SUCCESS WITH LOUISIANA ENERGY CODE

Recommended Practices for Optimized Energy Savings

for Builders/Trades & Code Officials

advanced energy

SEEA

SOUTH EAST ENERGY EFFICIENCY ALLIANCE

VERSION 2015.1.0

HVAC

HVAC INSTALLATION

HVAC MAINTENANCE

HVAC

Installation

- JC 1: HVAC system installed matches ACCA Manual J and Manual S or approved methods from the building plans.
- JC 2: Building cavities are not used as part of a duct system.
- JC 3: Seal all duct terminations to drywall and/or subfloor and all HVAC penetrations in the building envelope with mastic. Use fire-rated sealants where applicable.
- JC 4: Seal all HVAC components at all joints, seams and corners.
- JC 5: Duct leakage testing, if needed, meets Louisiana Energy Code compliance levels.
- JC 6: Mechanically fasten all metal ductwork with screws. Attach the inner liner of flexible ducts with nylon/ plastic straps and tighten with a manufacturer-approved tool.
- JC 7: Insulate all supply duct work in unconditioned attic space to R-8. Insulate all other duct work outside of conditioned space to R-6. If exterior insulation, mechanically fasten duct insulation with straps and seal all joints and seams of vapor retarder
- JC 8: Do not compress insulated flexible ducts more than the thickness of the insulation.
- JC 9: Support flexible duct (including spot ventilation) at least every 10 feet and do not bend greater than 90°.
- JC 10: Install a whole-house ventilation strategy. Required ventilation rates shall also include adequate provisions for makeup air system supplies and/or exhausts as required in either the IRC or IMC.
- JC 11: Install outside air ventilation intakes at least 10 feet from any exhaust vent or stack.
- JC 12: Coordinate bath fan exhaust duct direction with electrical contractor.
- JC 13: Terminate exhaust ventilation duct work to the outside. Install screens where applicable.

Maintenance

- JC 14: For heat pumps, install a heat strip outdoor temperature lockout that prevents supplemental heat operation and set it to the balance point.
- JC 15: For furnaces, install a programmable thermostat.
- JC 16: Install R-3 insulation around HVAC piping that carries fluids above 105ºF or below 55ºF.

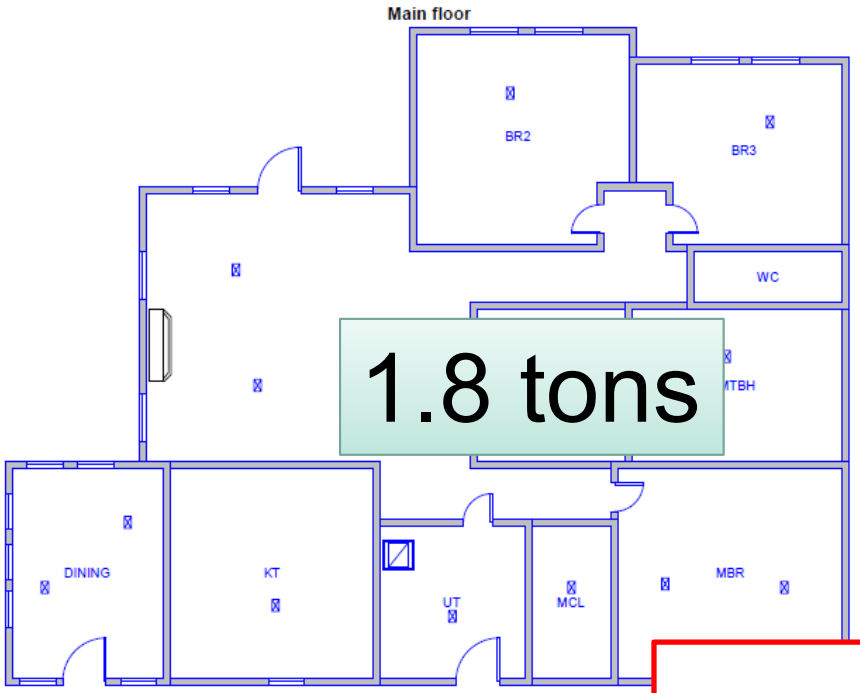
HVAC

HVAC INSTALLATION

JC 1: HVAC system installed matches ACCA Manual J , D and Manual S or approved methods from the building plans.

PROCESS

- How
- Why
- What to avoid



1.8 tons

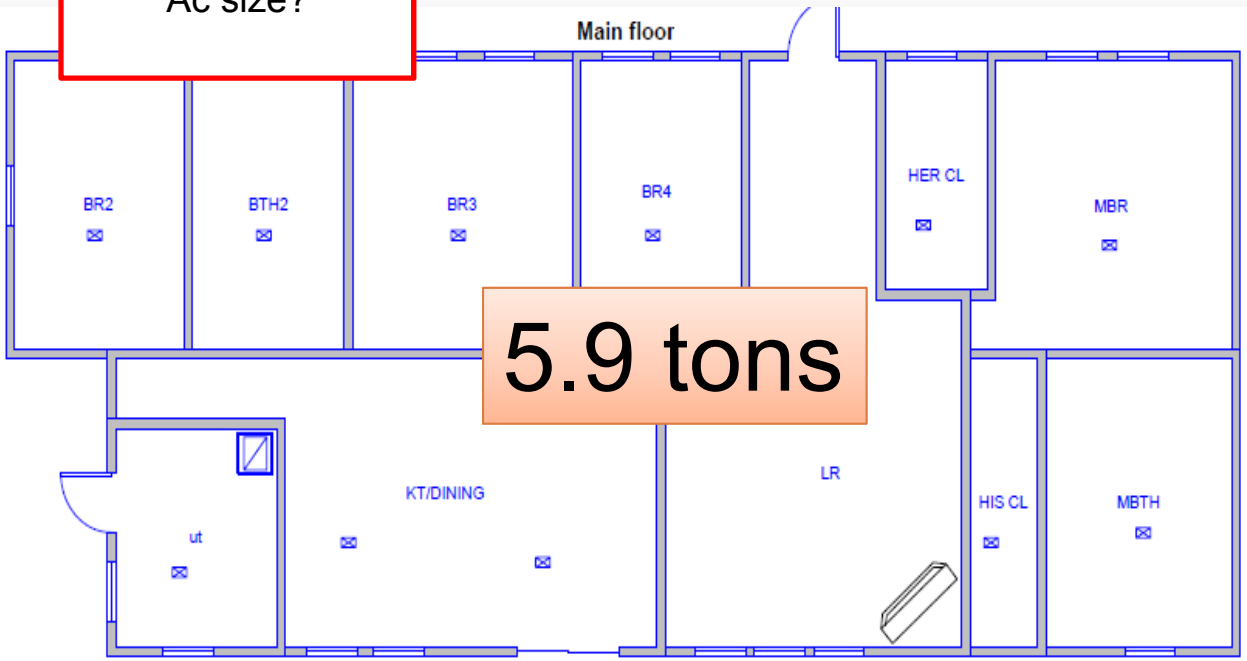
2,097 sq. ft. **House 1**
3 bedroom – 2 bath
New Orleans. La.
Current 2012 IRC - plus
- 18 (3x5) Low E Windows
- Floor – concrete slab
- R13 walls (2x4)
- R30 ceiling/ridge vented attic/radiant barrier
- R8 Flex duct

N

Ac size?

2,085 sq. ft**.** **House 2**
4 bedroom – 2 bath
Shreveport, La.
Current HUD minimum
- 18 (3x5) Double Pane Windows
- Floor - pier and beam R19
- R13 walls (2x4)
- R30 ceiling/ridge vented attic
- R4.2 Flex duct

N

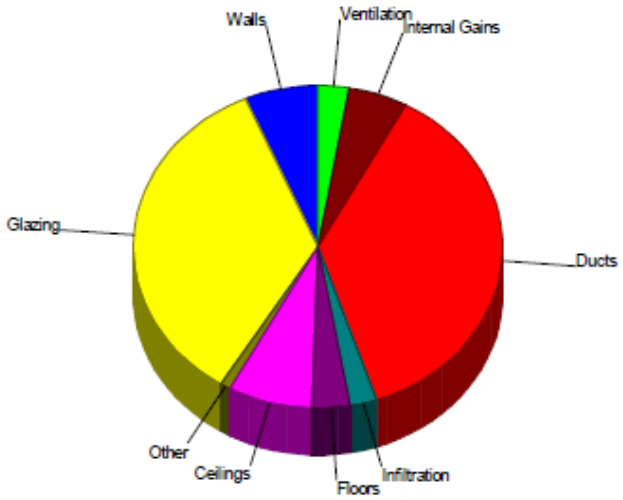


5.9 tons

Manual J - also analyzes the building

Cooling

Component	Btuh/ft²	Btuh	% of load
Walls	2.5	3218	6.5
Glazing	58.6	17264	34.7
Doors	11.0	461	0.9
Ceilings	1.8	3696	7.4
Floors	0.8	1635	3.3
Infiltration	0.7	1166	2.3
Ducts		18415	37.0
Ventilation		1341	2.7
Internal gains		2580	5.2
Blower		0	0
Adjustments		0	
Total		**49777**	**100.0**



So, what if? 5.9 tons

-Low E windows
-R8 flex duct
-Radiant barrier roof decking

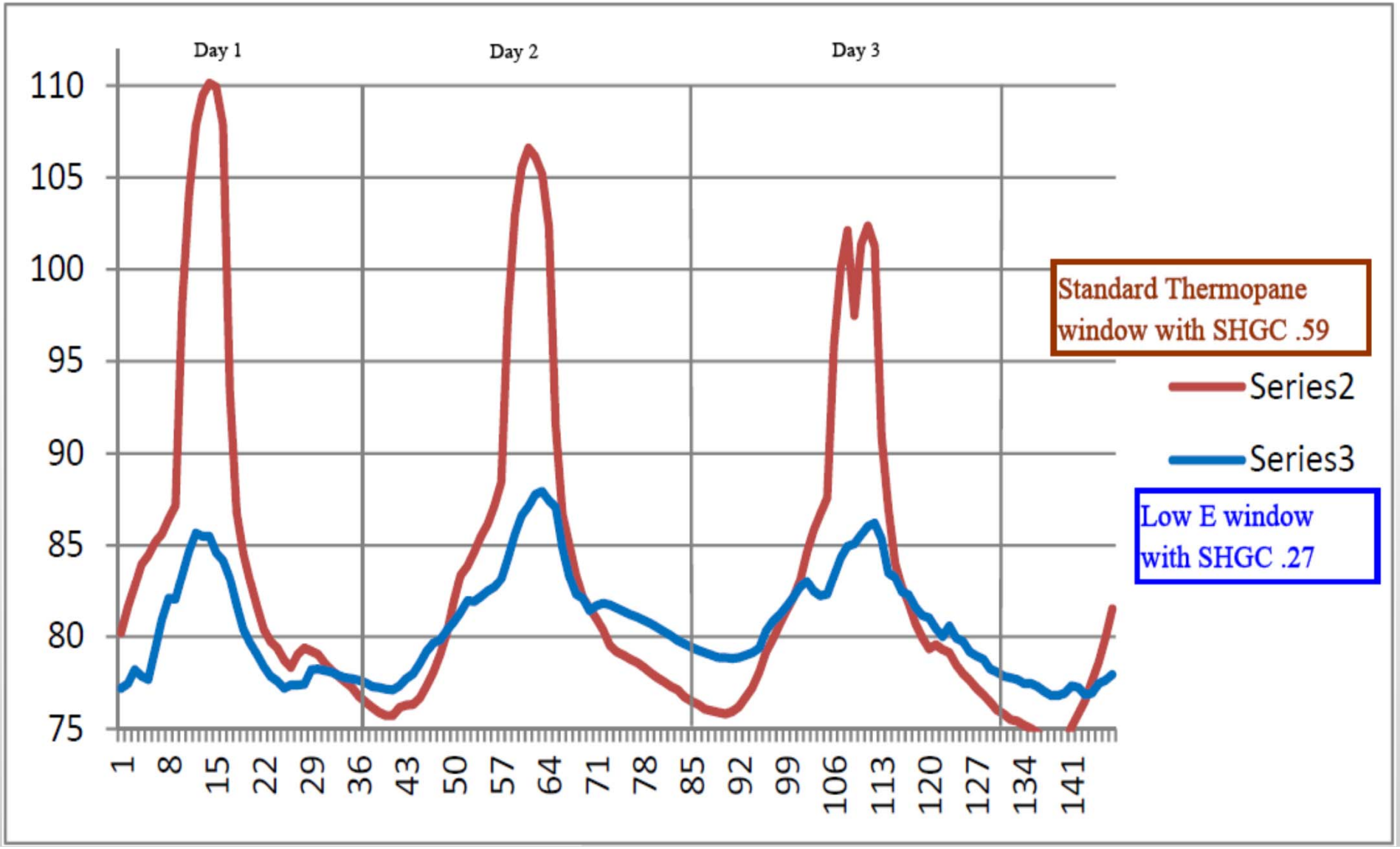
Sensible Cooling Equipment Load Sizing

Structure	19577	Btuh
Ducts	6294	Btuh
Central vent (60 cfm)	1333	Btuh
Blower	0	Btuh
Use manufacturer's data	n	
Rate/swing multiplier	1.00	
Equipment sensible load	27313	Btuh

