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A Field Perspective on Balanced Ventilation
HRV and ERV

2023 Energy Design Conference

By

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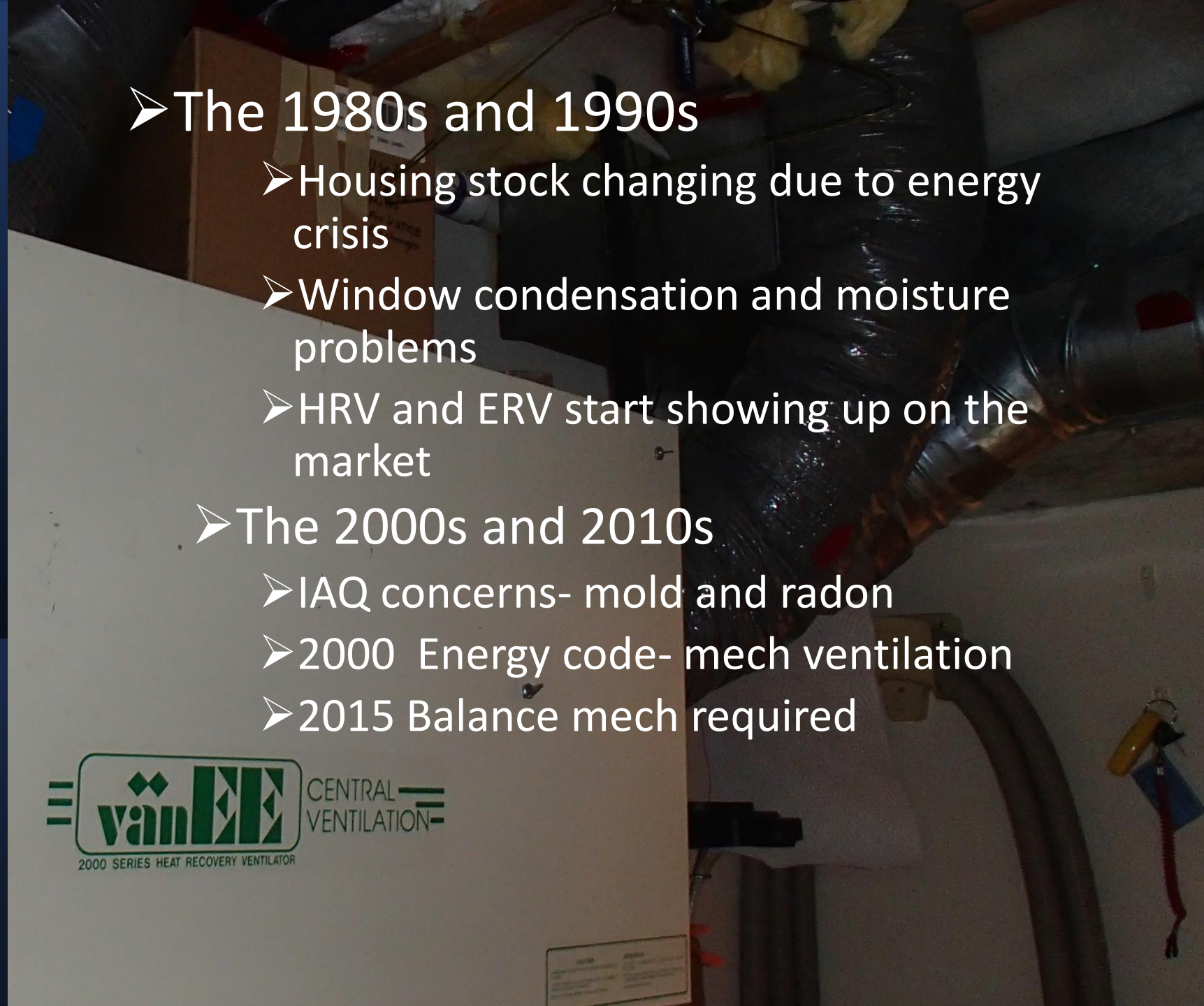
Session Overview

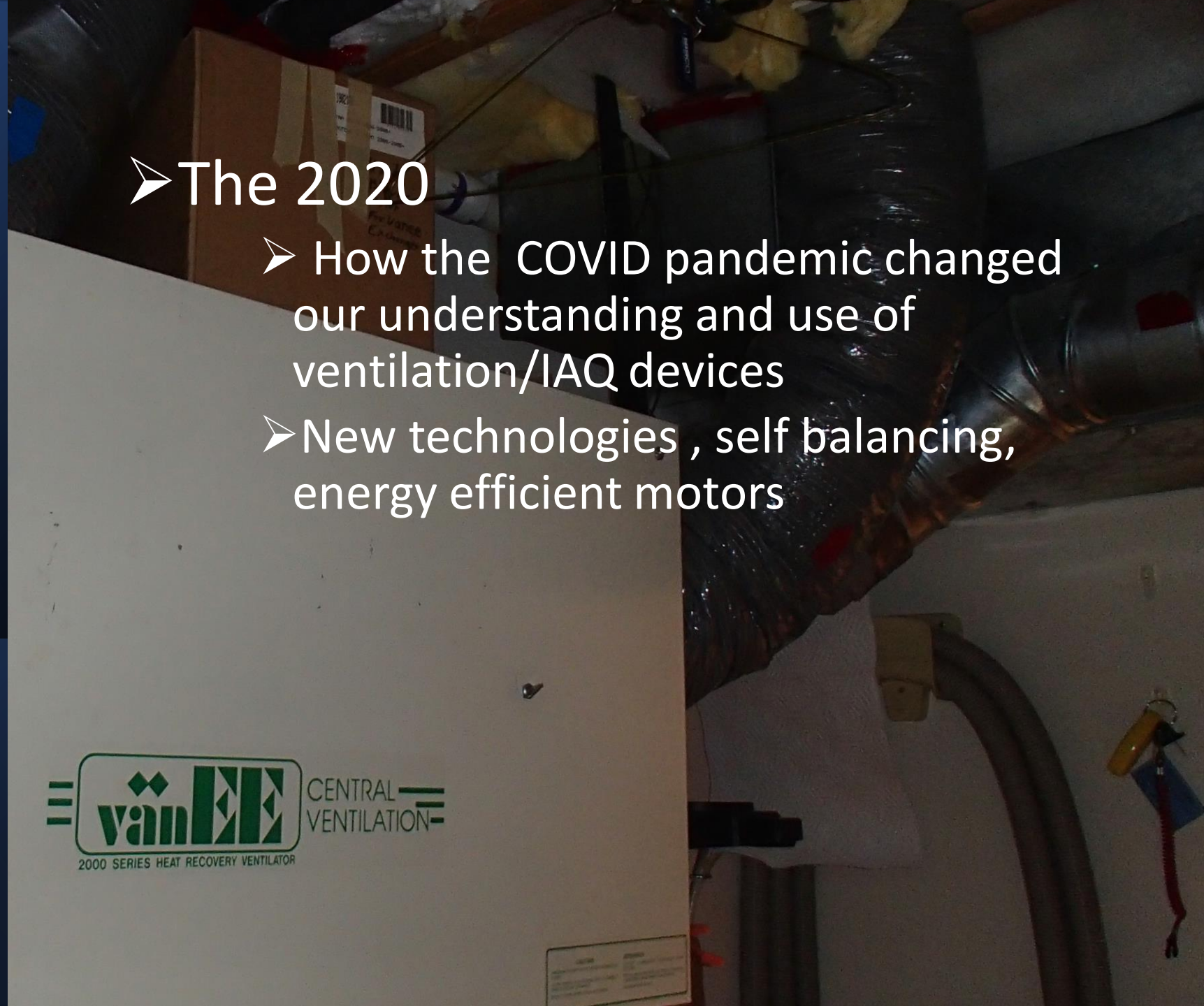
- This session is from a 35 year perspective on Balanced Ventilation on experience gained the Field
- Will follow language around 2015 Energy Code
- Discussion about balanced ventilation
  - What works
  - What does not work
- System types balanced
- Tools and methods on balancing
- Why dampers to the outside are so important
- How balanced ventilation effects IAQ
- Maintenance
- Check list service

Little History On Balanced Ventilation

- The 1980s and 1990s
  - Housing stock changing due to energy crisis
  - Window condensation and moisture problems
  - HRV and ERV start showing up on the market
- The 2000s and 2010s
  - IAQ concerns- mold and radon
  - 2000 Energy code- mech ventilation
  - 2015 Balance mech required

