


Slide 1

# HVAC 101: Residential

## Typical system components & cleaning techniques



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Slide 2



Presenter



Brooks Ingrassia

Brooks Ingrassia is the managing partner of True Cleaning Solutions in Denver, CO and Midwest Duct Cleaning in Kansas City, MO

Brooks Ingrassia ASCS, CVI, VSMR

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Slide 3



Disclaimer

This presentation is not intended to be a comprehensive program covering all aspects of this topic. All technicians are encouraged to read and follow all applicable standards, codes and regulations related to this topic.

- ✓ It is the responsibility of each individual contractor to follow local building codes and licensing requirements and to work safely in accordance with OSHA guidelines.
- ✓ It is the contractor's responsibility to take proper precautions on each project to prevent cross contamination. Always take the health and safety of the building occupants into consideration before you conduct any cleaning procedures.
- ✓ All of the following tips are only general tips. They do not cover every situation, and it is your responsibility to adapt these tips to the individual system you are working on.
- ✓ The Instructor is not responsible in any way for the work you perform after viewing this slide show. You are responsible for your own work.
- ✓ The views and opinions following are the instructor's opinions and not necessarily the official position of the National Air Duct Cleaners Association.

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Slide 4




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Supplemental Materials

This session covers key points but not every detail.  
The tips & techniques presented are for cleaning & restoration procedures.  
For a full understanding of this topic, attendees are encouraged to review additional materials including:

**ACR, The NADCA Standard – 2021 Edition**



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Slide 5



What We'll  
Learn

- Types of HVAC Systems
- Typical Components
- Tips for Cleaning These Systems
- Cleaning Requirements

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Slide 6



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**Section 1**  
**Types of HVAC systems**

- Up Flow System
- Down Flow System
- Ductless
- Geothermal
- Multi Zone

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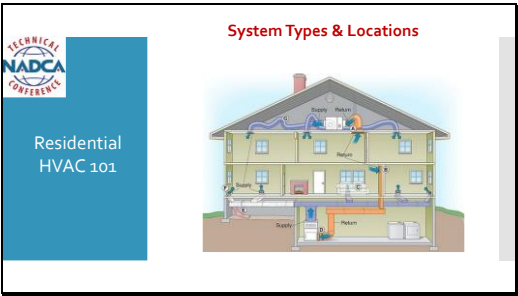
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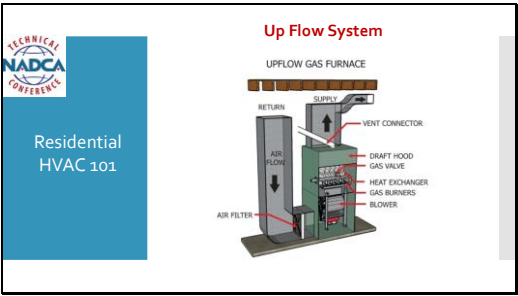
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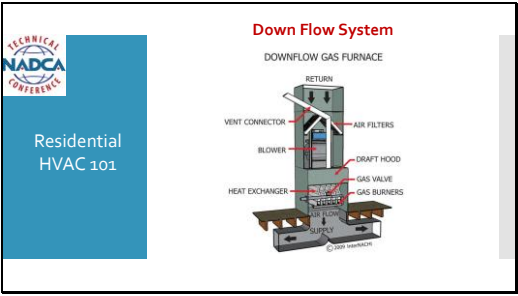
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Ductless Mini System



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Slide 11



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Ductless Mini System



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Geothermal System



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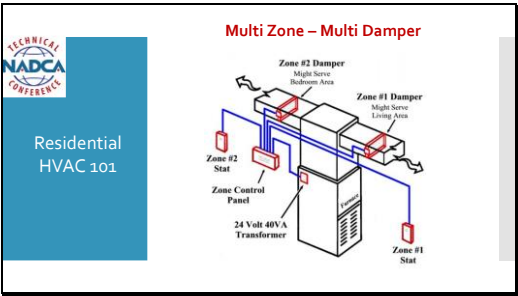
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Slide 14



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- Section 2  
Typical Components of Residential Systems
- Duct Work
  - Registers
  - Furnace Fan
  - Evaporator Coils & Drain
  - Humidifier
  - Washable Air Filter
- The NADCA logo is in the top left corner.

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Typical Components:  
Supply & Return Air Duct Work



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Typical Components:  
Registers & Vent Covers



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Typical Components:  
Furnace Fan



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Typical Components:  
Evaporator Coil & Drain pan



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Typical Components:  
Humidifier



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Typical Components:  
Washable Media Air Filters



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Typical Components:  
Real Life Install



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Typical Components



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Section 3  
Cleaning Methods

NADCA does not endorse or recommend any single method of cleaning or type of equipment.

NADCA recommends the use of source removal methods and equipment designed to clean HVAC systems to the cleanliness levels specified in NADCA Standard ACR.

Each different cleaning method has its advantages and disadvantages

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**Section 3**  
**Cleaning Methods: Vacuum Collection**

Good negative air (suction) is a must for capturing the particulate.