Latent Cooling Equipment Load Sizing

Structure	2722	Btuh
Ducts	1658	Btuh
Central vent (60 cfm)	1728	Btuh
Equipment latent load	6108	Btuh
Equipment total load	33420	Btuh
Req. total capacity at 0.70 SHR	3.3	ton

Standard Thermopane Windows
Vs.
Low E Windows



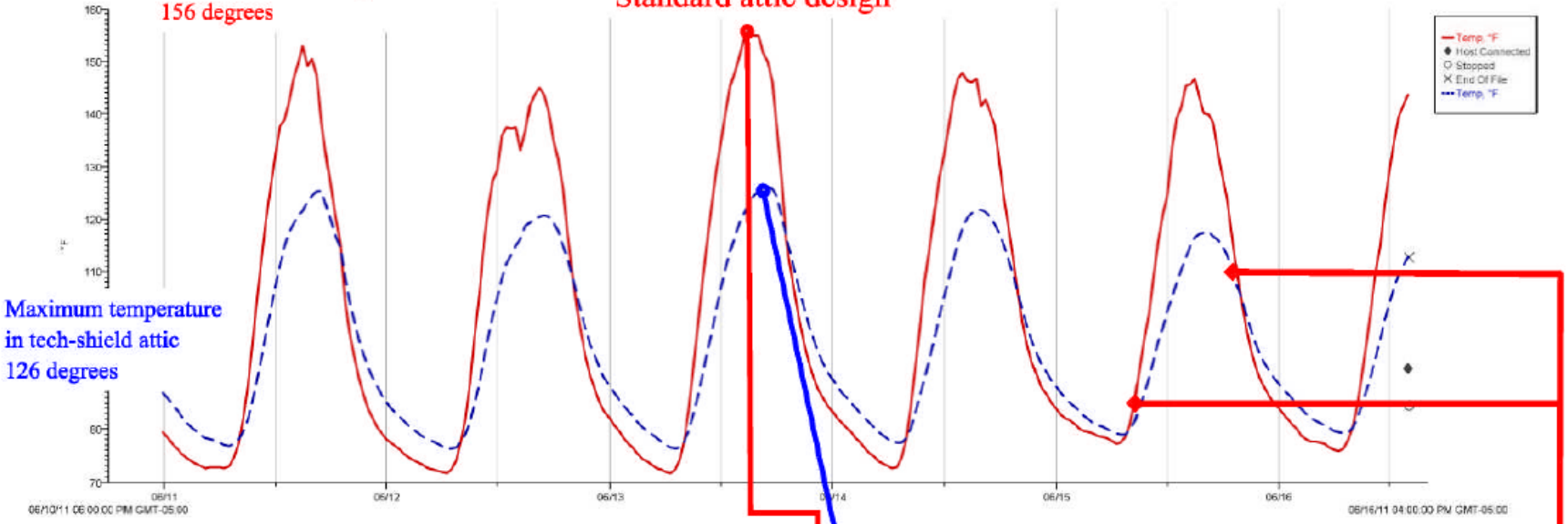
New Products

Testing performed by
Healthy Homes of Louisiana, LLLC
Test date June 2011
Homes located in Lafayette, Louisiana

Tech-shield attic
Vs.
Standard attic design

Maximum temperature
in standard attic design
156 degrees

Maximum temperature
in tech-shield attic
126 degrees

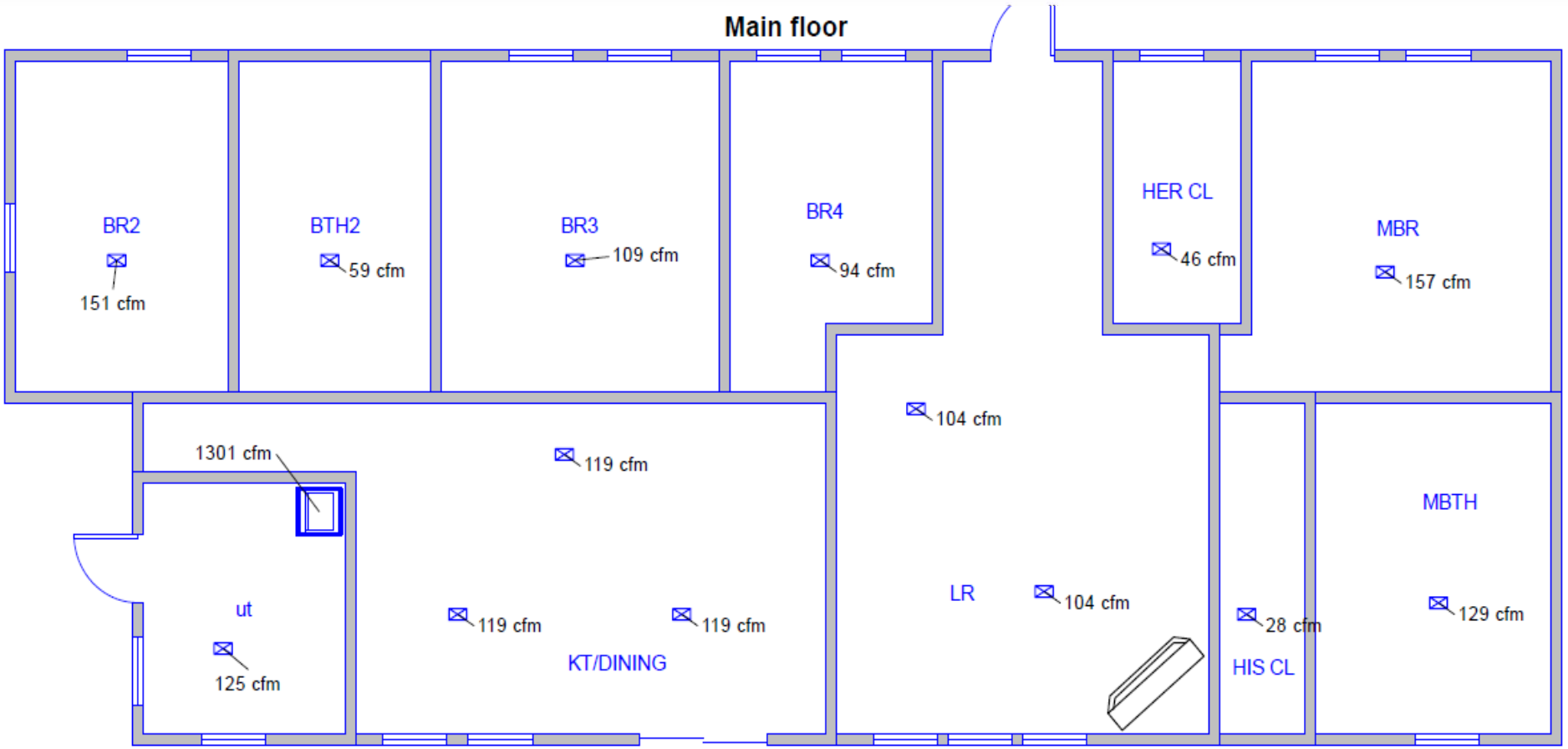


96 degree high outdoor temp 06-11-2011	95 degree high outdoor temp 06-12-2011	95 degree high outdoor temp 06-13-2011	96 degree high outdoor temp 06-14-2011	97 degree high outdoor temp 06-15-2011	98 degree high outdoor temp 06-16-2011

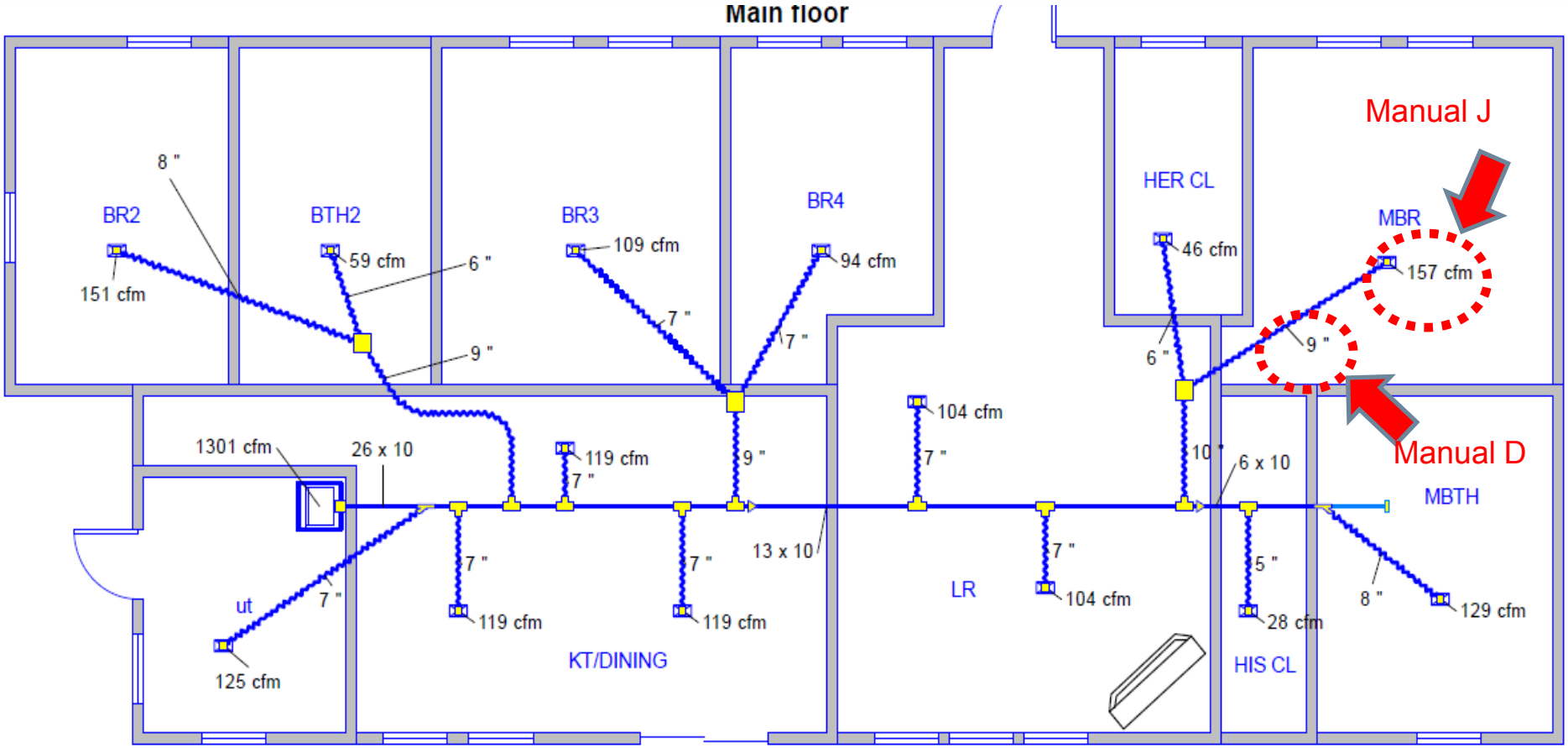
Facts	Peak temperature	Time of day attic reached peak temp.	*Standard attic is warmer than tech-shield attic by 8:30am and does not equalize until 7:30pm
Home with Tech-shield	126.095 degrees	average 4:30 pm	
Standard attic design	156.250 degrees	average 3:00 pm	

* Indicates that the standard attic design heats up faster and maintains higher temperatures for an average of 11 hrs a day longer than the Tech-shield attic.