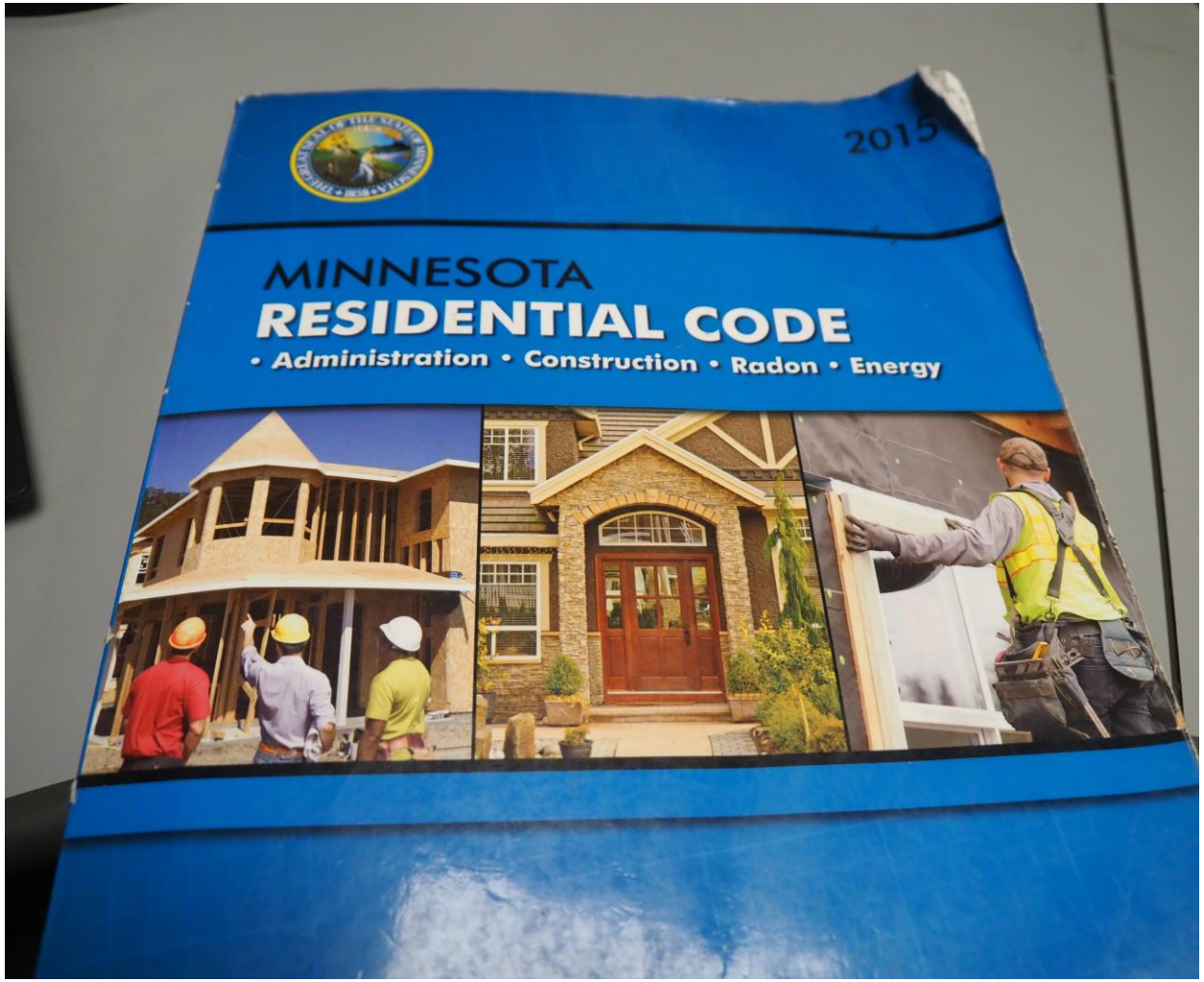


Little History On Balanced Ventilation



- The 2020
  - How the COVID pandemic changed our understanding and use of ventilation/IAQ devices
  - New technologies , self balancing, energy efficient motors

2015 MN Residential Energy Code R403.5 Mechanical Ventilation



Methods of Ventilation

- Continuous: Sometimes referred to as general, central, or whole-house ventilation. Should be quiet ,low volume, and continuous ventilation
- Intermittent: Sometimes referred to as spot, local, or source point ventilation. Commonly used in bathroom, kitchen, laundry, hobby, and home office. Should remove excessive moisture and pollutants quickly

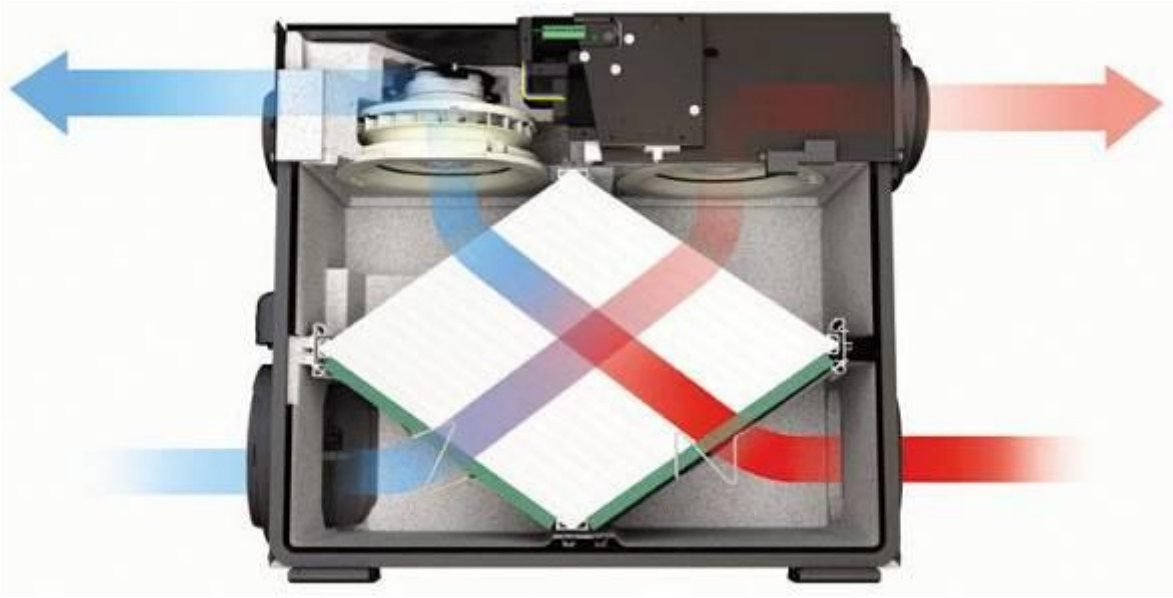
Ideally, an airtight home designed with both continuous and Intermittent ventilation will contribute to a healthy and comfortable living environment for the entire family

Ventilation Terminology

- CFM… Cubic feet per minute
- Sone… An internationally recognized measurement of sound output
- HRV… Heat recovery ventilator
- ERV… Energy recovery ventilator
- ACH… Air changes an hour
- P.A. … Pascal, a measurement in pressure
- HVI… Home Ventilation Institute

BALANCED VENTILATION- HOW DOES IT WORK

Stale air to outside



Fresh air to the home

Fresh air from outside

Stale air from the home

Difference Between Hrv And Erv

- HRV are by far most common type installed units
- HRV is best to reduce window condensation
- ERV will retain more humidity in home in the winter
- ERV will bring in less humidity in summer
- Climate, cost and application is the driving factor on what type is selected

New technologies

- Self balancing equipment
- Real time CFM read out
- More efficient blower motors
- Smaller design , footprint
- Easier installation
- Simple controls

New technology,

smaller , self balancing

Duct Design Hrv/Erv

- Source point
- General ventilation
- Return- return
- Return- supply
- Fully ducted

