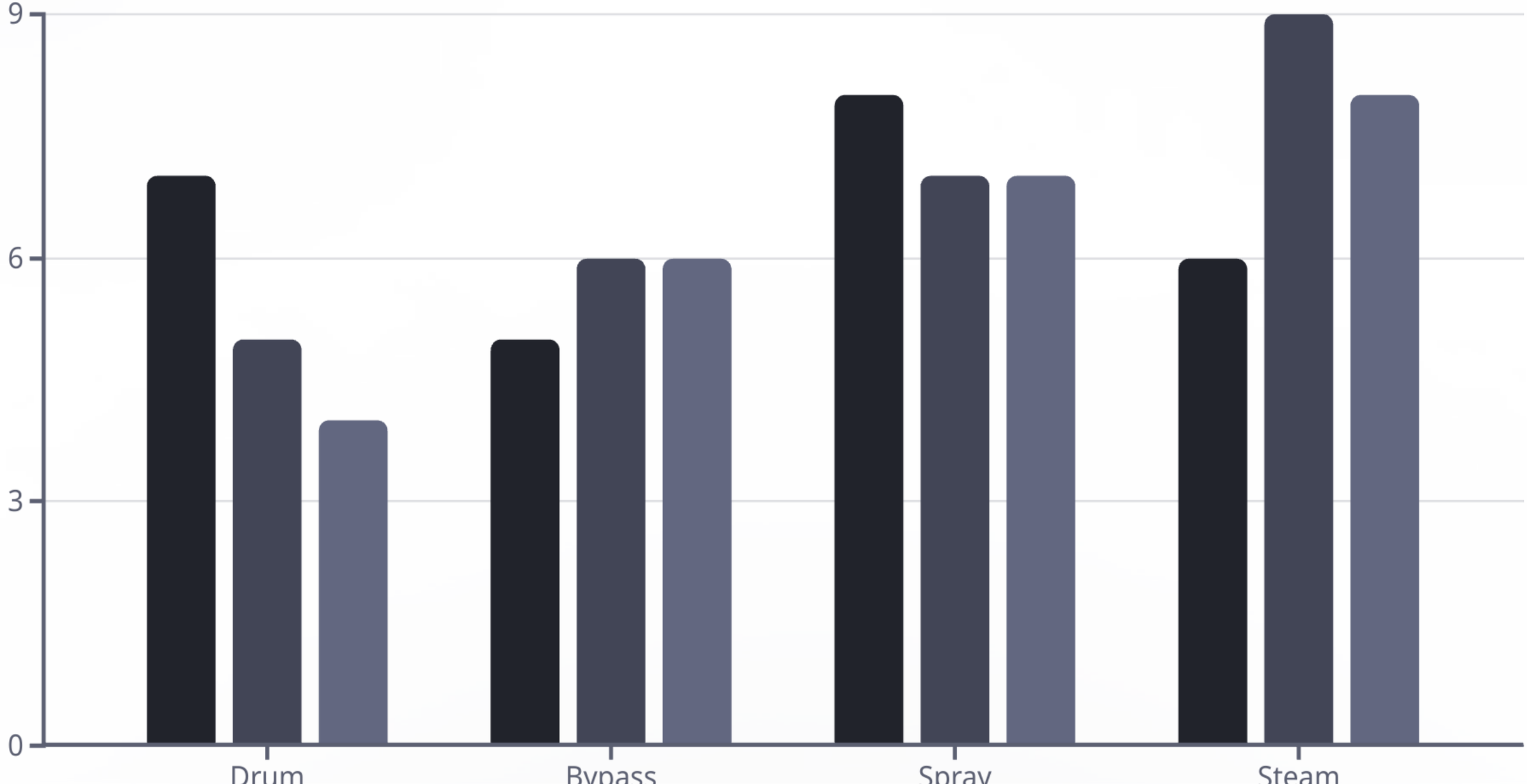
Mineral Deposits

Mineral deposits may cause a humidifier to switch itself off. If a component is locked or bound because of a mineral buildup, in some humidifiers, a thermal fault overload protector may open, shutting the unit off. In this case, clean or replace the component.

Other Potential Problems

Potential Problem	Description
Dust	If excessive dust is caused by a humidifier, the dust will be white since the cause is mineral buildup. Clean or replace the media.
Moisture in the ducts	Moisture may be found in the ducts if an atomizing humidifier is installed, and the humidifier is operating when the furnace blower is not. The atomizing humidifier must operate only when the furnace blower is on and the furnace is operating. Check to be sure it is not operating when the "fan only" mode is selected since heat is required to evaporate the water droplets created by the atomizing humidifier.
Water overflow	The float valve may need cleaning, replacement, or adjustment if water has overflowed. Check the drainage/overflow line in case it has become blocked.

Humidifier Types Comparison



Humidifier Installation Safety Checklist

1 Water Safety

Ensure all water connections are secure and properly sealed to prevent leaks that could damage the HVAC system or home

Electrical Safety

Verify all electrical connections are properly insulated and follow local electrical codes

Proper Positioning

Confirm the humidifier is positioned where water cannot spill onto electrical components

Drainage

Ensure drain lines are properly installed with appropriate slope to prevent water backup

Service Access

Verify there is adequate clearance for maintenance and service of all components

10-20°F	35%
0-10°F	30%
-10-0°F	25%

Recommended Humidity Levels by Season

30-40%

Winter Humidity

Recommended indoor humidity during cold winter months

40-50%

Spring/Fall Humidity

Ideal humidity during moderate temperature seasons

45-55%

Summer Humidity

Comfortable indoor humidity during warm summer months

Maintaining proper humidity levels throughout the year helps ensure comfort, protect home furnishings, and reduce static electricity. During winter, lower humidity levels help prevent condensation on windows and within walls.

