We will be starting soon!

Thanks for joining us

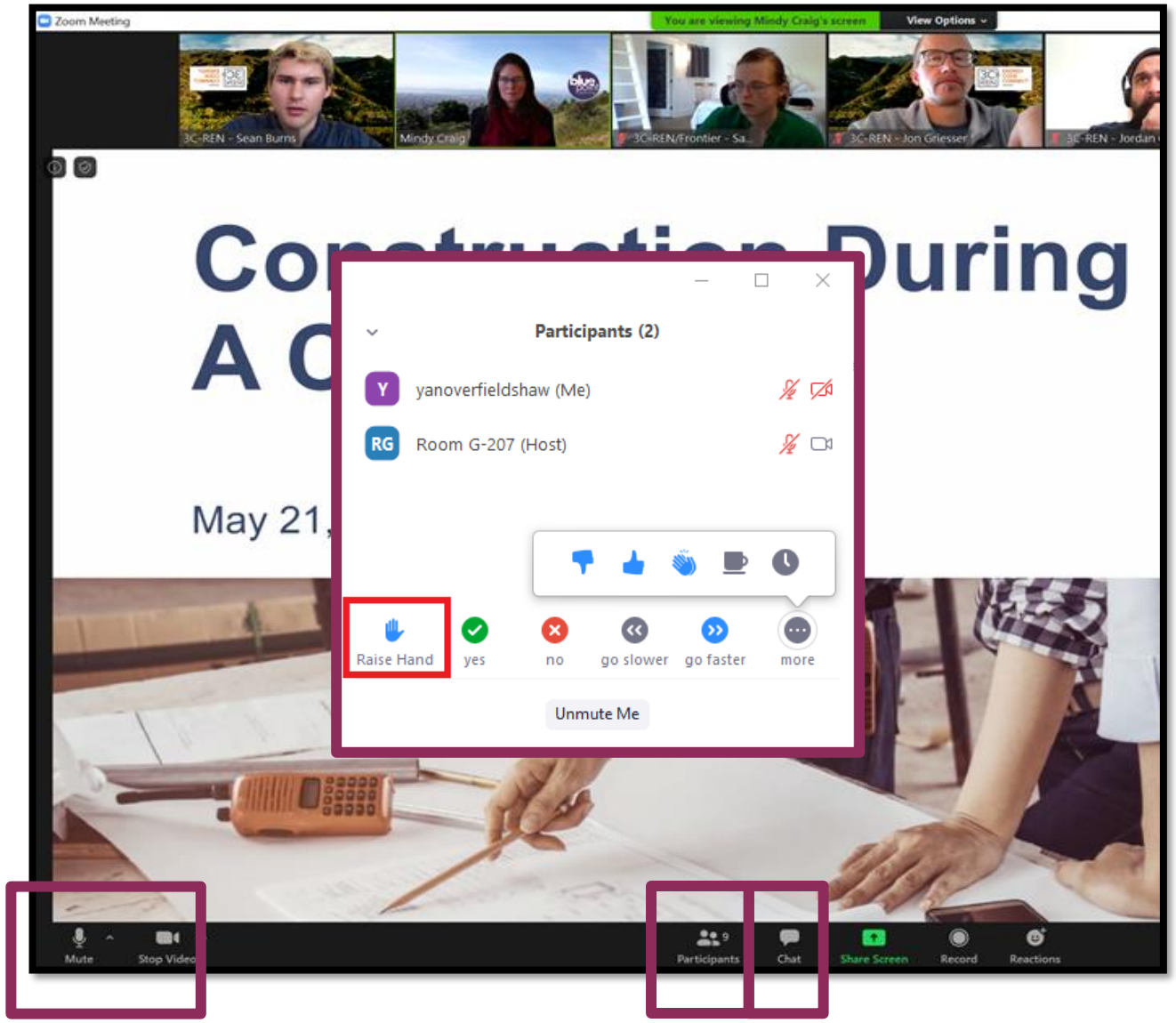
Intro to Residential HVAC Design (ACCA) Part 2

Russ King – Coded Energy

April 27, 2023

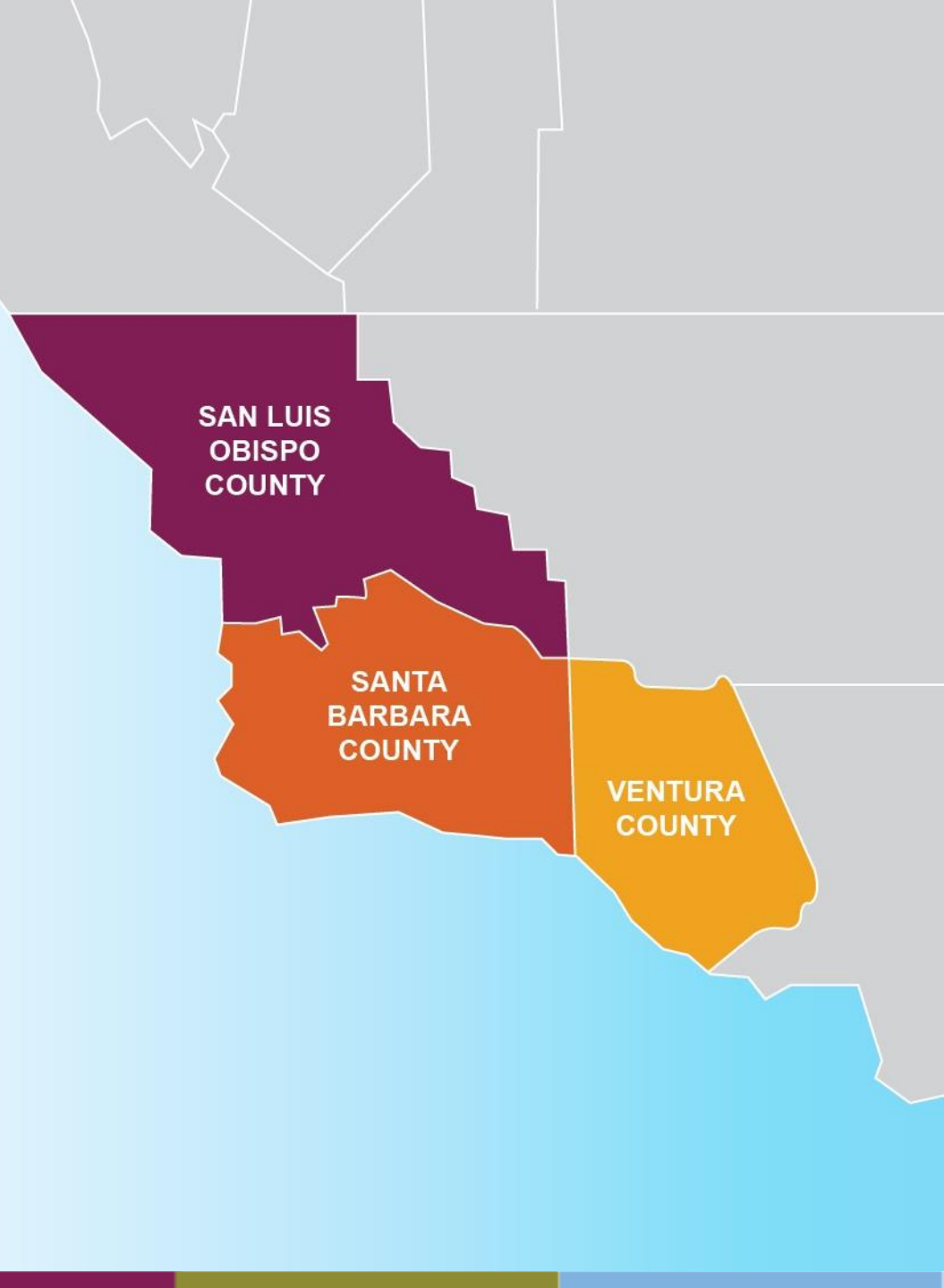
Zoom Orientation

- Please be sure your full name is displayed
- Please mute upon joining
- Use "Chat“ box to share questions or comments
- Under "Participant" select "Raise Hand" to share a question or comment verbally
- The session may be recorded and posted to 3C-REN's on-demand page. Feel free to ask questions via the chat and keep video off if you want to remain anonymous in the recording.



3C-REN: Tri-County Regional Energy Network

- Three counties working together to improve energy efficiency in the region
- Services for –
  - **Building Professionals:** industry events, training, and energy code compliance support
  - **Households:** free and discounted home upgrades
- Funded by ratepayer dollars that 3C-REN returns to the region




3C
REN
ENERGY
CODE
CONNECT


3C
REN
BUILDING
PERFORMANCE
TRAINING


3C
REN
HOME
ENERGY
SAVINGS

3C
REN

3C REN ENERGY CODE CONNECT

- Serves all building professionals
- Three services –
  - **Energy Code Coach**
  - **Training and Support**
  - **Regional Forums**
- Makes the Energy Code easy to follow

Energy Code Coach:
3c-ren.org/codes
805.220.9991

Event Registration:
3c-ren.org/events

BUILDING PERFORMANCE TRAINING

- Serves current and prospective building professionals
- Expert instruction:
  - **Technical skills**
  - **Soft skills**
- Helps workers to thrive in an evolving industry

Event Registration:
3c-ren.org/events

3C-REN HOME ENERGY SAVINGS

Multifamily (5+ units)

- No cost technical assistance
- Rebates up to $750/apartment plus additional rebates for specialty measures like heat pumps

Single Family (up to 4 units)

- Sign up to participate!
- Get paid for the metered energy savings of your customers

Enrollment:
3C-REN.org/contractor-participation

RESIDENTIAL HVAC DESIGN SERIES

PART 2 OF 2
ACCA MANUAL D
DUCT SYSTEM DESIGN

DEVELOPED FOR:

SONOMA COUNTY ENERGY AND SUSTAINABILITY

PRESENT BY:

CODED ENERGY, INC.
RUSSELL KING, ME

RESIDENTIAL HVAC DESIGN SERIES

This class is Part 2 of 2

- Part 1 - **ACCA Manual J Loads and Manual S Equipment Selection**
- Part 2 - **ACCA Manual D Duct Design**

Agenda for Today

1. Introduction (Some Review)
2. Overview of the HVAC Design Process (Review)
3. Manual D – Duct System Design

1. INTRODUCTION

CODED ENERGY

1. INTRODUCTION

- Instructor – Russell King, M.E.
- Licensed Mechanical Engineer (3 states)
- CEO of Coded Energy, Inc. (Developers of Kwik Model 3D software)
- 30+ years experience with residential HVAC design and energy efficiency
- russ@coded-energy.com
- Blog: www.russellking.me
- Website: www.kwikmodel.com
- YouTube: Kwik Model
- Author of *HVAC 1.0 – Introduction to Residential HVAC Systems* book.

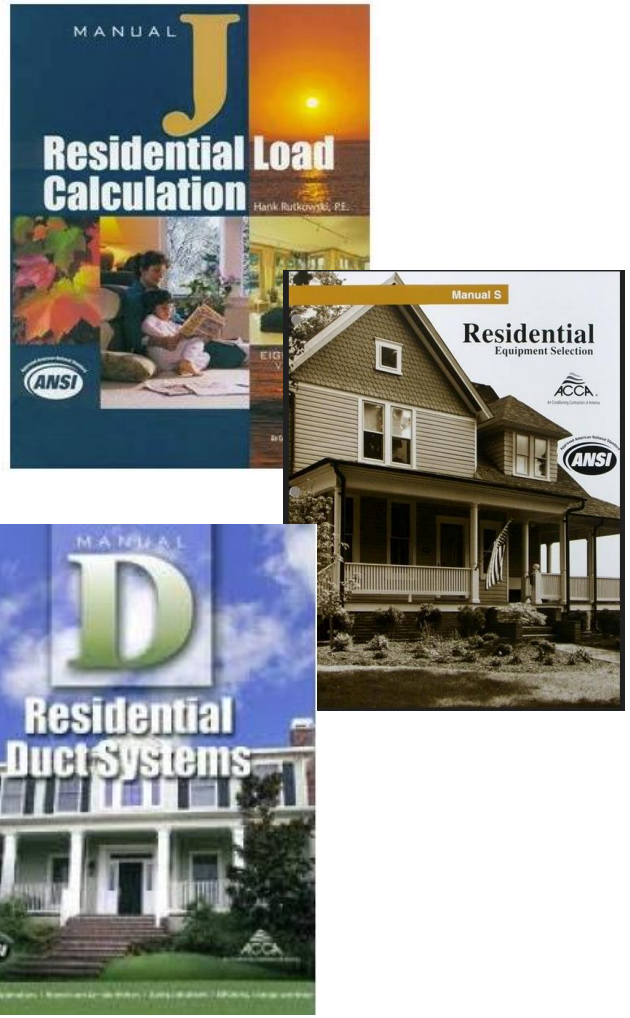
1. INTRODUCTION

About ***ACCA Manuals J/S/D***

- ACCA is **Air Conditioning Contractors of America**, the largest HVAC trade association in the United States.
- They write and publish ANSI approved manuals on residential and nonresidential HVAC design
- Widely recognized as the industry standard for residential HVAC design (though not the only recognized standard).

1. INTRODUCTION

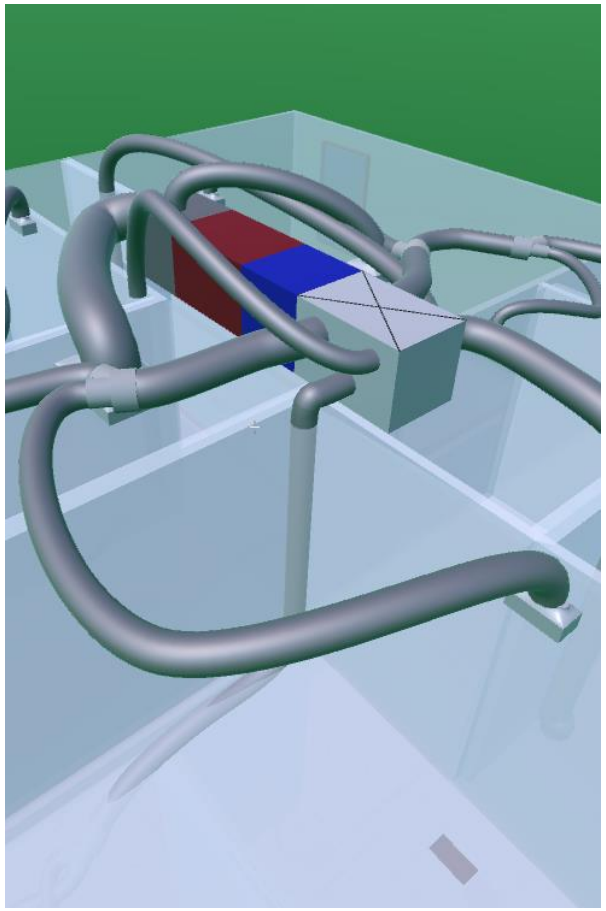
- Basic Design Manuals
  - Manual J – Residential Load Calculations
  - Manual S – Equipment Selection
  - Manual D – Duct Design
- Other Related Manuals
  - Manual RS – Residential System Design (overview)
  - Manual T – Terminal Selection (registers)
  - Manual H – Heat Pumps
  - Manual LLH – Low Load Homes
- Other Standards and Checklists. (QI, QM, etc.)
- www.acca.org



1. INTRODUCTION

The Importance of Good Design: Duct Sizing

- Since the temperature of the ***entire house*** (or zone) is determined by ***one location*** (at the thermostat) it is important for even temperature distribution that conditioned air be distributed evenly throughout the home.
- This is done by sizing the ducts to deliver the **proper airflow** to each room (register).

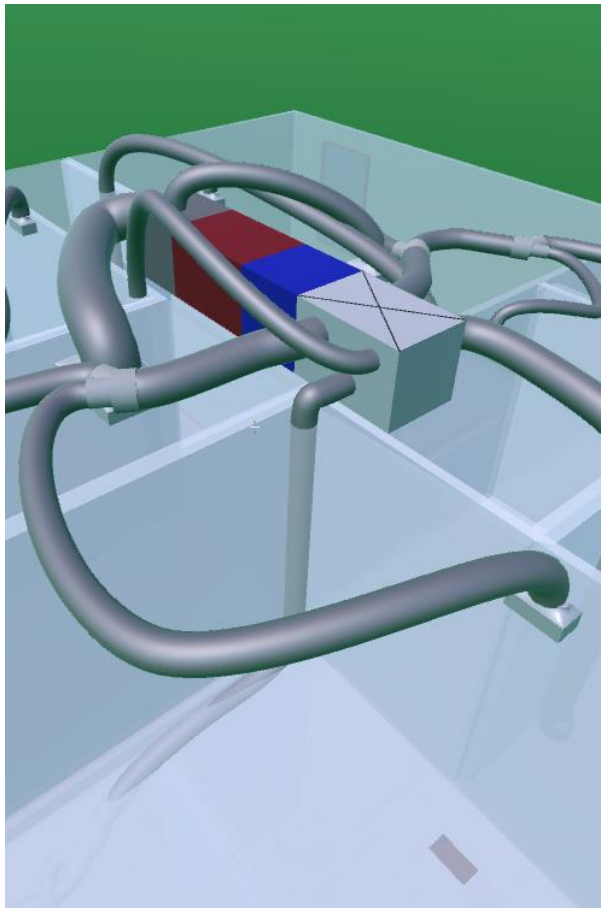


Screen snip from Kwik Model with EnergyGauge Loads

1. INTRODUCTION

The Importance of Good Design: Duct sizing

- Target room airflows need to be determined from **room-by-room loads** – you need to know what the load of a room is relative to other rooms.
- General undersizing of all ducts, especially return ducts, will reduce total system fan flow, which will reduce **capacity and efficiency** of system.

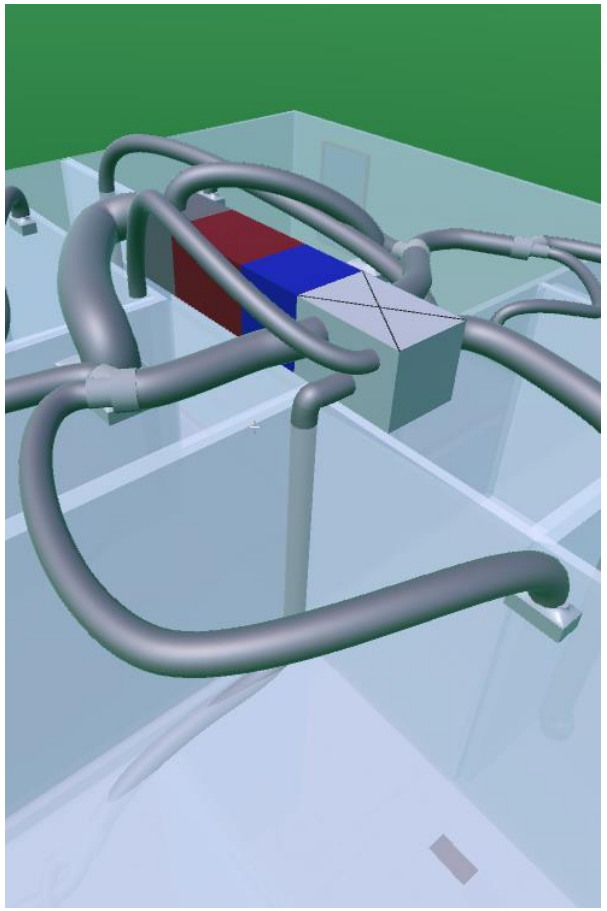


Screen snip from Kwik Model with EnergyGauge Loads

1. INTRODUCTION

The Importance of Good Design: Duct sizing

- Undersizing one or two ducts relative to the other ducts in the house will cause **poor air balance**.
- This will result in uneven temperature distribution in the house (some rooms warmer or cooler than others)
- These problems are made more noticeable by **low overall airflow**.

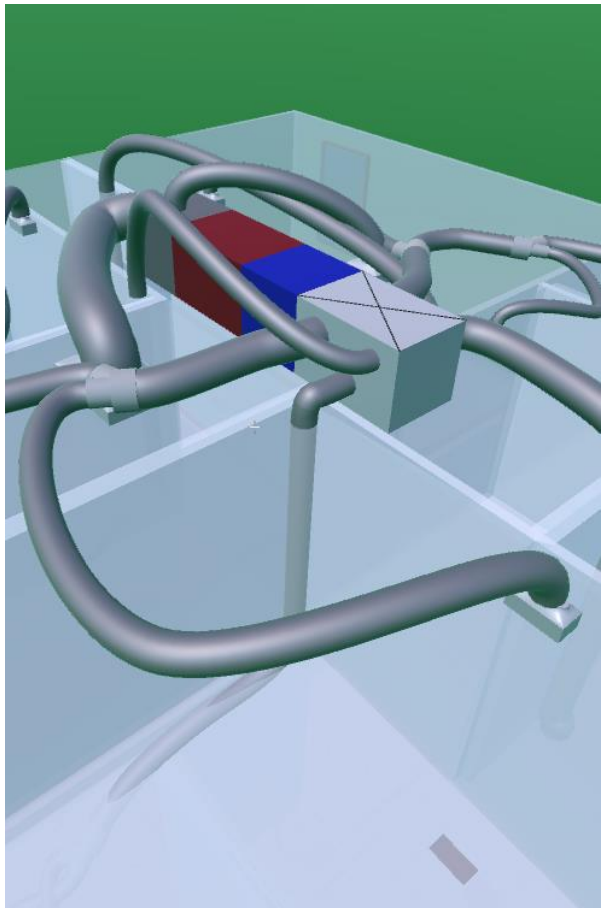


Screen snip from Kwik Model with EnergyGauge Loads

1. INTRODUCTION

Remember:

- Equipment cannot be properly sized unless you can accurately determine the **capacity** at design conditions. (Manual S)
- Equipment cannot be properly sized unless you know the **load** of the house. (Manual J)

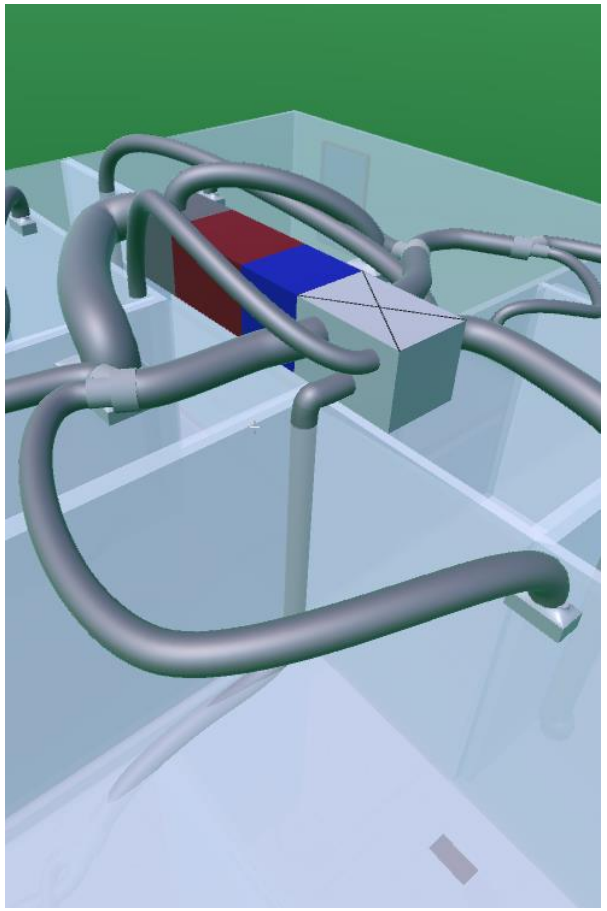


Screen snip from Kwik Model with EnergyGauge Loads

1. INTRODUCTION

Remember:

- Ducts cannot be properly sized unless you know how to **distribute the air**.
- To know how to distribute the air, you need **room by room** load calculations.