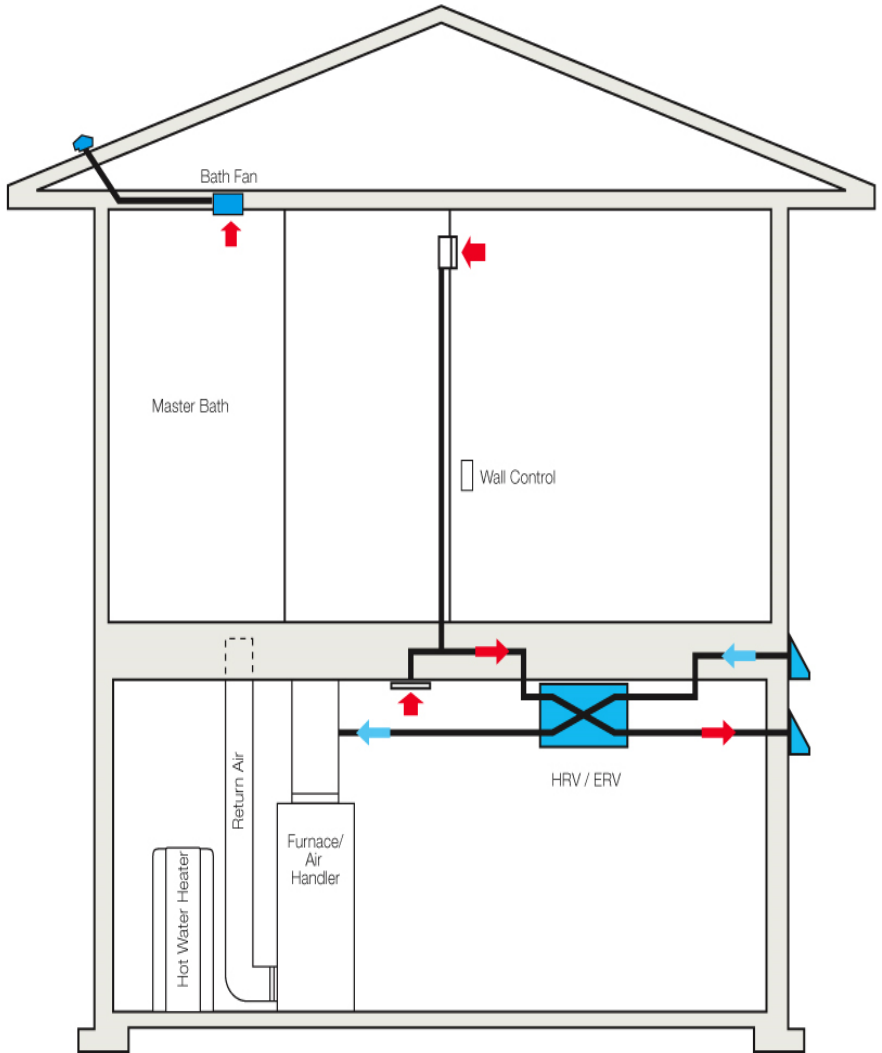
Source Point Design And Bath Fans

- DEPENDING ON DUCT LENGTH , TYPE AND SIZE OF THE BATH ROOM

ONE MAY USE HRV/ERV AS BATHROOM EXHAUST SYSTEM… 5 TO 6 ACH. NO BATH FAN NEEDED

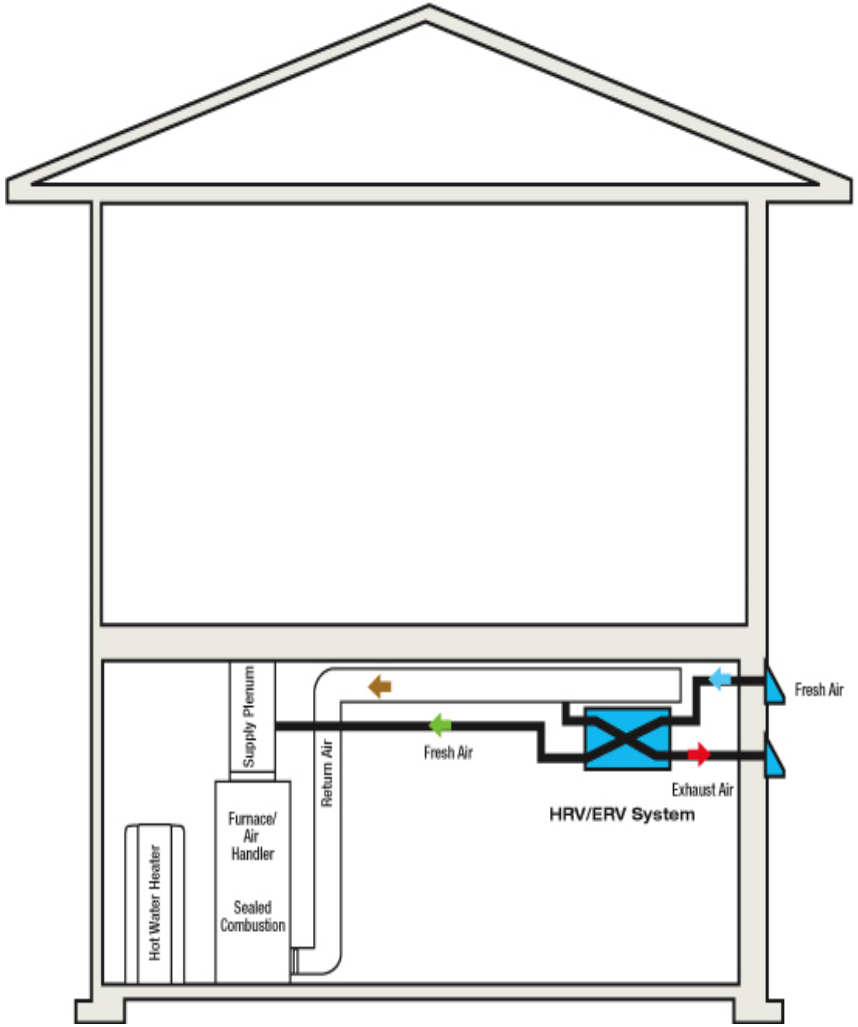
- ZONING OF HRV/ERV IS AN OPTION
- AN EXHAUST POINT FROM HRV/ERV AND BATH FAN IN THE SAME BATHROOM IS AN OPTION

GENERAL DUCT DESIGN



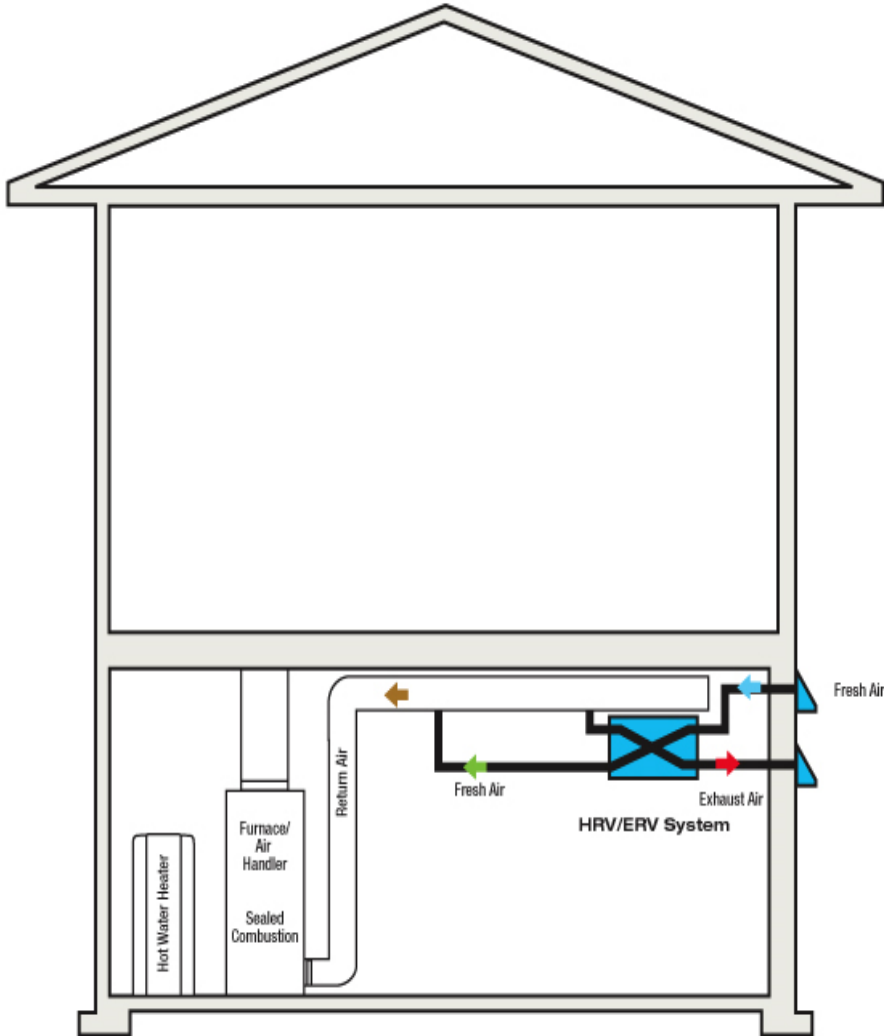
- One exhaust point per floor
- Air handler doesn't need to run full time
- Combination of bath fans & HRV/ERV
- Cost effective in new houses