Benefits of Proper Humidification

Health Benefits

Proper humidity reduces respiratory issues and helps prevent dry skin, eyes, and nasal passages

Home Protection

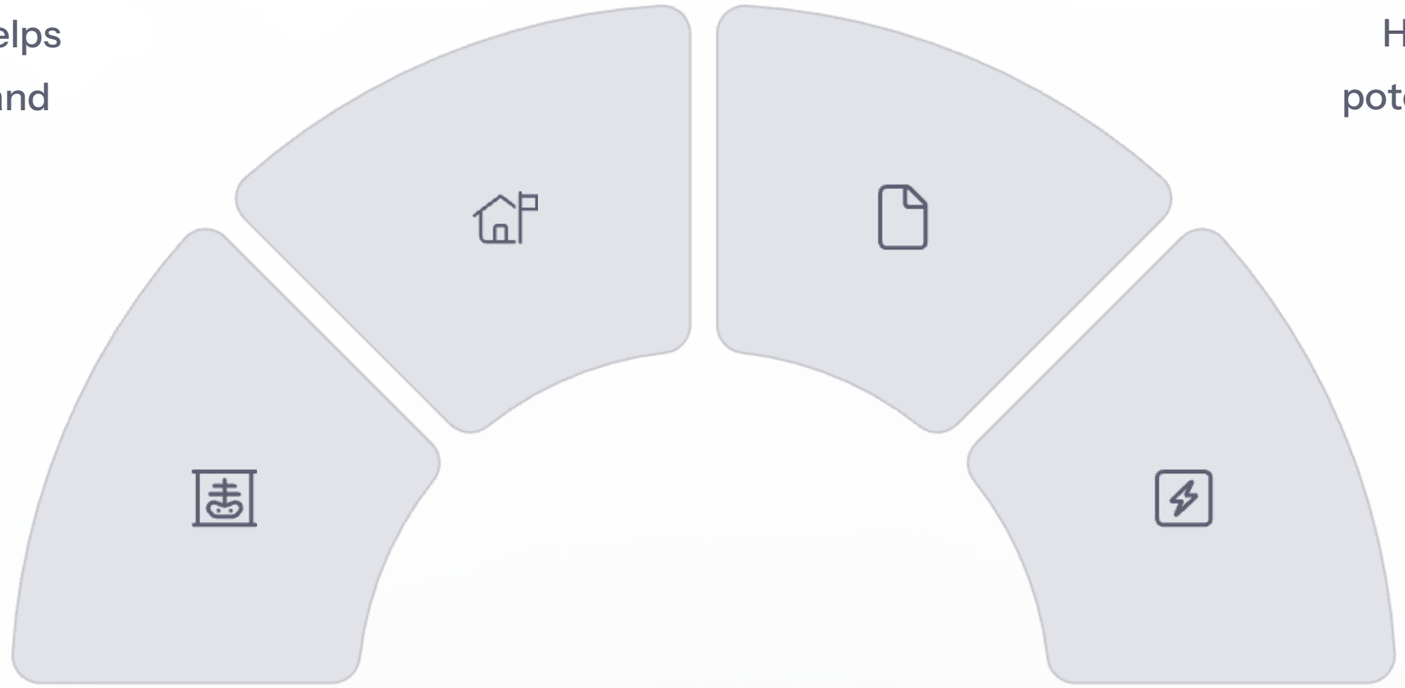
Prevents wood furniture, flooring, and musical instruments from cracking or warping

Comfort

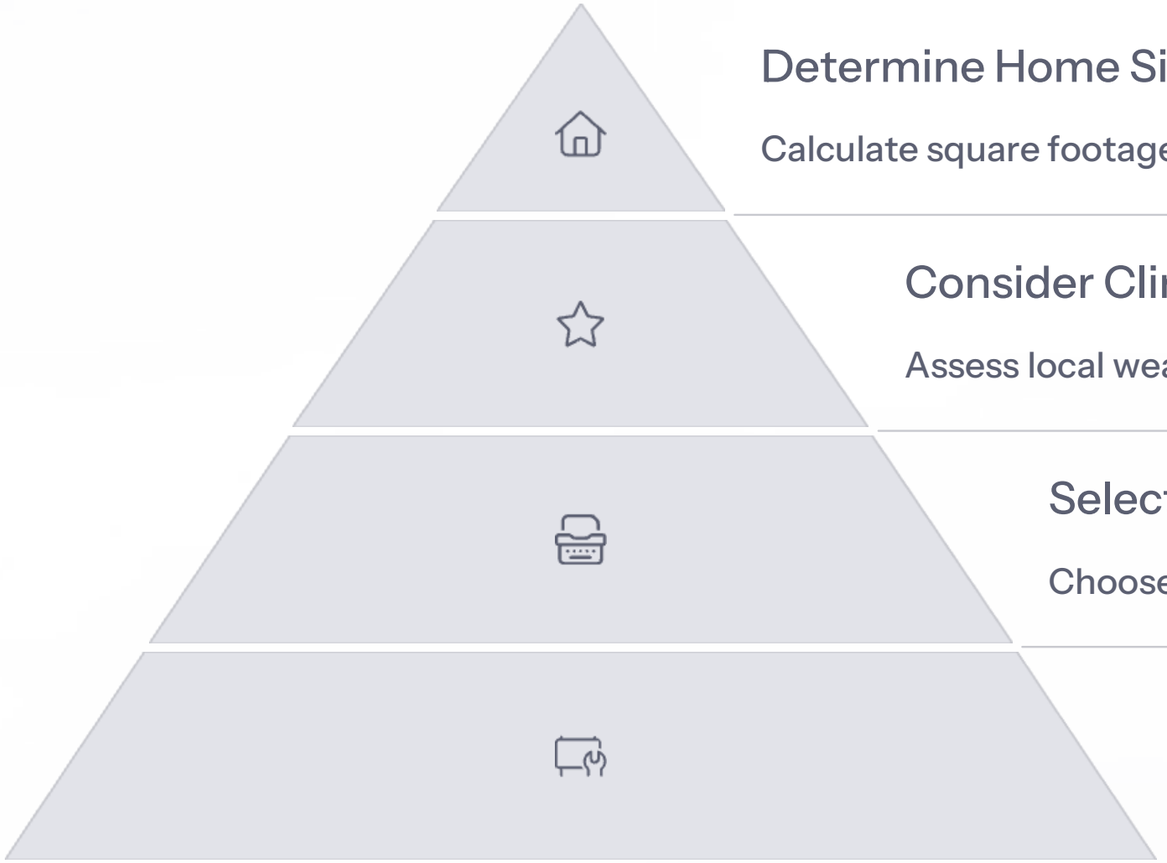
Properly humidified air feels warmer, potentially allowing lower thermostat settings