Screen snip from Kwik Model with EnergyGauge Loads

2. OVERVIEW OF HVAC DESIGN PROCESS

The Process

- The basic steps in designing a typical ducted central system for a home are:
  1. **Collect** information about the house (plans)
  2. **Perform** *room-by-room* load calculations (ACCA Manual J)
  3. **Select** equipment to meet the total loads (ACCA Manual S)
  4. **Design** the distribution system (ACCA Manual D)

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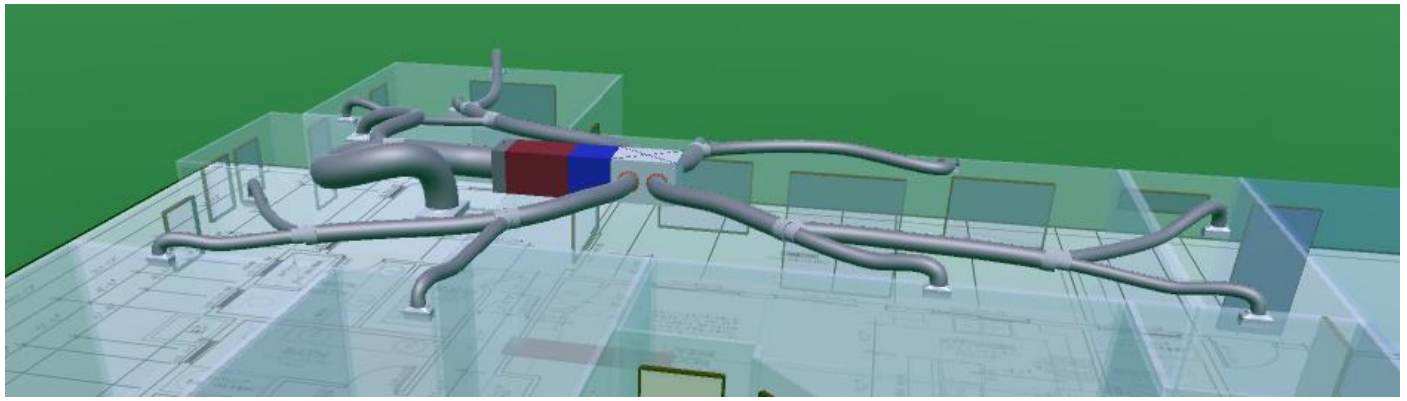
Covered in the Part 1 Class

2. OVERVIEW OF HVAC DESIGN PROCESS

Step 4. Design the Distribution System

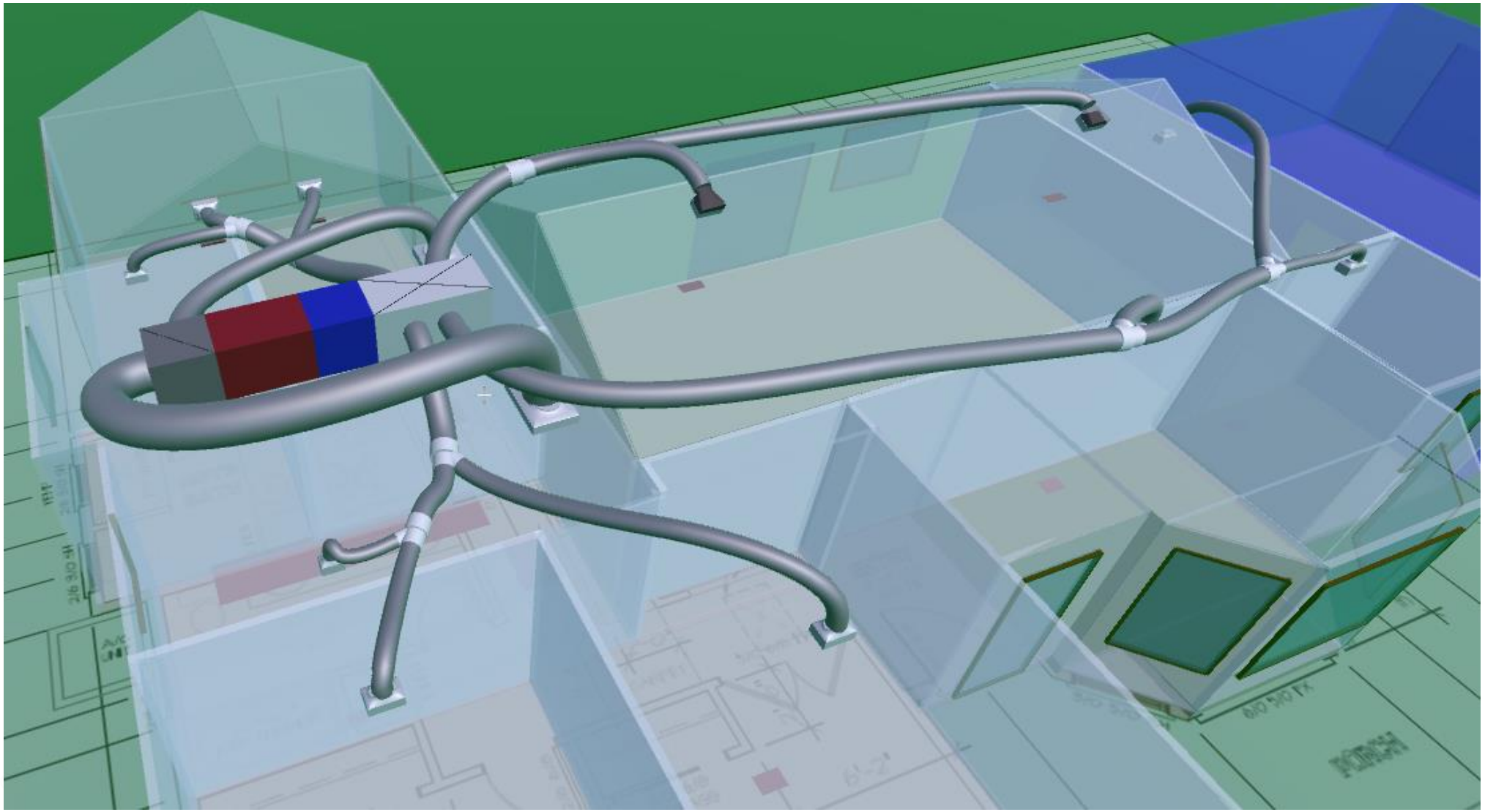
- This is one of the most overlooked aspects of HVAC design and one of the biggest sources of comfort problems.
- Sizing the ducts is also one of the easiest parts of the J/S/D process.
- Making the ducts fit in the house is where it can get difficult, especially in 2 story homes.



DESIGNING THE DISTRIBUTION SYSTEM

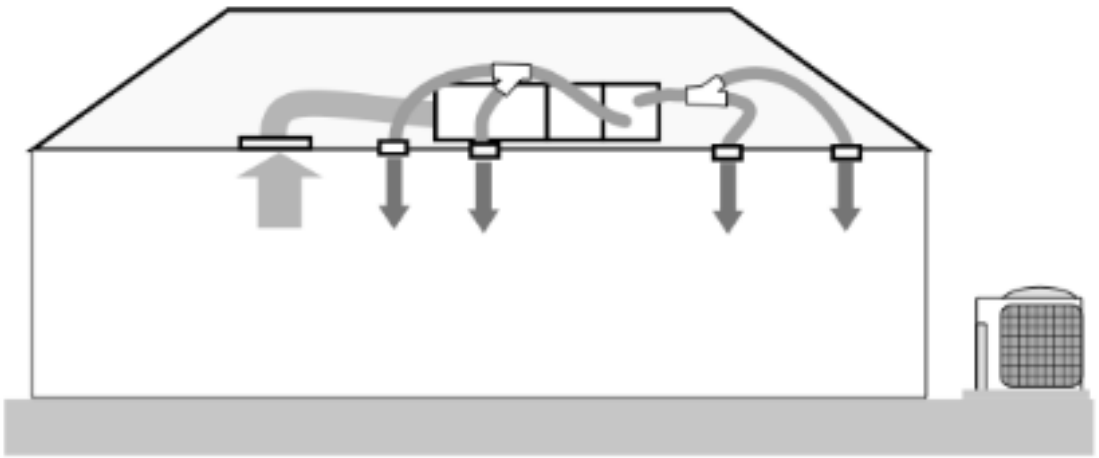
- The process for properly sizing ducts is quite easy **as long as you have room-by-room load calculations**.

- Consider the following layout for our example house…



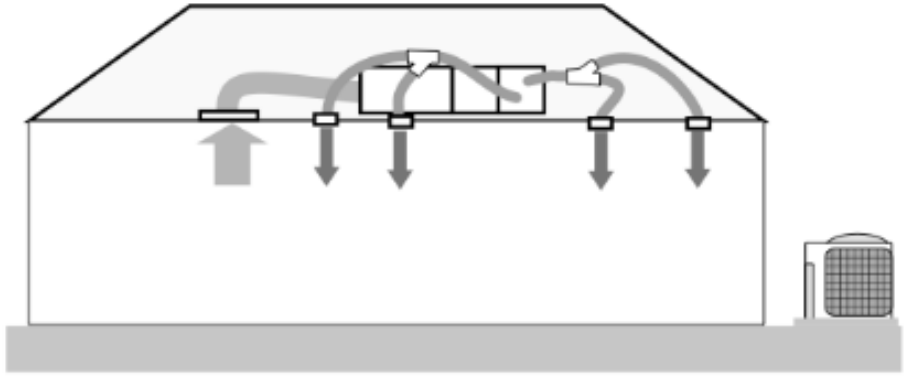
DESIGNING THE DISTRIBUTION SYSTEM

- This is a horizontal unit in an attic and is very typical of CA ranch style homes.

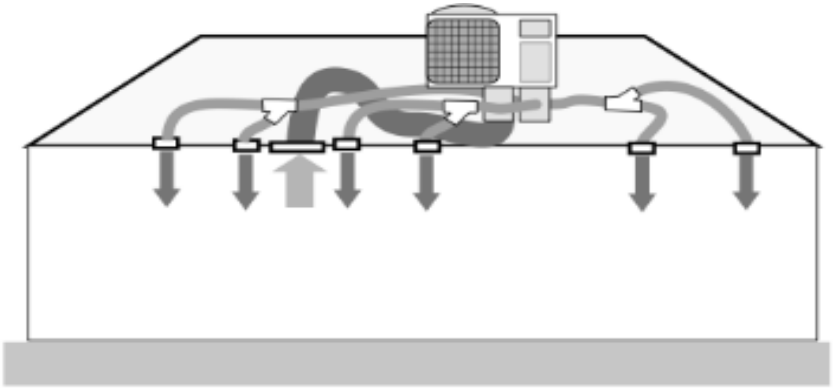


Images from *HVAC 1.0 – Introduction to Residential HVAC Systems*

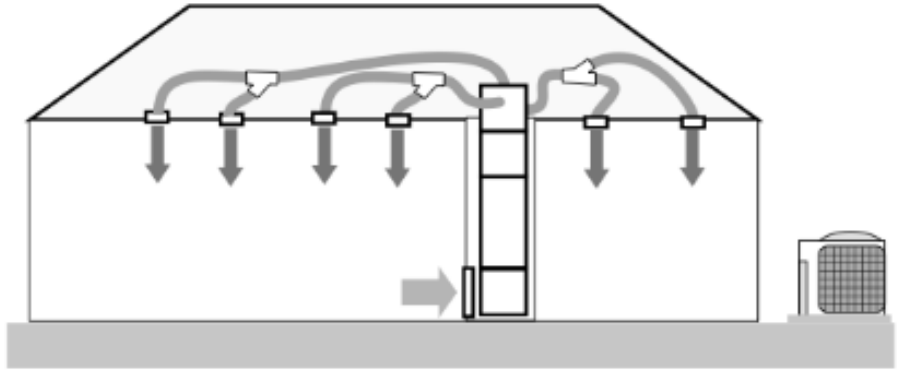
DESIGNING THE DISTRIBUTION SYSTEM



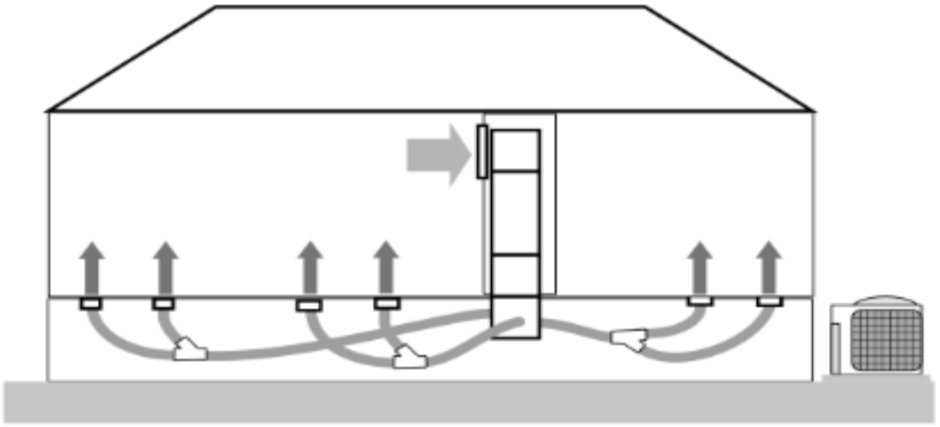
Horizontal unit in attic, ducts in attic



Package unit on roof, ducts in attic



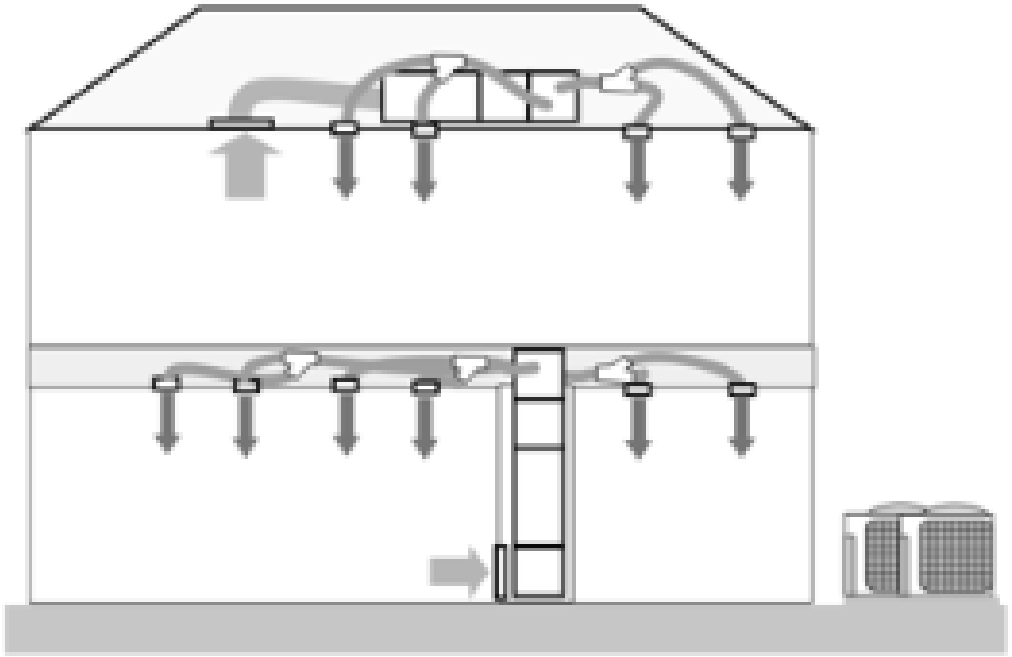
Upflow unit in closet, ducts in attic

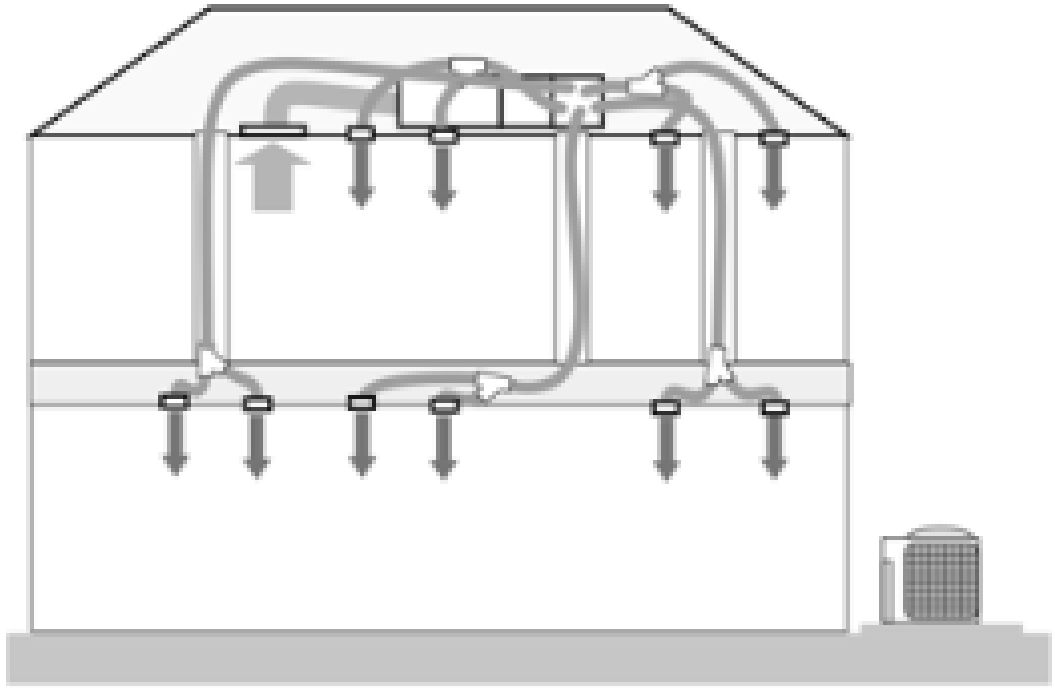


Downflow unit in closet, ducts in crawlspace

Images from *HVAC 1.0 – Introduction to Residential HVAC Systems*

DESIGNING THE DISTRIBUTION SYSTEM

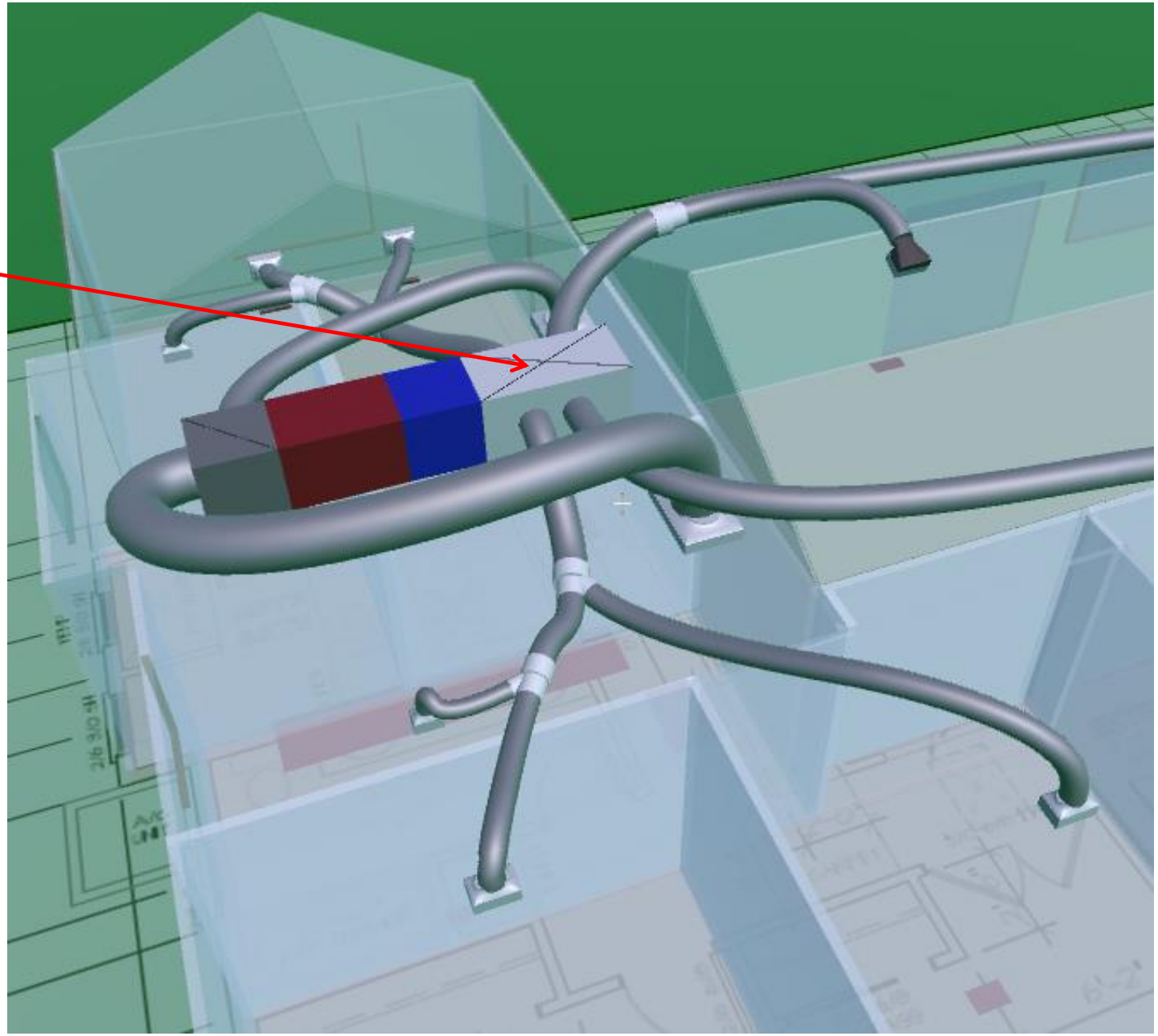




Images from *HVAC 1.0 – Introduction to Residential HVAC Systems*

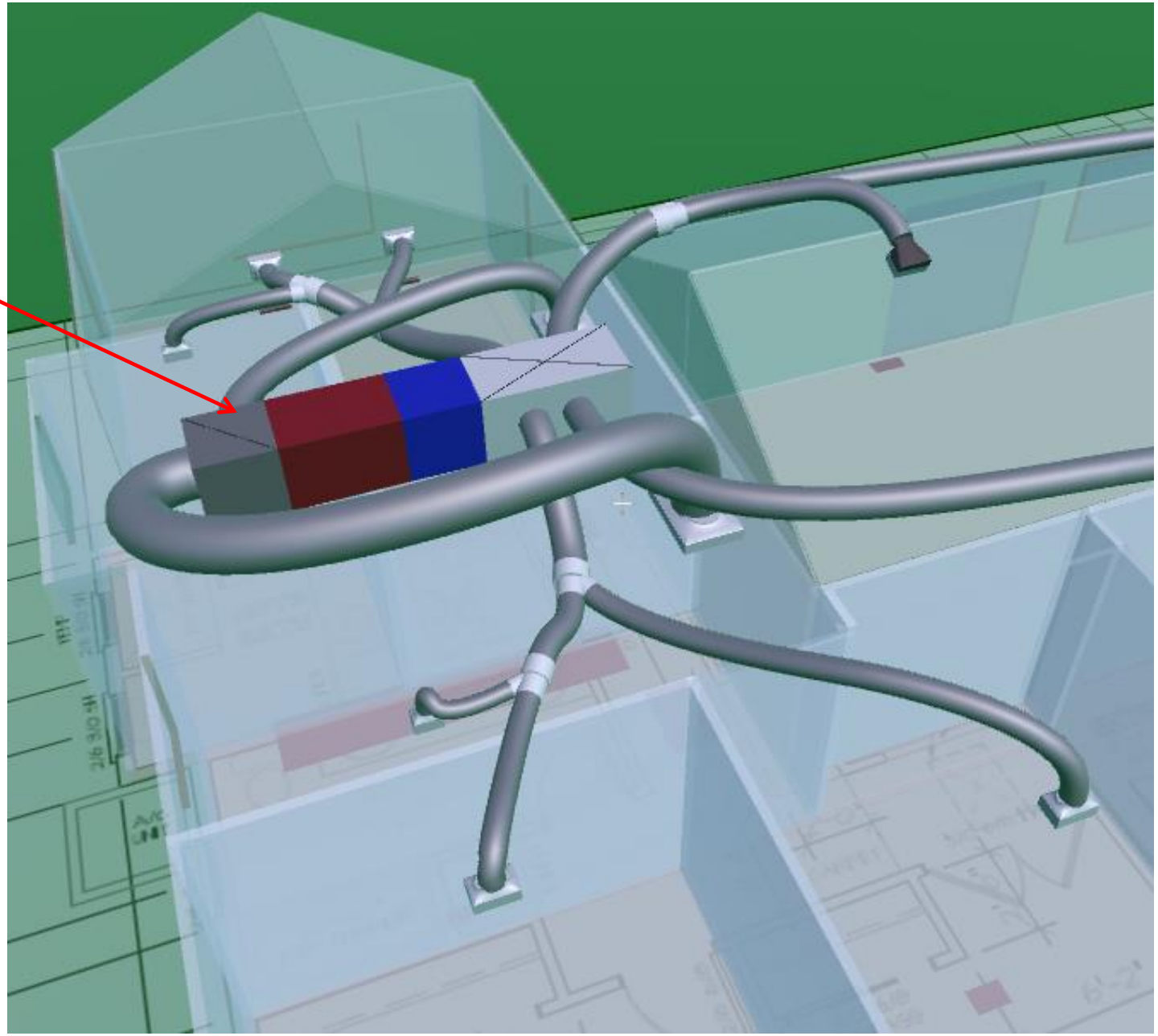
“Supply Plenum”

The supply plenum is the big box on the supply end of the air handler that the ducts are connected to. Typically made out of sheet metal or duct board.