RETURN – SUPPLY DUCT DESIGN



- Great for existing houses
- Air handler doesn't need to run full time
- Simple, quick installation
- Cost effective in new houses
- Most common installation

RETURN-RETURN DUCT DESIGN



- Great for existing houses
- Air handler runs to optimize filtration & fresh air distribution – great for allergy sufferers
- Simple, quick installation
- Cost effective in new houses

Findings From The Field

- What works
- What does not work

What does work

- Good design
- Read manual
- Follow current codes
- Verify operation
- Explain how system works
- Do maintenance
- Simple controls

BALANCED VENTILATION SYSTEM CHECK LIST

- ✓ Size air flow properly
- ✓ Size and seal duct work
- ✓ Choose rated / labeled product
- ✓ Use good controls
- ✓ Integrate with other systems
- ✓ Test, measure, balance
- ✓ Put the V back in HVAC

EQUIPMENT SELECTION

- Size you HRV/ERV or Balanced to meet TVR
- Size you HRV/ERV or Balanced to meet just CVR

- Exception under R403.5.5 Balanced and HRV/ERV systems

“ The balanced system and HRV/ERV system may include exhaust fans to meet the intermittent ventilation rate. Surface mounted fans shall have a maximum 1.0 sone per HVI Standard 915”

Simple Master Code

Integrated control and quick wiring connect

What Does Not Work

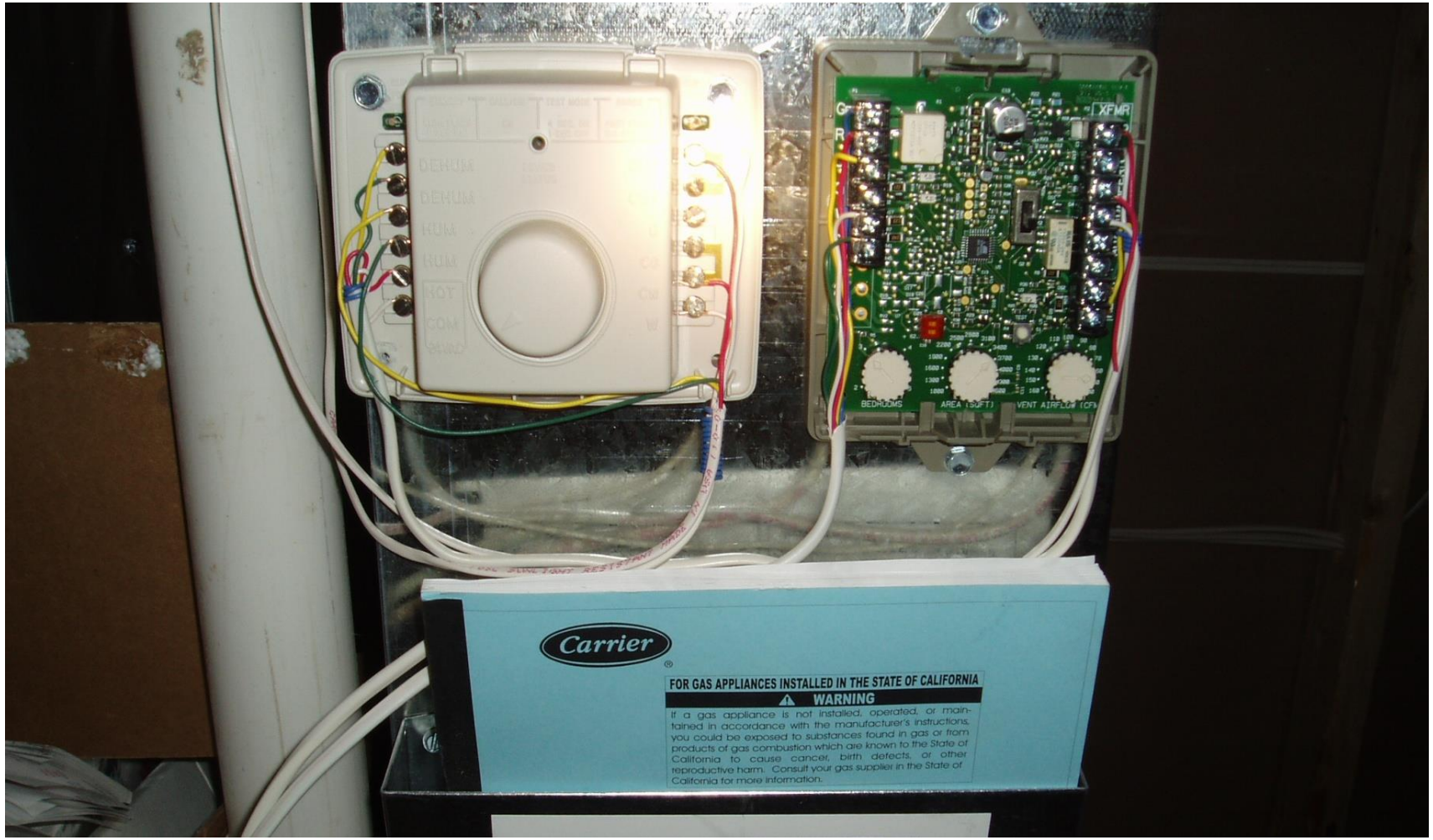
In the next several slides we will discuss what are common call back and failure issues, we'll break these down into these categories

1. Equipment selection
2. Poor or incorrect installation details
3. Call backs and complaints, summer and winter RH%, building pressure, AC does not work
4. Confusing controls