Energy Savings

Humid air feels warmer, potentially reducing heating costs by 4-5%



Humidifier Selection Guide



Determine Home Size

Calculate square footage and ceiling height

Consider Climate

Assess local weather patterns and humidity needs

Select Humidifier Type

Choose based on efficiency, maintenance, and budget

Plan Installation

Determine location and required connections

Selecting the right humidifier involves understanding your home's specific needs. Start by calculating the volume of space to be humidified, then consider your local climate conditions. Choose a humidifier type that balances efficiency with your maintenance preferences and budget constraints. Finally, plan the installation location carefully to ensure optimal performance.

Future Trends in Humidification Technology

Smart Connectivity

Integration with home automation systems and smartphone control allows for remote monitoring and adjustment of humidity levels

Energy Efficiency

Advanced designs minimize water and electricity usage while maximizing humidity output

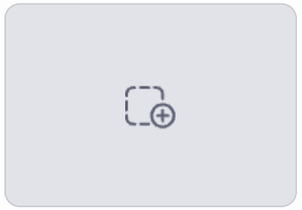
Multi-Zone Sensing

Multiple humidity sensors throughout the home provide more accurate control of humidity levels in different areas

Water Conservation

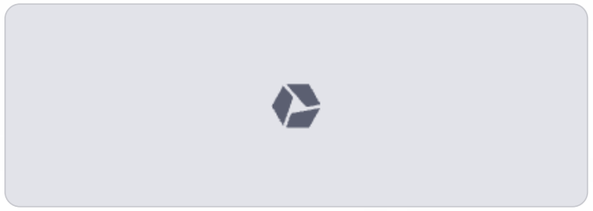
Improved water management systems reduce waste and increase efficiency

Summary: Humidifier Installation and Maintenance



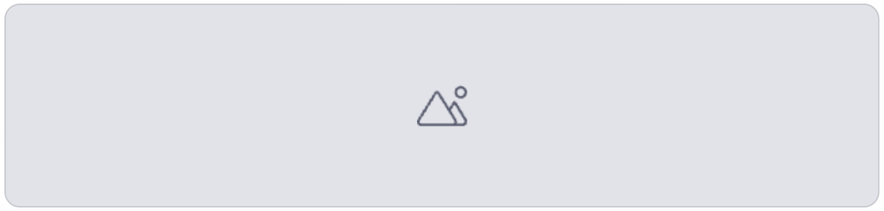
Select appropriate humidifier

Based on home size, climate, and specific needs



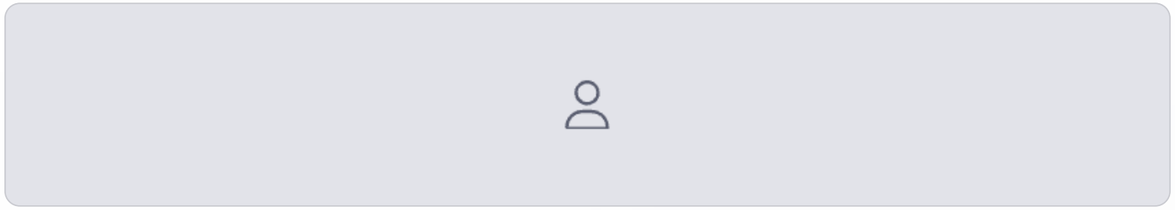
Install according to manufacturer guidelines

Follow proper positioning, water, and electrical connections



Perform regular maintenance

Clean components, replace media, and check operation



Troubleshoot issues promptly

Address water, electrical, or performance problems

Proper humidifier installation and maintenance are essential for optimal performance and longevity. By following manufacturer guidelines and performing regular service, technicians can ensure that humidifiers provide comfortable, healthy indoor environments while protecting the HVAC system from potential damage.

CSA Unit 23

Chapter 3
Cooling Coils

Refrigeration and air conditioning mechanics, not gas technicians/fitters, perform the installation and major servicing of cooling coils in conjunction with gas-fired forced-air furnaces. However, the gas technician/fitter must inspect and clean the cooling coil as part of regular furnace servicing.

Purpose and Objectives

Purpose

Refrigeration and air conditioning mechanics, not gas technicians/fitters, perform the installation and major servicing of cooling coils in conjunction with gas-fired forced-air furnaces. However, the gas technician/fitter must inspect and clean the cooling coil as part of regular furnace servicing.

Objectives

At the end of this chapter, you will be able to:

- describe how to check cooling coils for proper function and to clean cooling coils.