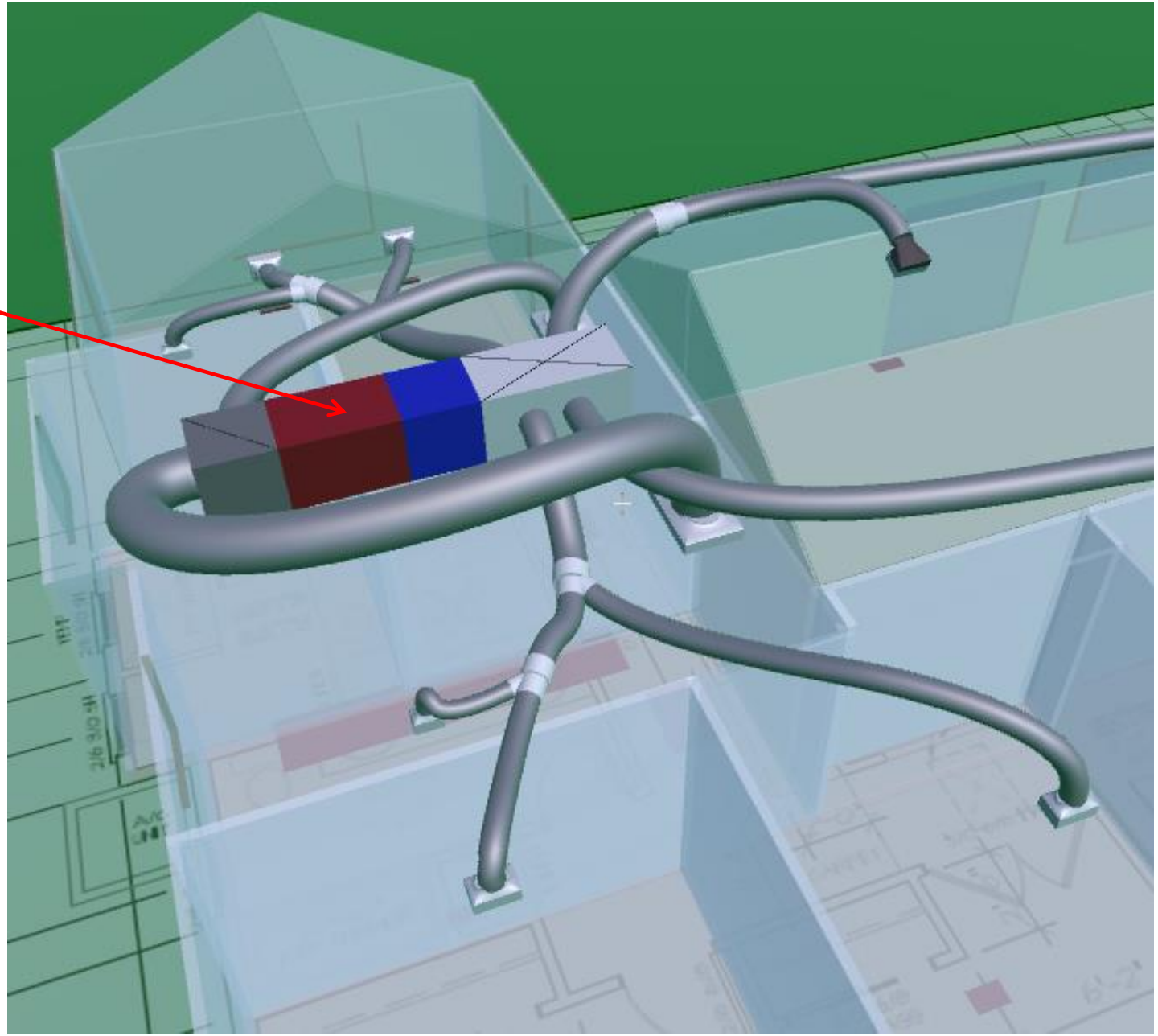
“Return Plenum”

Same as a supply plenum but on the other end of the air handler.



“Air handler unit (AHU)”

The big box that contains the fan that pushes the air through the supply ducts and pulls the air through the return ducts. Can be a furnace, or in the case of heat pumps, a fan coil unit.



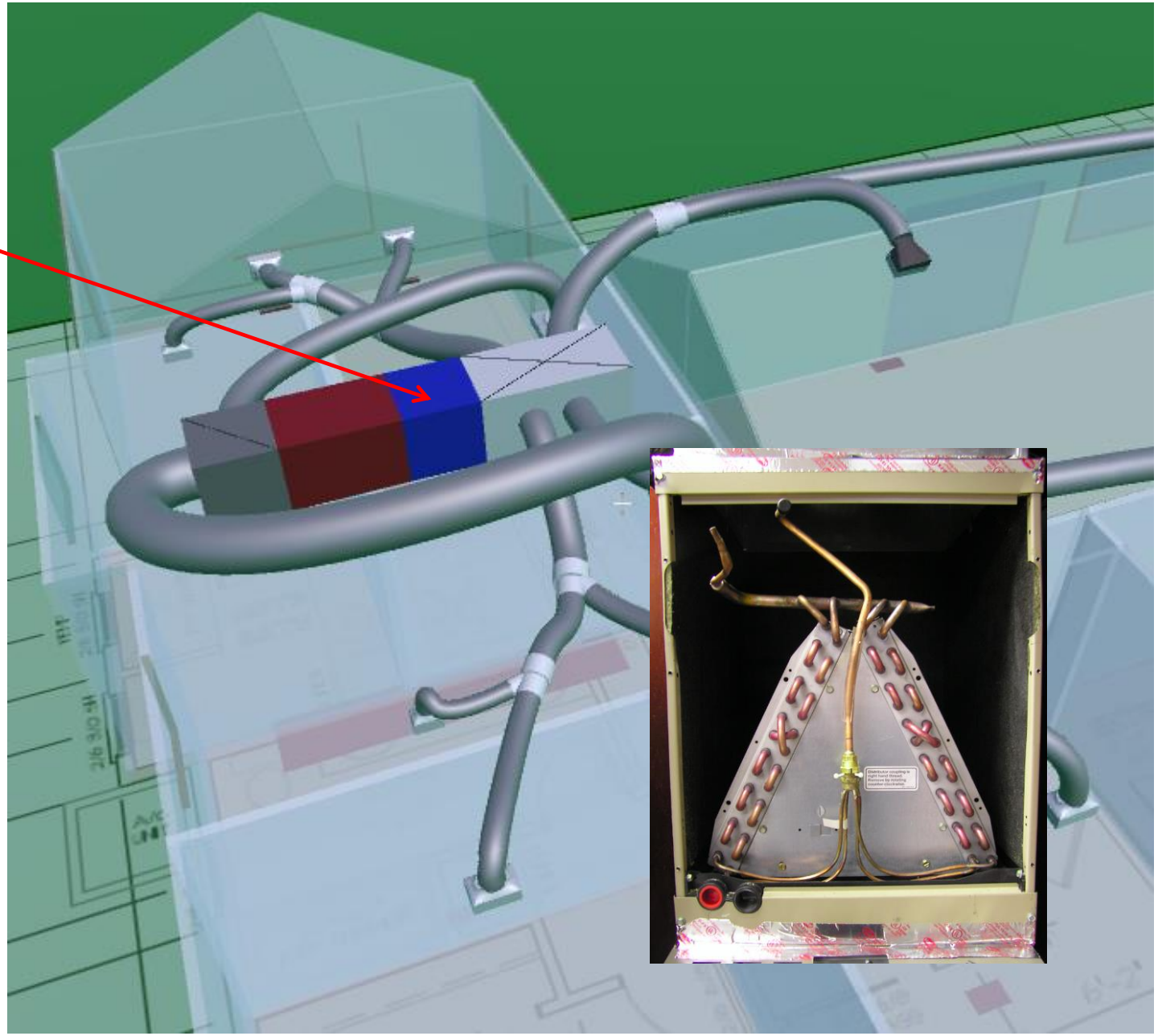
“Coil”

Aka, evaporator coil or indoor coil

Where the refrigerant “boils” and absorbs heat from the air thereby cooling it.

For heat pumps, it will also heat the air and the air handler and coil are usually all in one box.

Aka, fan-coil unit

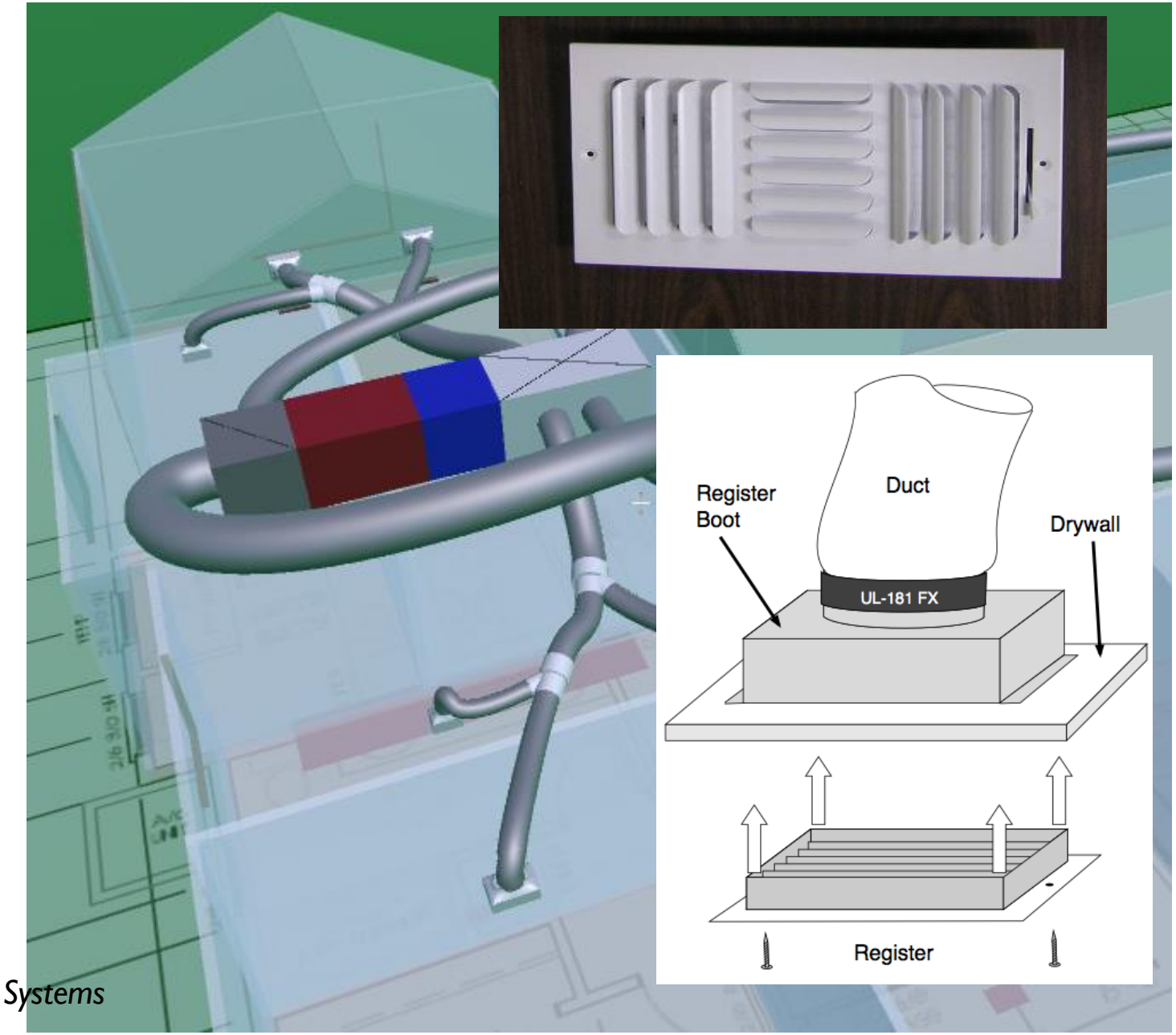


“Supply registers”

The grilles where the air comes out.

Can be in the ceiling, floor, or side walls.

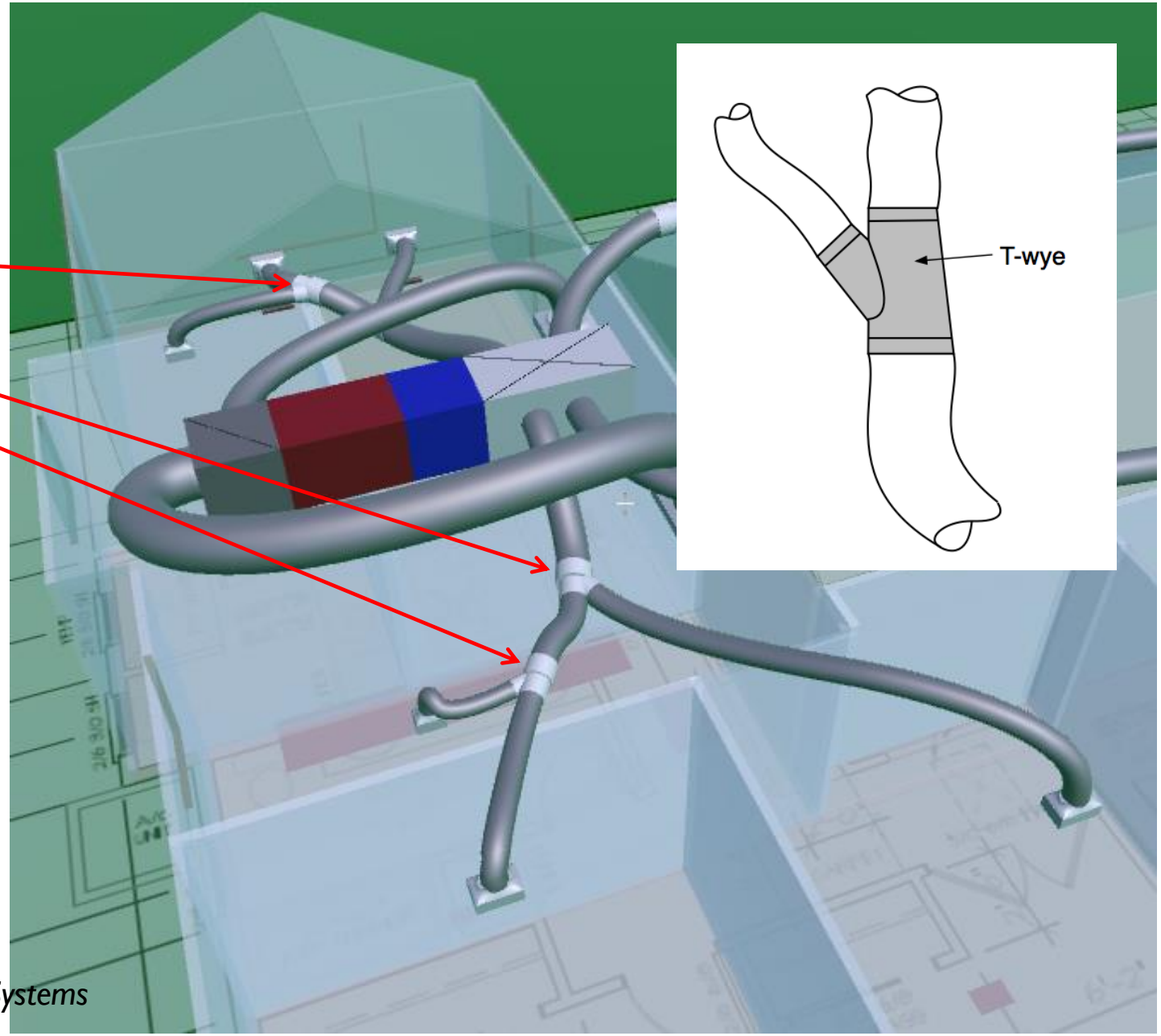
Attached to the duct by a fitting called a register boot.



Images from *HVAC 1.0 – Introduction to Residential HVAC Systems*

“T-wye”

A sheet metal fitting that allows one larger duct to be split into two or more smaller ducts.



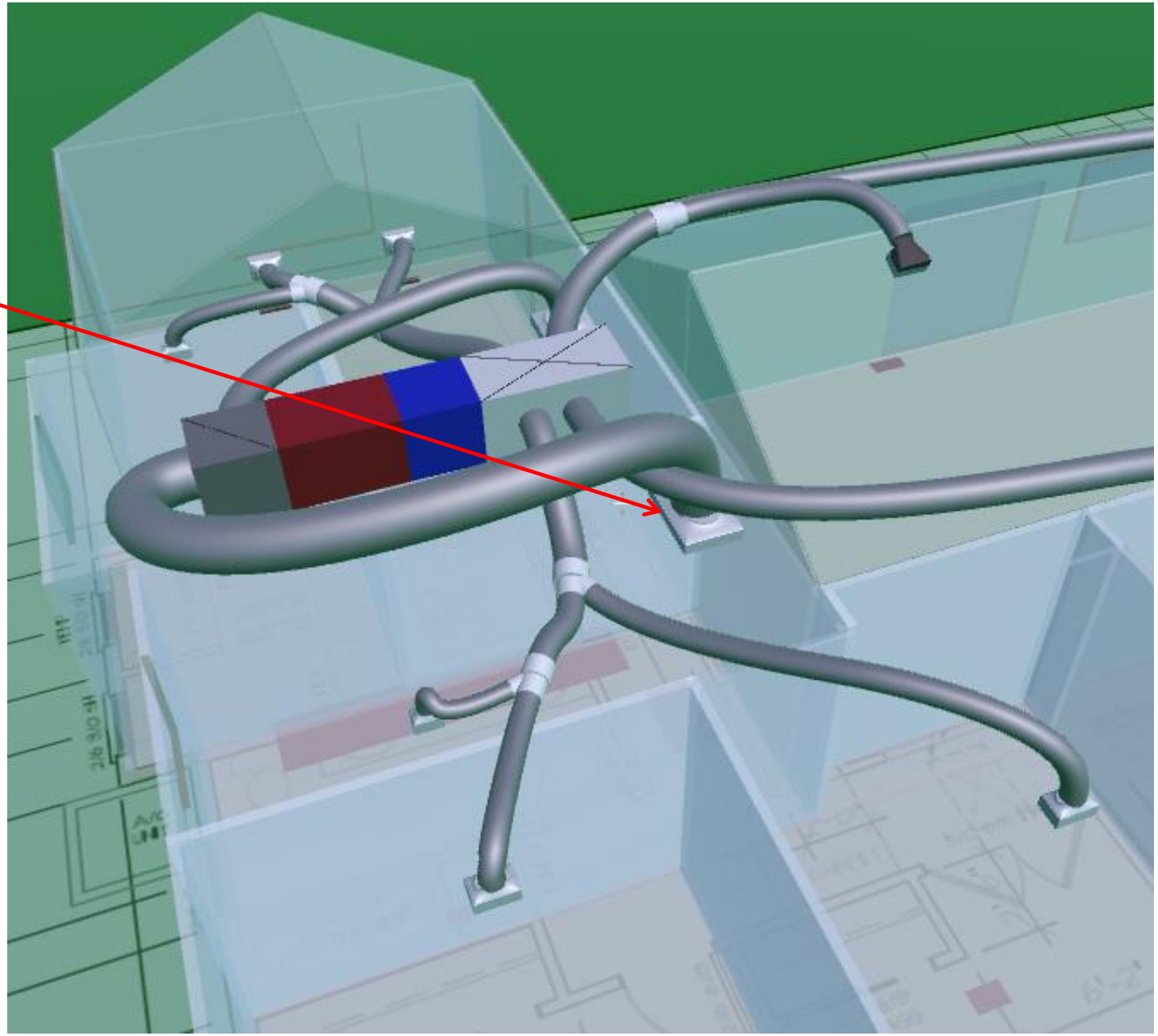
Images from *HVAC 1.0 – Introduction to Residential HVAC Systems*

“Return grille”

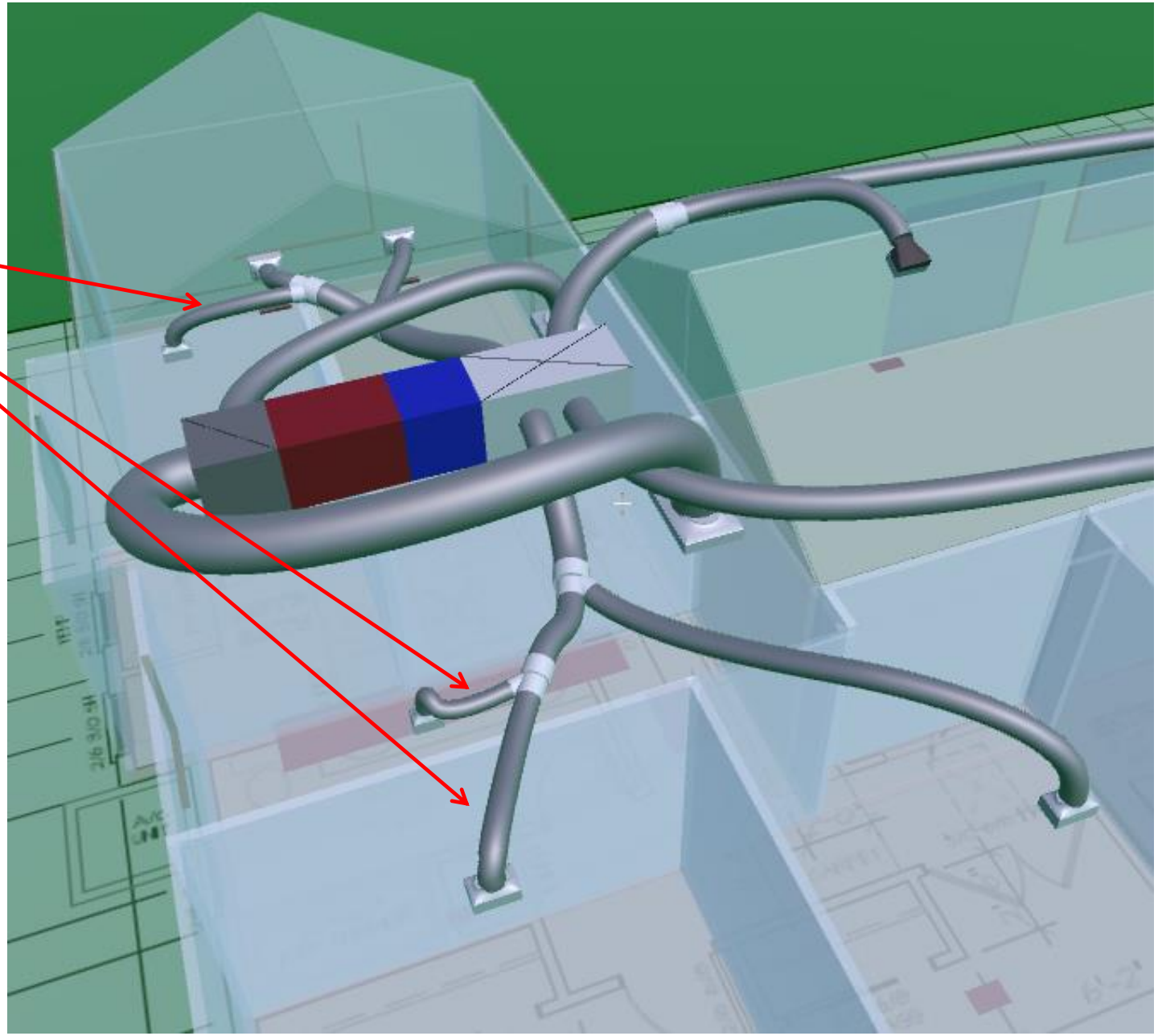
The grille where the return air goes.

Can be in the ceiling, floor or sidewall.

Sometimes holds the air filter, in which case would be called a filter grille.