Inlet Damper In The Return Air

Central Multi Point Exhaust Inline Fan

New Ventilation Controls, Can Be Confusing

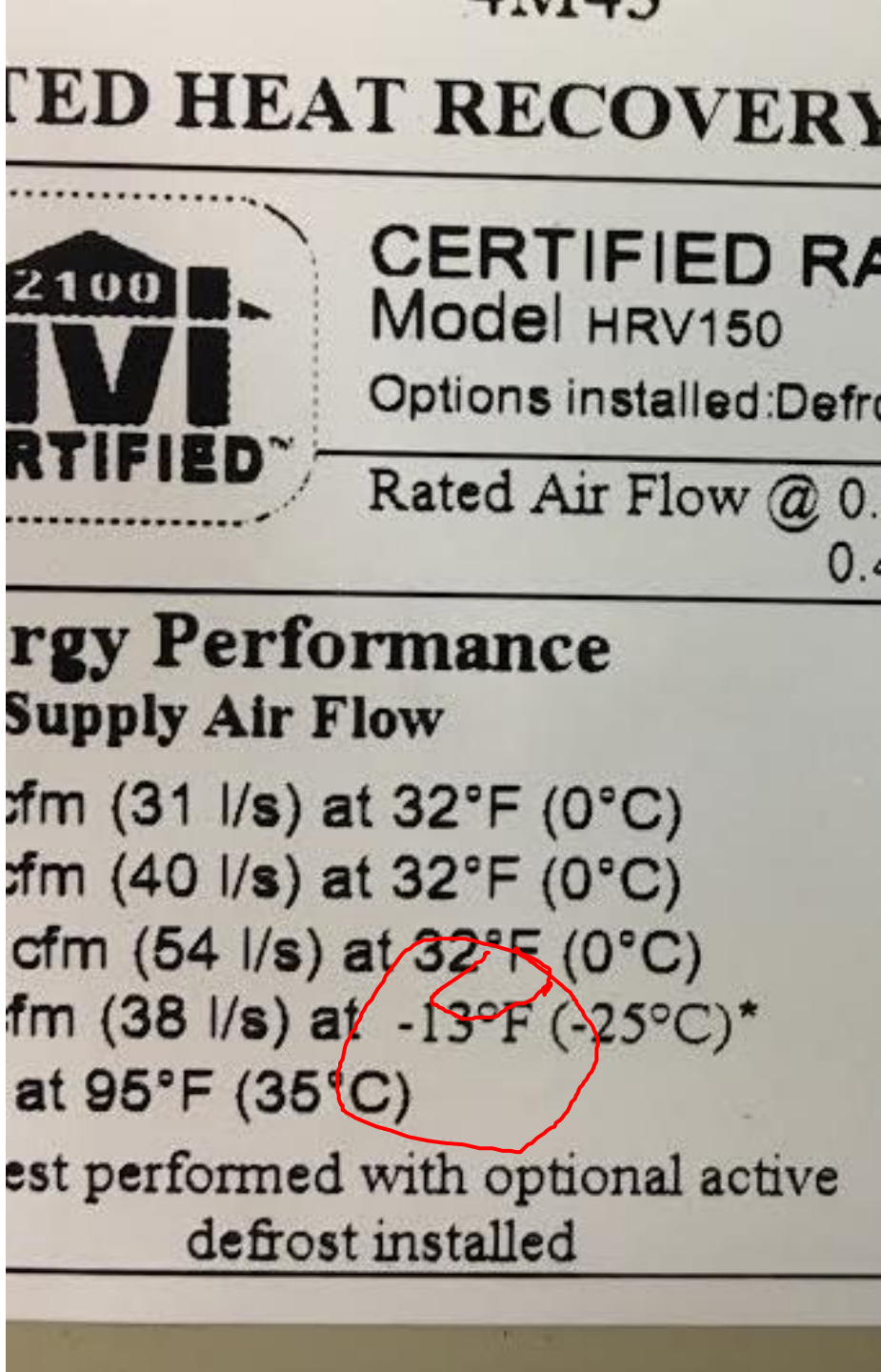


1.Improper Equipment Selection-Code Violation

- 32 DEGREE machines
- NO DAMPERS

R403.5.5 Balanced And HRV/ERV Systems

- Balanced with in 10% air flow
- HVI tested to – 13 Fahrenheit or certified by engineer
- Total and continuous shall be balanced or exception



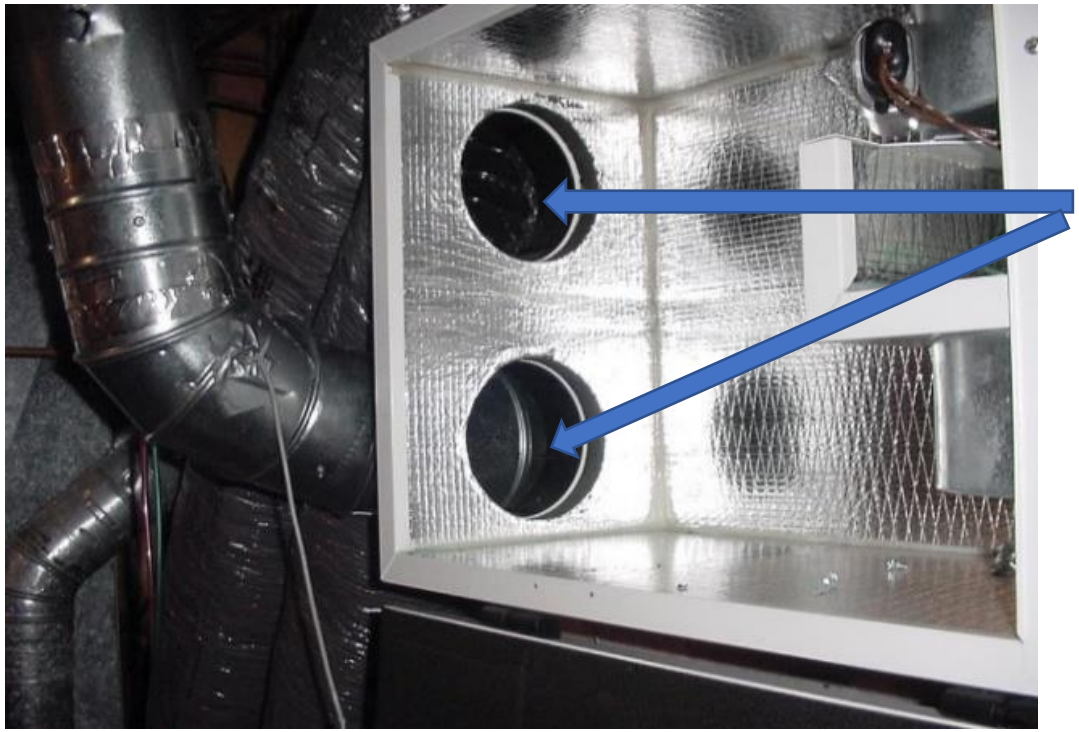
R403.5.10 Dampers

- Ventilation system supply and exhaust shall have accessible backflow dampers to minimize flow to the outside when system is off
- DAMPERS ARE CITED THREE TIMES IN THIS SECTION OF THE CODE
- R403.5
- R403.5.10
- R403.5.14

- AT THIS TIME EQUIPMENT AND SYSTEM THAT ARE BEING INSTALLED THAT DOES NOT MEET THESE REQUIREMENTS

R403.5.10 Dampers

- The mechanical ventilation system supply and exhaust ducts shall be provide with accessible backflow dampers to minimize flow to or from the outdoors when the ventilation system is off.