Terminology

Abbreviation (Symbol)	Definition
Normal air temperature rise or drop	The difference between supply air temperature and return air temperature

Checking and Cleaning Cooling Coils

Adding a cooling coil to a forced air furnace adapts it for use as a central air conditioner.

Although air conditioning technicians perform the installation and servicing of the air conditioning unit, as a gas technician/fitter, you must clean the cooling coil as part of regular furnace maintenance.

A dirty coil, like a dirty furnace filter, restricts air flow.

Cooling Coil

Also known as an "A" coil because of its shape, it may be attached to the supply plenum or in a cabinet between the supply plenum and the duct.

Condenser

Usually located outside the building, it works with the cooling coil to circulate refrigerant.

How Cooling Systems Work

Compressor Operation

The compressor moves the refrigerant around the loop.

Heat Absorption

As the furnace forces air through the "A" coil, the coil absorbs heat from the air, causing the liquid refrigerant to change to the vapour state.

Heat Removal

The refrigerant vapour moves to the condenser coil where heat is removed to the outdoors, causing the vaporous refrigerant to return to a liquid state.

Cycle Completion

The liquid refrigerant returns to the cooling coil.

Types of Cooling Coil Units

Up-flow furnaces

Cooling coils designed specifically for upward airflow systems.

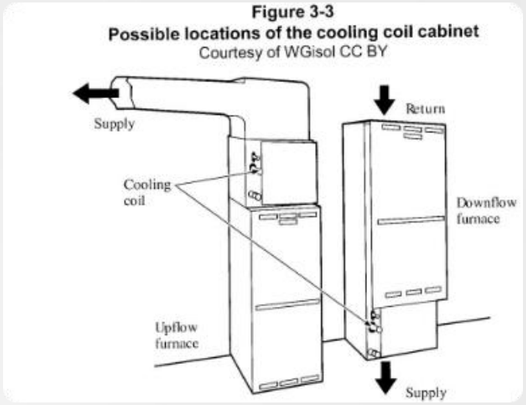
Down-flow furnaces

Cooling coils designed specifically for downward airflow systems.

Horizontal furnaces

Cooling coils designed specifically for horizontal airflow systems.

The coil is housed in a cabinet.



Cooling Coil Locations

Figure 3-3 shows possible locations of the cooling coil cabinet. The liquid used as a coolant varies depending on the specific unit.

Cabinet Placement

The cooling coil cabinet can be placed in various locations depending on the furnace type and installation requirements.

Coolant Variation

Different cooling systems may use different types of refrigerant depending on the manufacturer specifications and environmental regulations.

Measuring Temperature Change

Create Access Points

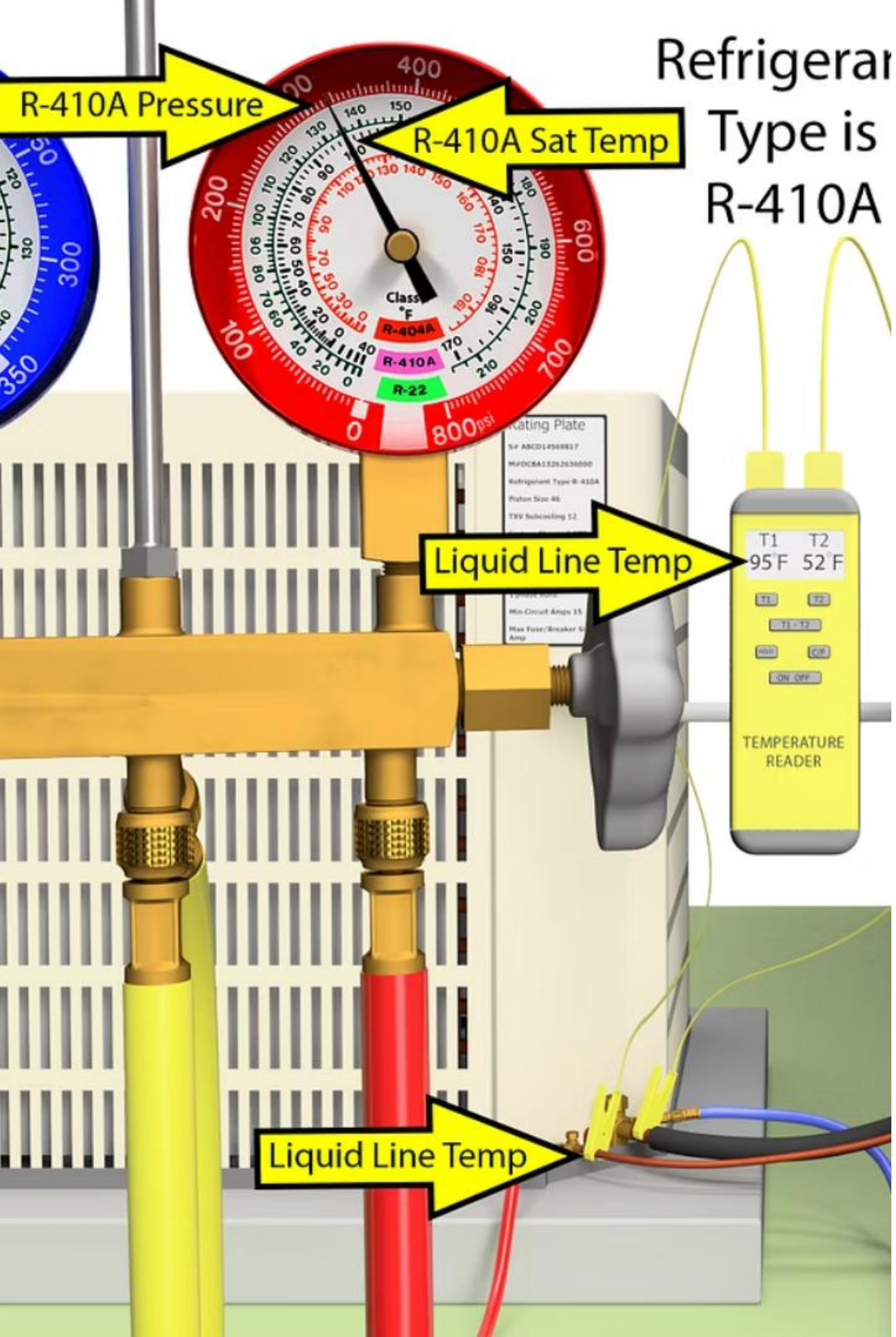
Punch or drill a hole in the supply and return air plenums. Where possible the holes should be about three feet from the furnace.