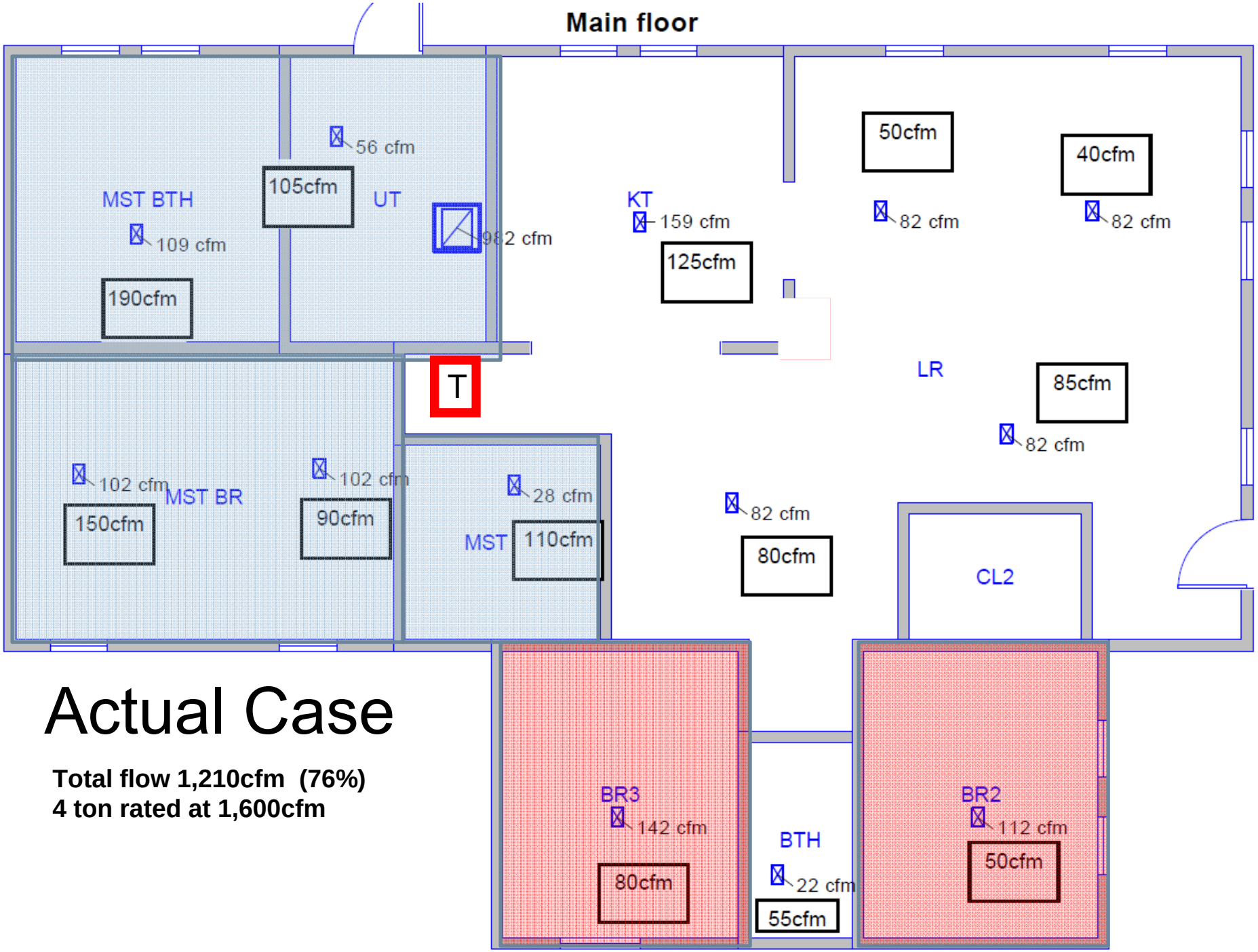
Manual J…. also gives us a room-by-room analysis



Manual D



HVAC accounts for 70% of energy usage, **when done correctly**



Actual Case

Total flow 1,210cfm (76%)
4 ton rated at 1,600cfm

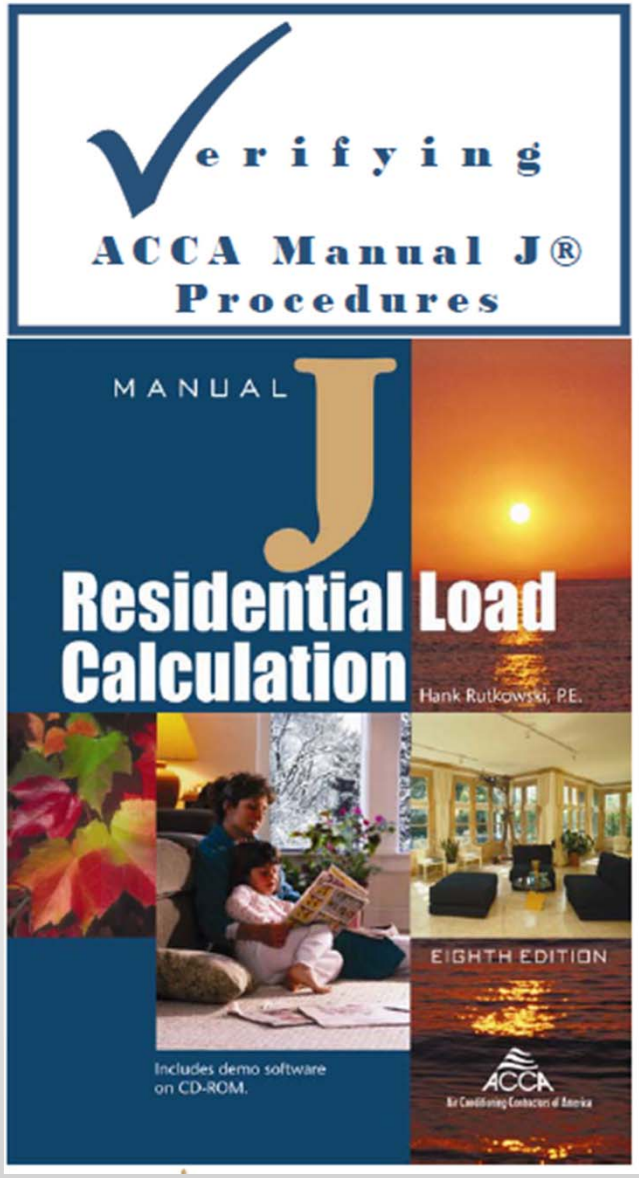
Heat Loss/Gain Method

- Takes lots of inputs into consideration to find out how much heating/cooling is needed
- Calculation Methods
  - Manual J
  - ASHRAE 2009
  - Other – authority having jurisdiction approval (if any?)

Full Load Calculation Report

Report includes:

- Location and design conditions
- House inputs
- House (load) outputs
- Individual room airflows



Equipment Selection Method

- Selects equipment that is correctly sized to match the heat gain and heat loss of the house
- Calculation Methods
  - Manual S
  - OEM recommendations

Other – authority having jurisdiction approval?... (AHRI?)

AHRI CERTIFIED®
www.ahridirectory.org

Certificate of Product Ratings

AHRI Certified Reference Number: 3140934 Date: 6/1/2015

Product: Split System: Heat Pump with Remote Outdoor Unit-Air-Source

Outdoor Unit Model Number: FT4BF-036KA

Indoor Unit Model Number: C6B(A,H)-X36(C,U)-B

Furnace Model Number: FG7T(*)-B

Manufacturer: FRIGIDAIRE

Trade/Brand name: FRIGIDAIRE

Series name: FRIGIDAIRE FT4BF SERIES

Manufacturer responsible for the rating of this system combination is FRIGIDAIRE

Rated as follows in accordance with AHRI Standard 210/240-2008 for Unitary Air-Conditioning and Air-Source Heat Pump Equipment and subject to verification of rating accuracy by AHRI-sponsored, independent, third party testing:

Cooling Capacity (Btuh):	36000
EER Rating (Cooling):	12.00
SEER Rating (Cooling):	15.20
Heating Capacity(Btuh) @ 47 F:	35600
Region IV HSPF Rating (Heating):	8.10
Heating Capacity(Btuh) @ 17 F:	22200

* Ratings followed by an asterisk (*) indicate a voluntary rerate of previously published data, unless accompanied with a WAS, which indicates an involuntary rerate.

AHRI
AIR-CONDITIONING, HEATING, & REFRIGERATION INSTITUTE
we make life better®

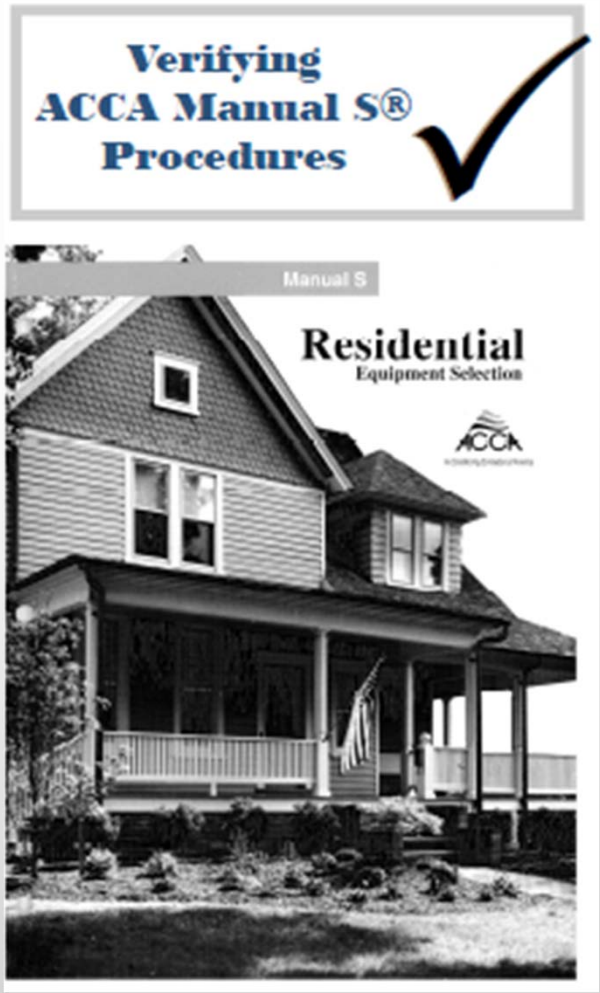
CERTIFICATE NO.: 130776648740857535

- **The Manufacturer's Expanded Engineering Data-** manufacturers publish engineering data for all "Design Conditions". Your Consultant must retrieve from the manufacturer this engineering data, in order to choose the proper size of equipment for your home. Your Consultant must never use the AHRI rated BTU output. **The AHRI data is a nominal, rating-test based on 95 degree outdoor-80 degree indoor with a 67 degree wet bulb (moisture content).** These parameters are only used to compare all brands of equipment. This is similar to the mileage sticker on the window of new car–not accurate and good for comparison only.

Sizing Calculation Report –Manual S

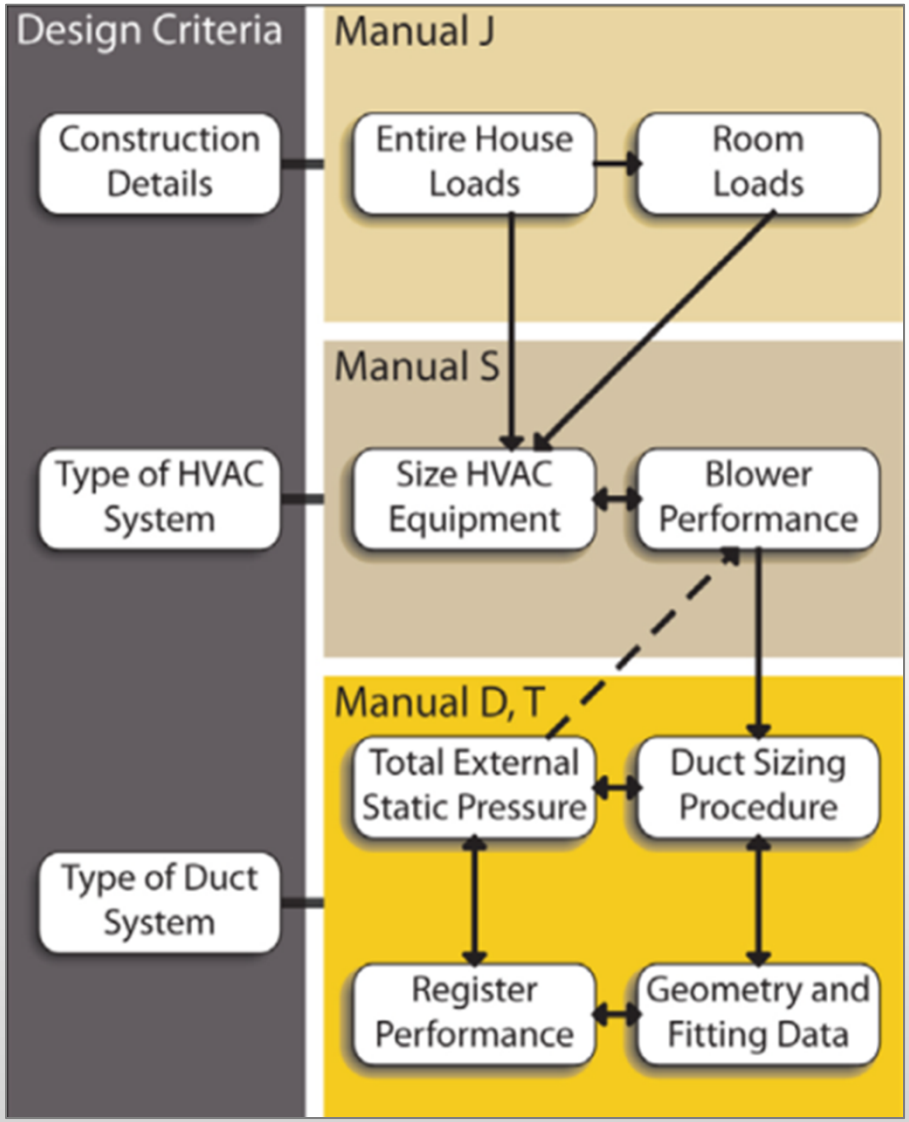
Report includes:

- Location and design conditions
- Manufacturer's performance parameters
- Heating and cooling capacity



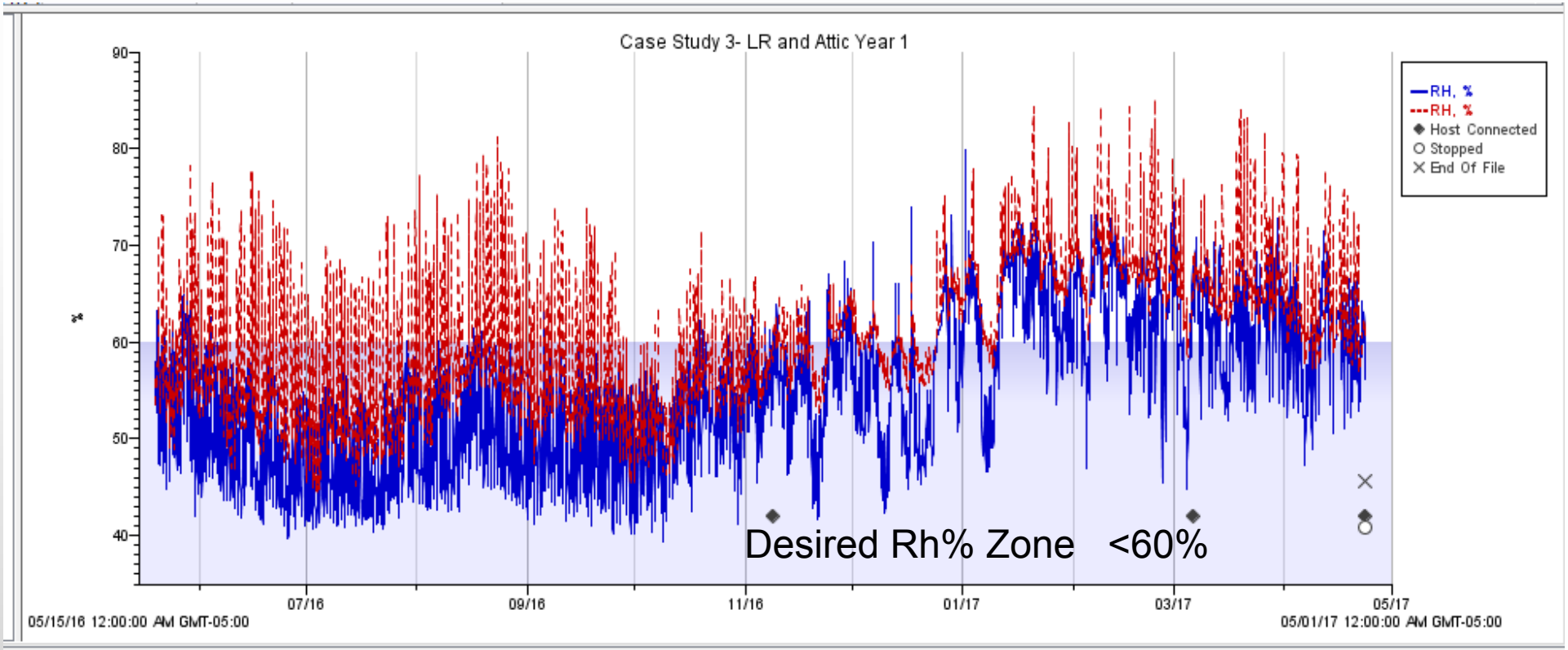
Heating and Cooling System Design

- Sizing
- Selection
- Duct Design
- Installation
- Commissioning



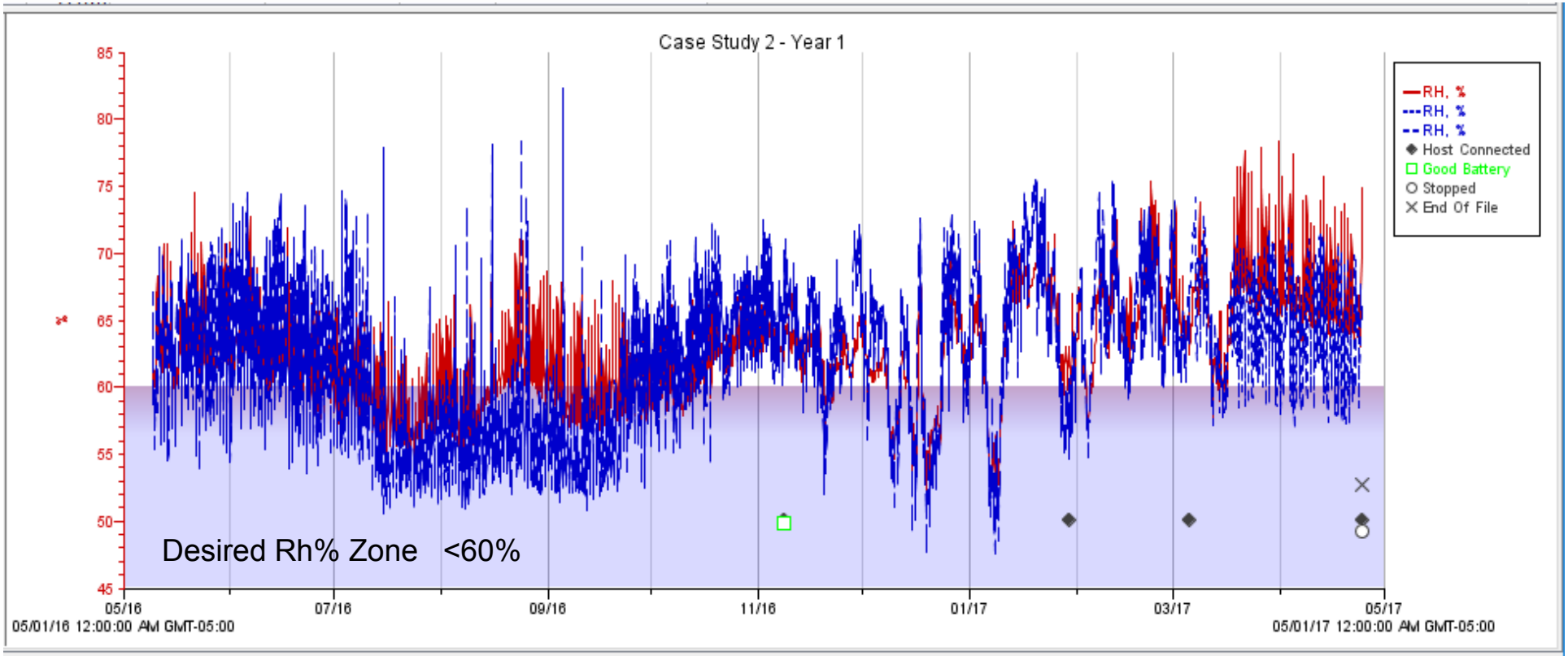
Case Study 3 – Commissioned
Sized within ½ ton of load

May 2016 thru May 2017
Average 50%Rh living space and 60% Rh attic



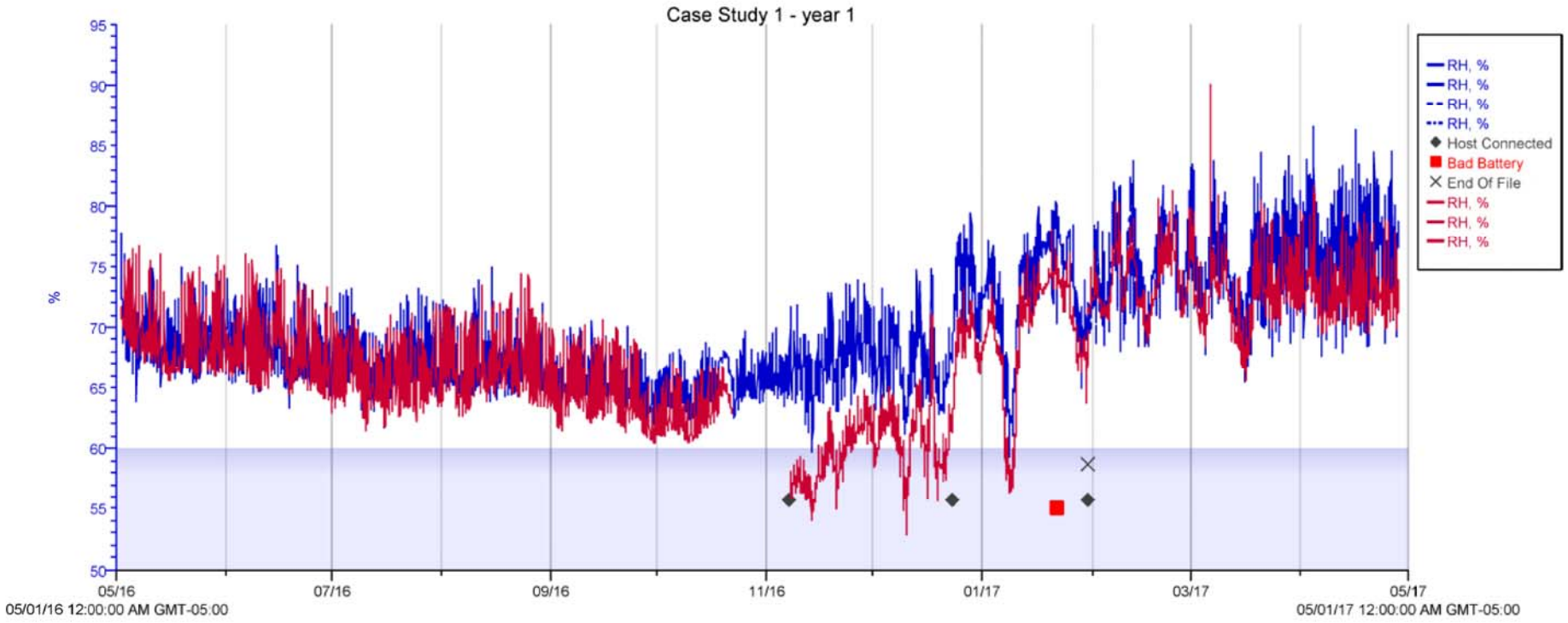
Case Study 2 – Commissioned
Sized slightly over 1 ton of load

May 2016 thru May 2017
Average 62%Rh living space and 64% Rh attic



Case Study 1 – Commissioned
Sized > 1.5 ton of load
Load was 2.2 –ton and had 4-ton installed

May 2016 thru May 2017
Average 68%Rh living space and 70% Rh attic

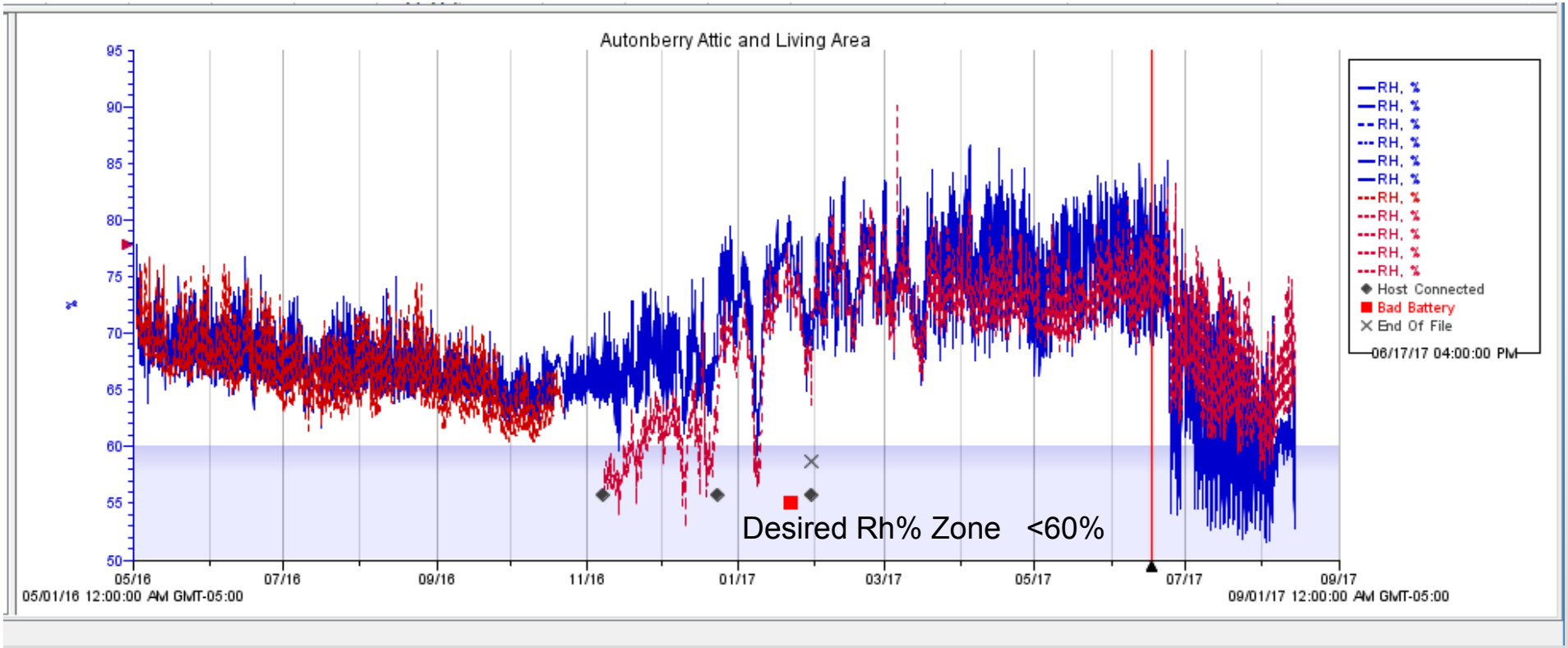


Case Study 1 – Full Year

A/C downsized from 4-ton to 3-ton

load is 2.2-ton

on 06/17/2017



HVAC

HVAC INSTALLATION

JC 2: Building cavities are not part of a duct system.