NO DAMPERS

Must Have External Dampers if Internal Dampers are not Provided with Unit

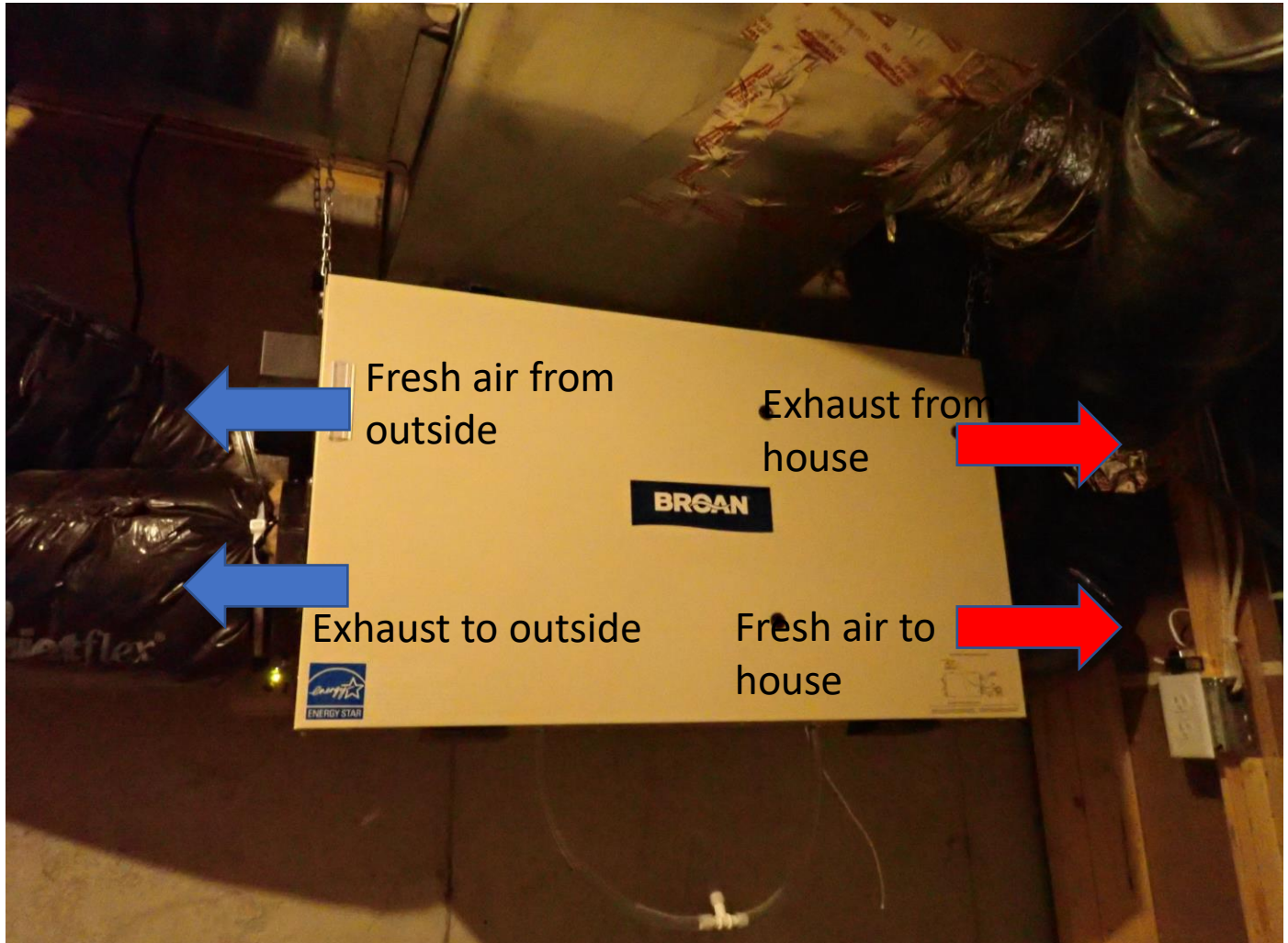
- Backdraft Damper


VANEE EX.
Ex
FRESH AIR INTAKE ?!#

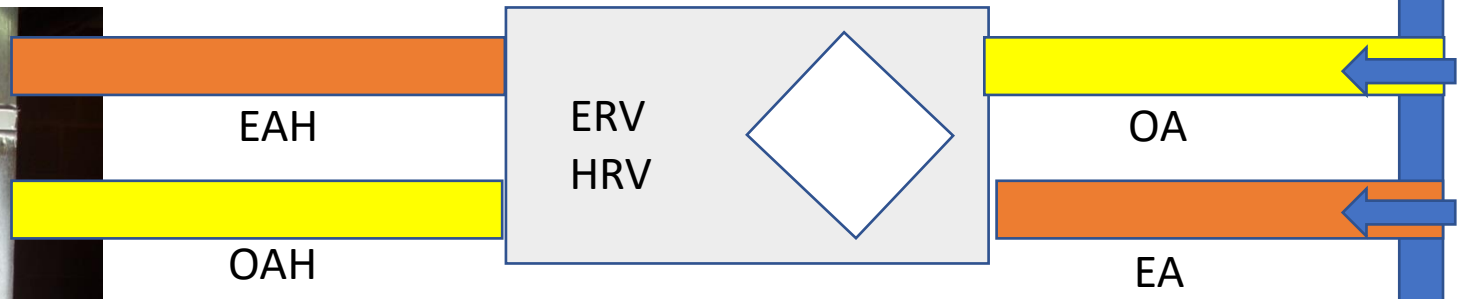
2. Poor Or Incorrect Installation Details

- Duct placement on hoods or ports incorrect
- Insulated flex ducted not sealed or not covering tin duct on ducts to the outside
- Hoods to close to grade
- Unit or ducts do not have isolation for vibration
- Control not wired correctly
- Poor duct sizing and installation

Make Sure Proper Duct Placement –ducts are installed on correct ports



Return- Return Duct Design, No Dampers



- SEASON - WINTER
- CALL FOR HEATING OR FAN ON
- ERV OR HRV IS OFF
- ACTUAL MEASURED FLOWS 6 INCH DUCT
  1. OUTSIDE AIR TO HOUSE DUCT, IS NOW SUCKING IN 50 TO 80 CFM OF 10 DEGREE AIR AT 5% RH
  2. EXHAUST AIR TO OUTSIDE DUCT IS ALSO IN REVERSE FLOW IT IS SUCKING IN 50 to 80 CFM OF 10 DEGREE AIR AT 5% RH

APPLY THIS TO SUMMER OPERATION #?!

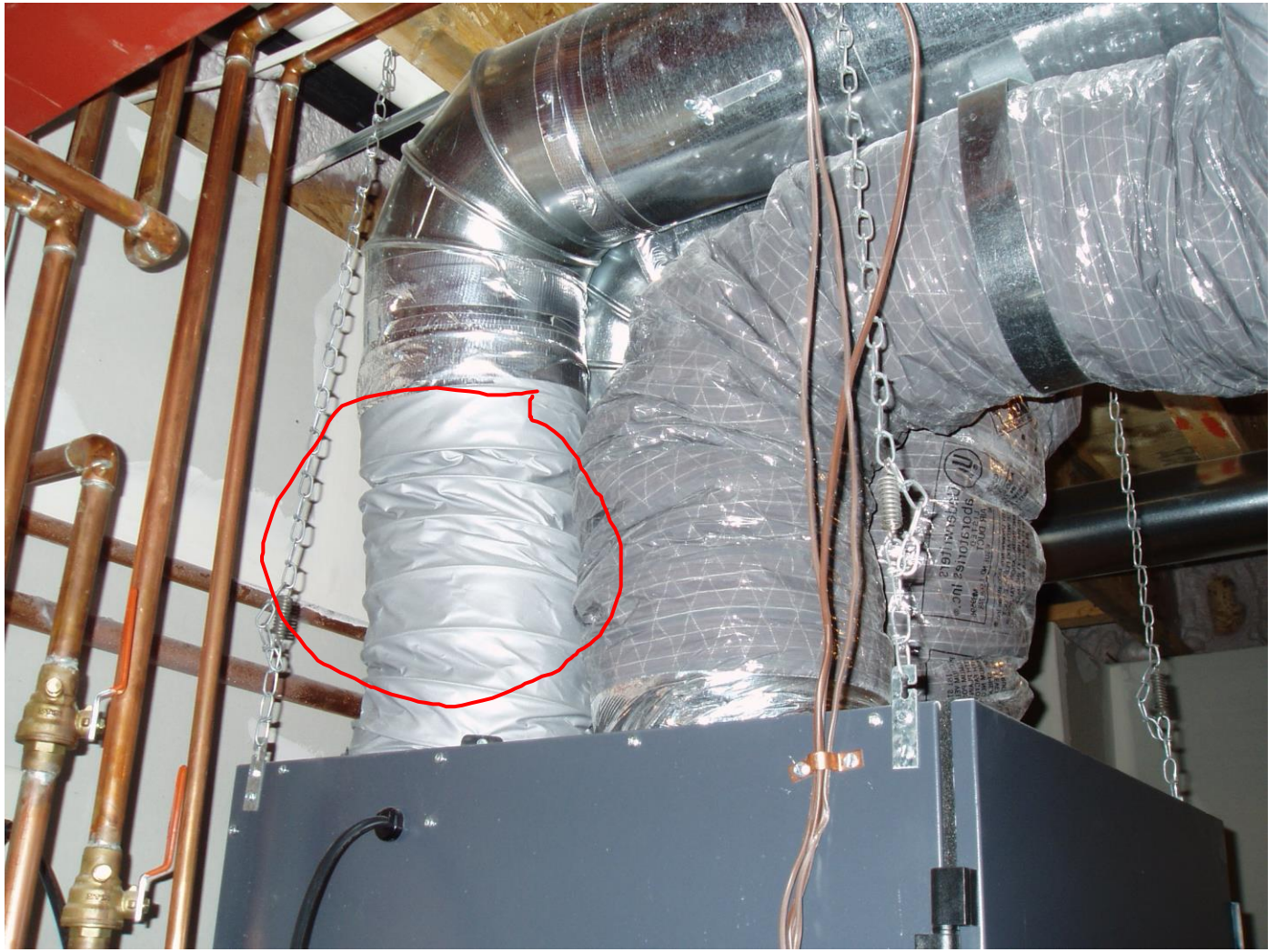
To Close To Grade


Shelter Supply

R 403.5.13 Noise And Vibration

- Isolation duct connection shall be used to mitigate noise transmission

Vibration Flex- Duct Detail



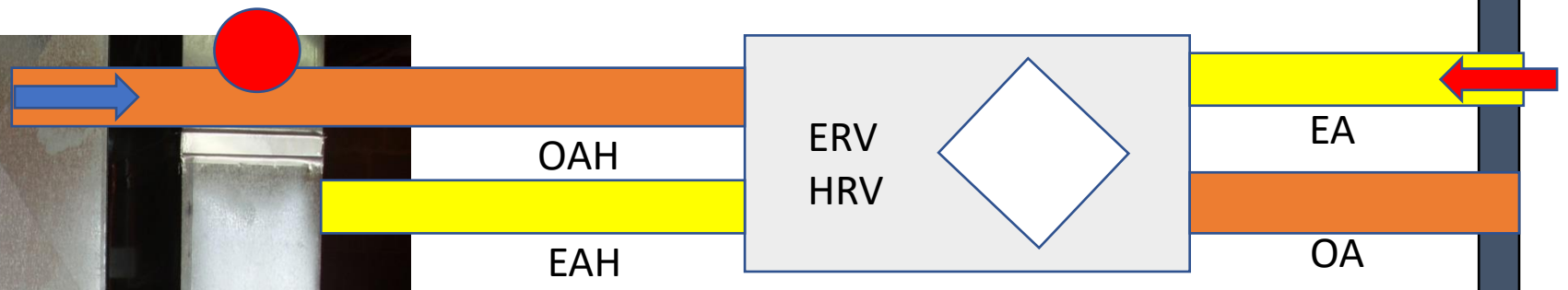
3.Call Backs And Complaints

- Humidity
  - Winter – to high or to low
  - Summer –to high
- Noise
- Comfort and Poor IAQ
- How to operate and maintain

Window Condensation

- LIFESTYLE ?
- VENTILATION ?
- HUMIDIFIER OPERATION
- TEMP. OUTSIDE AND INSIDE ?
- RH% RELATIVE HUMIDITY?