Insert Thermometers

Place a thermometer into the air flow through each of the holes. Most good quality electronic multimeters have a temperature probe accessory or a pocket digital thermometer that works.

Operate and Measure

Operate the equipment for about five minutes, with the fan running to establish the normal air temperature rise or drop, which is the difference between supply air temperature and return air temperature.



Temperature Calculation Methods

To calculate temperature	Then
Drop across the coil	Subtract the supply side temperature from the return side temperature.
Rise across the heat exchanger	Subtract the return side temperature from the supply side temperature.

Diagnosing Temperature Change

Measure Normal Operation

Note that the temperature drop across the cooling coil is about 11 °C (20°F) when it is operating at a typical condition of 24 °C (75°F) and 50% relative humidity.

Identify Issues

If the measured temperature drop is too low, you may need to clean the cooling coil unit or adjust the blower.

Check Specifications

Refer to the manufacturer's manual for the correct temperature drop and air volume.

Clean and Retest

Clean the unit and retest temperature drop before adjusting the blower speed.

Make Adjustments

Then, if necessary, adjust the blower speed to obtain the correct pressure drop and air volume.

Refer if Needed

If the blower is not operating correctly, you will need to refer the customer to a refrigeration and air conditioning mechanic to troubleshoot the cooling system.

Importance of Coil Cleanliness

The surfaces of the cooling coil must be clean.

Reduced Cooling Capacity

During the cooling season, the coil will not deliver its full cooling capacity.

Restricted Air Flow

Air flow to the building will be reduced.

Increased Temperature

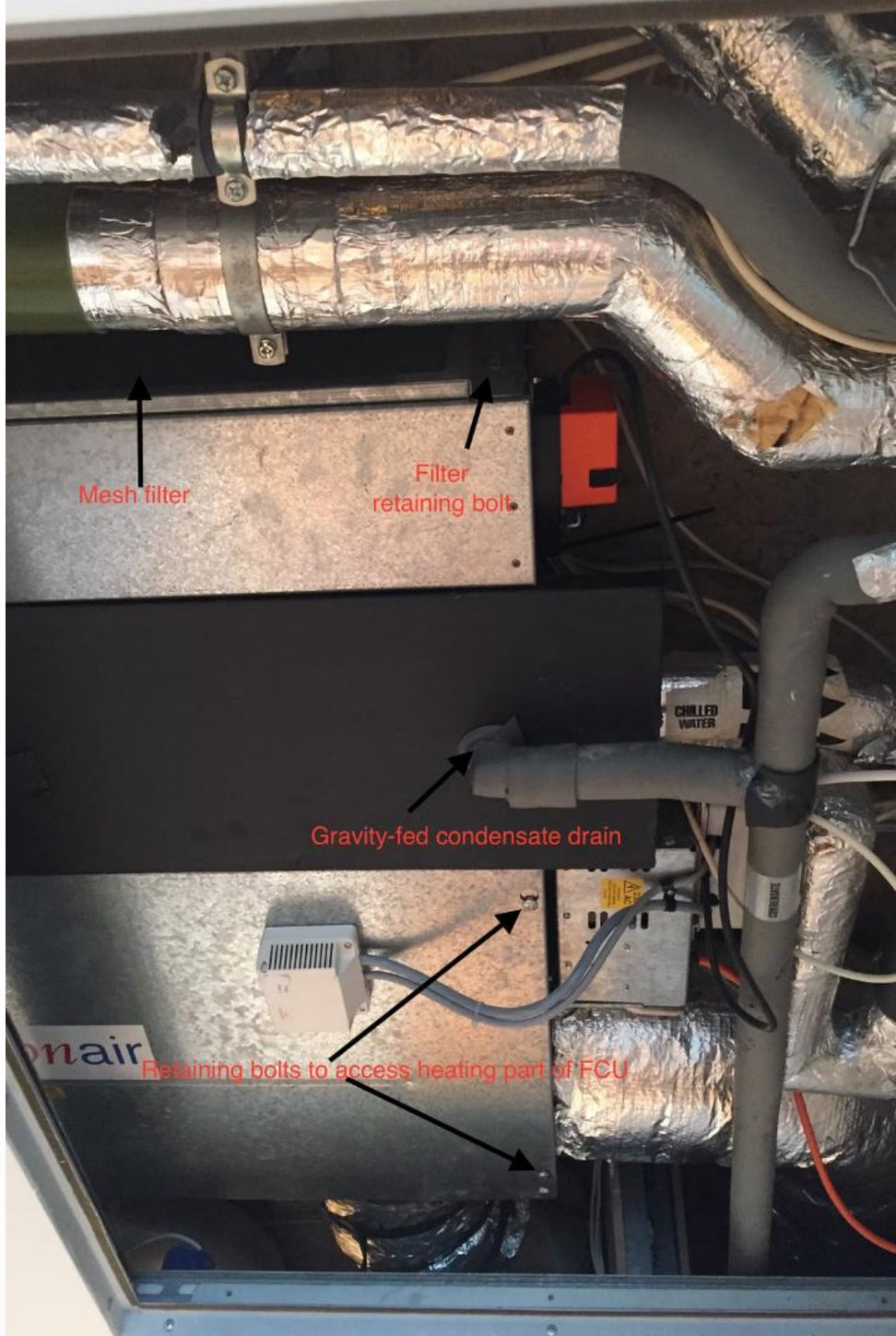
During the heating season, both temperature rise across the furnace and stack temperature will increase.