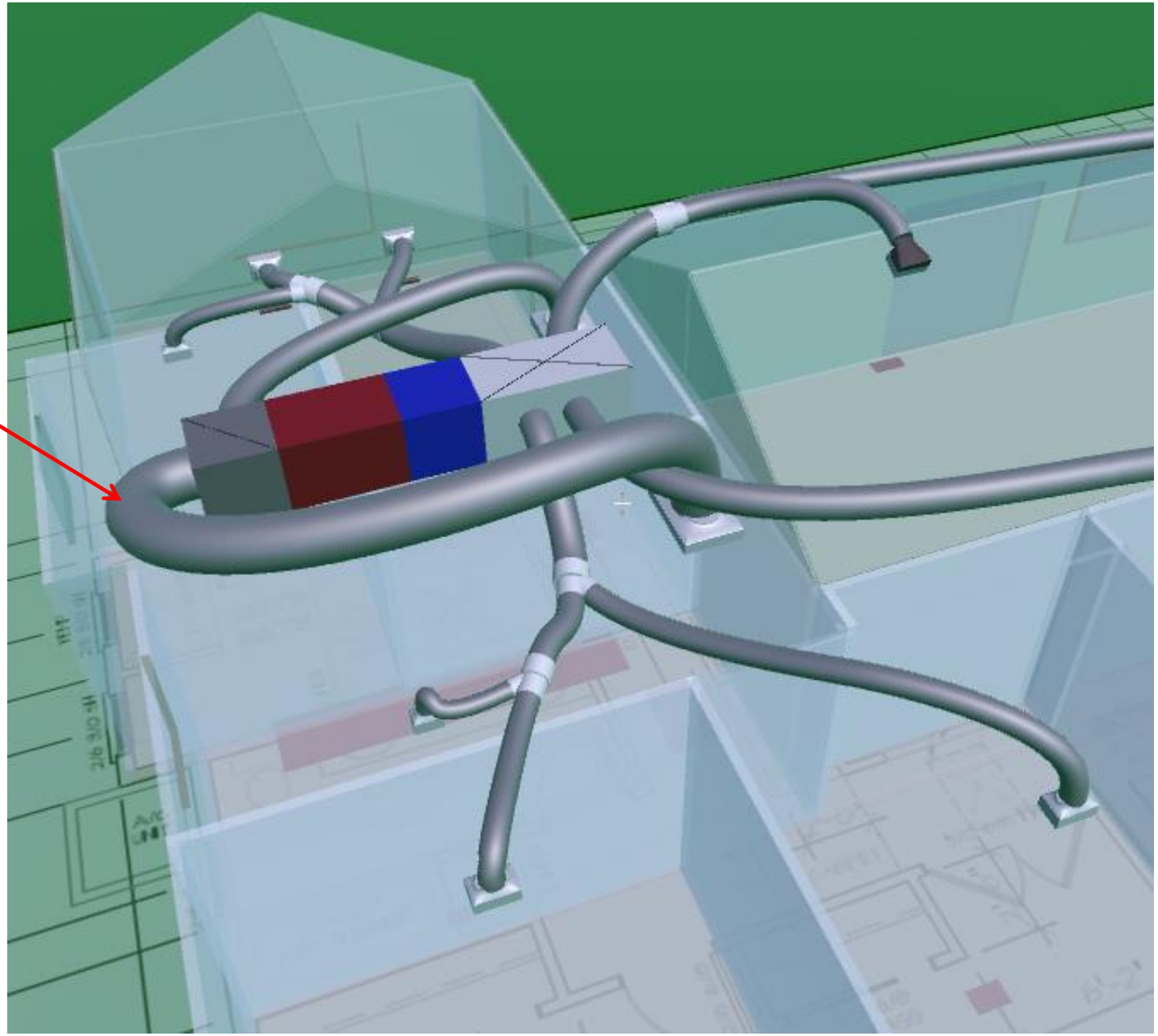


“Supply branch”
A duct that terminates in a supply register.

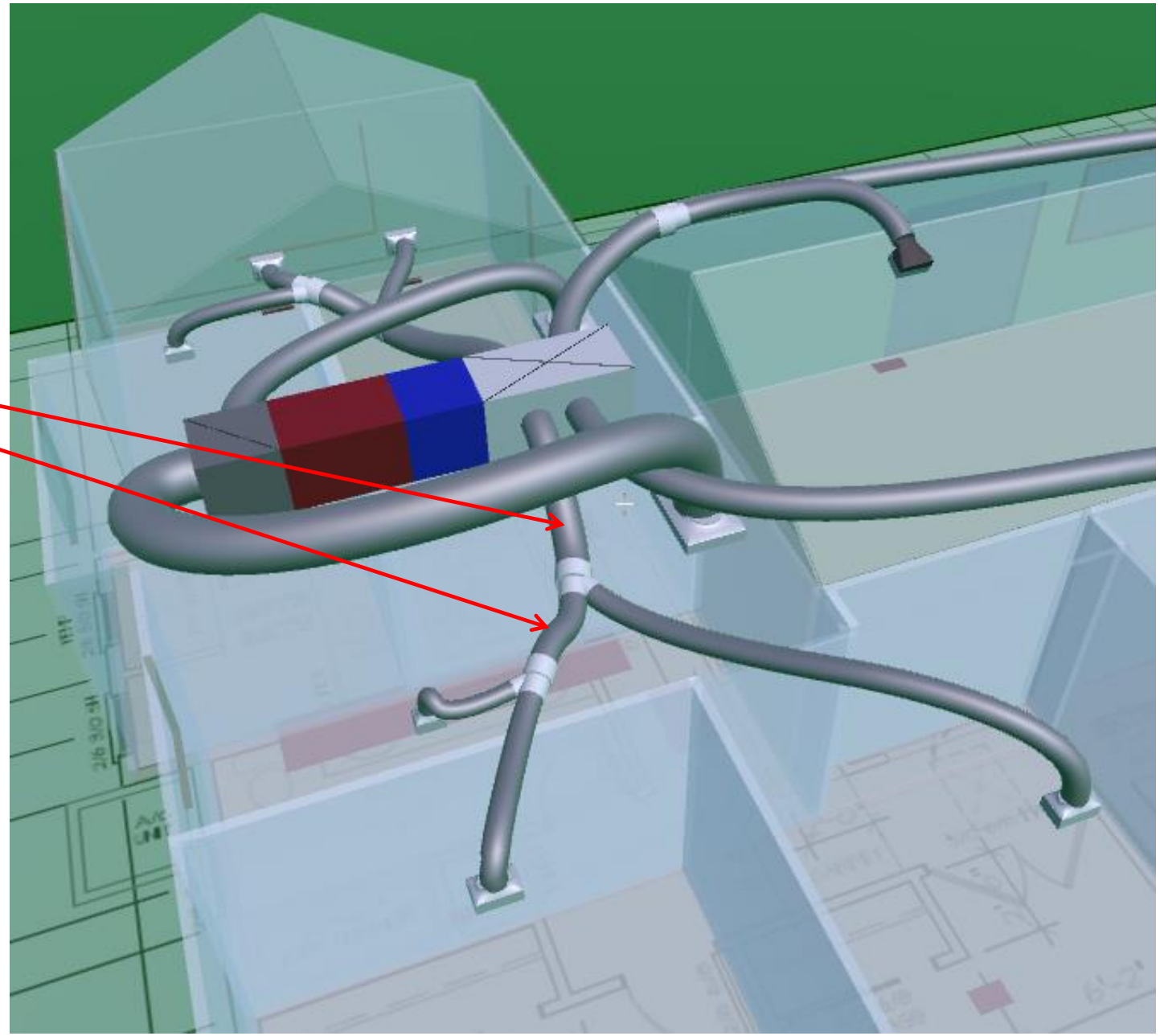


“Return branch”

A return duct that terminates in a return grille



“Supply trunk”
A supply duct that splits into more than one duct.

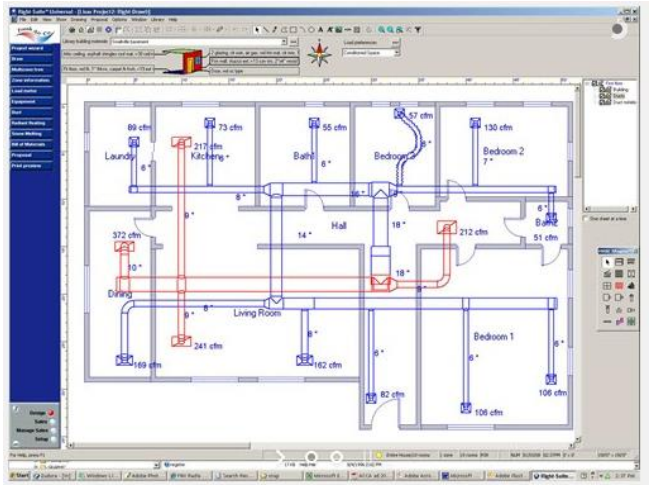


SOFTWARE

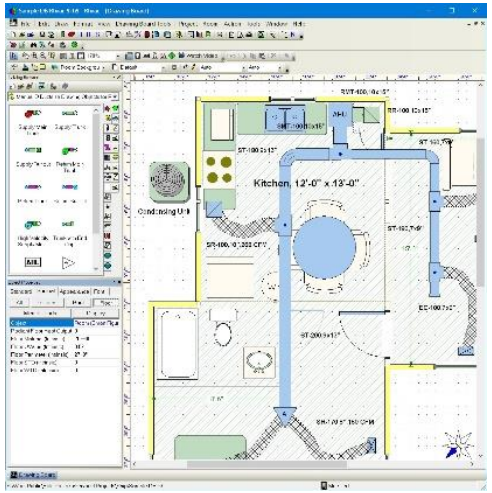
- Room-by-room cooling loads will come from the software

Much of the math presented in this example is done automatically by the software, but it is very important to understand the math that the software is doing for you.

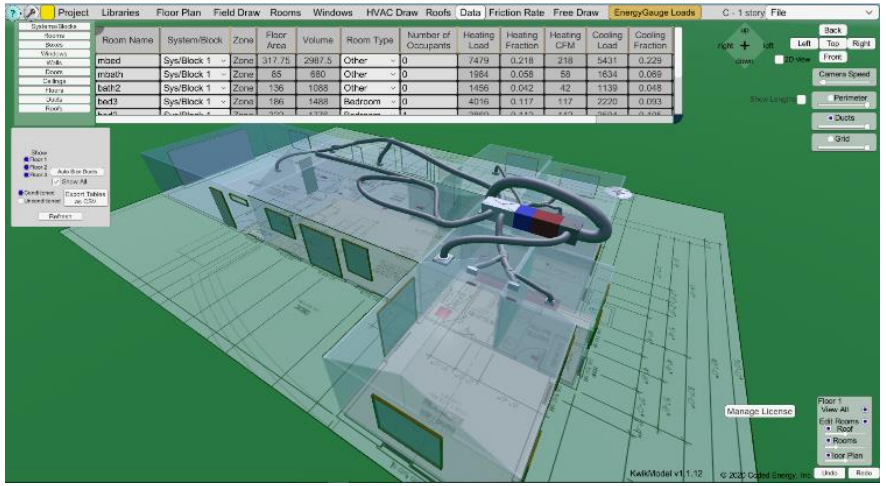
Right-Suite® by Wrightsoft



RHVAC by Elite Software



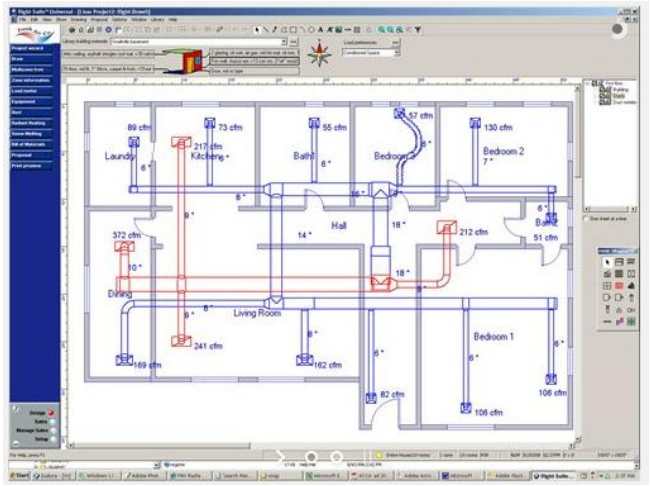
Kwik Model® with *EnergyGauge Loads*



SOFTWARE

To perform the load calcs, it is recommended that you take a class on how to use a load calculation software.

Right-Suite® by Wrightsoft



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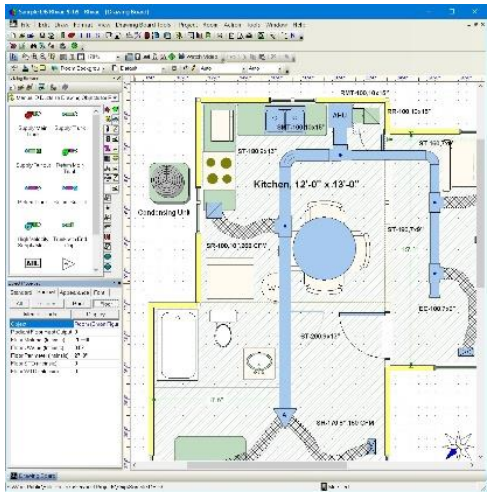

Kwik Model® with *EnergyGauge Loads*

SOFTWARE

- Example room-by-room cooling loads:

This is an example of what you might see in the software.

Room Name	Floor	System/Block	Zone	Floor Area	Volume	Room Type	Number of Occupants	Heating Load	Heating Fraction	Heating CFM	Sens Cooling Load	Cooling Fraction	Cooling CFM	Duct Size CFM
mbed	1	Sys/Block 1	Zone	317.75	2987.5	Bedroom	0	6632	0.216	183	4411	0.217	217	217
mbath	1	Sys/Block 1	Zone	85	680	Other	0	1745	0.057	48	1310	0.065	64	64
bath2	1	Sys/Block 1	Zone	136	1088	Other	0	1330	0.043	37	948	0.047	47	47
bed3	1	Sys/Block 1	Zone	186	1488	Bedroom	1	3534	0.115	98	1993	0.098	98	98
bed2	1	Sys/Block 1	Zone	222	1776	Bedroom	1	3432	0.112	95	2033	0.1	100	100
liv/kit	1	Sys/Block 1	Zone	493	4930	Kitchen	2	5744	0.187	159	5174	0.255	255	255
din	1	Sys/Block 1	Zone	184.25	1474	Other	0	3497	0.114	97	2620	0.129	129	129
pdr	1	Sys/Block 1	Zone	102	816	Other	0	3002	0.098	83	1032	0.051	51	83
util	1	Sys/Block 1	Zone	59.5	476	Other	0	1848	0.06	51	769	0.038	38	51
Total	---	---	---	1785.5	15715.5	---	4	30762	1	850	20289	1	1000	1045

SOFTWARE

Room Names

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SOFTWARE

System Information

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liv/kit	1	Sys/Block 1	Zone	493	4930	Kitchen	2	5744	0.187	159	5174	0.255	255	255
din	1	Sys/Block 1	Zone	184.25	1474	Other	0	3497	0.114	97	2620	0.129	129	129
pdr	1	Sys/Block 1	Zone	102	816	Other	0	3002	0.098	83	1032	0.051	51	83
util	1	Sys/Block 1	Zone	59.5	476	Other	0	1848	0.06	51	769	0.038	38	51
Total	---	---	---	1785.5	15715.5	---	4	30762	1	850	20289	1	1000	1045

SOFTWARE

Floor area and volume for each room

Room Name	Floor	System/Block	Zone	Floor Area	Volume	Room Type	Number of Occupants	Heating Load	Heating Fraction	Heating CFM	Sens Cooling Load	Cooling Fraction	Cooling CFM	Duct Size CFM
mbed	1	Sys/Block 1	Zone	317.75	2987.5	Bedroom	0	6632	0.216	183	4411	0.217	217	217
mbath	1	Sys/Block 1	Zone	85	680	Other	0	1745	0.057	48	1310	0.065	64	64
bath2	1	Sys/Block 1	Zone	136	1088	Other	0	1330	0.043	37	948	0.047	47	47
bed3	1	Sys/Block 1	Zone	186	1488	Bedroom	1	3534	0.115	98	1993	0.098	98	98
bed2	1	Sys/Block 1	Zone	222	1776	Bedroom	1	3432	0.112	95	2033	0.1	100	100
liv/kit	1	Sys/Block 1	Zone	493	4930	Kitchen	2	5744	0.187	159	5174	0.255	255	255
din	1	Sys/Block 1	Zone	184.25	1474	Other	0	3497	0.114	97	2620	0.129	129	129
pdr	1	Sys/Block 1	Zone	102	816	Other	0	3002	0.098	83	1032	0.051	51	83
util	1	Sys/Block 1	Zone	59.5	476	Other	0	1848	0.06	51	769	0.038	38	51
Total	---	---	---	1785.5	15715.5	---	4	30762	1	850	20289	1	1000	1045

SOFTWARE

Room type and occupant info

Room Name	Floor	System/Block	Zone	Floor Area	Volume	Room Type	Number of Occupants	Heating Load	Heating Fraction	Heating CFM	Sens Cooling Load	Cooling Fraction	Cooling CFM	Duct Size CFM
mbed	1	Sys/Block 1	Zone	317.75	2987.5	Bedroom	0	6632	0.216	183	4411	0.217	217	217
mbath	1	Sys/Block 1	Zone	85	680	Other	0	1745	0.057	48	1310	0.065	64	64
bath2	1	Sys/Block 1	Zone	136	1088	Other	0	1330	0.043	37	948	0.047	47	47
bed3	1	Sys/Block 1	Zone	186	1488	Bedroom	1	3534	0.115	98	1993	0.098	98	98
bed2	1	Sys/Block 1	Zone	222	1776	Bedroom	1	3432	0.112	95	2033	0.1	100	100
liv/kit	1	Sys/Block 1	Zone	493	4930	Kitchen	2	5744	0.187	159	5174	0.255	255	255
din	1	Sys/Block 1	Zone	184.25	1474	Other	0	3497	0.114	97	2620	0.129	129	129
pdr	1	Sys/Block 1	Zone	102	816	Other	0	3002	0.098	83	1032	0.051	51	83
util	1	Sys/Block 1	Zone	59.5	476	Other	0	1848	0.06	51	769	0.038	38	51
Total	---	---	---	1785.5	15715.5	---	4	30762	1	850	20289	1	1000	1045

SOFTWARE

Heating load and CFM information

Room Name	Floor	System/Block	Zone	Floor Area	Volume	Room Type	Number of Occupants	Heating Load	Heating Fraction	Heating CFM	Sens Cooling Load	Cooling Fraction	Cooling CFM	Duct Size CFM
mbed	1	Sys/Block 1	Zone	317.75	2987.5	Bedroom	0	6632	0.216	183	4411	0.217	217	217
mbath	1	Sys/Block 1	Zone	85	680	Other	0	1745	0.057	48	1310	0.065	64	64
bath2	1	Sys/Block 1	Zone	136	1088	Other	0	1330	0.043	37	948	0.047	47	47
bed3	1	Sys/Block 1	Zone	186	1488	Bedroom	1	3534	0.115	98	1993	0.098	98	98
bed2	1	Sys/Block 1	Zone	222	1776	Bedroom	1	3432	0.112	95	2033	0.1	100	100
liv/kit	1	Sys/Block 1	Zone	493	4930	Kitchen	2	5744	0.187	159	5174	0.255	255	255
din	1	Sys/Block 1	Zone	184.25	1474	Other	0	3497	0.114	97	2620	0.129	129	129
pdr	1	Sys/Block 1	Zone	102	816	Other	0	3002	0.098	83	1032	0.051	51	83
util	1	Sys/Block 1	Zone	59.5	476	Other	0	1848	0.06	51	769	0.038	38	51
Total	---	---	---	1785.5	15715.5	---	4	30762	1	850	20289	1	1000	1045

SOFTWARE

Cooling load and CFM information

Room Name	Floor	System/Block	Zone	Floor Area	Volume	Room Type	Number of Occupants	Heating Load	Heating Fraction	Heating CFM	Sens Cooling Load	Cooling Fraction	Cooling CFM	Duct Size CFM
mbed	1	Sys/Block 1	Zone	317.75	2987.5	Bedroom	0	6632	0.216	183	4411	0.217	217	217
mbath	1	Sys/Block 1	Zone	85	680	Other	0	1745	0.057	48	1310	0.065	64	64
bath2	1	Sys/Block 1	Zone	136	1088	Other	0	1330	0.043	37	948	0.047	47	47
bed3	1	Sys/Block 1	Zone	186	1488	Bedroom	1	3534	0.115	98	1993	0.098	98	98
bed2	1	Sys/Block 1	Zone	222	1776	Bedroom	1	3432	0.112	95	2033	0.1	100	100
liv/kit	1	Sys/Block 1	Zone	493	4930	Kitchen	2	5744	0.187	159	5174	0.255	255	255
din	1	Sys/Block 1	Zone	184.25	1474	Other	0	3497	0.114	97	2620	0.129	129	129
pdr	1	Sys/Block 1	Zone	102	816	Other	0	3002	0.098	83	1032	0.051	51	83
util	1	Sys/Block 1	Zone	59.5	476	Other	0	1848	0.06	51	769	0.038	38	51
Total	---	---	---	1785.5	15715.5	---	4	30762	1	850	20289	1	1000	1045

SOFTWARE

Cooling loads and cooling CFM are typically used to size ducts because the air handler runs on a higher fan speed in cooling mode than in heating mode.

The software will check both heating and cooling CFM automatically.

Room Name	Floor	System/Block	Zone	Floor Area	Volume	Room Type	Number of Occupants	Heating Load	Heating Fraction	Heating CFM	Sens Cooling Load	Cooling Fraction	Cooling CFM	Duct Size CFM
mbed	1	Sys/Block 1	Zone	317.75	2987.5	Bedroom	0	6632	0.216	183	4411	0.217	217	217
mbath	1	Sys/Block 1	Zone	85	680	Other	0	1745	0.057	48	1310	0.065	64	64
bath2	1	Sys/Block 1	Zone	136	1088	Other	0	1330	0.043	37	948	0.047	47	47
bed3	1	Sys/Block 1	Zone	186	1488	Bedroom	1	3534	0.115	98	1993	0.098	98	98
bed2	1	Sys/Block 1	Zone	222	1776	Bedroom	1	3432	0.112	95	2033	0.1	100	100
liv/kit	1	Sys/Block 1	Zone	493	4930	Kitchen	2	5744	0.187	159	5174	0.255	255	255
din	1	Sys/Block 1	Zone	184.25	1474	Other	0	3497	0.114	97	2620	0.129	129	129
pdr	1	Sys/Block 1	Zone	102	816	Other	0	3002	0.098	83	1032	0.051	51	83
util	1	Sys/Block 1	Zone	59.5	476	Other	0	1848	0.06	51	769	0.038	38	51
Total	---	---	---	1785.5	15715.5	---	4	30762	1	850	20289	1	1000	1045

SOFTWARE

Higher of Heating or Cooling CFM.
(Used to size the ducts.)

Room Name	Floor	System/Block	Zone	Floor Area	Volume	Room Type	Number of Occupants	Heating Load	Heating Fraction	Heating CFM	Sens Cooling Load	Cooling Fraction	Cooling CFM	Duct Size CFM
mbed	1	Sys/Block 1	Zone	317.75	2987.5	Bedroom	0	6632	0.216	183	4411	0.217	217	217
mbath	1	Sys/Block 1	Zone	85	680	Other	0	1745	0.057	48	1310	0.065	64	64
bath2	1	Sys/Block 1	Zone	136	1088	Other	0	1330	0.043	37	948	0.047	47	47
bed3	1	Sys/Block 1	Zone	186	1488	Bedroom	1	3534	0.115	98	1993	0.098	98	98
bed2	1	Sys/Block 1	Zone	222	1776	Bedroom	1	3432	0.112	95	2033	0.1	100	100
liv/kit	1	Sys/Block 1	Zone	493	4930	Kitchen	2	5744	0.187	159	5174	0.255	255	255
din	1	Sys/Block 1	Zone	184.25	1474	Other	0	3497	0.114	97	2620	0.129	129	129
pdr	1	Sys/Block 1	Zone	102	816	Other	0	3002	0.098	83	1032	0.051	51	83
util	1	Sys/Block 1	Zone	59.5	476	Other	0	1848	0.06	51	769	0.038	38	51
Total	---	---	---	1785.5	15715.5	---	4	30762	1	850	20289	1	1000	1045

SOFTWARE

Room Name	Sens Cooling Load	Cooling Fraction	Cooling CFM
mbed	4411	0.217	217
mbath	1310	0.065	64
bath2	948	0.047	47
bed3	1993	0.098	98
bed2	2033	0.1	100
liv/kit	5174	0.255	255
din	2620	0.129	129
pdr	1032	0.051	51
util	769	0.038	38
Total	20289	1	1000

Zooming in . . .

This is the total cooling load of just the rooms.
It does not include infiltration and other whole house loads.

SOFTWARE

Room Name	Sens Cooling Load	Cooling Fraction	Cooling CFM
mbed	4411	0.217	217
mbath	1310	0.065	64
bath2	948	0.047	47
bed3	1993	0.098	98
bed2	2033	0.1	100
liv/kit	5174	0.255	255
din	2620	0.129	129
pdr	1032	0.051	51
util	769	0.038	38
Total	20289	1	1000

Total cooling airflow based on selected equipment. Entered in the Manual S

ROOM AIRFLOWS

Note:

- This example is using a 2½ ton system and has 400 CFM/ton at 0.5 inches of water column.
- These are common numbers used in examples or when the actual equipment is not known.
- The actual numbers used must come from the manufacturer's fan tables of the air handler selected.

ROOM AIRFLOWS

Room Name	Sens Cooling Load	Cooling Fraction	Cooling CFM
mbed	4411	0.217	217
mbath	1310	0.065	64
bath2	948	0.047	47
bed3	1993	0.098	98
bed2	2033	0.1	100
liv/kit	5174	0.255	255
din	2620	0.129	129
pdr	1032	0.051	51
util	769	0.038	38
Total	20289	1	1000

So, where do these **room** airflows come from?

ROOM AIRFLOWS

Room Name	Sens Cooling Load	Cooling Fraction	Cooling CFM
mbed	4411	0.217	217
mbath	1310	0.065	64
bath2	948	0.047	47
bed3	1993	0.098	98
bed2	2033	0.1	100
liv/kit	5174	0.255	255
din	2620	0.129	129
pdr	1032	0.051	51
util	769	0.038	38
Total	20289	1	1000

Room airflow is proportional to room load

ROOM AIRFLOWS

Room Name	Sens Cooling Load	Cooling Fraction	Cooling CFM
mbed	4411	0.217	217
mbath	1310	0.065	64
bath2	948	0.047	47
bed3	1993	0.098	98
bed2	2033	0.1	100
liv/kit	5174	0.255	255
din	2620	0.129	129
pdr	1032	0.051	51
util	769	0.038	38
Total	20289	1	1000

In other words,
if a room is 10% of the total **load**,
it should get 10% of the **air**.