Supply- Return Duct Design, No Dampers



- SEASON -SUMMER
- CALL FOR COOLING OR FAN ON
- ERV OR HRV IS OFF
- ACTUAL MEASURED FLOWS 6 INCH DUCT
  1. OUTSIDE AIR TO HOUSE DUCT, IS NOW REVERSE IN FLOW AND IS BLOWING 110 CFM OF 50 DEGREE TO THE OUTSIDE
  2. EXHAUST AIR TO OUTSIDE DUCT IS ALSO IN REVERSE FLOW IT IS SUCKING IN 65 CFM OF 85 DEGREE 58 DEGREE DEWPOINT FROM OUTSIDE

APPLY THIS TO WINTER OPERATION #?!

Fresh air intake needs to be fully covered with insulation

Noise- Vibration Into Return Of Furnace

R403.5.6.1 Air Distribution/ Circulation

- 0.075 cfm per conditioned floor area
- No less then 40 degrees at grill

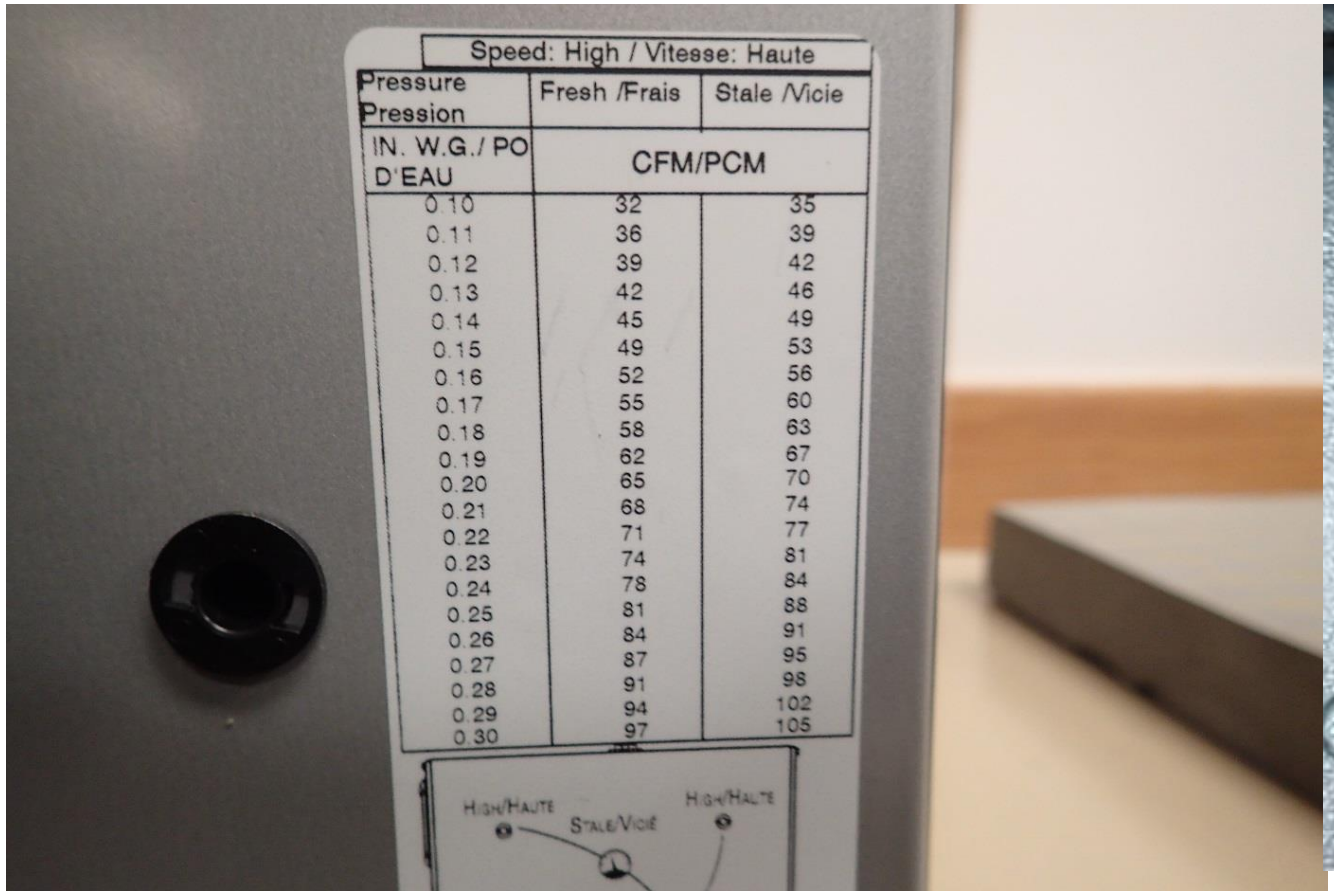
Balancing R403.5.6.1.3 Airflow Verification

- Consequence if you don’t balance your system
- Building pressure
- Method of testing air flow

Tools to measure air flow

- integrated pressure taps built into the ventilator
- Flow stations
- Pitot tube
- Annmoeter
- Airflow should be measured at unit
- New technology equipment will automatically balance , self balance

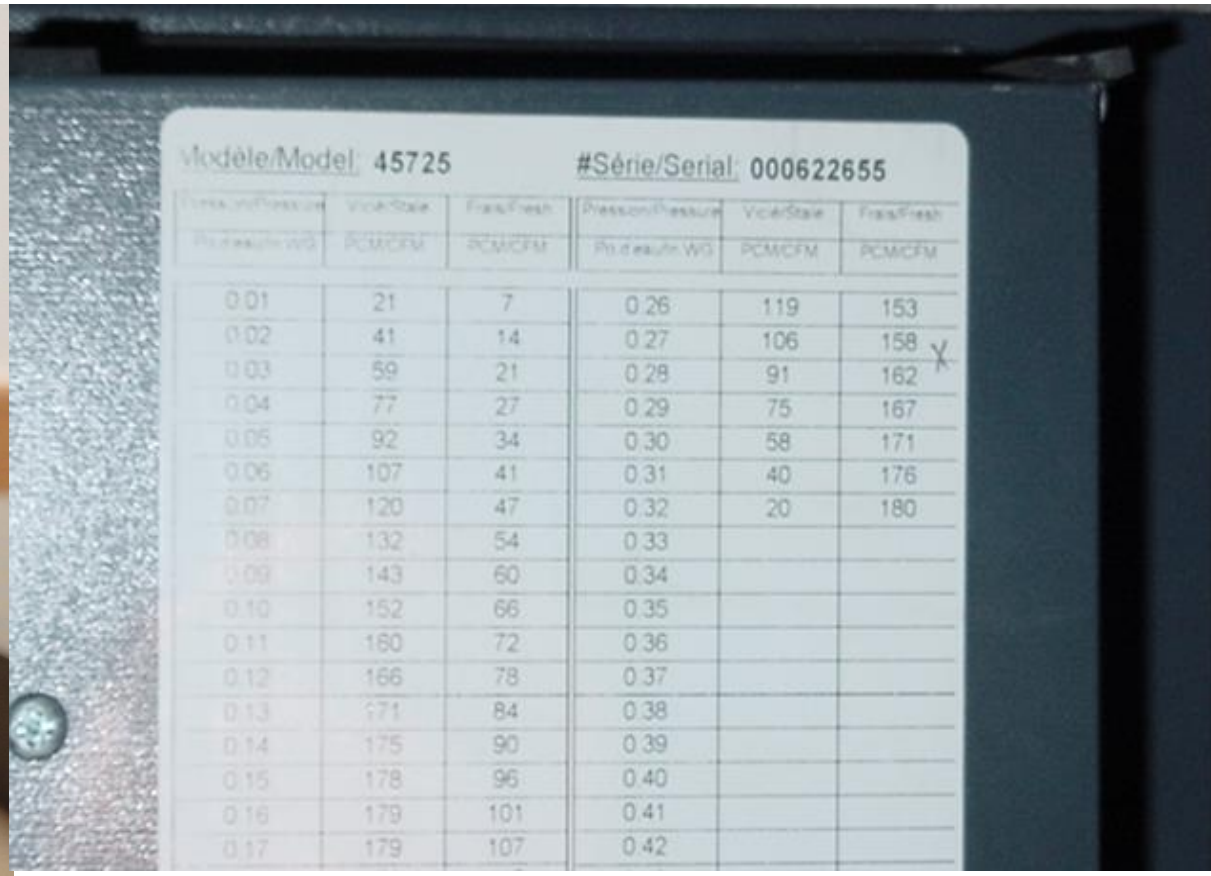
CFM Balancing Stickers On Unit



Speed: High / Vitesse: Haute

Pressure Pression	Fresh /Frais	Stale /Vicie
IN. W.G./ PO D'EAU	CFM/PCM	
0.10	32	35
0.11	36	39
0.12	39	42
0.13	42	46
0.14	45	49
0.15	49	53
0.16	52	56
0.17	55	60
0.18	58	63
0.19	62	67
0.20	65	70
0.21	68	74
0.22	71	77
0.23	74	81
0.24	78	84
0.25	81	88
0.26	84	91
0.27	87	95
0.28	91	98
0.29	94	102
0.30	97	105