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**Section 3**  
**Cleaning Methods: Vacuum Collection**

A vacuum collection device alone will not get an HVAC system clean.

Methods and tools designed to agitate debris adhered to surfaces along with use of vacuum collection device(s), is required.



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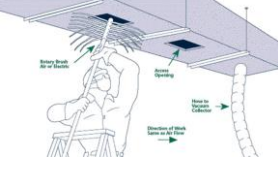
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**Section 3**  
**Cleaning Methods: Brushing**



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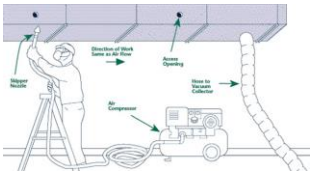
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Section 3  
Cleaning Methods: Air Washing



The diagram illustrates the air washing process. A technician on a ladder uses a blast nozzle to clean the interior of a duct. A vacuum hose is connected to the other end of the duct, leading to a vacuum unit on the floor. Arrows indicate the direction of air flow from the vacuum unit through the duct and out through the blast nozzle. Labels include: 'Blast Nozzle', 'Direction of Blast Air at the Time', 'Vacuum Hose', 'Vacuum Unit', and 'Blow Up Section Outside'.

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Section 3  
Cleaning Methods: Air Washing

Whips, Rods, Blast Nozzles



Two photographs showing cleaning tools. The left photo shows a blue whip being used to clean a duct. The right photo shows a coiled blue whip and a blue rod.

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Section 3  
Cleaning Methods: Contact Vacuuming



The diagram illustrates the contact vacuuming process. A technician on a ladder uses a vacuum nozzle to clean the interior of a duct. A vacuum hose is connected to the other end of the duct, leading to a vacuum unit on the floor. Arrows indicate the direction of air flow from the vacuum unit through the duct and out through the vacuum nozzle. Labels include: 'Vacuum Nozzle', 'Direction of Blast Air at the Time', 'Vacuum Hose', 'Vacuum Unit', and 'Blow Up Section Outside'.

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**Section 3**  
**Cleaning Methods: Hand Washing**

This procedure is just what its name implies—washing components by hand. Involves hand tools such as brushes, sponges or damp cloths to wipe clean a designated area.



Liquids cannot be applied to porous components such as fibrous glass. Make sure that no chemical residues are left in the system during hand washing.

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Cleaning  
Methods



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**Section 3**  
**Component Cleaning - Fans**



Fan Compartment  
Fan Housing  
Fan Blades or Vanes  
Motor/ Drive Assemblies

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Section 3  
Component Cleaning - Fans



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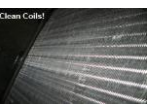
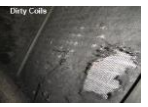
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Section 3  
Component Cleaning – Evaporator Coils



Vacuum with brush  
Blow out with air  
Aerosol cleaner  
Pump sprayer with chemical



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Section 3  
Component Cleaning – Evaporator Coils

- Containment – separate coil from furnace with sheet metal or poly.
- Capture water during cleaning with a wet vac, vacuum out the drain pan as needed.
- Always verify drain line from the pan is actually operational before wet cleaning!
- Go slowly- the pan is small and only holds a small amount it's easy to overflow.

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### Section 3

#### Component Cleaning – Drain Lines

The condensate drain pan and line should be flushed.  
Verify operation before cleaning.  
Blow out with compressed air first to remove large buildup.



Usually, a drain pan, and line have the highest amounts of contamination when compared to all other system components.

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### Section 3

#### Component Cleaning – Duct System Tips



It's faster to cut an access opening and vacuum large debris out of the ducts instead of trying to use air to push it towards the collection unit.

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Here's a Tip...

### Section 3

#### Component Cleaning – Duct System Tips

- Standardize your access holes – Only stock 2 sizes of premade sheet metal patches on your truck.
- Try to minimize your trips to the truck – steps cost money, bring in your tools from the beginning.
- Establish negative air before you remove vent covers- this helps to minimize mess inside the home when covers are removed.

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Component Cleaning:  
Ductless Mini Split



Same components of a standard furnace, just compact.  
Contains a fan, filter, evaporator coil, and drain pan.

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Component Cleaning:  
Ductless Mini Split



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Component Cleaning:  
Ductless Mini Split



Remove covers, vacuum fan and coils.  
Compressed air can be used to blow items out.

Purchase or create a containment to capture the water overflow to wet clean the coils.

 Here's a Tip...

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Component Cleaning:  
Geothermal Air Handler



Mysterious looking?

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Component Cleaning: Geothermal Air Handler



Same components as normal furnaces, fan, coils, drain pan.  
Be aware of coil placement, usually on return air side of the system.  
Tightly spaced coils, don't tolerate aggressive cleaning agents.