ROOM AIRFLOWS

Room Name	Sens Cooling Load	Cooling Fraction	Cooling CFM
mbed	4411	0.217	217
mbath	1310	0.065	64
bath2	948	0.047	47
bed3	1993	0.098	98
bed2	2033	0.1	100
liv/kit	5174	0.255	255
din	2620	0.129	129
pdr	1032	0.051	51
util	769	0.038	38
Total	20289	1	1000

"Cooling Fraction" represents the fraction (percent) of the total load that that room's load represents.

ROOM AIRFLOWS

Room Name	Sens Cooling Load	Cooling Fraction	Cooling CFM
mbed	4411	0.217	217
mbath	1310	0.065	64
bath2	948	0.047	47
bed3	1993	0.098	98
bed2	2033	0.1	100
liv/kit	5174	0.255	255
din	2620	0.129	129
pdr	1032	0.051	51
util	769	0.038	38
Total	20289	1	1000

It's calculated by dividing the room load by the total room load.

4411 / 20289 = 0.217

ROOM AIRFLOWS

Room Name	Sens Cooling Load	Cooling Fraction	Cooling CFM
mbed	4411	0.217	217
mbath	1310	0.065	64
bath2	948	0.047	47
bed3	1993	0.098	98
bed2	2033	0.1	100
liv/kit	5174	0.255	255
din	2620	0.129	129
pdr	1032	0.051	51
util	769	0.038	38
Total	20289	1	1000

So, in this example the kitchen is 21.7% of the cooling load.

4411 / 20289 = 0.217

ROOM AIRFLOWS

Room Name	Sens Cooling Load	Cooling Fraction	Cooling CFM
mbed	4411	0.217	217
mbath	1310	0.065	64
bath2	948	0.047	47
bed3	1993	0.098	98
bed2	2033	0.1	100
liv/kit	5174	0.255	255
din	2620	0.129	129
pdr	1032	0.051	51
util	769	0.038	38
Total	20289	1	1000

This means that the kitchen needs 21.7% of the air.

4411 / 20289 = 0.217

ROOM AIRFLOWS

Room Name	Sens Cooling Load	Cooling Fraction	Cooling CFM
mbed	4411	0.217	217
mbath	1310	0.065	65
bath2	948	0.047	47
bed3	1993	0.098	98
bed2	2033	0.1	100
liv/kit	5174	0.255	255
din	2620	0.129	129
pdr	1032	0.051	51
util	769	0.038	38
Total	20289	1	1000

The total airflow is multiplied by the room's cooling fraction to get the room's cooling cfm.

0.217 x 1000 = 217

Don't worry about small roundoff error.

ROOM AIRFLOWS

Room Name	Sens Cooling Load	Cooling Fraction	Cooling CFM
mbed	4411	0.217	217
mbath	1310	0.065	64
bath2	948	0.047	47
bed3	1993	0.098	98
bed2	2033	0.1	100
liv/kit	5174	0.255	255
din	2620	0.129	129
pdr	1032	0.051	51
util	769	0.038	38
Total	20289	1	1000

Each room's cooling fraction is multiplied by the total CFM to get each room's target airflow

They will add up to the total.

ROOM AIRFLOWS

Room Name	Sens Cooling Load	Cooling Fraction	Cooling CFM
mbed	4411	0.217	217
mbath	1310	0.065	64
bath2	948	0.047	47
bed3	1993	0.098	98
bed2	2033	0.1	100
liv/kit	5174	0.255	255
din	2620	0.129	129
pdr	1032	0.051	51
util	769	0.038	38
Total	20289	1	1000

This table represents each room's **"fair share"** of the total airflow.

ROOM AIRFLOWS

Room Name	Sens Cooling Load	Cooling Fraction	Cooling CFM
mbed	4411	0.217	217
mbath	1310	0.065	64
bath2	948	0.047	47
bed3	1993	0.098	98
bed2	2033	0.1	100
liv/kit	5174	0.255	255
din	2620	0.129	129
pdr	1032	0.051	51
util	769	0.038	38
Total	20289	1	1000

This is VERY useful information and was relatively easy to obtain, but only because we did *room by room* load calcs.

ROOM AIRFLOWS

Room Name	Heating Load	Heating Fraction	Heating CFM
mbed	6632	0.216	183
mbath	1745	0.057	48
bath2	1330	0.043	37
bed3	3534	0.115	98
bed2	3432	0.112	95
liv/kit	5744	0.187	159
din	3497	0.114	97
pdr	3002	0.098	83
util	1848	0.06	51
Total	30762	1	850

The same process is done to determine the heating CFM for each room.

Notice that the heating total CFM (850) is lower than the cooling total CFM (1000)

This is because the air handler typically runs on a lower fan speed in heating mode.

ROOM AIRFLOWS

Room Name	Heating CFM	Cooling CFM	Duct Size CFM
mbed	183	217	217
mbath	48	64	64
bath2	37	47	47
bed3	98	98	98
bed2	95	100	100
liv/kit	159	255	255
din	97	129	129
pdr	83	51	83
util	51	38	51
Total	850	1000	1045

The heating CFM is compared to the cooling CFM for each room.

Ducts should be sized to the higher of the two.

Note that in a couple cases the heating CFM is higher.

ROOM AIRFLOWS

Room Name	Heating CFM	Cooling CFM	Duct Size CFM
mbed	183	217	217
mbath	48	64	64
bath2	37	47	47
bed3	98	98	98
bed2	95	100	100
liv/kit	159	255	255
din	97	129	129
pdr	83	51	83
util	51	38	51
Total	850	1000	1045

The next step is to size the **supply branches.**

(The ducts going to each room.)

ROOM AIRFLOWS

Room Name	Heating CFM	Cooling CFM	Duct Size CFM
mbed	183	217	217
mbath	48	64	64
bath2	37	47	47
bed3	98	98	98
bed2	95	100	100
liv/kit	159	255	255
din	97	129	129
pdr	83	51	83
util	51	38	51
Total	850	1000	1045

To size ducts we need to know airflow, which we now have, and another number, called **“friction rate”**.

FRICTION RATE

Friction Rate (FR)

- FR is a number used to size ducts based on
  - design static pressure - the pressure at which the air handler will deliver the design CFM
    - pressure losses and
    - total equivalent lengths.

FRICTION RATE

Friction Rate (FR)

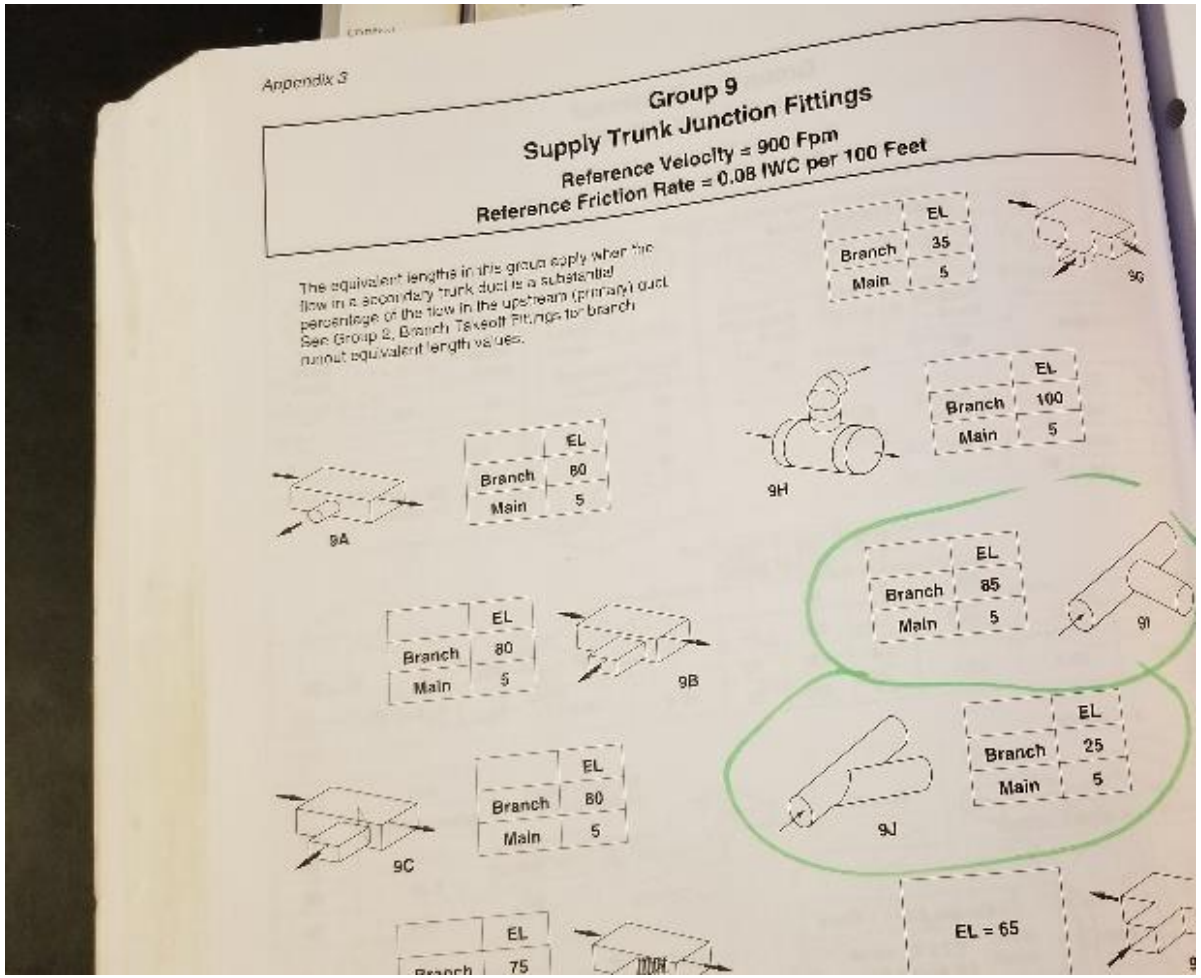
- It's the number used on a duct slide rule (do not confuse it with *external static pressure* that is used to determine the airflow of the air handler)
- The units of FR are *inches of water column* per 100 feet.
- The equation for FR is:

(available static pressure) x 100 / (total equivalent length)

FRICTION RATE

Equivalent Lengths

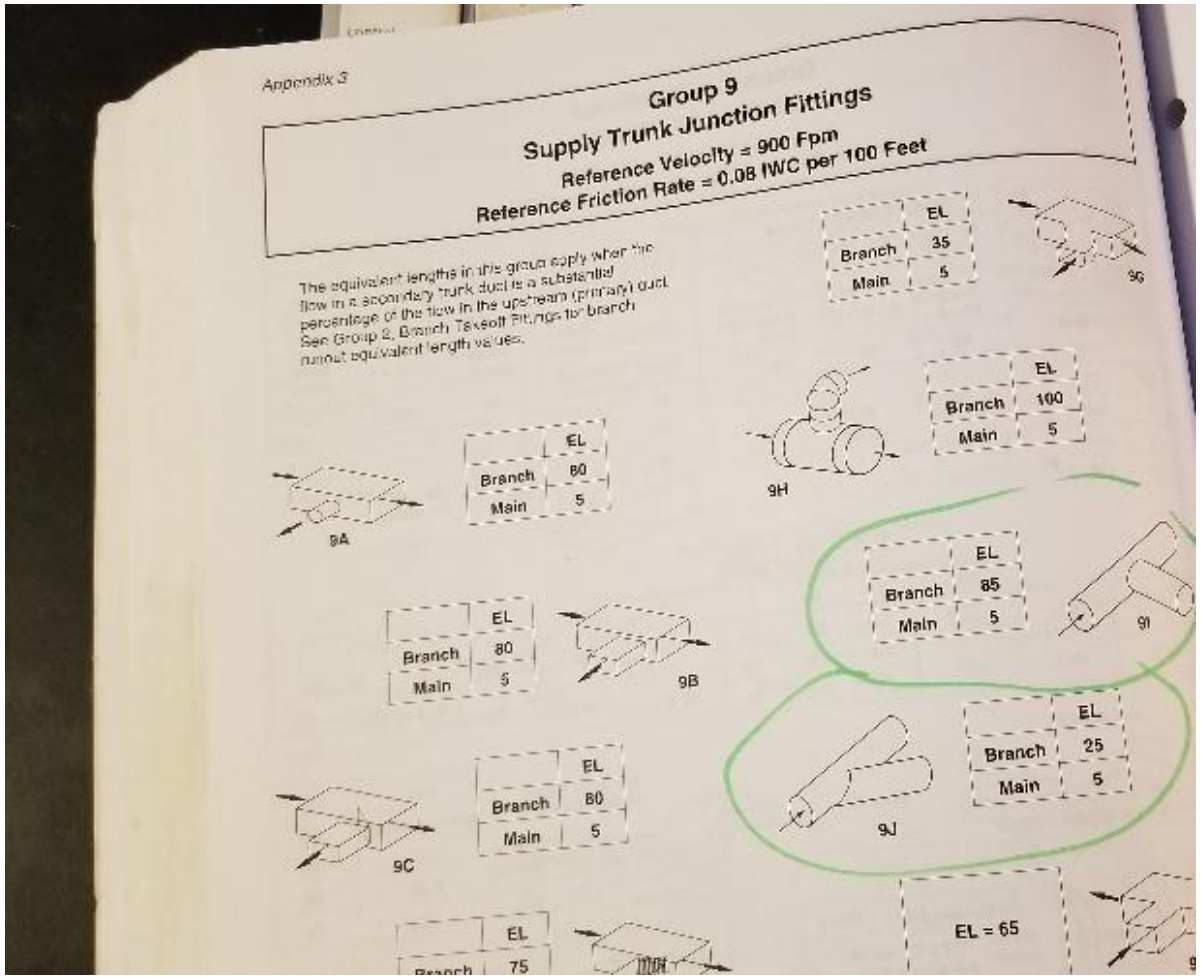
- Manual D accounts for resistance created by various fittings in the duct system, by equating them to the resistance of a certain length of straight duct hence the name “equivalent length”.



FRICTION RATE

Equivalent Lengths

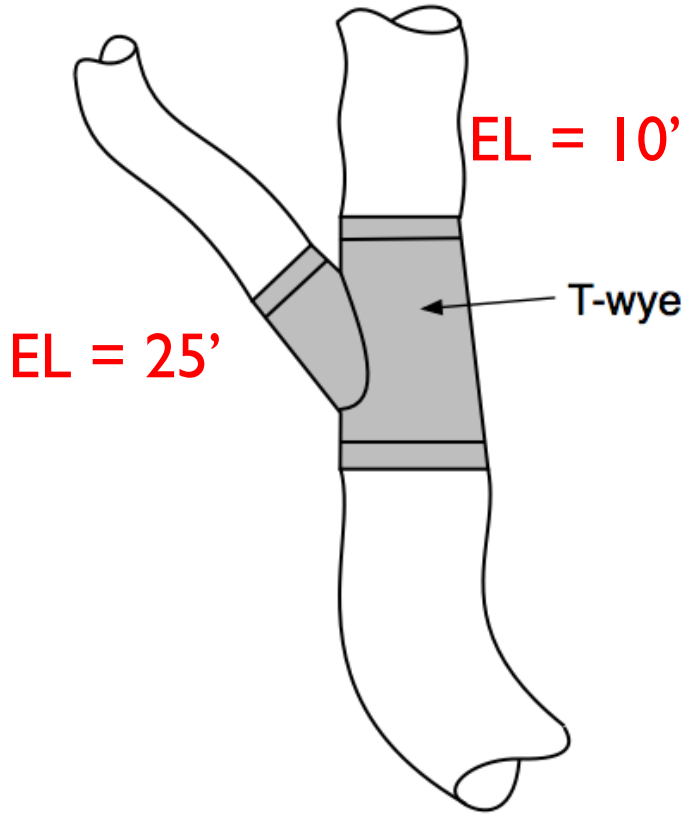
- For example: the resistance created by a simple 90-degree bend can have the same resistance as between 15 and 30 feet of straight duct, depending on the velocity of the air and the radius of the bend.



FRICTION RATE

Equivalent Lengths

- The resistance to airflow created by a T-wye, depends on which direction the air is going.
- For the air going straight, the resistance is equal to about 10 feet of straight duct, but the air being diverted off at an angle might have a resistance equal to 25 feet of straight duct.



Images from *HVAC 1.0 – Introduction to Residential HVAC Systems*

FRICTION RATE

Equivalent Lengths

- By adding up the equivalent lengths of all the fittings in a single run with the actual lengths of the duct itself, we get the **total equivalent length (TEL)** for that run.
- That number can be plugged into the formula and a friction rate can be calculated for each specific run.
- The good news is that the software does all this math for you.

(available static pressure) x 100 / (total equivalent length)

FRICTION RATE

Equivalent Lengths

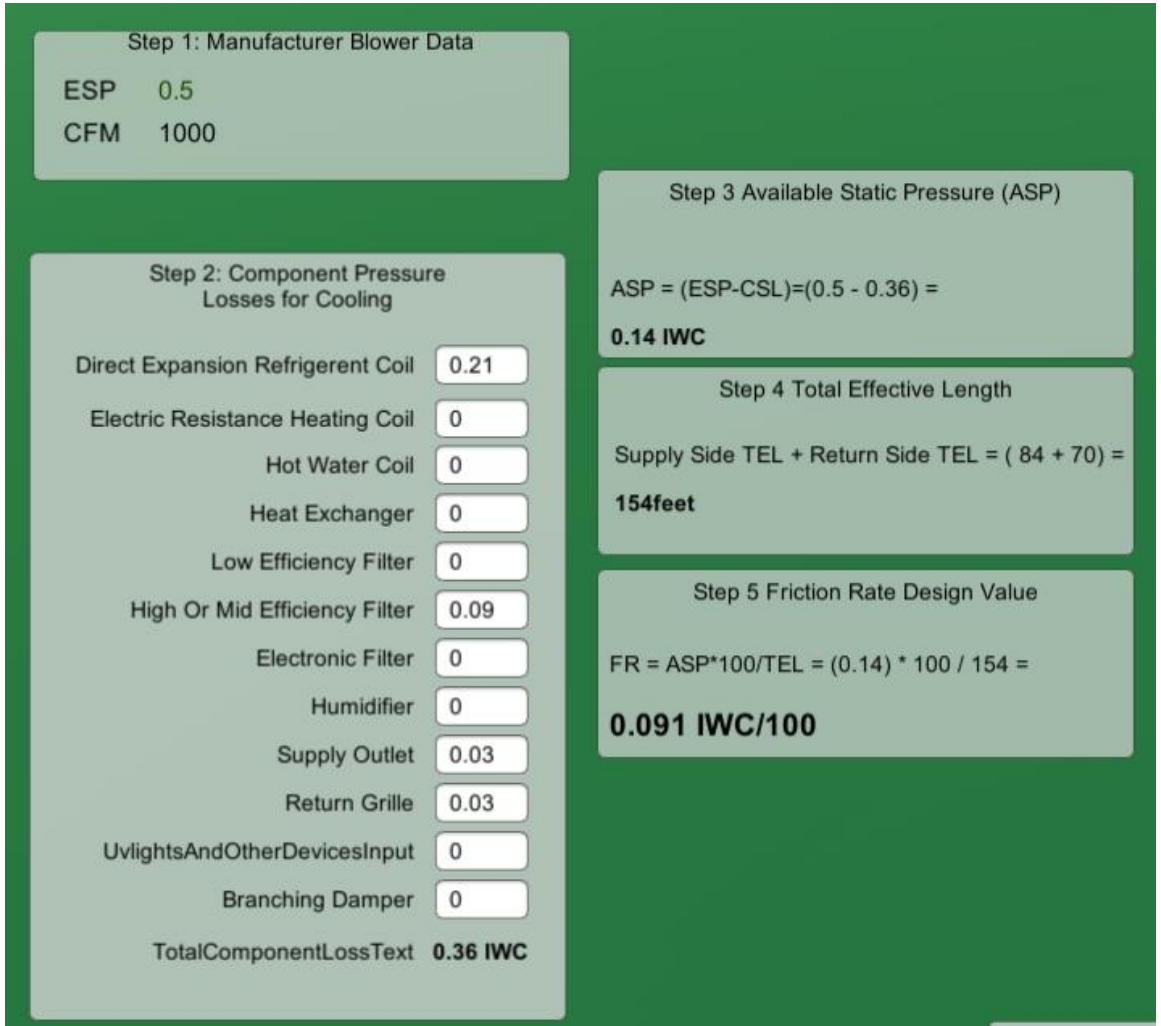
- Very long runs with lots of fittings will have a very high TEL, which will result in a lower friction rate, which *might* result in a larger duct.
- That's why on some Manual D designs you might see two similar airflows calling coming from two different size ducts. One run probably has a lot more resistance and a different friction rate.

FRICTION RATE

Friction Rate (FR)

- FR represents how much static pressure can be "used up" as the air passes through the ducts.
- Lower friction rate = bigger ducts.
- FR is lower for longer runs than for shorter runs.
- 0.09 to 0.11 are common FRs for simple systems like this example.
- For a detailed explanation of Friction Rate, visit the blog www.russellking.me and search for "friction rate".

FRICTION RATE



This table shows how Friction Rate is calculated by a software program.

It is based on ACCA Manual D's Friction Rate Worksheet.

FRICTION RATE

- Another way to size ducts is to use a duct calculator (aka, duct slide rule or "duct-u-lator")
- These are two examples.
- Some are only for one type of duct material (e.g., vinyl flex or sheet metal)
- Make sure you use the right type.

SIZING DUCTS

- This table is based on a duct slide rule using a friction rate of 0.1
- We can use this table to size flex ducts, **but only when the friction rate is 0.1.**
- Choose the size of duct that provides the **next *largest* airflow to what you need**.
- For example, if you need 89 cfm, you will choose a 7" duct because a 6" duct will only give you 80 cfm.

Duct Diameter	Air Flow CFM
4"	20
5"	50
6"	80
7"	120
8"	170
9"	230
10"	300
12"	500
14"	740
16"	1050
18"	1400
20"	1875

SIZING DUCTS

- Notice the difference in airflow by going up just one size (e.g., 6" to 7")
  - 6" = 80 cfm
  - 7" = 120 cfm
- That's a 50% increase in airflow by just going up one size!
- Conversely, that's a 33% reduction by going down one size.
- So, if you undersize by one duct size on every duct, you risk losing 1/3 of your total airflow.

Duct Diameter	Air Flow CFM
4"	20
5"	50
6"	80
7"	120
8"	170
9"	230
10"	300
12"	500
14"	740
16"	1050
18"	1400
20"	1875

SIZING DUCTS

- Some installers only use **even** size ducts.
- No 5", 7" or 9"
- If this is the case, **round UP** to the next even size.
- Never round down a size.
- Rounding up will improve airflow and overall system performance!