- How
- Why
- What to avoid

PROCESS

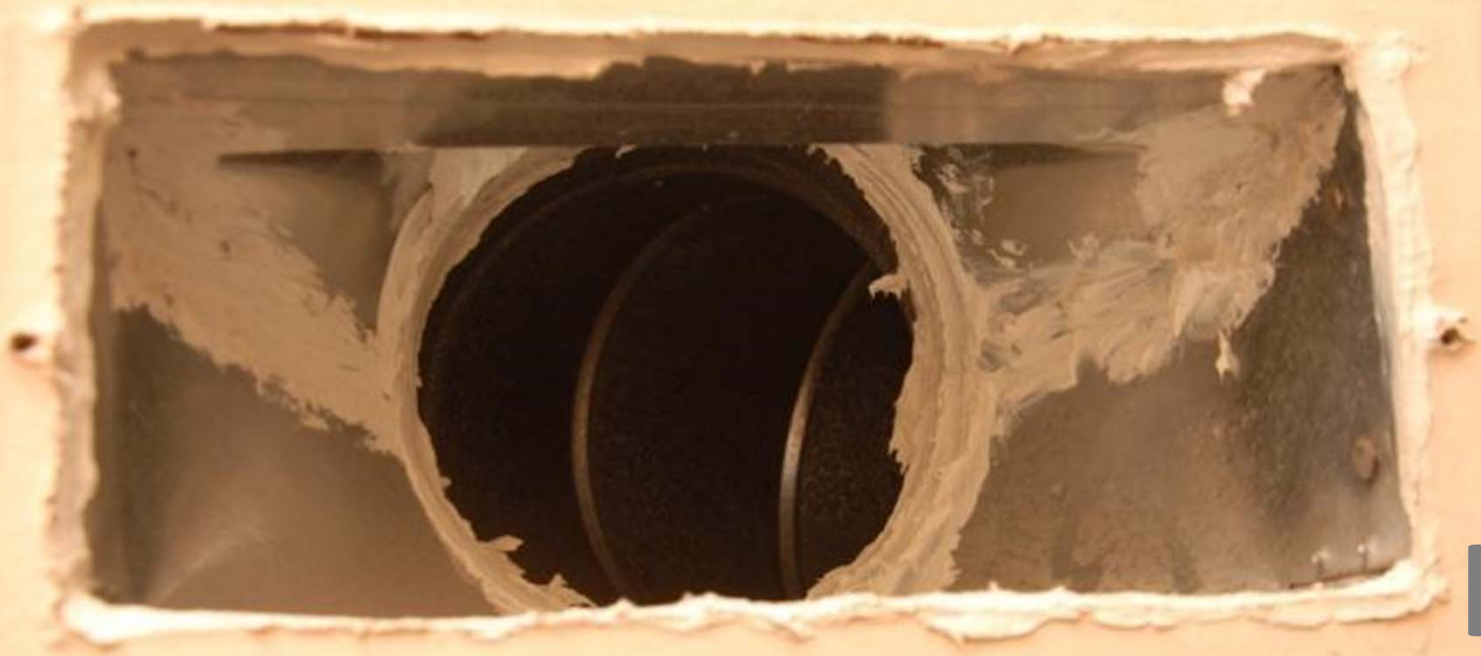
HVAC

HVAC INSTALLATION

JC 3: Seal all duct terminations to drywall and/or subfloor and all HVAC penetrations in the building envelope with mastic. Use fire-rated sealants where applicable.

PROCESS

- How
- Why
- What to avoid



How?

-Seal during framing

-Seal at final

HVAC

HVAC INSTALLATION

JC 4: Seal all HVAC components at all joints, seams and corners with mastic.

- How
- Why
- What to avoid

PROCESS


How?
Seal all holes,
gaps, seams


Critical Concept:
If you can reach
it, seal it!
Basically everywhere

Terrible

Bad

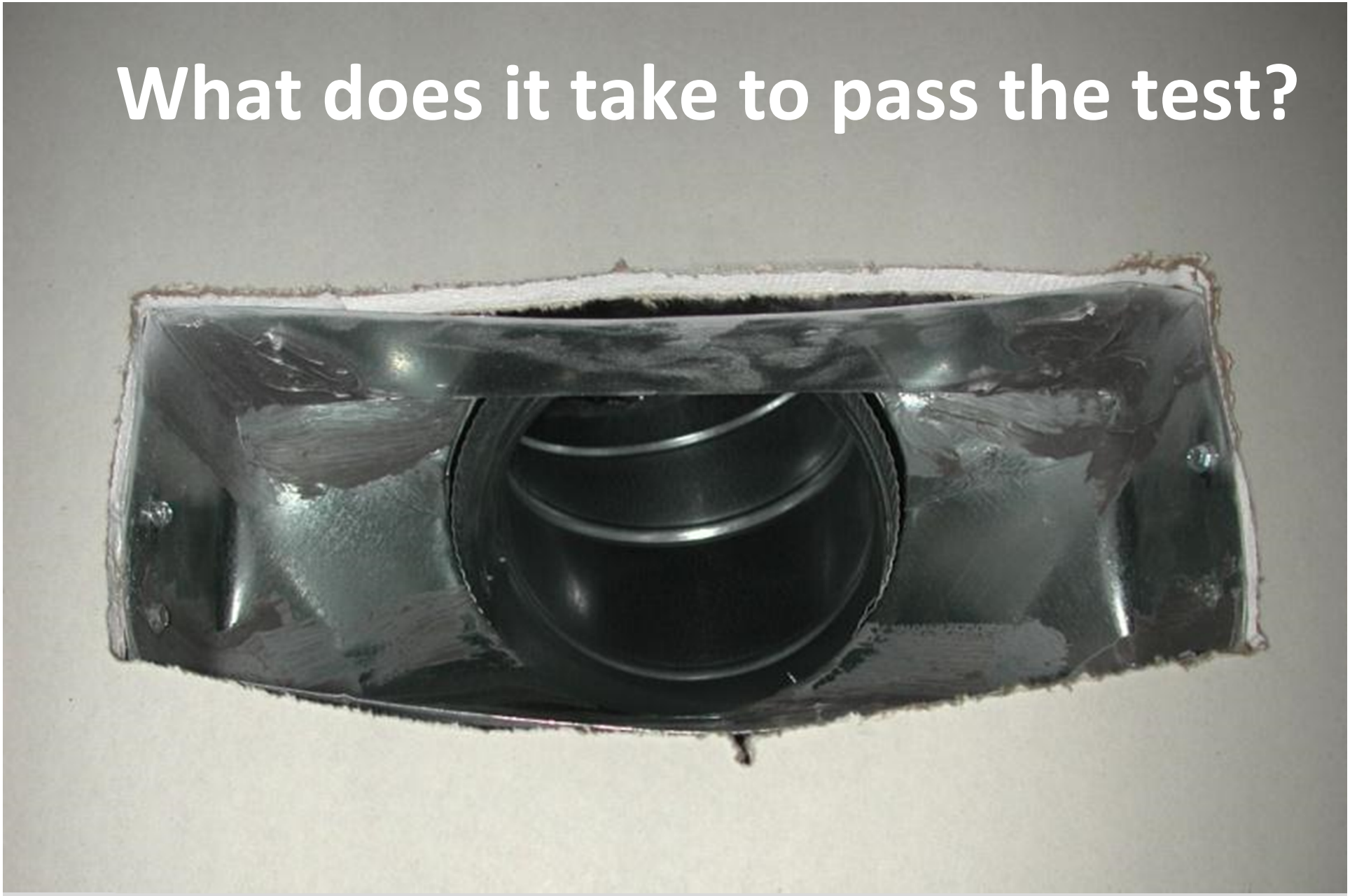
Look at that duct tape!

Better

Best


Why?

What does it take to pass the test?



HVAC

HVAC INSTALLATION

JC 5: Duct leakage testing, if needed, meets Louisiana Energy Code compliance levels.

- How
- Why
- What to avoid

PROCESS

PERFORMANCE

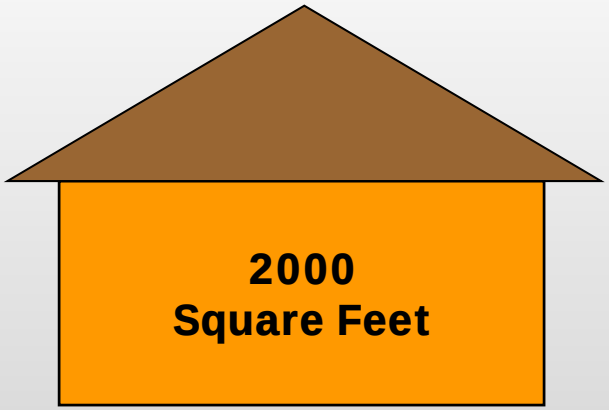
How much air would a duct leak leak if a duct system does in fact leak?

Option 2: Duct Leakage Test

Duct Leakage Testing Requirements	
Rough-in	CFM/100 sq ft conditioned floor area
Total Leakage	≤ 6 CFM
Total leakage without air handler in place	≤ 4 CFM
Post Construction	CFM/100 sq ft conditioned floor area
Leakage to the Outdoors	≤ 8 CFM
Total Leakage	≤ 12 CFM

How much leak can a duct leak leak if a duct leak leaks?