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Component Cleaning:  
Humidifiers



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### Component Cleaning: Humidifiers

- Disassemble and wash components.
- Pad can be replaced and sometimes washed.
- Verify that drain is working.
- HVAC microbial issues often start with the humidifier and evaporator coils.

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### Component Cleaning: Washable Media Air Filters



Wash with mild detergent, coil cleaner or degreaser

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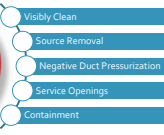

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### Section 4: Cleaning Requirements & Standards



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### Section 4: Cleaning Requirements & Standards

#### Cleaning Methods

- Vacuum Collection
- Brushing
- Air Washing
- Hand or Contact Vacuuming
- Hand Washing
- Power Washing



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### Section 4: Cleaning Requirements & Standards

#### Visibly Clean Standard

**Key Terms**

**Visibly Clean:**  
An interior surface is considered visibly clean when it is free from "**non-adhered**" substances and debris.

**Definition: What does non-adhered mean?**  
Any material not intended or designed to be present in an HVAC system, and which can be removed by contact vacuuming.



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### Section 4: Cleaning Requirements & Standards



#### Source Removal

**Key Terms**

**Source Removal**  
The mechanical cleaning of system components to remove dirt and debris.

Requires two key elements to be effective:

1. **Agitation** of dust and debris within the HVAC system.
2. **Extraction** of contaminants from the HVAC system



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**Section 4:  
Cleaning Requirements & Standards**

**Negative Duct Pressurization**

**Key Terms**  
**Negative Pressure**  
Used to prevent debris from entering the occupied space or leaving the contained area.

Prior to and throughout the duration of the cleaning process, the HVAC system and associated air duct *shall* be kept at an appropriate negative pressure differential relative to the indoor non-work area.

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**Section 4:  
Cleaning Requirements & Standards**

**Effective negative pressure containment requires:**

- Physical barrier around work area
- Sealing off HVAC return air grills
- Continuously pulling air through a HEPA filtration device to reduce airborne particles.
- Exhausting more cubic feet per minute of clean, HEPA-filtered air out of the space than is supplied into it.

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**Section 4:  
Cleaning Requirements & Standards**

**Participant Poll Question:**

Has anyone experienced an HVAC System cleaning job where negative pressurization was not maintained properly?

If so, what was the result?

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**Section 4:**  
**Cleaning Requirements & Standards**

**Service Openings**

Minimum Requirements for Service Openings

Service openings shall:

- not** degrade the structural, thermal, or functional integrity of the system;
- not** hinder, restrict, or alter the airflow within the air duct;
- not** be made in flexible ductwork;
- be** created in a manner that allows for proper closure;
- comply** with applicable UL, SMACNA and NFPA standards, as well as local, regional, state and federal codes.



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**Section 4:**  
**Cleaning Requirements & Standards**

**Service Openings**

Service Panels

- Shall be of an equivalent gauge or heavier
- Shall be mechanically fastened (screwed or riveted) at minimum every 4" on center.
- Shall overlap the ductwork surfaces by a minimum of 1" on all sides.
- Recommended to be sealed with gaskets, duct sealants, mastic or tape.



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**Section 4:**  
**Cleaning Requirements & Standards**

**Evaporator Coils**

All portions of each coil assembly **must be cleaned**.

- Both upstream and downstream sides of each coil section shall be accessed for cleaning.
- When both sides of a coil are not accessible for cleaning then removal and/or replacement may be required.
- Visual inspection of the coil and drain pan will determine whether Type 1 or Type 2 cleaning is required.



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**Section 4:**  
**Cleaning Requirements & Standards**

**Evaporator Coils**

The substances impacted on the evaporator coil help determine the initial cleaning protocol. Evaporator coil cleaning is broken into two (2) categories known as **Types**. Evaporator coil reconditioning will utilize **Type 1** or **Type 2** cleaning methods.

Type 1  
(Dry Cleaning)

Type 2  
(Wet Cleaning)

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**Section 4:**  
**Cleaning Requirements & Standards**

**Pop Quiz** Does this coil require Type 1 or Type 2 cleaning?



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**Section 4:**  
**Cleaning Requirements & Standards**

**Answer:**

Perform a Type 1 cleaning.

After performing Type 1 cleaning determine whether you need to proceed to Type 2 cleaning.

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Section 4:  
Cleaning Requirements & Standards

Participant Poll Question:  
Recommend Cleaning or Replacement?



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Section 4:  
Cleaning Requirements & Standards

Containment



*Be prepared to cover everything in your work area if needed.*

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Section 4:  
Cleaning Requirements & Standards

Containment



Simple critical barriers

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Section 4:  
Cleaning Requirements & Standards

Containment



Coils covered by cardboard, keeps debris from damaging coils

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Section 4:  
Cleaning Requirements & Standards

Containment



Replace filter with cardboard, sheet metal etc. to section furnace from duct system

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Conclusion

- Residential HVAC types
- Common components
- Cleaning procedures
- Standards

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HVAC<sub>101</sub>

Presenter Contact Information

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Thank you  
for  
Participating!



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