Duct Diameter	Air Flow CFM
4"	20
~~5"~~	~~50~~
6"	80
~~7"~~	~~120~~
8"	170
~~9"~~	~~230~~
10"	300
12"	500
14"	740
16"	1050
18"	1400
20"	1875

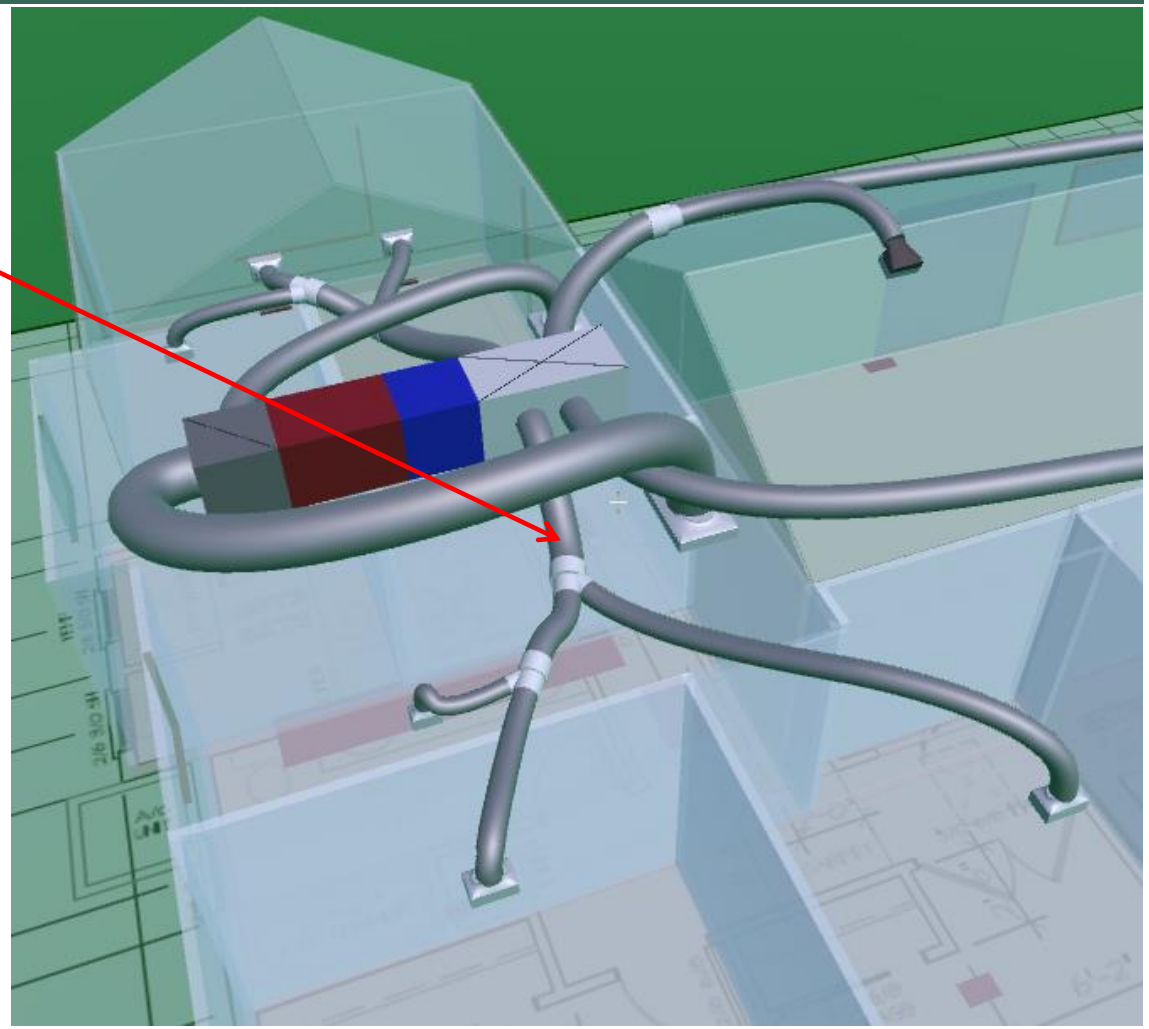
SIZING DUCTS

- The software has formulas built into it for sizing ducts that are like the formulas used by duct calculators.
- It uses the airflow, friction rate and type of duct material to size the ducts.
- Here are the results for our example:

Room Served	AirFlow CFM	Friction Rate	Diameter Inches
mbed	109	0.11	7
mbed	109	0.09	7
mbath	64	0.09	6
bath2	47	0.09	5
bed3	98	0.1	7
bed2	100	0.09	7
liv/kit	128	0.07	8
liv/kit	128	0.06	8
din	129	0.08	8
pdr	83	0.07	7
util	51	0.09	5

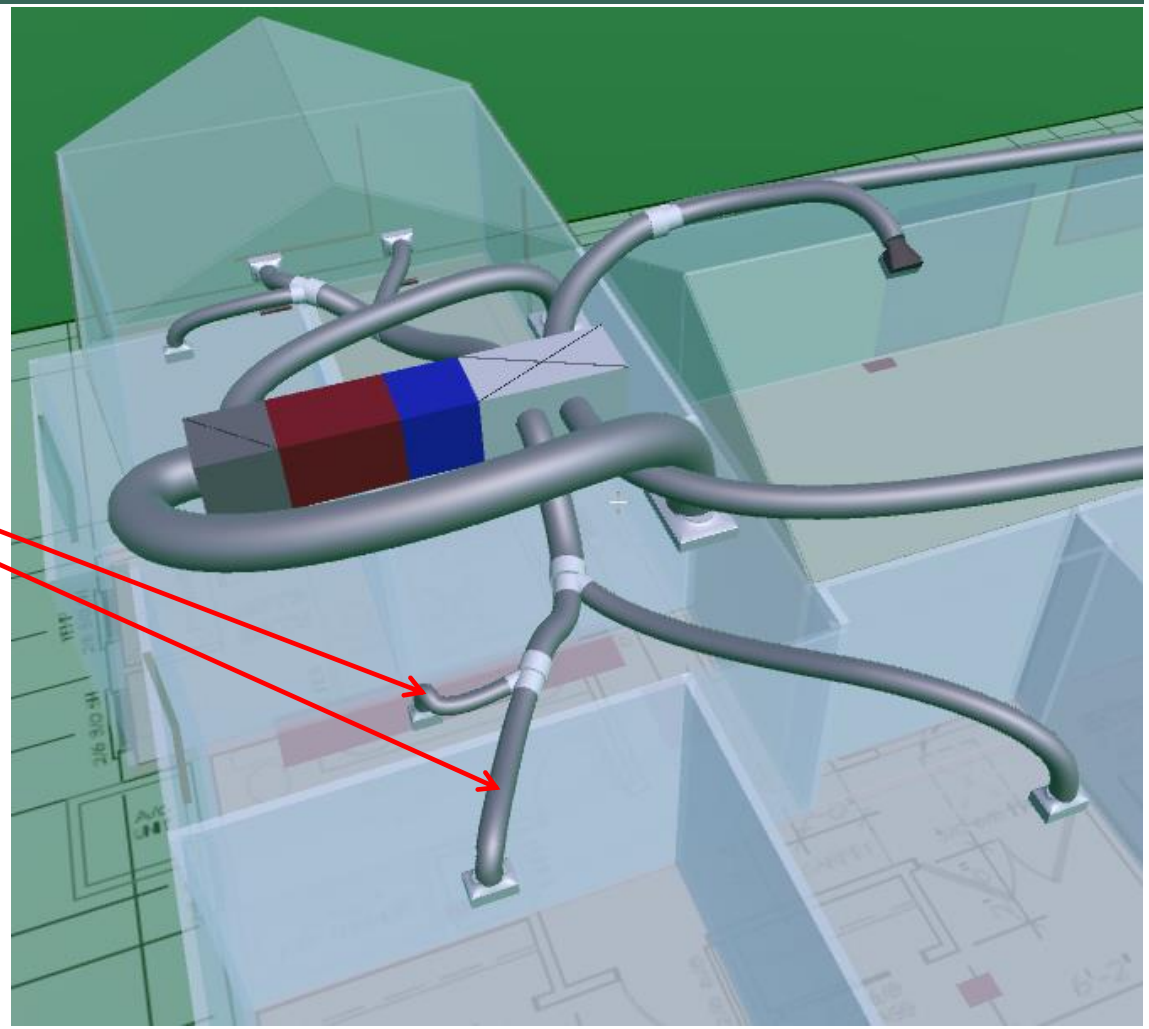
SIZING DUCTS

- The next step is to size the **trunks**.
- Since trunks serve more than one duct, they need to be able to handle all of the air for the ducts that they serve.



SIZING DUCTS

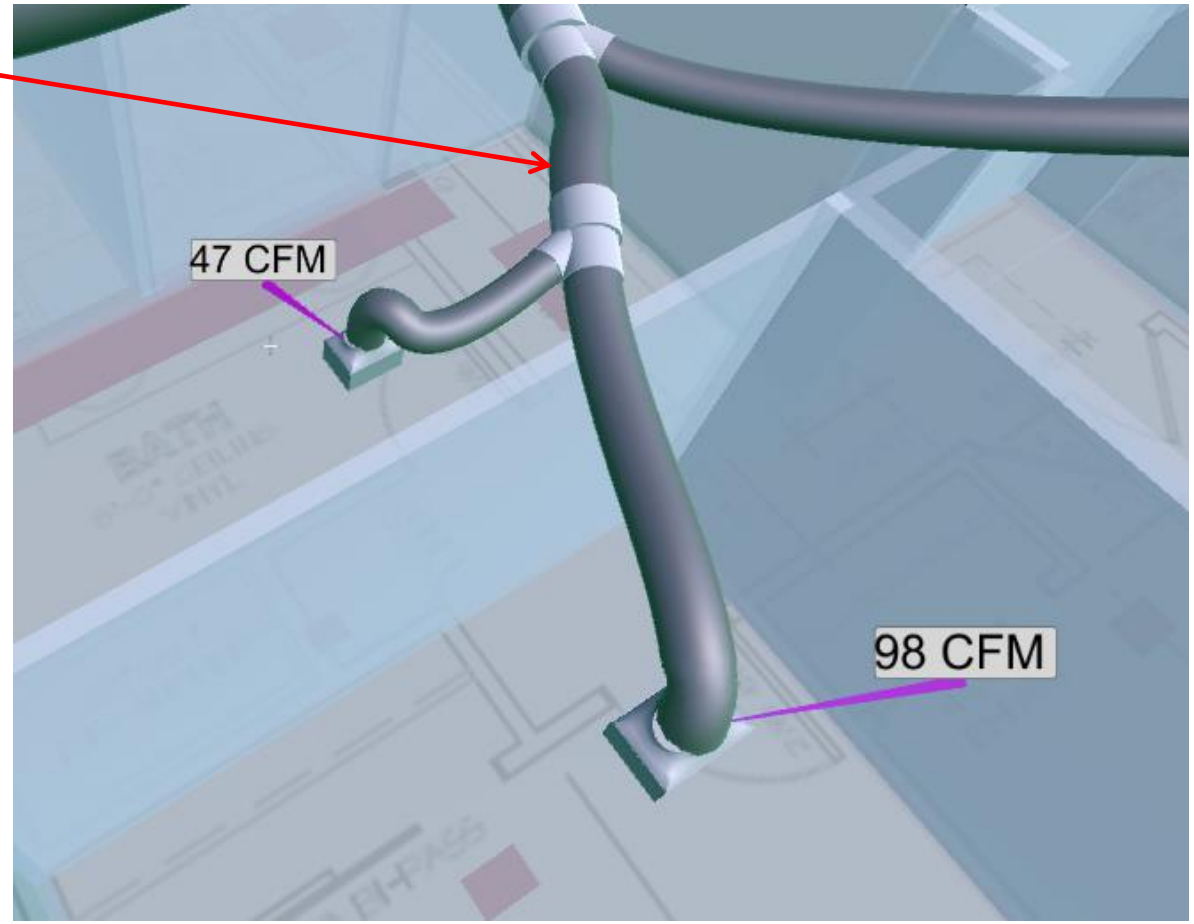
- To do this, just sum the target airflows of the **branches** downstream.



SIZING DUCTS

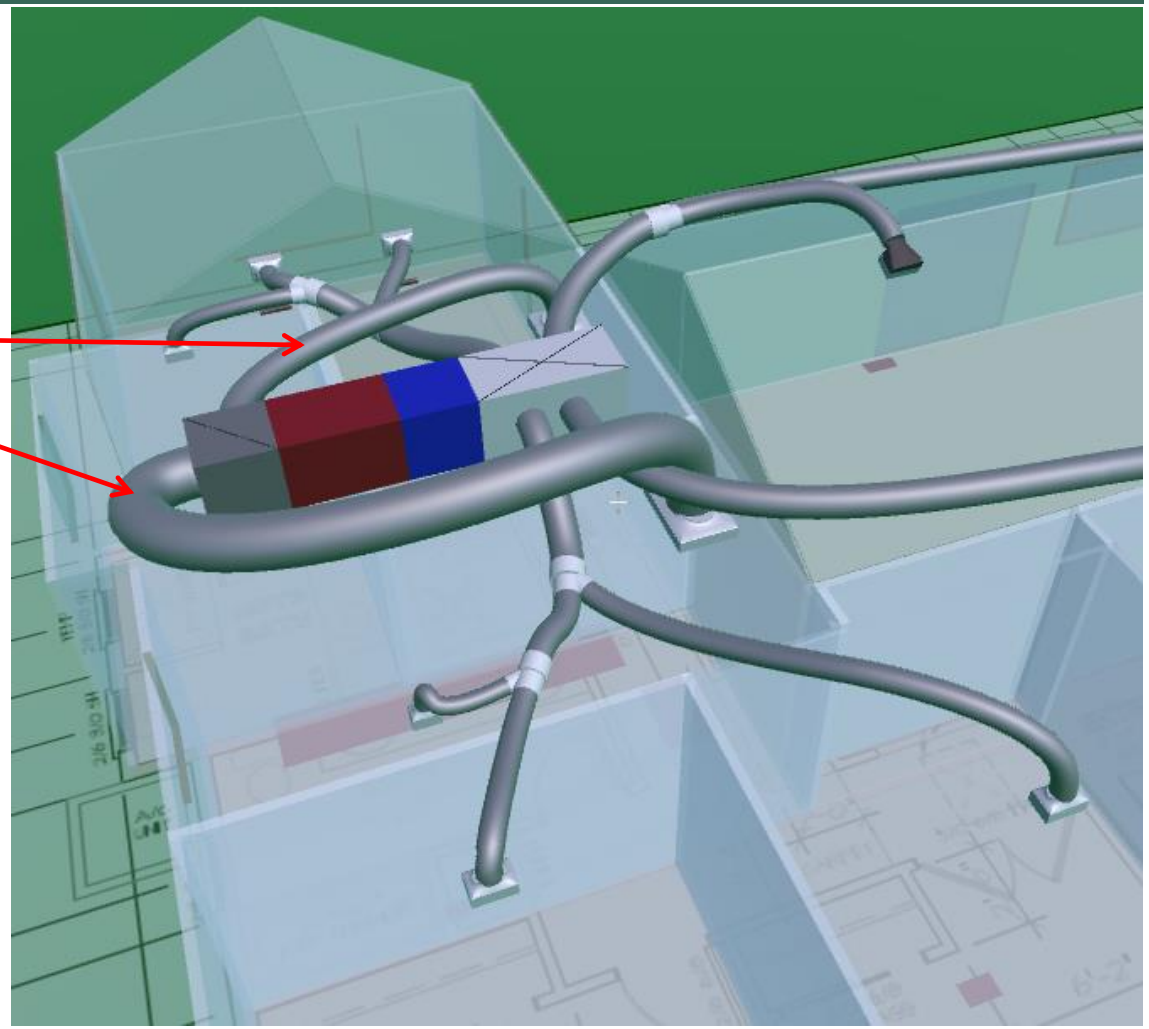
For example:

- If one duct needs 47 cfm and the other duct needs 98 cfm, the trunk serving both of these must be able to handle 145 cfm



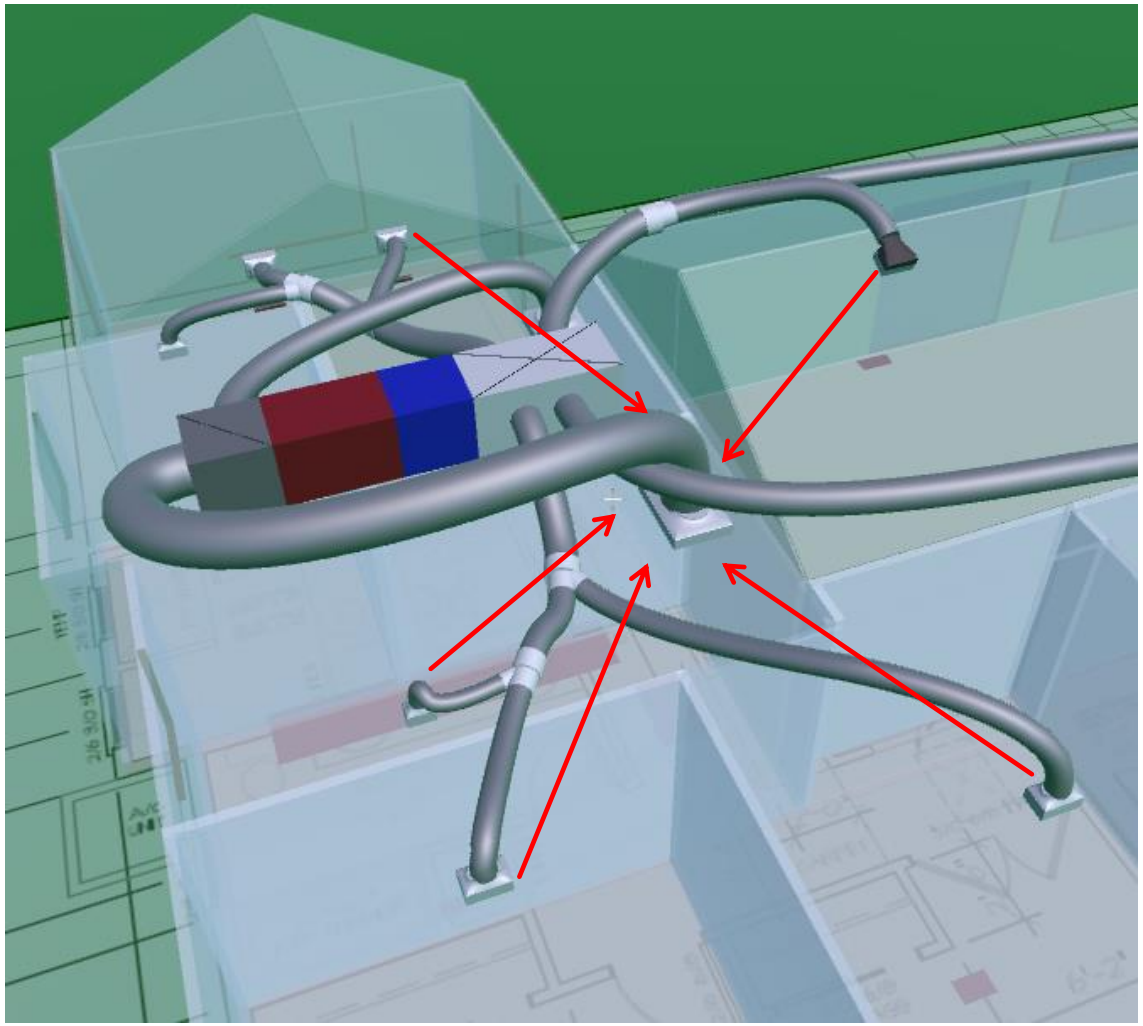
SIZING DUCTS

- The next step is to size the **return ducts**.
- If you have more than one return grille, you must decide which rooms are going to be ***served*** by which return.



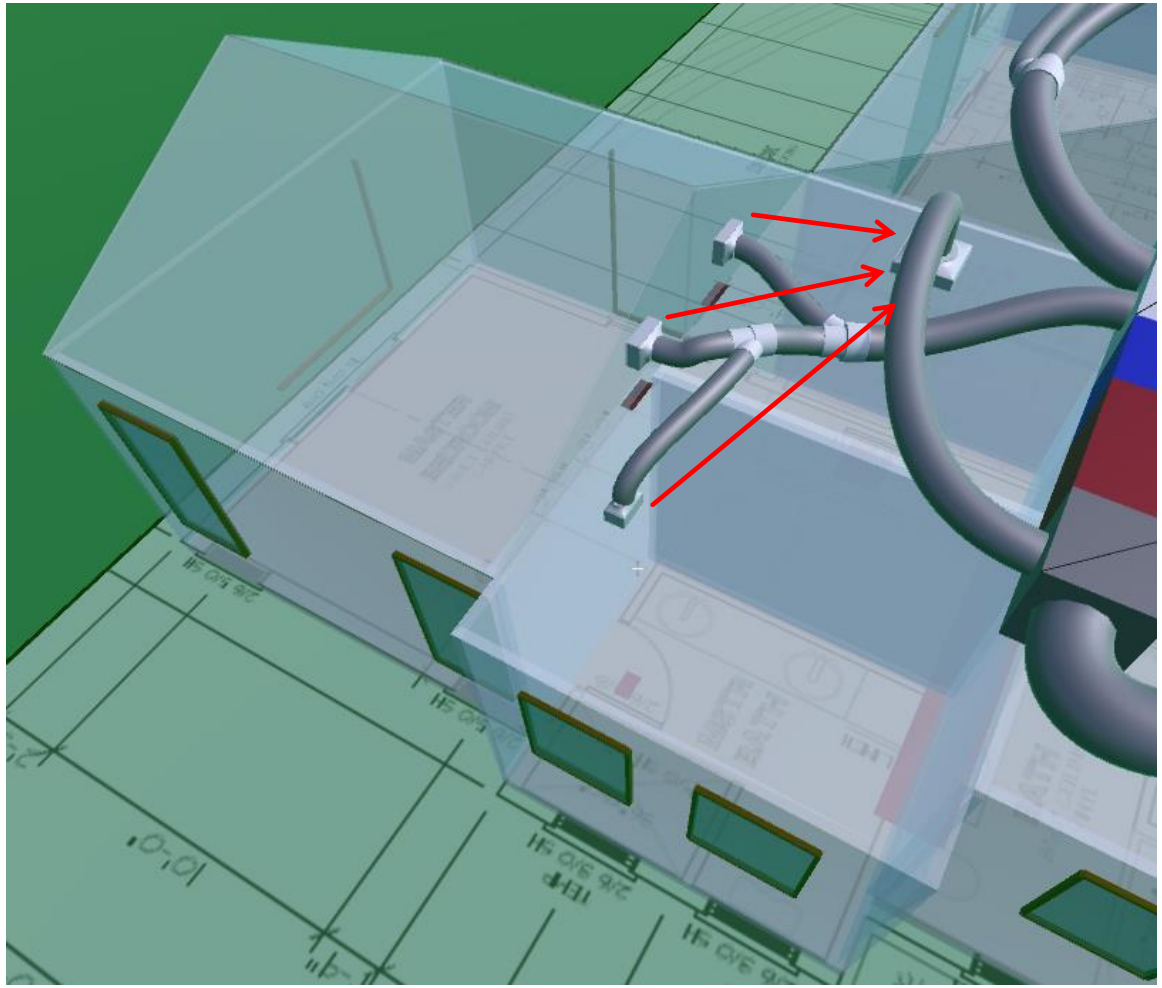
SIZING DUCTS

- To do this you must each assign supply registers to a return.
- This is somewhat arbitrary if there are more than one return.
- Just determine which air is most likely to be drawn toward each return.



SIZING DUCTS

- If a return is behind a closeable door, then all supplies on that side of the door should be assigned to that return.
- This example has a return in the master suite. All supply registers in the master suite should be assigned to this return.
- All the other supplies should be assigned to the main return



SIZING DUCTS

This table summarizes the entire duct system for this example.