- Total Duct Leakage
- No more than 12% of the conditioned floor area



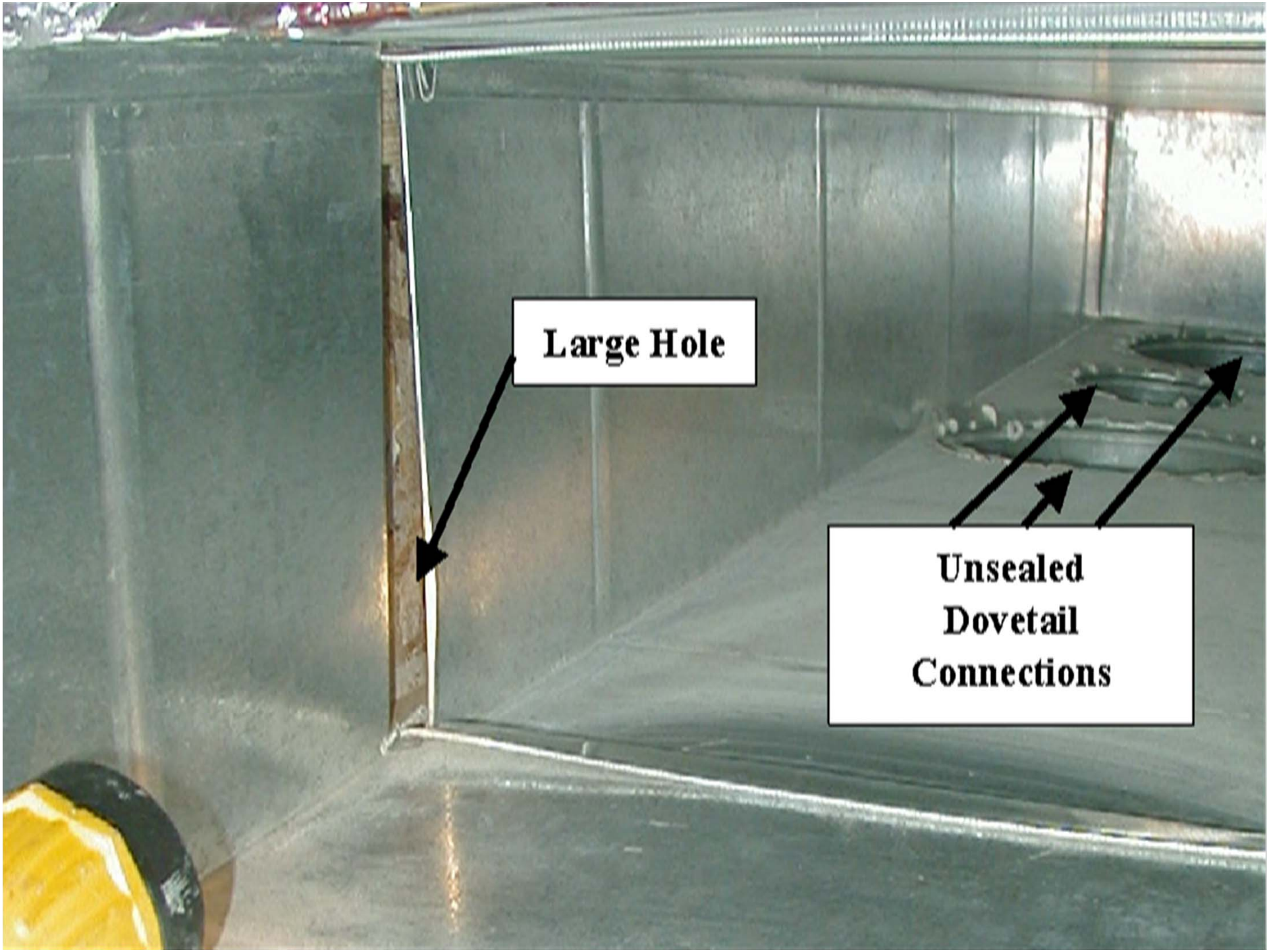
No more than 240 CFM

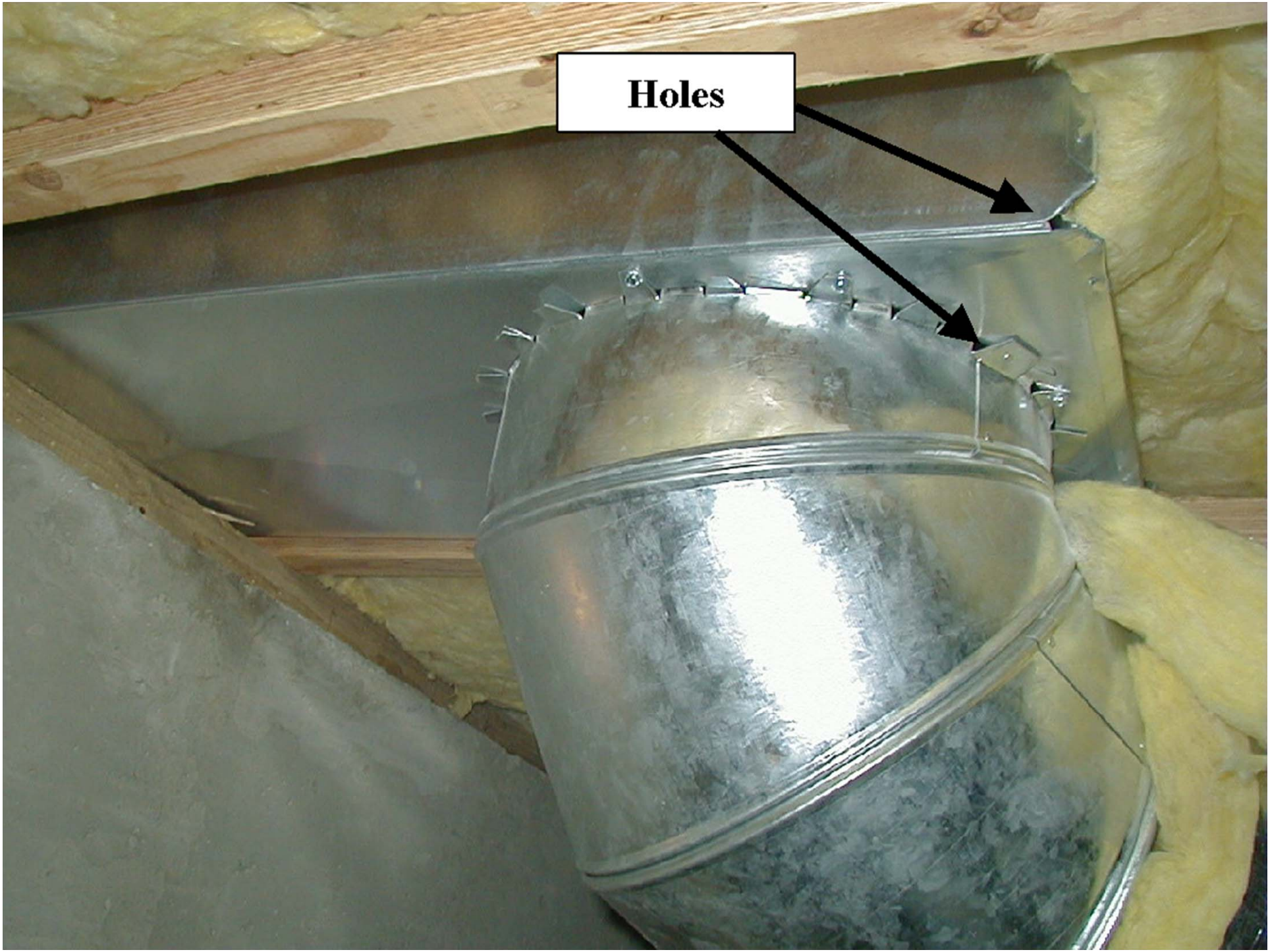
Sealing Ducts

- Is mastic required?
  - No
- Can tape be used?
  - Yes, if it meets the standards
- Will ducts be tested?
  - Yes, if in unconditioned space

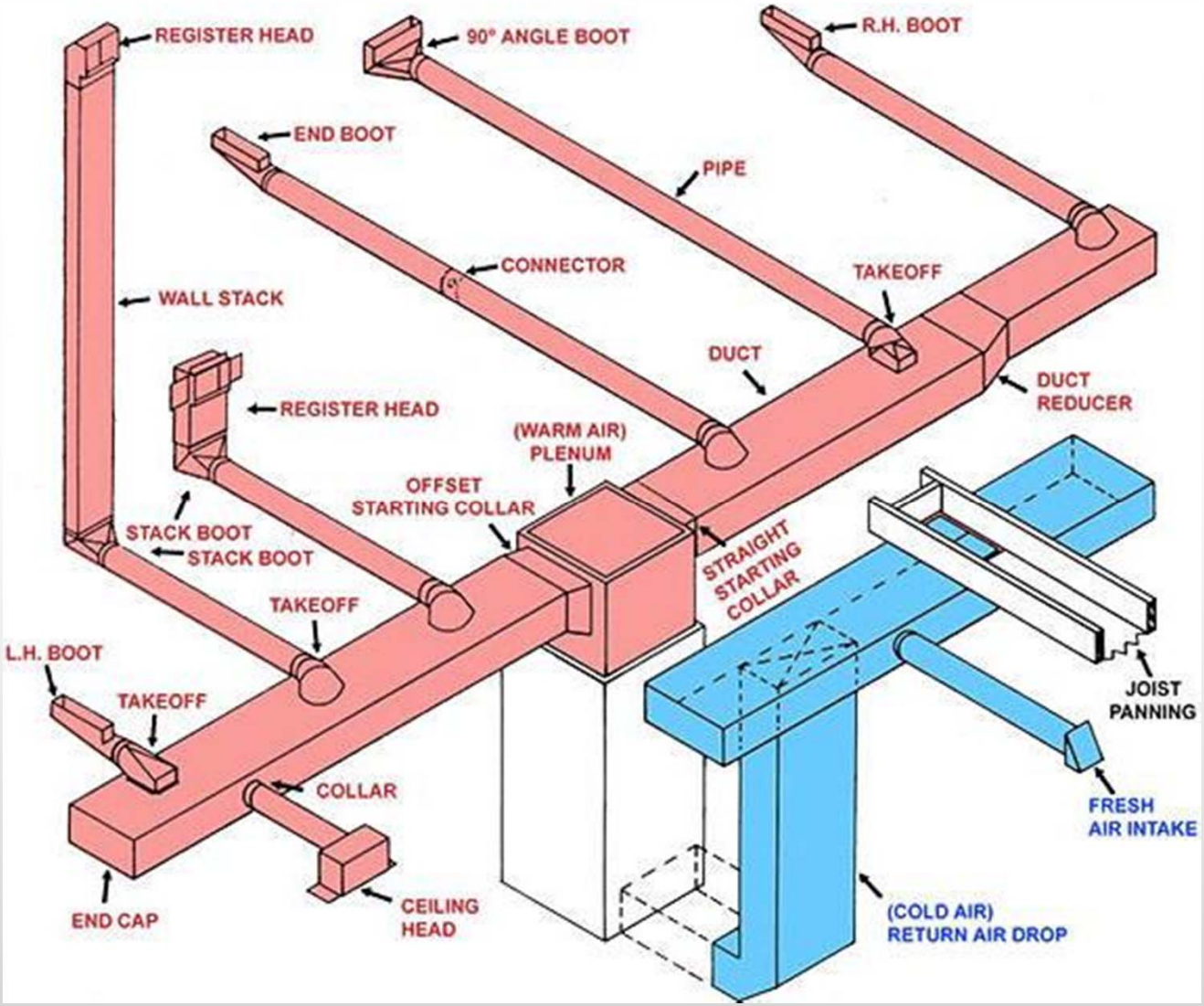
System Deficiencies

Hole at Dovetail Connection


Large Hole
Unsealed
Dovetail
Connections


Holes

Parts of the System



HVAC

HVAC INSTALLATION

JC 6: Mechanically fasten all metal ductwork with screws. Mechanically attach the inner liner of flexible ducts with nylon/ plastic straps and tighten with a manufacturer-approved tool.