Regular Inspection

The coil will require visual checking for cleanliness when the furnace is cleaned.

Accessing the Cooling Coil

If the coil is	Then
Located in a cabinet	An access door is provided.
Mounted in the plenum	It may be necessary to cut an inspection port. Be careful to not damage the coil if you cut a port.



Cleaning the Cooling Coil: Overview

The cooling coil requires cleaning when it is dirty. For the gas technician/fitter, this involves cleaning the:

Exterior Cleaning

Cleaning the exterior of the coil itself to ensure proper heat transfer.

Fin Cleaning

Cleaning the fins through which air is forced over the coil to maintain proper airflow.

Cleaning Procedure: Fin Inspection

Check Fins

Check the fins for accumulated dirt or dust.

Clean If Necessary

If the fins are clogged or dirty, clean with a vacuum cleaner, compressed air or nitrogen, brush or a fin comb.

Use Caution

Use the vacuum, brush, or comb carefully to not damage the coil.

Cleaning Procedure: Tubing Inspection

Inspect Connections

Inspect the tubing and connections for signs of oil leaks.

Identify Leaks

Spots of oil indicate a leak that the air conditioning technician must repair.

Clean Surfaces

Brush or clean outer surfaces of the lines with a vacuum cleaner.

Wash If Needed

If necessary, you can wash them with low-pressure water and mild detergent.

Cleaning Procedure: Condensate System

Check Drain System

Check and clean the condensate drain system.

Clean Drip Tray

Clean the drip tray of accumulated dust or dirt.

Clear Drain Hole

Probe the drain hole with a screwdriver to be sure it is not clogged.

Test Drainage

Pour a small amount of water in the drip tray and watch to ensure it drains properly.

Clear Clogs

Blow out with compressed air or nitrogen if clogged.

Digital Thermometers

Most good quality electronic multimeters have a temperature probe accessory or a pocket digital thermometer that works for measuring temperature changes in HVAC systems.

Precision Measurement

Digital thermometers provide accurate temperature readings essential for proper HVAC diagnostics.

Portability

Pocket-sized digital thermometers are convenient for field technicians to carry and use.

Versatility

Many digital thermometers can be used for multiple applications beyond HVAC work.

Refrigerant Vapour Compression Cycle

Compression

The compressor moves the refrigerant around the loop.

Return

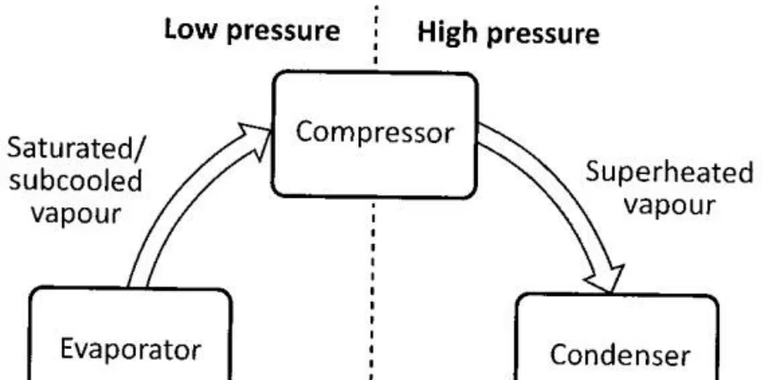
The liquid refrigerant returns to the cooling coil.

Heat Absorption

As the furnace forces air through the "A" coil, the coil absorbs heat from the air, causing the liquid refrigerant to change to the vapour state.

Condensation

The refrigerant vapour moves to the condenser coil where heat is removed to the outdoors, causing the vaporous refrigerant to return to a liquid state.



Typical Cooling Coil

A cooling coil (sometimes called an "A" coil because of its shape) is a critical component in air conditioning systems that work with forced-air furnaces.