SB Number (Does not match EG)	Room Served	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Register Size (in)	Trunk #	Return #	Type
SB 01.1	mbed	109	0.11	7	2	407	12 x 8	ST2	RB2(mbed(4))	Vinyl Flex
SB 01.2	mbed	109	0.09	7	3	407	12 x 8	ST1	RB2(mbed(4))	Vinyl Flex
SB 02.1	mbath	64	0.09	6	4	328	10 x 6	ST2	RB2(mbed(4))	Vinyl Flex
SB 03.1	bath2	47	0.09	5	3	342	8 x 6	ST4	RB1(bath2(1))	Vinyl Flex
SB 04.1	bed3	98	0.1	7	5	367	12 x 8	ST4	RB1(bath2(1))	Vinyl Flex
SB 05.1	bed2	100	0.09	7	13	375	12 x 8	ST3	RB1(bath2(1))	Vinyl Flex
SB 06.1	liv/kit	128	0.07	8	7	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 06.2	liv/kit	128	0.06	8	24	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 07.1	din	129	0.08	8	4	370	12 x 8	ST5	RB1(bath2(1))	Vinyl Flex
SB 08.1	pdr	83	0.07	7	14	310	10 x 6	ST6	RB1(bath2(1))	Vinyl Flex
SB 09.1	util	51	0.09	5	6	375	12 x 6	ST6	RB1(bath2(1))	Vinyl Flex
ST Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type
ST1	---	282	0.09	10	6	517	---	handler	---	Vinyl Flex
ST2	---	173	0.09	8	1	496	---	ST1	---	Vinyl Flex
ST3	---	245	0.09	10	4	449	---	handler	---	Vinyl Flex
ST4	---	145	0.09	8	2	415	---	ST3	---	Vinyl Flex
ST5	---	263	0.07	10	24	482	---	handler	---	Vinyl Flex
ST6	---	134	0.07	8	7	384	---	ST5	---	Vinyl Flex
ST7	---	255	0.06	12	6	325	---	handler	---	Vinyl Flex
RB Number	Location	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Grille Size (inches)	Trunk #	---	Type
RB1	bath2	763	0.06	16	20	547	30 x 20	handler	---	Vinyl Flex
RB2	mbed	282	0.09	10	14	517	20 x 20	handler	---	Vinyl Flex
RT Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type

SIZING DUCTS

Supply Branches →

SB Number (Does not match EG)	Room Served	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Register Size (in)	Trunk #	Return #	Type
SB 01.1	mbed	109	0.11	7	2	407	12 x 8	ST2	RB2(mbed(4))	Vinyl Flex
SB 01.2	mbed	109	0.09	7	3	407	12 x 8	ST1	RB2(mbed(4))	Vinyl Flex
SB 02.1	mbath	64	0.09	6	4	328	10 x 6	ST2	RB2(mbed(4))	Vinyl Flex
SB 03.1	bath2	47	0.09	5	3	342	8 x 6	ST4	RB1(bath2(1))	Vinyl Flex
SB 04.1	bed3	98	0.1	7	5	367	12 x 8	ST4	RB1(bath2(1))	Vinyl Flex
SB 05.1	bed2	100	0.09	7	13	375	12 x 8	ST3	RB1(bath2(1))	Vinyl Flex
SB 06.1	liv/kit	128	0.07	8	7	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 06.2	liv/kit	128	0.06	8	24	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 07.1	din	129	0.08	8	4	370	12 x 8	ST5	RB1(bath2(1))	Vinyl Flex
SB 08.1	pdr	83	0.07	7	14	310	10 x 6	ST6	RB1(bath2(1))	Vinyl Flex
SB 09.1	util	51	0.09	5	6	375	12 x 6	ST6	RB1(bath2(1))	Vinyl Flex
ST Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type
ST1	---	282	0.09	10	6	517	---	handler	---	Vinyl Flex
ST2	---	173	0.09	8	1	496	---	ST1	---	Vinyl Flex
ST3	---	245	0.09	10	4	449	---	handler	---	Vinyl Flex
ST4	---	145	0.09	8	2	415	---	ST3	---	Vinyl Flex
ST5	---	263	0.07	10	24	482	---	handler	---	Vinyl Flex
ST6	---	134	0.07	8	7	384	---	ST5	---	Vinyl Flex
ST7	---	255	0.06	12	6	325	---	handler	---	Vinyl Flex
RB Number	Location	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Grille Size (inches)	Trunk #	---	Type
RB1	bath2	763	0.06	16	20	547	30 x 20	handler	---	Vinyl Flex
RB2	mbed	282	0.09	10	14	517	20 x 20	handler	---	Vinyl Flex
RT Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type

SIZING DUCTS

Supply Trunks

SB Number (Does not match EG)	Room Served	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Register Size (in)	Trunk #	Return #	Type
SB 01.1	mbed	109	0.11	7	2	407	12 x 8	ST2	RB2(mbed(4))	Vinyl Flex
SB 01.2	mbed	109	0.09	7	3	407	12 x 8	ST1	RB2(mbed(4))	Vinyl Flex
SB 02.1	mbath	64	0.09	6	4	328	10 x 6	ST2	RB2(mbed(4))	Vinyl Flex
SB 03.1	bath2	47	0.09	5	3	342	8 x 6	ST4	RB1(bath2(1))	Vinyl Flex
SB 04.1	bed3	98	0.1	7	5	367	12 x 8	ST4	RB1(bath2(1))	Vinyl Flex
SB 05.1	bed2	100	0.09	7	13	375	12 x 8	ST3	RB1(bath2(1))	Vinyl Flex
SB 06.1	liv/kit	128	0.07	8	7	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 06.2	liv/kit	128	0.06	8	24	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 07.1	din	129	0.08	8	4	370	12 x 8	ST5	RB1(bath2(1))	Vinyl Flex
SB 08.1	pdr	83	0.07	7	14	310	10 x 6	ST6	RB1(bath2(1))	Vinyl Flex
SB 09.1	util	51	0.09	5	6	375	12 x 6	ST6	RB1(bath2(1))	Vinyl Flex
ST Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type
ST1	---	282	0.09	10	6	517	---	handler	---	Vinyl Flex
ST2	---	173	0.09	8	1	496	---	ST1	---	Vinyl Flex
ST3	---	245	0.09	10	4	449	---	handler	---	Vinyl Flex
ST4	---	145	0.09	8	2	415	---	ST3	---	Vinyl Flex
ST5	---	263	0.07	10	24	482	---	handler	---	Vinyl Flex
ST6	---	134	0.07	8	7	384	---	ST5	---	Vinyl Flex
ST7	---	255	0.06	12	6	325	---	handler	---	Vinyl Flex
RB Number	Location	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Grille Size (inches)	Trunk #	---	Type
RB1	bath2	763	0.06	16	20	547	30 x 20	handler	---	Vinyl Flex
RB2	mbed	282	0.09	10	14	517	20 x 20	handler	---	Vinyl Flex
RT Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type

SIZING DUCTS

SB Number (Does not match EG)	Room Served	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Register Size (in)	Trunk #	Return #	Type
SB 01.1	mbed	109	0.11	7	2	407	12 x 8	ST2	RB2(mbed(4))	Vinyl Flex
SB 01.2	mbed	109	0.09	7	3	407	12 x 8	ST1	RB2(mbed(4))	Vinyl Flex
SB 02.1	mbath	64	0.09	6	4	328	10 x 6	ST2	RB2(mbed(4))	Vinyl Flex
SB 03.1	bath2	47	0.09	5	3	342	8 x 6	ST4	RB1(bath2(1))	Vinyl Flex
SB 04.1	bed3	98	0.1	7	5	367	12 x 8	ST4	RB1(bath2(1))	Vinyl Flex
SB 05.1	bed2	100	0.09	7	13	375	12 x 8	ST3	RB1(bath2(1))	Vinyl Flex
SB 06.1	liv/kit	128	0.07	8	7	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 06.2	liv/kit	128	0.06	8	24	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 07.1	din	129	0.08	8	4	370	12 x 8	ST5	RB1(bath2(1))	Vinyl Flex
SB 08.1	pdr	83	0.07	7	14	310	10 x 6	ST6	RB1(bath2(1))	Vinyl Flex
SB 09.1	util	51	0.09	5	6	375	12 x 6	ST6	RB1(bath2(1))	Vinyl Flex
ST Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type
ST1	---	282	0.09	10	6	517	---	handler	---	Vinyl Flex
ST2	---	173	0.09	8	1	496	---	ST1	---	Vinyl Flex
ST3	---	245	0.09	10	4	449	---	handler	---	Vinyl Flex
ST4	---	145	0.09	8	2	415	---	ST3	---	Vinyl Flex
ST5	---	263	0.07	10	24	482	---	handler	---	Vinyl Flex
ST6	---	134	0.07	8	7	384	---	ST5	---	Vinyl Flex
ST7	---	255	0.06	12	6	325	---	handler	---	Vinyl Flex
RB Number	Location	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Grille Size (inches)	Trunk #	---	Type
RB1	bath2	763	0.06	16	20	547	30 x 20	handler	---	Vinyl Flex
RB2	mbed	282	0.09	10	14	517	20 x 20	handler	---	Vinyl Flex
RT Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type

Return Branches

SIZING DUCTS

SB Number (Does not match EG)	Room Served	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Register Size (in)	Trunk #	Return #	Type
SB 01.1	mbed	109	0.11	7	2	407	12 x 8	ST2	RB2(mbed(4))	Vinyl Flex
SB 01.2	mbed	109	0.09	7	3	407	12 x 8	ST1	RB2(mbed(4))	Vinyl Flex
SB 02.1	mbath	64	0.09	6	4	328	10 x 6	ST2	RB2(mbed(4))	Vinyl Flex
SB 03.1	bath2	47	0.09	5	3	342	8 x 6	ST4	RB1(bath2(1))	Vinyl Flex
SB 04.1	bed3	98	0.1	7	5	367	12 x 8	ST4	RB1(bath2(1))	Vinyl Flex
SB 05.1	bed2	100	0.09	7	13	375	12 x 8	ST3	RB1(bath2(1))	Vinyl Flex
SB 06.1	liv/kit	128	0.07	8	7	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 06.2	liv/kit	128	0.06	8	24	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 07.1	din	129	0.08	8	4	370	12 x 8	ST5	RB1(bath2(1))	Vinyl Flex
SB 08.1	pdr	83	0.07	7	14	310	10 x 6	ST6	RB1(bath2(1))	Vinyl Flex
SB 09.1	util	51	0.09	5	6	375	12 x 6	ST6	RB1(bath2(1))	Vinyl Flex
ST Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type
ST1	---	282	0.09	10	6	517	---	handler	---	Vinyl Flex
ST2	---	173	0.09	8	1	496	---	ST1	---	Vinyl Flex
ST3	---	245	0.09	10	4	449	---	handler	---	Vinyl Flex
ST4	---	145	0.09	8	2	415	---	ST3	---	Vinyl Flex
ST5	---	263	0.07	10	24	482	---	handler	---	Vinyl Flex
ST6	---	134	0.07	8	7	384	---	ST5	---	Vinyl Flex
ST7	---	255	0.06	12	6	325	---	handler	---	Vinyl Flex
RB Number	Location	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Grille Size (inches)	Trunk #	---	Type
RB1	bath2	763	0.06	16	20	547	30 x 20	handler	---	Vinyl Flex
RB2	mbed	282	0.09	10	14	517	20 x 20	handler	---	Vinyl Flex
RT Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type

No Return Trunks (Both trunks were attached directly to return plenum.)

SIZING DUCTS

Airflow

SB Number (Does not match EG)	Room Served	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Register Size (in)	Trunk #	Return #	Type
SB 01.1	mbed	109	0.11	7	2	407	12 x 8	ST2	RB2(mbed(4))	Vinyl Flex
SB 01.2	mbed	109	0.09	7	3	407	12 x 8	ST1	RB2(mbed(4))	Vinyl Flex
SB 02.1	mbath	64	0.09	6	4	328	10 x 6	ST2	RB2(mbed(4))	Vinyl Flex
SB 03.1	bath2	47	0.09	5	3	342	8 x 6	ST4	RB1(bath2(1))	Vinyl Flex
SB 04.1	bed3	98	0.1	7	5	367	12 x 8	ST4	RB1(bath2(1))	Vinyl Flex
SB 05.1	bed2	100	0.09	7	13	375	12 x 8	ST3	RB1(bath2(1))	Vinyl Flex
SB 06.1	liv/kit	128	0.07	8	7	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 06.2	liv/kit	128	0.06	8	24	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 07.1	din	129	0.08	8	4	370	12 x 8	ST5	RB1(bath2(1))	Vinyl Flex
SB 08.1	pdr	83	0.07	7	14	310	10 x 6	ST6	RB1(bath2(1))	Vinyl Flex
SB 09.1	util	51	0.09	5	6	375	12 x 6	ST6	RB1(bath2(1))	Vinyl Flex
ST Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type
ST1	---	282	0.09	10	6	517	---	handler	---	Vinyl Flex
ST2	---	173	0.09	8	1	496	---	ST1	---	Vinyl Flex
ST3	---	245	0.09	10	4	449	---	handler	---	Vinyl Flex
ST4	---	145	0.09	8	2	415	---	ST3	---	Vinyl Flex
ST5	---	263	0.07	10	24	482	---	handler	---	Vinyl Flex
ST6	---	134	0.07	8	7	384	---	ST5	---	Vinyl Flex
ST7	---	255	0.06	12	6	325	---	handler	---	Vinyl Flex
RB Number	Location	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Grille Size (inches)	Trunk #	---	Type
RB1	bath2	763	0.06	16	20	547	30 x 20	handler	---	Vinyl Flex
RB2	mbed	282	0.09	10	14	517	20 x 20	handler	---	Vinyl Flex
RT Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type

SIZING DUCTS

Friction Rate

SB Number (Does not match EG)	Room Served	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Register Size (in)	Trunk #	Return #	Type
SB 01.1	mbed	109	0.11	7	2	407	12 x 8	ST2	RB2(mbed(4))	Vinyl Flex
SB 01.2	mbed	109	0.09	7	3	407	12 x 8	ST1	RB2(mbed(4))	Vinyl Flex
SB 02.1	mbath	64	0.09	6	4	328	10 x 6	ST2	RB2(mbed(4))	Vinyl Flex
SB 03.1	bath2	47	0.09	5	3	342	8 x 6	ST4	RB1(bath2(1))	Vinyl Flex
SB 04.1	bed3	98	0.1	7	5	367	12 x 8	ST4	RB1(bath2(1))	Vinyl Flex
SB 05.1	bed2	100	0.09	7	13	375	12 x 8	ST3	RB1(bath2(1))	Vinyl Flex
SB 06.1	liv/kit	128	0.07	8	7	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 06.2	liv/kit	128	0.06	8	24	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 07.1	din	129	0.08	8	4	370	12 x 8	ST5	RB1(bath2(1))	Vinyl Flex
SB 08.1	pdr	83	0.07	7	14	310	10 x 6	ST6	RB1(bath2(1))	Vinyl Flex
SB 09.1	util	51	0.09	5	6	375	12 x 6	ST6	RB1(bath2(1))	Vinyl Flex
ST Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type
ST1	---	282	0.09	10	6	517	---	handler	---	Vinyl Flex
ST2	---	173	0.09	8	1	496	---	ST1	---	Vinyl Flex
ST3	---	245	0.09	10	4	449	---	handler	---	Vinyl Flex
ST4	---	145	0.09	8	2	415	---	ST3	---	Vinyl Flex
ST5	---	263	0.07	10	24	482	---	handler	---	Vinyl Flex
ST6	---	134	0.07	8	7	384	---	ST5	---	Vinyl Flex
ST7	---	255	0.06	12	6	325	---	handler	---	Vinyl Flex
RB Number	Location	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Grille Size (inches)	Trunk #	---	Type
RB1	bath2	763	0.06	16	20	547	30 x 20	handler	---	Vinyl Flex
RB2	mbed	282	0.09	10	14	517	20 x 20	handler	---	Vinyl Flex
RT Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type

SIZING DUCTS

Duct Size

SB Number (Does not match EG)	Room Served	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Register Size (in)	Trunk #	Return #	Type
SB 01.1	mbed	109	0.11	7	2	407	12 x 8	ST2	RB2(mbed(4))	Vinyl Flex
SB 01.2	mbed	109	0.09	7	3	407	12 x 8	ST1	RB2(mbed(4))	Vinyl Flex
SB 02.1	mbath	64	0.09	6	4	328	10 x 6	ST2	RB2(mbed(4))	Vinyl Flex
SB 03.1	bath2	47	0.09	5	3	342	8 x 6	ST4	RB1(bath2(1))	Vinyl Flex
SB 04.1	bed3	98	0.1	7	5	367	12 x 8	ST4	RB1(bath2(1))	Vinyl Flex
SB 05.1	bed2	100	0.09	7	13	375	12 x 8	ST3	RB1(bath2(1))	Vinyl Flex
SB 06.1	liv/kit	128	0.07	8	7	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 06.2	liv/kit	128	0.06	8	24	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 07.1	din	129	0.08	8	4	370	12 x 8	ST5	RB1(bath2(1))	Vinyl Flex
SB 08.1	pdr	83	0.07	7	14	310	10 x 6	ST6	RB1(bath2(1))	Vinyl Flex
SB 09.1	util	51	0.09	5	6	375	12 x 6	ST6	RB1(bath2(1))	Vinyl Flex
ST Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type
ST1	---	282	0.09	10	6	517	---	handler	---	Vinyl Flex
ST2	---	173	0.09	8	1	496	---	ST1	---	Vinyl Flex
ST3	---	245	0.09	10	4	449	---	handler	---	Vinyl Flex
ST4	---	145	0.09	8	2	415	---	ST3	---	Vinyl Flex
ST5	---	263	0.07	10	24	482	---	handler	---	Vinyl Flex
ST6	---	134	0.07	8	7	384	---	ST5	---	Vinyl Flex
ST7	---	255	0.06	12	6	325	---	handler	---	Vinyl Flex
RB Number	Location	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Grille Size (inches)	Trunk #	---	Type
RB1	bath2	763	0.06	16	20	547	30 x 20	handler	---	Vinyl Flex
RB2	mbed	282	0.09	10	14	517	20 x 20	handler	---	Vinyl Flex
RT Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type

SIZING DUCTS

Duct Length

SB Number (Does not match EG)	Room Served	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Register Size (in)	Trunk #	Return #	Type
SB 01.1	mbed	109	0.11	7	2	407	12 x 8	ST2	RB2(mbed(4))	Vinyl Flex
SB 01.2	mbed	109	0.09	7	3	407	12 x 8	ST1	RB2(mbed(4))	Vinyl Flex
SB 02.1	mbath	64	0.09	6	4	328	10 x 6	ST2	RB2(mbed(4))	Vinyl Flex
SB 03.1	bath2	47	0.09	5	3	342	8 x 6	ST4	RB1(bath2(1))	Vinyl Flex
SB 04.1	bed3	98	0.1	7	5	367	12 x 8	ST4	RB1(bath2(1))	Vinyl Flex
SB 05.1	bed2	100	0.09	7	13	375	12 x 8	ST3	RB1(bath2(1))	Vinyl Flex
SB 06.1	liv/kit	128	0.07	8	7	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 06.2	liv/kit	128	0.06	8	24	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 07.1	din	129	0.08	8	4	370	12 x 8	ST5	RB1(bath2(1))	Vinyl Flex
SB 08.1	pdr	83	0.07	7	14	310	10 x 6	ST6	RB1(bath2(1))	Vinyl Flex
SB 09.1	util	51	0.09	5	6	375	12 x 6	ST6	RB1(bath2(1))	Vinyl Flex
ST Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type
ST1	---	282	0.09	10	6	517	---	handler	---	Vinyl Flex
ST2	---	173	0.09	8	1	496	---	ST1	---	Vinyl Flex
ST3	---	245	0.09	10	4	449	---	handler	---	Vinyl Flex
ST4	---	145	0.09	8	2	415	---	ST3	---	Vinyl Flex
ST5	---	263	0.07	10	24	482	---	handler	---	Vinyl Flex
ST6	---	134	0.07	8	7	384	---	ST5	---	Vinyl Flex
ST7	---	255	0.06	12	6	325	---	handler	---	Vinyl Flex
RB Number	Location	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Grille Size (inches)	Trunk #	---	Type
RB1	bath2	763	0.06	16	20	547	30 x 20	handler	---	Vinyl Flex
RB2	mbed	282	0.09	10	14	517	20 x 20	handler	---	Vinyl Flex
RT Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type

SIZING DUCTS

Duct Velocity

SB Number (Does not match EG)	Room Served	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Register Size (in)	Trunk #	Return #	Type
SB 01.1	mbed	109	0.11	7	2	407	12 x 8	ST2	RB2(mbed(4))	Vinyl Flex
SB 01.2	mbed	109	0.09	7	3	407	12 x 8	ST1	RB2(mbed(4))	Vinyl Flex
SB 02.1	mbath	64	0.09	6	4	328	10 x 6	ST2	RB2(mbed(4))	Vinyl Flex
SB 03.1	bath2	47	0.09	5	3	342	8 x 6	ST4	RB1(bath2(1))	Vinyl Flex
SB 04.1	bed3	98	0.1	7	5	367	12 x 8	ST4	RB1(bath2(1))	Vinyl Flex
SB 05.1	bed2	100	0.09	7	13	375	12 x 8	ST3	RB1(bath2(1))	Vinyl Flex
SB 06.1	liv/kit	128	0.07	8	7	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 06.2	liv/kit	128	0.06	8	24	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 07.1	din	129	0.08	8	4	370	12 x 8	ST5	RB1(bath2(1))	Vinyl Flex
SB 08.1	pdr	83	0.07	7	14	310	10 x 6	ST6	RB1(bath2(1))	Vinyl Flex
SB 09.1	util	51	0.09	5	6	375	12 x 6	ST6	RB1(bath2(1))	Vinyl Flex
ST Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type
ST1	---	282	0.09	10	6	517	---	handler	---	Vinyl Flex
ST2	---	173	0.09	8	1	496	---	ST1	---	Vinyl Flex
ST3	---	245	0.09	10	4	449	---	handler	---	Vinyl Flex
ST4	---	145	0.09	8	2	415	---	ST3	---	Vinyl Flex
ST5	---	263	0.07	10	24	482	---	handler	---	Vinyl Flex
ST6	---	134	0.07	8	7	384	---	ST5	---	Vinyl Flex
ST7	---	255	0.06	12	6	325	---	handler	---	Vinyl Flex
RB Number	Location	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Grille Size (inches)	Trunk #	---	Type
RB1	bath2	763	0.06	16	20	547	30 x 20	handler	---	Vinyl Flex
RB2	mbed	282	0.09	10	14	517	20 x 20	handler	---	Vinyl Flex
RT Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type

SIZING DUCTS

Register Size
(optional, done later)

SB Number (Does not match EG)	Room Served	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Register Size (in)	Trunk #	Return #	Type
SB 01.1	mbed	109	0.11	7	2	407	12 x 8	ST2	RB2(mbed(4))	Vinyl Flex
SB 01.2	mbed	109	0.09	7	3	407	12 x 8	ST1	RB2(mbed(4))	Vinyl Flex
SB 02.1	mbath	64	0.09	6	4	328	10 x 6	ST2	RB2(mbed(4))	Vinyl Flex
SB 03.1	bath2	47	0.09	5	3	342	8 x 6	ST4	RB1(bath2(1))	Vinyl Flex
SB 04.1	bed3	98	0.1	7	5	367	12 x 8	ST4	RB1(bath2(1))	Vinyl Flex
SB 05.1	bed2	100	0.09	7	13	375	12 x 8	ST3	RB1(bath2(1))	Vinyl Flex
SB 06.1	liv/kit	128	0.07	8	7	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 06.2	liv/kit	128	0.06	8	24	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 07.1	din	129	0.08	8	4	370	12 x 8	ST5	RB1(bath2(1))	Vinyl Flex
SB 08.1	pdr	83	0.07	7	14	310	10 x 6	ST6	RB1(bath2(1))	Vinyl Flex
SB 09.1	util	51	0.09	5	6	375	12 x 6	ST6	RB1(bath2(1))	Vinyl Flex
ST Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type
ST1	---	282	0.09	10	6	517	---	handler	---	Vinyl Flex
ST2	---	173	0.09	8	1	496	---	ST1	---	Vinyl Flex
ST3	---	245	0.09	10	4	449	---	handler	---	Vinyl Flex
ST4	---	145	0.09	8	2	415	---	ST3	---	Vinyl Flex
ST5	---	263	0.07	10	24	482	---	handler	---	Vinyl Flex
ST6	---	134	0.07	8	7	384	---	ST5	---	Vinyl Flex
ST7	---	255	0.06	12	6	325	---	handler	---	Vinyl Flex
RB Number	Location	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Grille Size (inches)	Trunk #	---	Type
RB1	bath2	763	0.06	16	20	547	30 x 20	handler	---	Vinyl Flex
RB2	mbed	282	0.09	10	14	517	20 x 20	handler	---	Vinyl Flex
RT Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type

SIZING DUCTS

Which trunk serves each supply branch

SB Number (Does not match EG)	Room Served	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Register Size (in)	Trunk #	Return #	Type
SB 01.1	mbed	109	0.11	7	2	407	12 x 8	ST2	RB2(mbed(4))	Vinyl Flex
SB 01.2	mbed	109	0.09	7	3	407	12 x 8	ST1	RB2(mbed(4))	Vinyl Flex
SB 02.1	mbath	64	0.09	6	4	328	10 x 6	ST2	RB2(mbed(4))	Vinyl Flex
SB 03.1	bath2	47	0.09	5	3	342	8 x 6	ST4	RB1(bath2(1))	Vinyl Flex
SB 04.1	bed3	98	0.1	7	5	367	12 x 8	ST4	RB1(bath2(1))	Vinyl Flex
SB 05.1	bed2	100	0.09	7	13	375	12 x 8	ST3	RB1(bath2(1))	Vinyl Flex
SB 06.1	liv/kit	128	0.07	8	7	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 06.2	liv/kit	128	0.06	8	24	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 07.1	din	129	0.08	8	4	370	12 x 8	ST5	RB1(bath2(1))	Vinyl Flex
SB 08.1	pdr	83	0.07	7	14	310	10 x 6	ST6	RB1(bath2(1))	Vinyl Flex
SB 09.1	util	51	0.09	5	6	375	12 x 6	ST6	RB1(bath2(1))	Vinyl Flex
ST Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type
ST1	---	282	0.09	10	6	517	---	handler	---	Vinyl Flex
ST2	---	173	0.09	8	1	496	---	ST1	---	Vinyl Flex
ST3	---	245	0.09	10	4	449	---	handler	---	Vinyl Flex
ST4	---	145	0.09	8	2	415	---	ST3	---	Vinyl Flex
ST5	---	263	0.07	10	24	482	---	handler	---	Vinyl Flex
ST6	---	134	0.07	8	7	384	---	ST5	---	Vinyl Flex
ST7	---	255	0.06	12	6	325	---	handler	---	Vinyl Flex
RB Number	Location	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Grille Size (inches)	Trunk #	---	Type
RB1	bath2	763	0.06	16	20	547	30 x 20	handler	---	Vinyl Flex
RB2	mbed	282	0.09	10	14	517	20 x 20	handler	---	Vinyl Flex
RT Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type

SIZING DUCTS

This column is where you would assign the branches to different returns, if there are more than one.