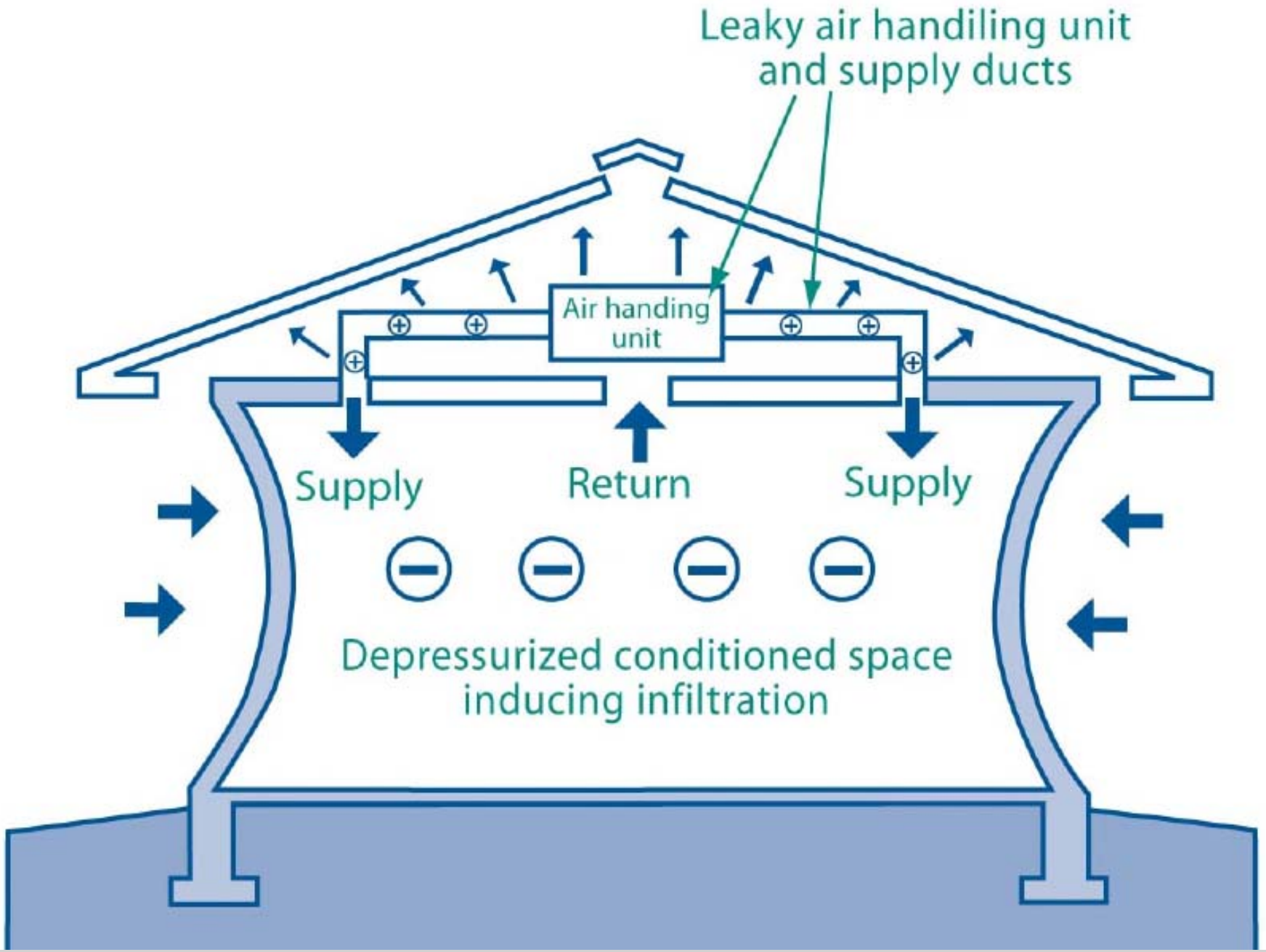
PROCESS

- How
- Why
- What to avoid


How?
Flex: straps
Metal: fasteners

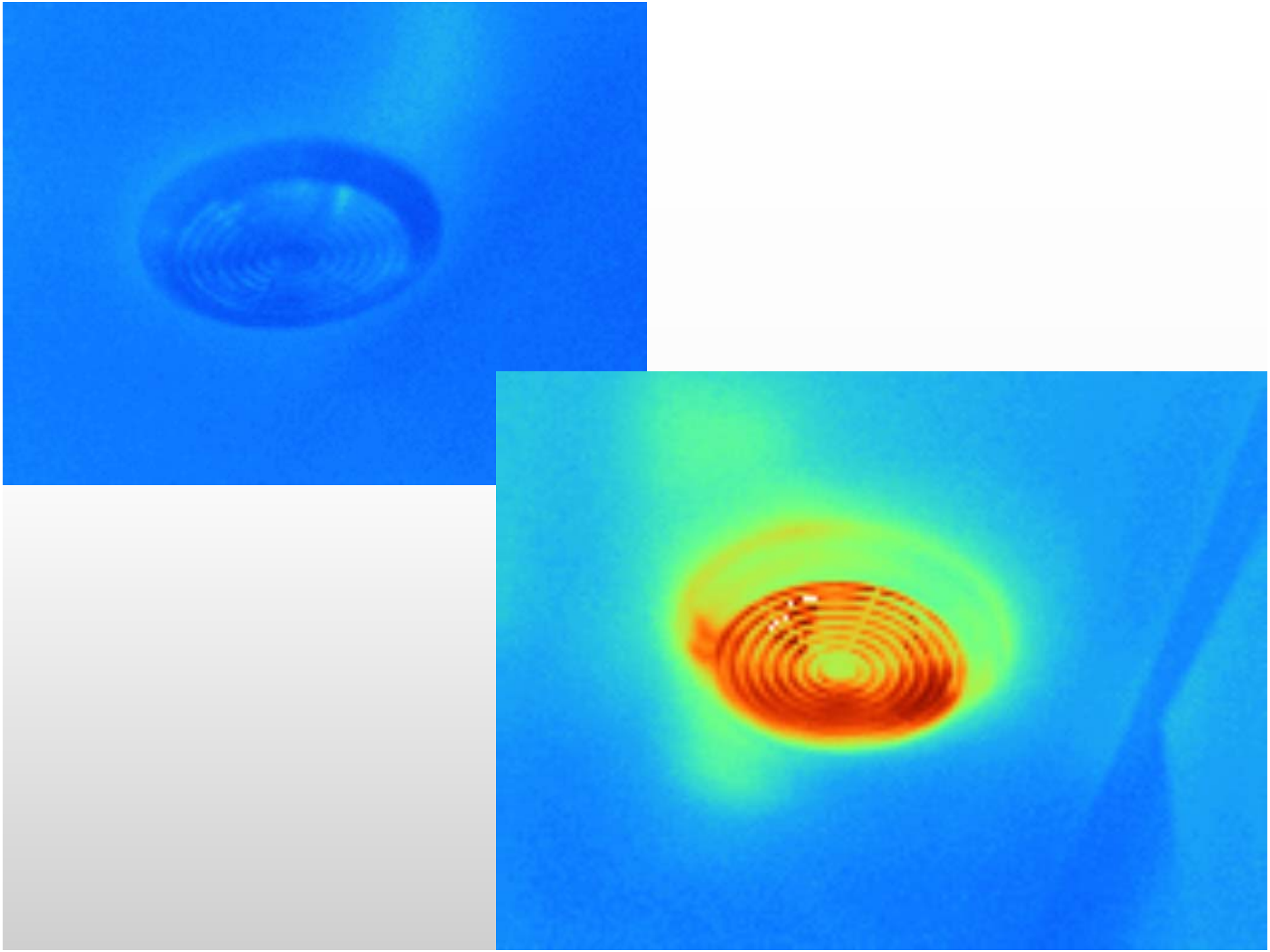
Why?

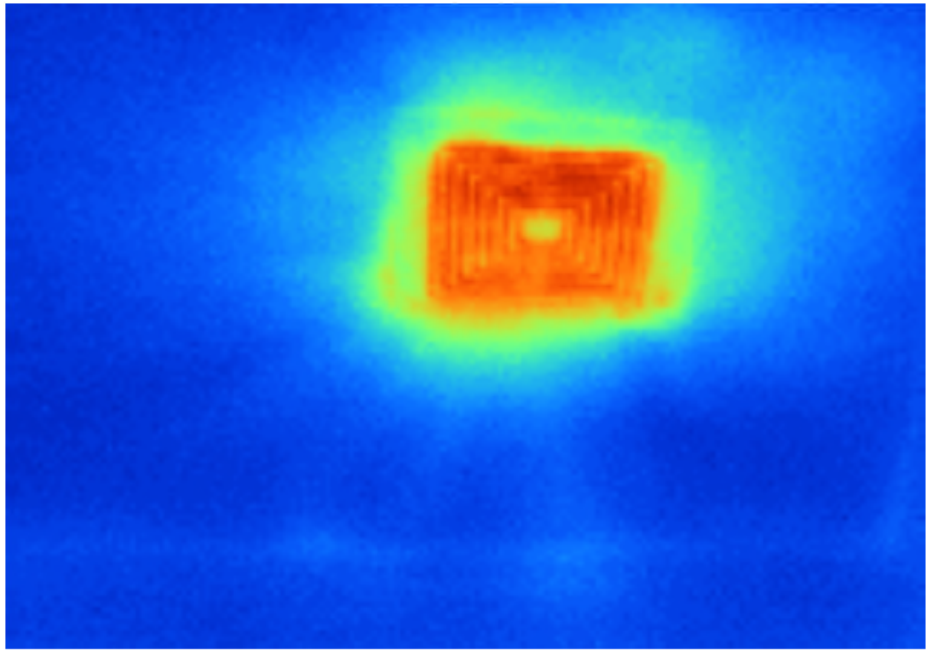

What are we cooling?


Leaky air handiling unit
and supply ducts
Air handing
unit
Supply
Return
Supply
Depressurized conditioned space
inducing infiltration

The tighter the building ….

The more important in-line backdraft dampers become





WARNING

HVAC

HVAC INSTALLATION

JC 7: Insulate all supply duct work in unconditioned attics to R-8. Insulate all other duct work outside of conditioned space to R-6. ….

PRODUCT

Excerpt:
a. Adopt and amend 2012 IRC Section R301.2.1., Part IV-Energy Conservation of the latest edition of the International Residential Code is hereby amended to require that supply and return ducts be insulated to a minimum of R-6.

- How
- Why
- What to avoid

HVAC

HVAC INSTALLATION

JC 8: Do not compress insulated flexible ducts more than the thickness of the insulation.

PERFORMANCE

- How
- Why
- What to avoid


How?
Planning
No squeezing!

HVAC

HVAC INSTALLATION

JC 9: Support flexible duct (including spot ventilation) at least every 10 feet and do not bend greater than 90°.

PROCESS

- How
- Why
- What to avoid

Code actually states that manufacturer's instructions shall be followed.

How?
More planning

Mechanical Ventilation: Local

(a.k.a. point source or spot ventilation)

How?
Exhaust ventilation

HVAC

HVAC INSTALLATION

JC 10: Install a whole-house ventilation strategy. Required ventilation rates shall also include adequate provisions for makeup air system supplies and/or exhausts as required in either the IRC or IMC.

PRODUCT

- How
- Why
- What to avoid

Ventilation

The goal of good ventilation

- **Take-out stale, moist, polluted air**
- Bring in fresh air
- Distribute throughout the house
- Quiet enough to run continuous
- Comfortable in all climate zones

Acceptable Indoor Air Quality Defined: (ASHRAE 62.2 - 2010)

Air toward which a substantial majority of occupants express no dissatisfaction with respect to odor and sensory irritation and in which there are not likely to be contaminants at concentrations that are known to pose a health risk