Design Purpose

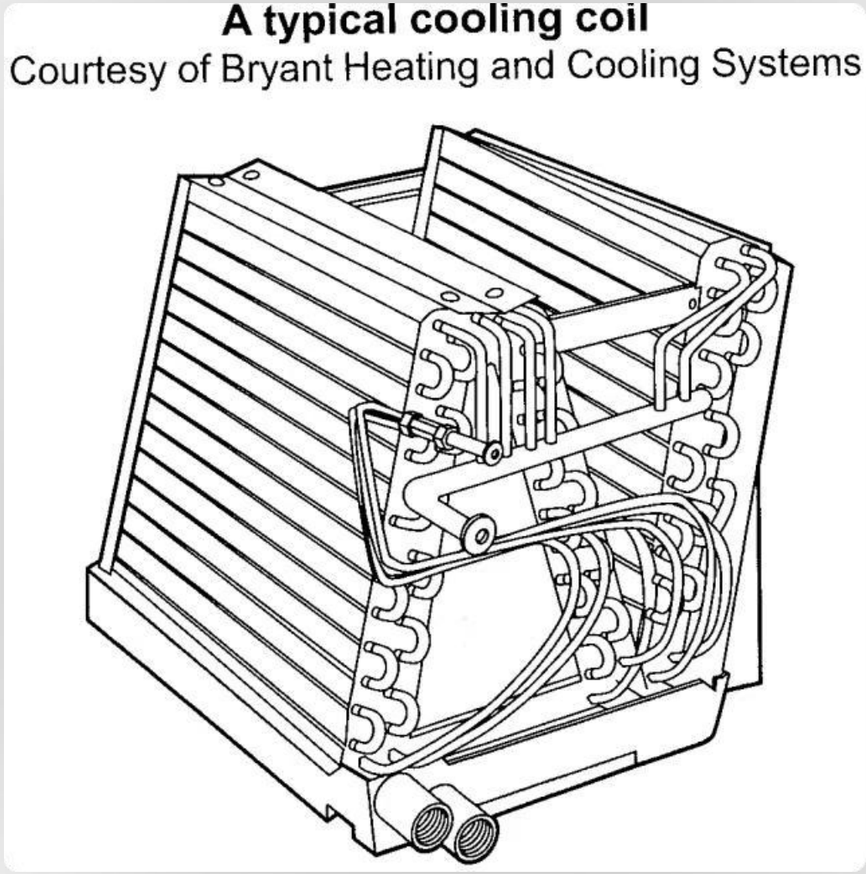
The A-shaped design maximizes surface area for heat exchange while fitting within the constraints of typical HVAC systems.

Installation Location

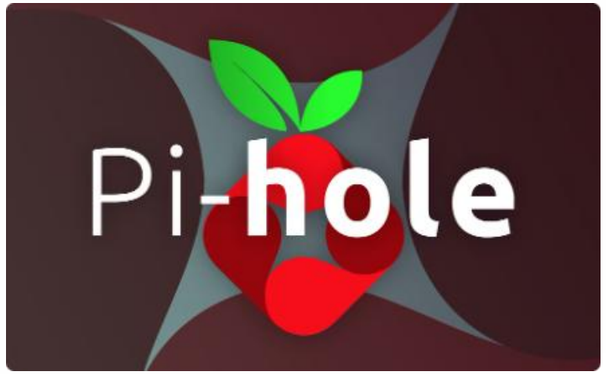
May be attached to the supply plenum or in a cabinet between the supply plenum and the duct.

Maintenance Responsibility

While installation is performed by refrigeration technicians, regular cleaning is the responsibility of gas technicians during furnace maintenance.



Temperature Measurement Process



Creating Access Points

Punch or drill holes in the supply and return air plenums, ideally about three feet from the furnace, to allow for temperature measurement.

Inserting Measurement Tools

Place thermometers or temperature probes into the airflow through each of the access holes to get accurate readings.

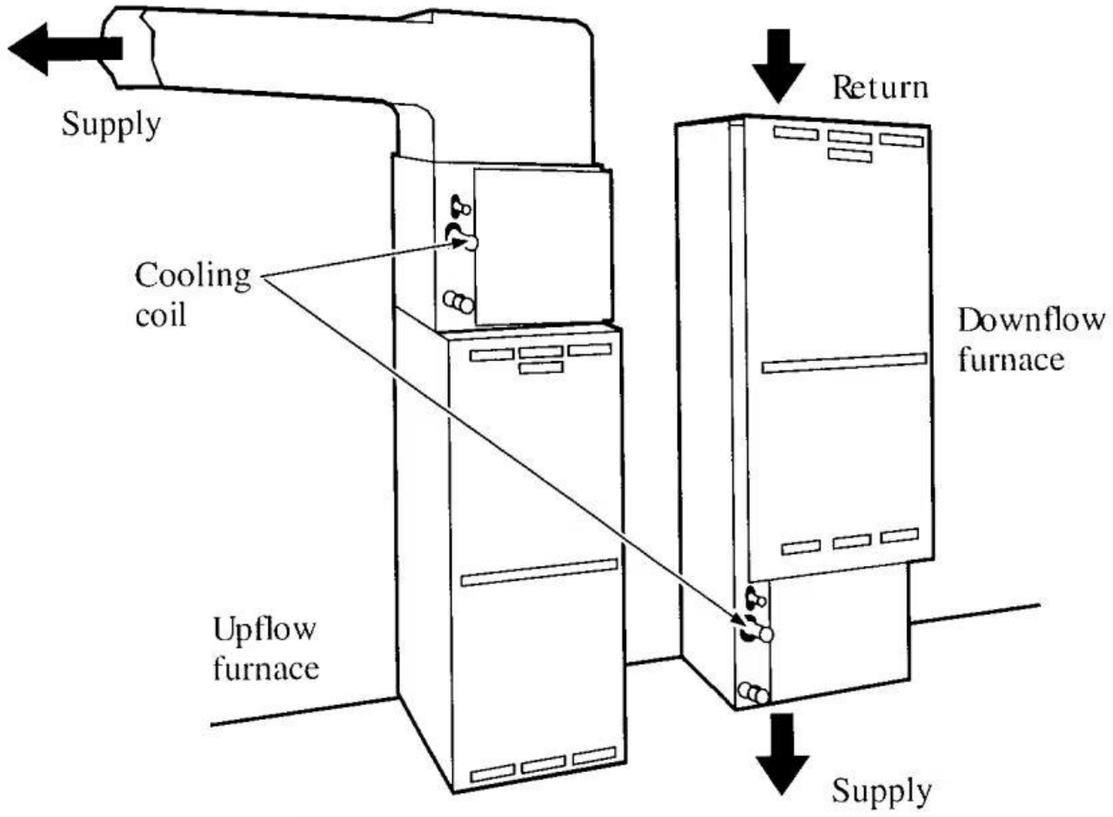
Taking Readings

After operating the equipment for about five minutes with the fan running, record the temperatures to calculate the normal air temperature rise or drop.