SB Number (Does not match EG)	Room Served	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Register Size (in)	Trunk #	Return #	Type
SB 01.1	mbed	109	0.11	7	2	407	12 x 8	ST2	RB2(mbed(4))	Vinyl Flex
SB 01.2	mbed	109	0.09	7	3	407	12 x 8	ST1	RB2(mbed(4))	Vinyl Flex
SB 02.1	mbath	64	0.09	6	4	328	10 x 6	ST2	RB2(mbed(4))	Vinyl Flex
SB 03.1	bath2	47	0.09	5	3	342	8 x 6	ST4	RB1(bath2(1))	Vinyl Flex
SB 04.1	bed3	98	0.1	7	5	367	12 x 8	ST4	RB1(bath2(1))	Vinyl Flex
SB 05.1	bed2	100	0.09	7	13	375	12 x 8	ST3	RB1(bath2(1))	Vinyl Flex
SB 06.1	liv/kit	128	0.07	8	7	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 06.2	liv/kit	128	0.06	8	24	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 07.1	din	129	0.08	8	4	370	12 x 8	ST5	RB1(bath2(1))	Vinyl Flex
SB 08.1	pdr	83	0.07	7	14	310	10 x 6	ST6	RB1(bath2(1))	Vinyl Flex
SB 09.1	util	51	0.09	5	6	375	12 x 6	ST6	RB1(bath2(1))	Vinyl Flex
ST Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type
ST1	---	282	0.09	10	6	517	---	handler	---	Vinyl Flex
ST2	---	173	0.09	8	1	496	---	ST1	---	Vinyl Flex
ST3	---	245	0.09	10	4	449	---	handler	---	Vinyl Flex
ST4	---	145	0.09	8	2	415	---	ST3	---	Vinyl Flex
ST5	---	263	0.07	10	24	482	---	handler	---	Vinyl Flex
ST6	---	134	0.07	8	7	384	---	ST5	---	Vinyl Flex
ST7	---	255	0.06	12	6	325	---	handler	---	Vinyl Flex
RB Number	Location	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Grille Size (inches)	Trunk #	---	Type
RB1	bath2	763	0.06	16	20	547	30 x 20	handler	---	Vinyl Flex
RB2	mbed	282	0.09	10	14	517	20 x 20	handler	---	Vinyl Flex
RT Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type

SIZING DUCTS

The supplies in the master suite are assigned to RB2

SB Number (Does not match EG)	Room Served	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Register Size (in)	Trunk #	Return #	Type
SB 01.1	mbed	109	0.11	7	2	407	12 x 8	ST2	RB2(mbed(4))	Vinyl Flex
SB 01.2	mbed	109	0.09	7	3	407	12 x 8	ST1	RB2(mbed(4))	Vinyl Flex
SB 02.1	mbath	64	0.09	6	4	328	10 x 6	ST2	RB2(mbed(4))	Vinyl Flex
SB 03.1	bath2	47	0.09	5	3	342	8 x 6	ST4	RB1(bath2(1))	Vinyl Flex
SB 04.1	bed3	98	0.1	7	5	367	12 x 8	ST4	RB1(bath2(1))	Vinyl Flex
SB 05.1	bed2	100	0.09	7	13	375	12 x 8	ST3	RB1(bath2(1))	Vinyl Flex
SB 06.1	liv/kit	128	0.07	8	7	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 06.2	liv/kit	128	0.06	8	24	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 07.1	din	129	0.08	8	4	370	12 x 8	ST5	RB1(bath2(1))	Vinyl Flex
SB 08.1	pdr	83	0.07	7	14	310	10 x 6	ST6	RB1(bath2(1))	Vinyl Flex
SB 09.1	util	51	0.09	5	6	375	12 x 6	ST6	RB1(bath2(1))	Vinyl Flex
ST Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type
ST1	---	282	0.09	10	6	517	---	handler	---	Vinyl Flex
ST2	---	173	0.09	8	1	496	---	ST1	---	Vinyl Flex
ST3	---	245	0.09	10	4	449	---	handler	---	Vinyl Flex
ST4	---	145	0.09	8	2	415	---	ST3	---	Vinyl Flex
ST5	---	263	0.07	10	24	482	---	handler	---	Vinyl Flex
ST6	---	134	0.07	8	7	384	---	ST5	---	Vinyl Flex
ST7	---	255	0.06	12	6	325	---	handler	---	Vinyl Flex
RB Number	Location	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Grille Size (inches)	Trunk #	---	Type
RB1	bath2	763	0.06	16	20	547	30 x 20	handler	---	Vinyl Flex
RB2	mbed	282	0.09	10	14	517	20 x 20	handler	---	Vinyl Flex
RT Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type

SIZING DUCTS

All of the other supplies are assigned to RB1

SB Number (Does not match EG)	Room Served	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Register Size (in)	Trunk #	Return #	Type
SB 01.1	mbed	109	0.11	7	2	407	12 x 8	ST2	RB2(mbed(4))	Vinyl Flex
SB 01.2	mbed	109	0.09	7	3	407	12 x 8	ST1	RB2(mbed(4))	Vinyl Flex
SB 02.1	mbath	64	0.09	6	4	328	10 x 6	ST2	RB2(mbed(4))	Vinyl Flex
SB 03.1	bath2	47	0.09	5	3	342	8 x 6	ST4	RB1(bath2(1))	Vinyl Flex
SB 04.1	bed3	98	0.1	7	5	367	12 x 8	ST4	RB1(bath2(1))	Vinyl Flex
SB 05.1	bed2	100	0.09	7	13	375	12 x 8	ST3	RB1(bath2(1))	Vinyl Flex
SB 06.1	liv/kit	128	0.07	8	7	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 06.2	liv/kit	128	0.06	8	24	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 07.1	din	129	0.08	8	4	370	12 x 8	ST5	RB1(bath2(1))	Vinyl Flex
SB 08.1	pdr	83	0.07	7	14	310	10 x 6	ST6	RB1(bath2(1))	Vinyl Flex
SB 09.1	util	51	0.09	5	6	375	12 x 6	ST6	RB1(bath2(1))	Vinyl Flex
ST Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type
ST1	---	282	0.09	10	6	517	---	handler	---	Vinyl Flex
ST2	---	173	0.09	8	1	496	---	ST1	---	Vinyl Flex
ST3	---	245	0.09	10	4	449	---	handler	---	Vinyl Flex
ST4	---	145	0.09	8	2	415	---	ST3	---	Vinyl Flex
ST5	---	263	0.07	10	24	482	---	handler	---	Vinyl Flex
ST6	---	134	0.07	8	7	384	---	ST5	---	Vinyl Flex
ST7	---	255	0.06	12	6	325	---	handler	---	Vinyl Flex
RB Number	Location	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Grille Size (inches)	Trunk #	---	Type
RB1	bath2	763	0.06	16	20	547	30 x 20	handler	---	Vinyl Flex
RB2	mbed	282	0.09	10	14	517	20 x 20	handler	---	Vinyl Flex
RT Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type

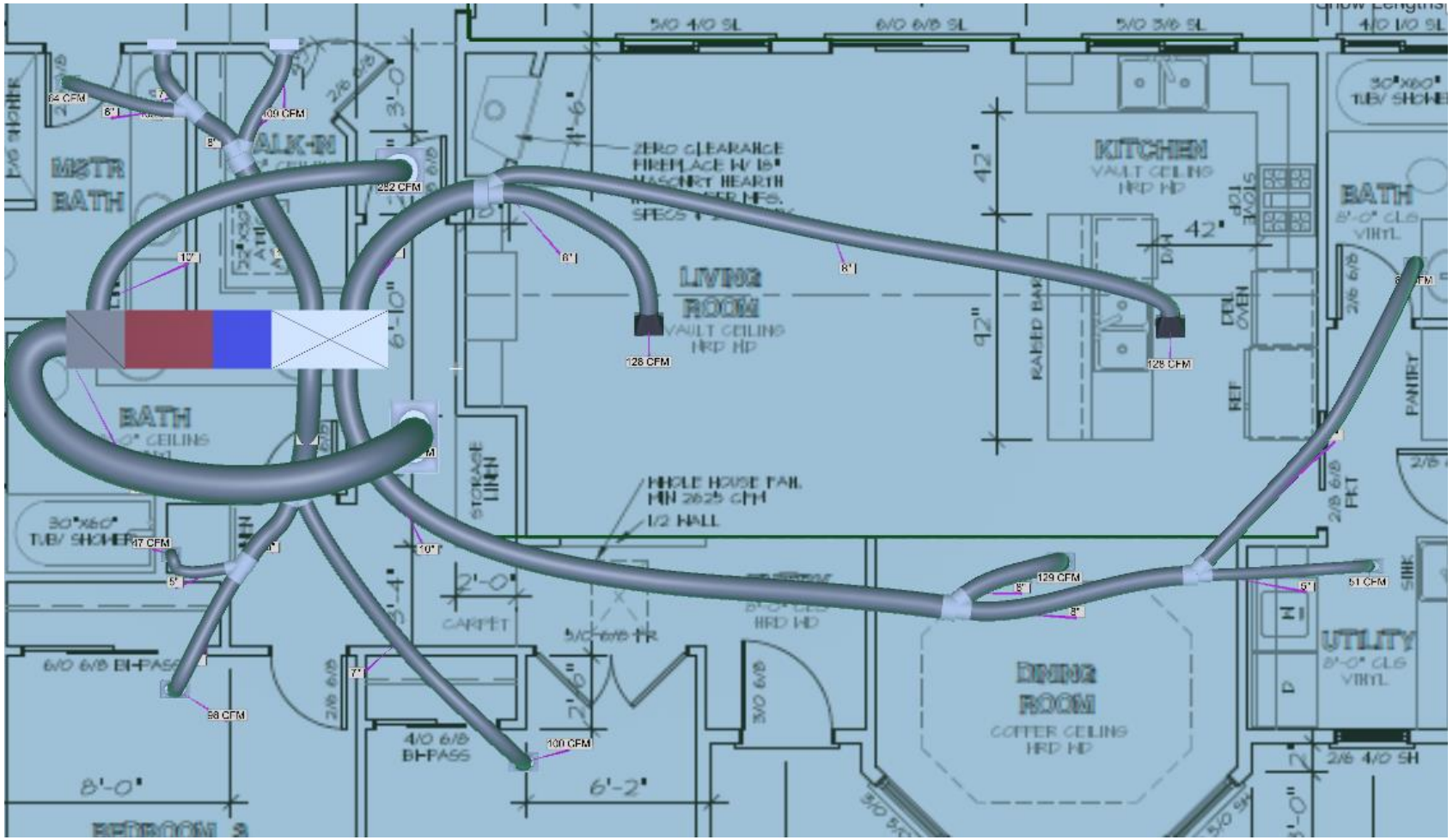
SIZING DUCTS

This last column allows you to specify the duct type.
Choices are vinyl Flex, sheet metal, and duct board

SB Number (Does not match EG)	Room Served	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Register Size (in)	Trunk #	Return #	Type
SB 01.1	mbed	109	0.11	7	2	407	12 x 8	ST2	RB2(mbed(4))	Vinyl Flex
SB 01.2	mbed	109	0.09	7	3	407	12 x 8	ST1	RB2(mbed(4))	Vinyl Flex
SB 02.1	mbath	64	0.09	6	4	328	10 x 6	ST2	RB2(mbed(4))	Vinyl Flex
SB 03.1	bath2	47	0.09	5	3	342	8 x 6	ST4	RB1(bath2(1))	Vinyl Flex
SB 04.1	bed3	98	0.1	7	5	367	12 x 8	ST4	RB1(bath2(1))	Vinyl Flex
SB 05.1	bed2	100	0.09	7	13	375	12 x 8	ST3	RB1(bath2(1))	Vinyl Flex
SB 06.1	liv/kit	128	0.07	8	7	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 06.2	liv/kit	128	0.06	8	24	365	12 x 8	ST7	RB1(bath2(1))	Vinyl Flex
SB 07.1	din	129	0.08	8	4	370	12 x 8	ST5	RB1(bath2(1))	Vinyl Flex
SB 08.1	pdr	83	0.07	7	14	310	10 x 6	ST6	RB1(bath2(1))	Vinyl Flex
SB 09.1	util	51	0.09	5	6	375	12 x 6	ST6	RB1(bath2(1))	Vinyl Flex
ST Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type
ST1	---	282	0.09	10	6	517	---	handler	---	Vinyl Flex
ST2	---	173	0.09	8	1	496	---	ST1	---	Vinyl Flex
ST3	---	245	0.09	10	4	449	---	handler	---	Vinyl Flex
ST4	---	145	0.09	8	2	415	---	ST3	---	Vinyl Flex
ST5	---	263	0.07	10	24	482	---	handler	---	Vinyl Flex
ST6	---	134	0.07	8	7	384	---	ST5	---	Vinyl Flex
ST7	---	255	0.06	12	6	325	---	handler	---	Vinyl Flex
RB Number	Location	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	Grille Size (inches)	Trunk #	---	Type
RB1	bath2	763	0.06	16	20	547	30 x 20	handler	---	Vinyl Flex
RB2	mbed	282	0.09	10	14	517	20 x 20	handler	---	Vinyl Flex
RT Number	---	AirFlow CFM	Friction Rate	Diameter Inches	Length Feet	Velocity FPM	---	Trunk #	---	Type

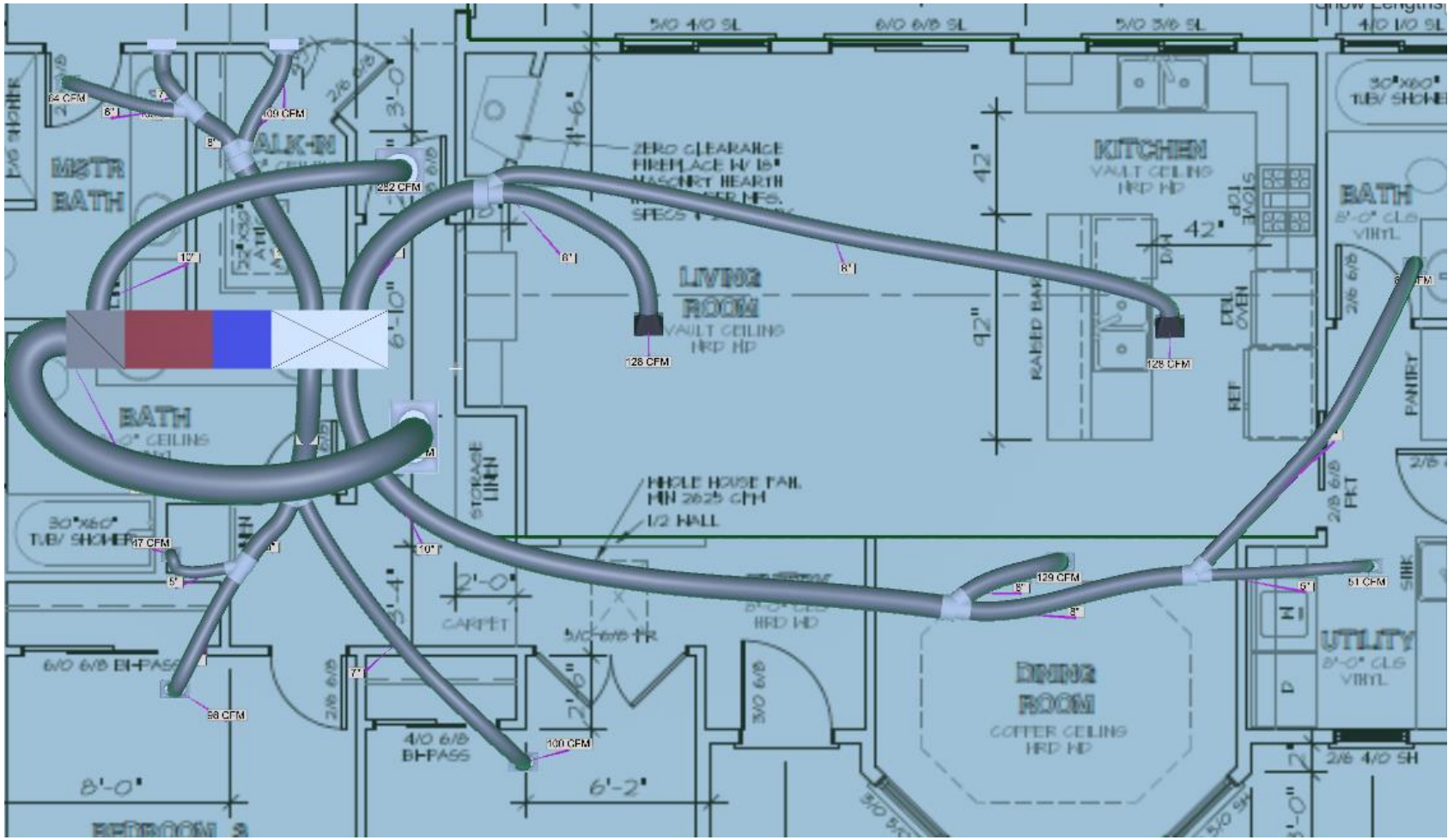
SIZING DUCTS

- This is what the final design would look like.



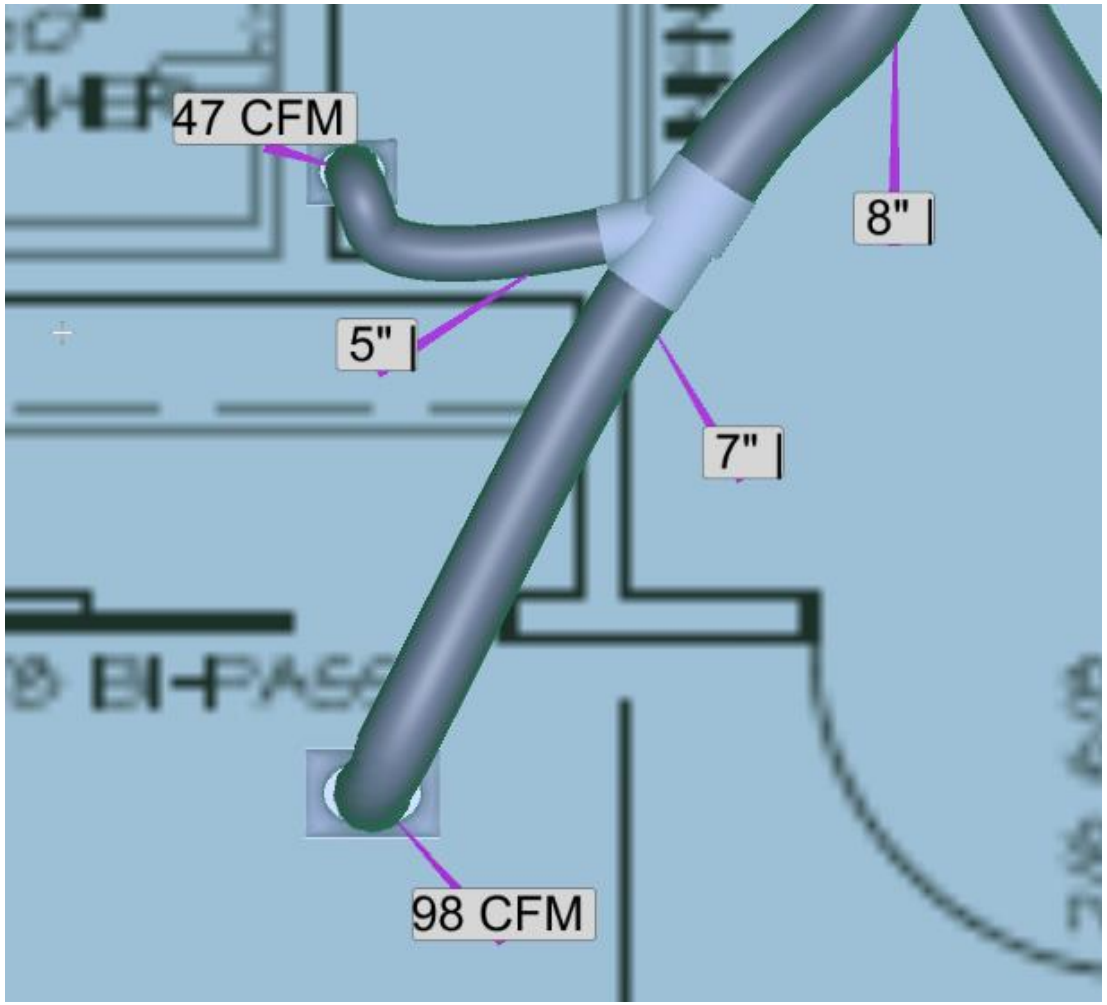
SIZING DUCTS

- A good, readable layout that somewhat **resembles reality** is very important to ensure good installation in the field.



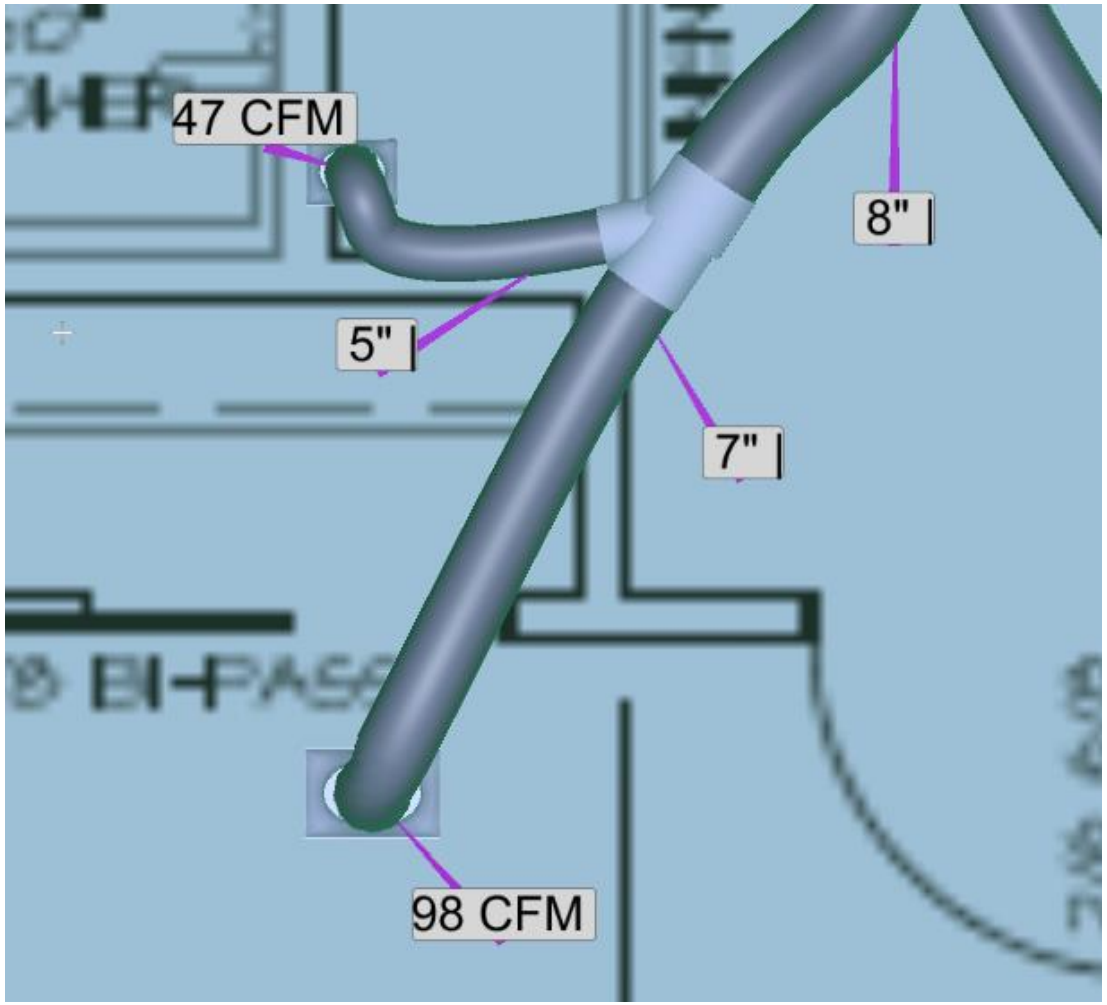
SIZING DUCTS

- It is also a good idea to show the target airflows next to each register so that they can be verified after the system is installed.



SIZING DUCTS

- When possible, compare installed airflows and static pressure to design targets.
- This feedback from the field is critical, especially if you are just learning to design systems.



WRAP UP

Where things can go wrong.

- Incomplete information or bad assumptions about the house.
- House not built the way you were told.
- Equipment undersized.
- Equipment oversized.
- Low total system airflow
- Target room flows incorrect – poor balance
- Supply register types and locations
- Thermostat location
- Occupant behavior/expectations

WRAP UP

How to avoid these problems.

- Become proficient and confident with the software.
- Practice, practice, practice.
- Double check your work.
- Join user's groups. Share your designs with others. Ask for feedback and comments.
- Test your designs after they are installed. Airflow, static pressure and duct leakage. (required in CA for new systems)
- Educate homeowners on proper system operation.
- Err toward smaller equipment and larger ducts.

Closing

- Continuing Education Units Available
  - Contact ggautereaux@co.slo.ca.us for AIA LUs
- Coming to Your Inbox Soon!
  - Slides, Recording, & Survey – Please Take It and Help Us Out!
- Upcoming Courses:
  - Introduction to Passive House 4hr – (5/1)
  - Is Mechanical Ventilation Really Necessary? – (5/2)
  - 2022 CALGreen Code for Residential and Non-Residential – (5/4)
  - Crafting High Performance Enclosures: Roofs, Walls, and Floors – (5/4)
  - 2022 Energy Code: Non-Residential – (5/17)

Thank you!

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