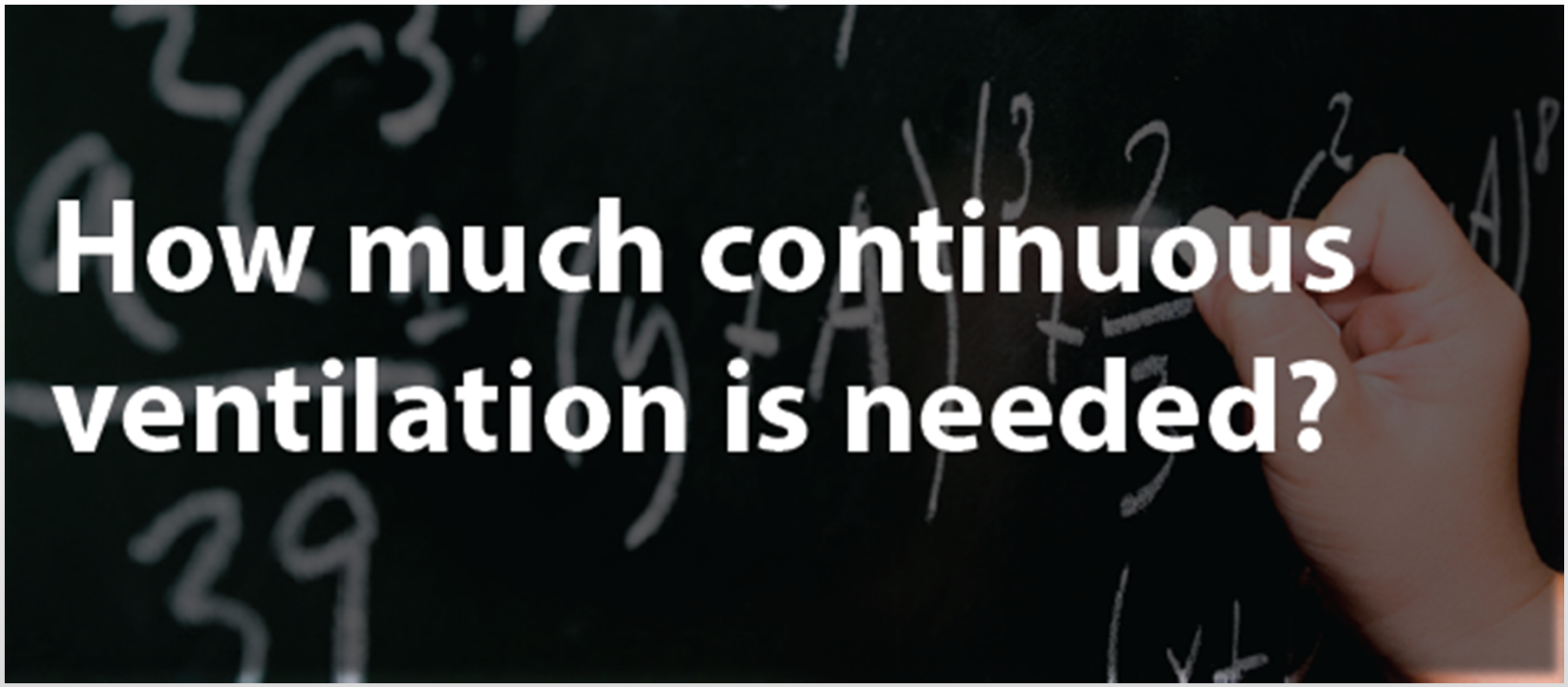

(# Bedrooms+1)(7.5CFM)
+(.01CFM)(House SF)=
Cont. Ventilation Rate

1432 square foot, 3 bedroom house

3BR+1= 4x7.5= 30cfm

1432x.01= 14cfm

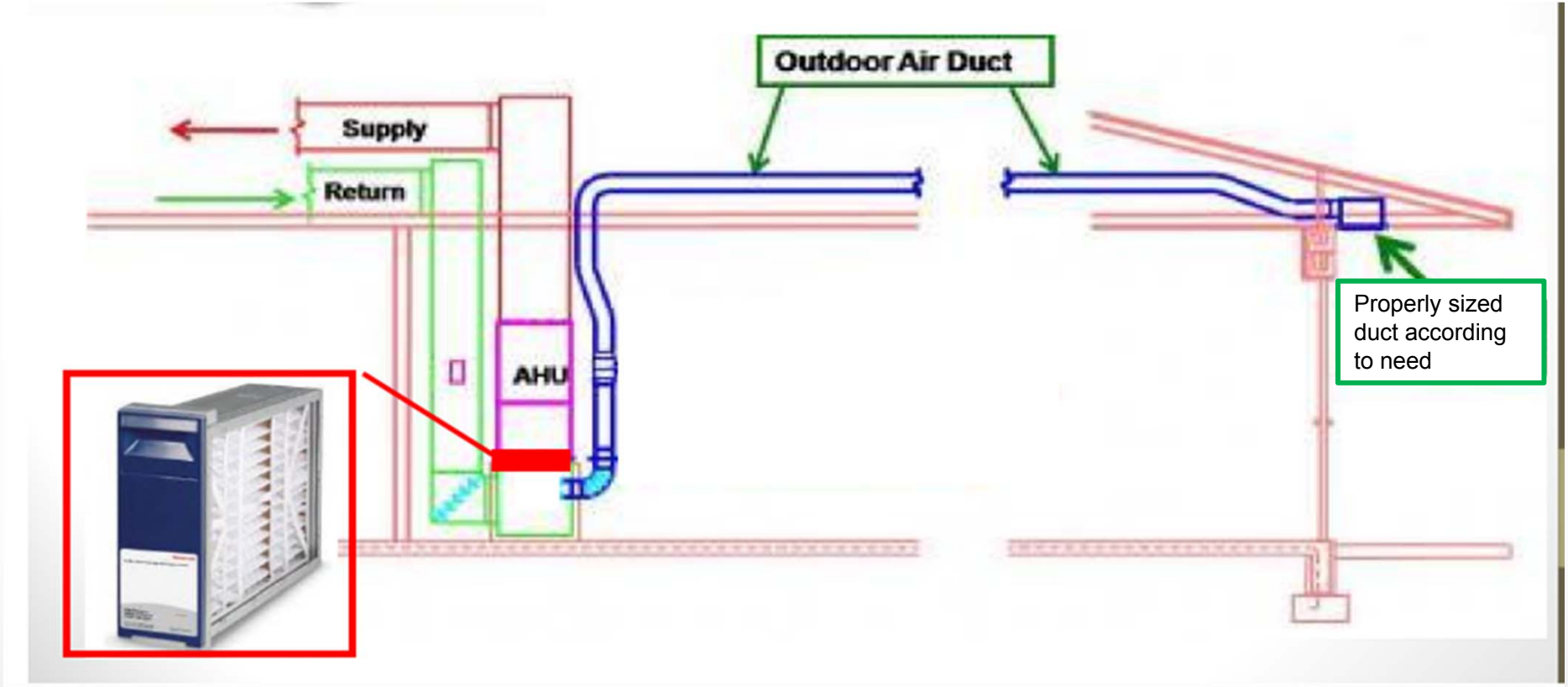
30 + 14 = 44cfm continuous



Pros and Cons of Various Mechanical Ventilation Systems

Ventilation Type	Pros	Cons
Exhaust Only (air is exhausted from the house with a fan)	• Easy to install • Simple method for spot ventilation • Inexpensive	• Negative pressure may cause backdrafting • Makeup air is from random sources • Removes heated or cooled air
Supply Only (air is supplied into the house with a fan)	• Does not interfere with combustion appliances • Positive pressures inhibit pollutants from entering • Delivers to important locations	• Does not remove indoor air pollutants at their source • Brings in hot or cold air or moisture from outside • Air circulation can feel drafty • Furnace fan runs more often unless fan has an ECM (variable-speed motor)
Balanced Air Exchange System (heat and energy recovery ventilators)	• No combustion impact • No induced infiltration/exfiltration • Can be regulated to optimize performance • Provides equal supply and exhaust air • Recovers up to 80% of the energy in air exchanged	• More complicated design considerations • Over ventilation unless the building is tight • Cost

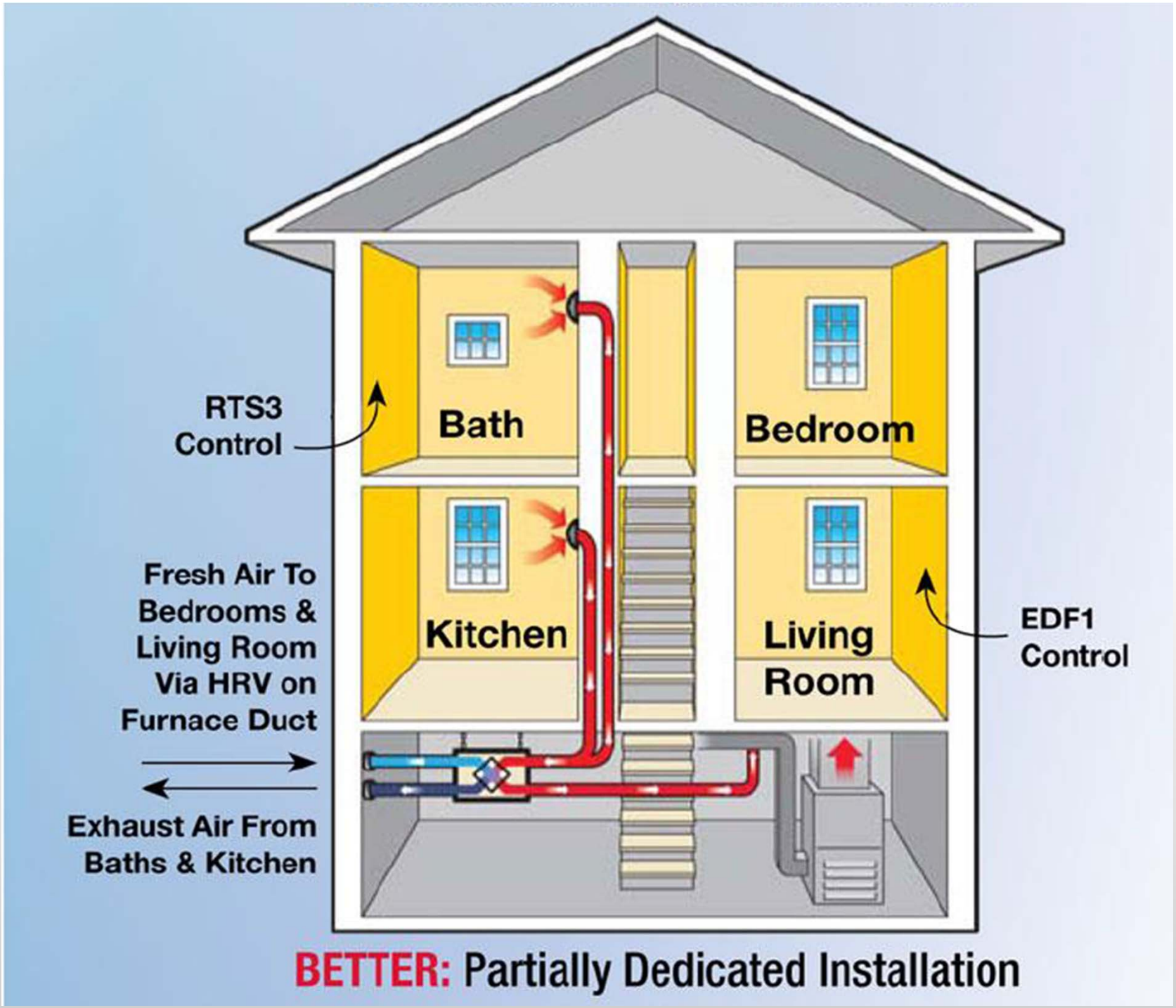
Whole House Mechanical Ventilation Options



How?
Supply ventilation / balanced


How?
Supply ventilation in central return

How?
Balanced ventilation?????


RTS3
Control
Bath
Bedroom
Kitchen
Living
Room
EDF1
Control
Fresh Air To
Bedrooms &
Living Room
Via HRV on
Furnace Duct
Exhaust Air From
Baths & Kitchen
BETTER: Partially Dedicated Installation

Why?

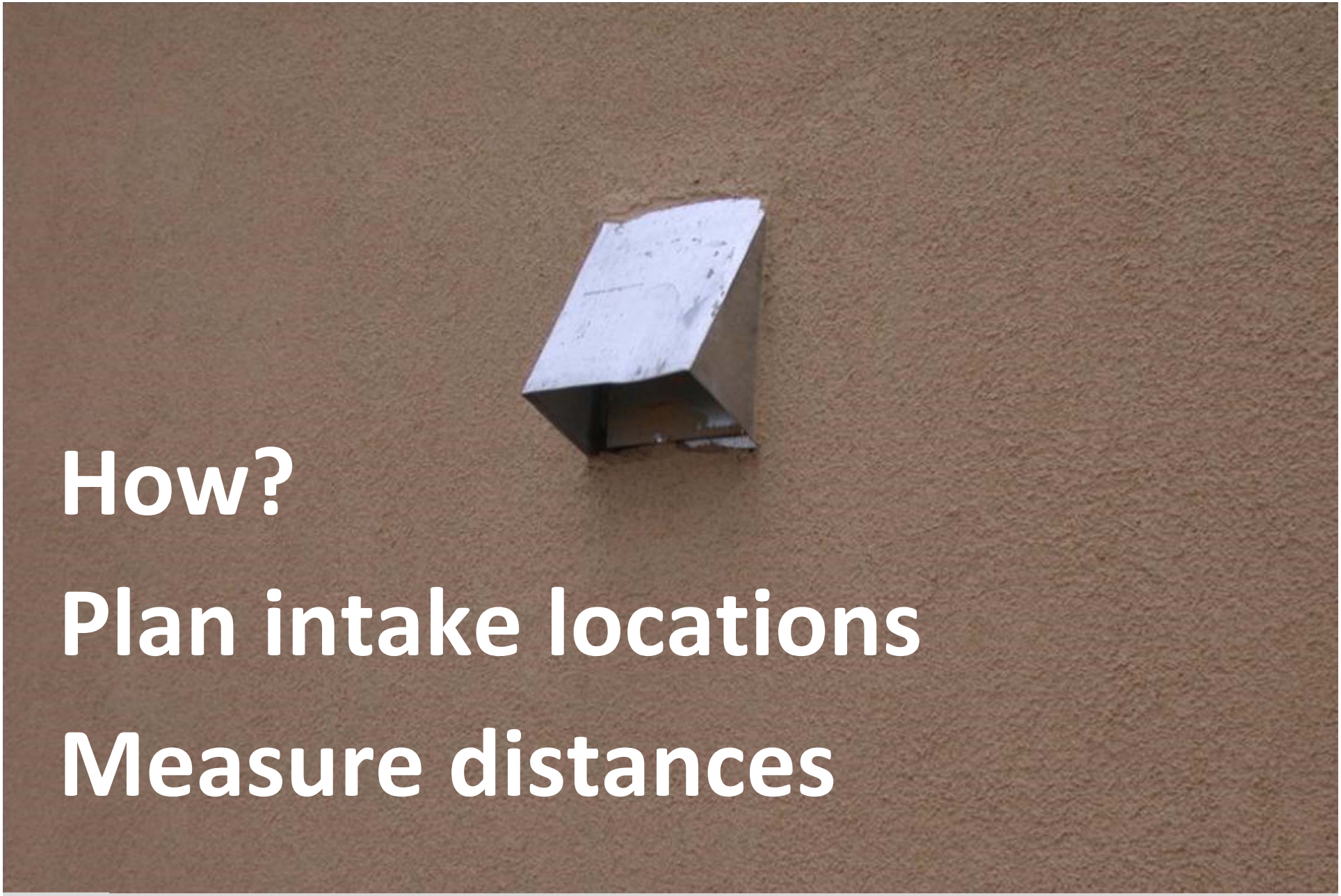
HVAC

HVAC INSTALLATION

JC 11: Install outside air ventilation intakes at least 10 feet from any exhaust vent or stack.

PRODUCT

- How
- Why
- What to avoid



How?

Plan intake locations

Measure distances

Why?

Combustion air? Bathroom air? Fresh!


Someone got confused…

HVAC

HVAC INSTALLATION

JC 12: Coordinate bath fan exhaust duct direction with electrical contractor.

- How
- Why
- What to avoid

PROCESS

How much air flow will there be?

HVAC

HVAC INSTALLATION

JC 13: Terminate exhaust ventilation duct work to the outside and install a screen over the termination.

- How
- Why
- What to avoid

PROCESS

PRODUCT

How?
Terminations: large opening, easy moving


Why?

HVAC

HVAC MAINTENANCE

JC 14: For heat pumps, install a heat strip outdoor temperature lockout that prevents supplemental heat operation and set it to the balance point.

PRODUCT

HVAC

HVAC MAINTENANCE

JC 15: For furnaces, install a programmable thermostat.

PRODUCT

HVAC

HVAC MAINTENANCE

JC 16: Install R-3 insulation around all HVAC piping that carries fluid above 105*F degrees or below 55*F degrees

PROCESS

Condensate drain lines?

PRODUCT