Cooling Coil Cabinet Locations

Figure 3-3 shows possible locations of the cooling coil cabinet in different furnace configurations.

Figure 3-3
Possible locations of the cooling coil cabinet
Courtesy of WGisol CC BY



Up-flow Configuration

Coil positioned above the furnace

Down-flow Configuration

Temperature Change Diagnostics

11°C

Normal Temperature Drop

The typical temperature drop across a properly functioning cooling coil at 24°C and 50% humidity

20°F

Fahrenheit Equivalent

The same temperature drop expressed in Fahrenheit units

24°C

Typical Operating Temperature

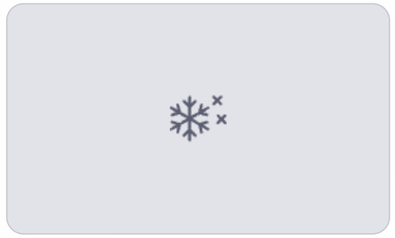
The standard ambient temperature for measuring cooling coil performance

50%

Relative Humidity

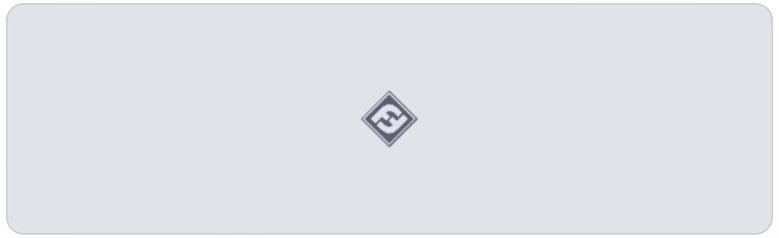
The standard humidity level for measuring cooling coil performance

Problems Caused by Dirty Coils



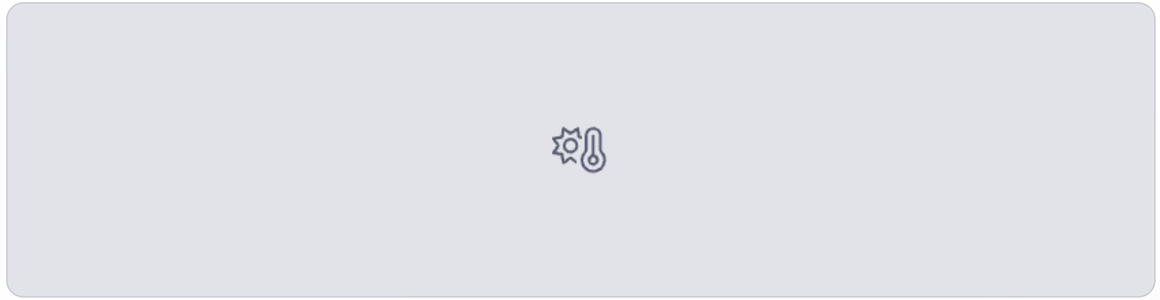
Reduced Cooling Capacity

During the cooling season, the coil will not deliver its full cooling capacity.



Restricted Air Flow

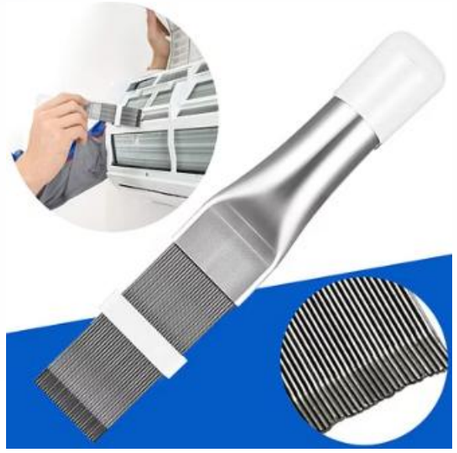
Air flow to the building will be reduced.

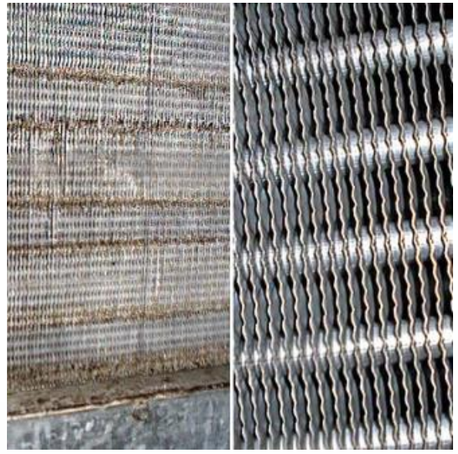


Increased Temperature

During the heating season, both temperature rise across the furnace and stack temperature will increase.

Cleaning Tools and Methods





Various tools can be used to clean cooling coils, including vacuum cleaners, compressed air or nitrogen, brushes, and fin combs. For more stubborn dirt, low-pressure water with mild detergent may be used. Always use these tools carefully to avoid damaging the delicate fins and coil structure.

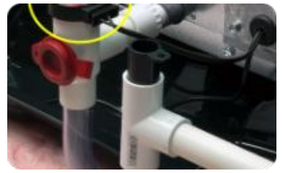
Condensate Drain System Maintenance

Drip Tray Cleaning

Clean the drip tray of accumulated dust or dirt to prevent blockages and ensure proper drainage.

Drain Hole Inspection

Probe the drain hole with a screwdriver to be sure it is not clogged and water can flow freely.



Drainage Testing

Pour a small amount of water in the drip tray and watch to ensure it drains properly without backing up.

Clearing Blockages

If the drain is clogged, use compressed air or nitrogen to blow out the obstruction and restore proper flow.