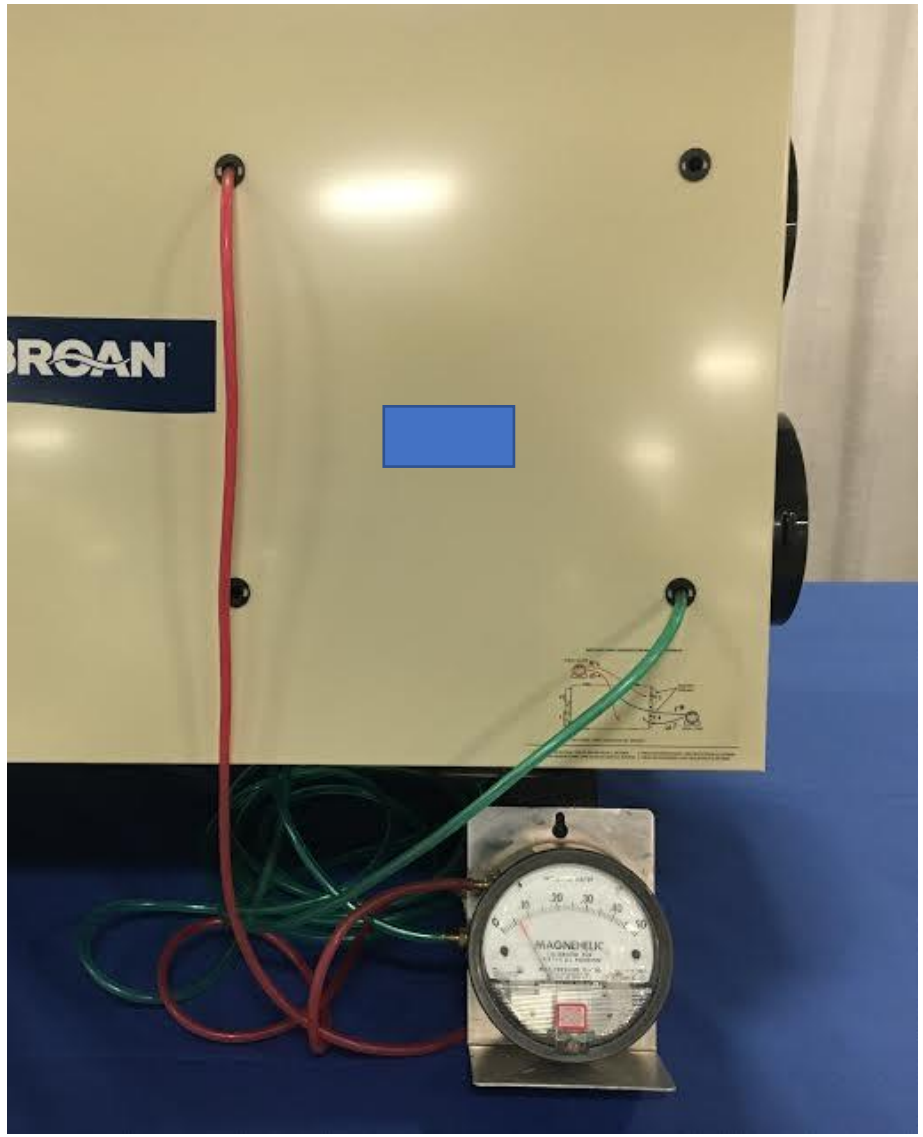
HIGH/HAUTE STALE/VICIÉ HIGH/HAUTE

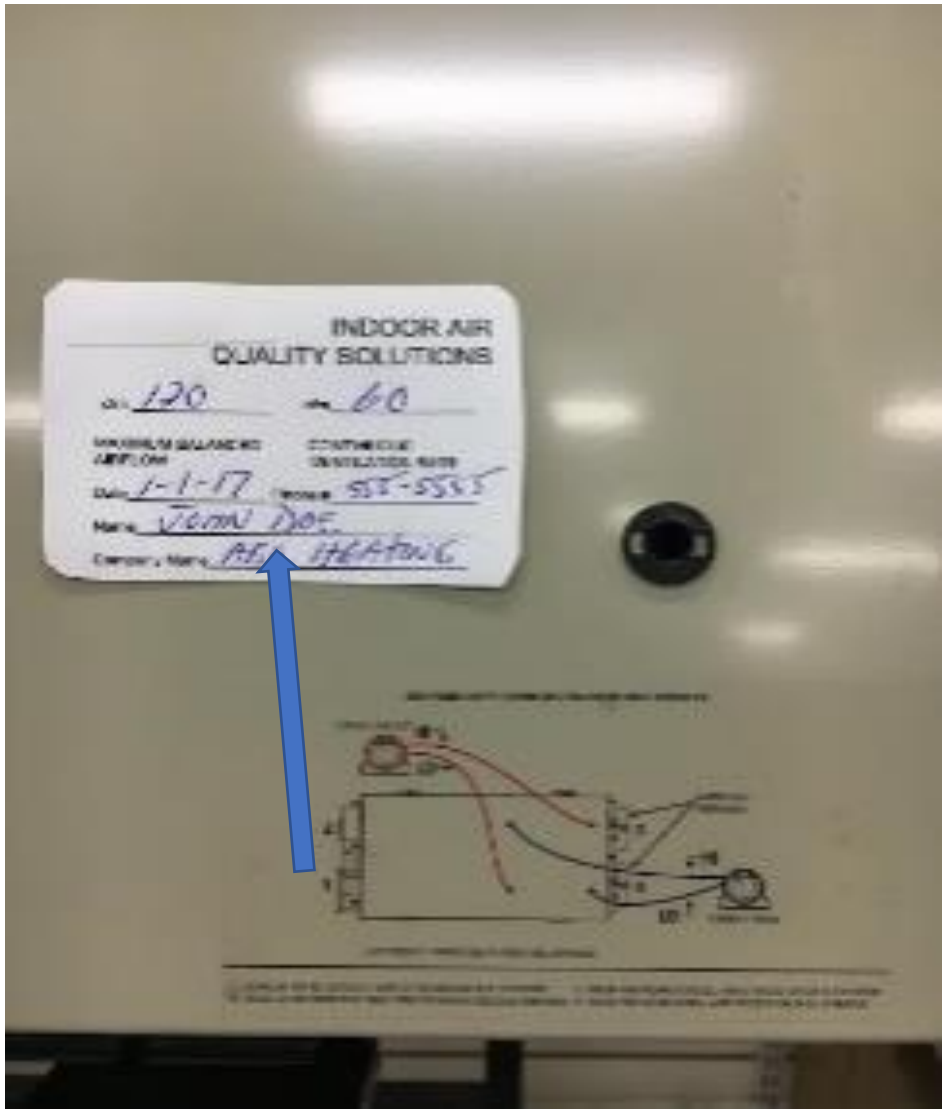


Modèle/Model: 45725 #Série/Serial: 000622655

0.01	21	7	0.26	119	153
0.02	41	14	0.27	106	158
0.03	59	21	0.28	91	162
0.04	77	27	0.29	75	167
0.05	92	34	0.30	58	171
0.06	107	41	0.31	40	176
0.07	120	47	0.32	20	180
0.08	132	54	0.33		
0.09	143	60	0.34		
0.10	152	66	0.35		
0.11	160	72	0.36		
0.12	166	78	0.37		
0.13	171	84	0.38		
0.14	175	90	0.39		
0.15	178	96	0.40		
0.16	179	101	0.41		
0.17	179	107	0.42		

Pressure tap measurement with Magnahelic gauge



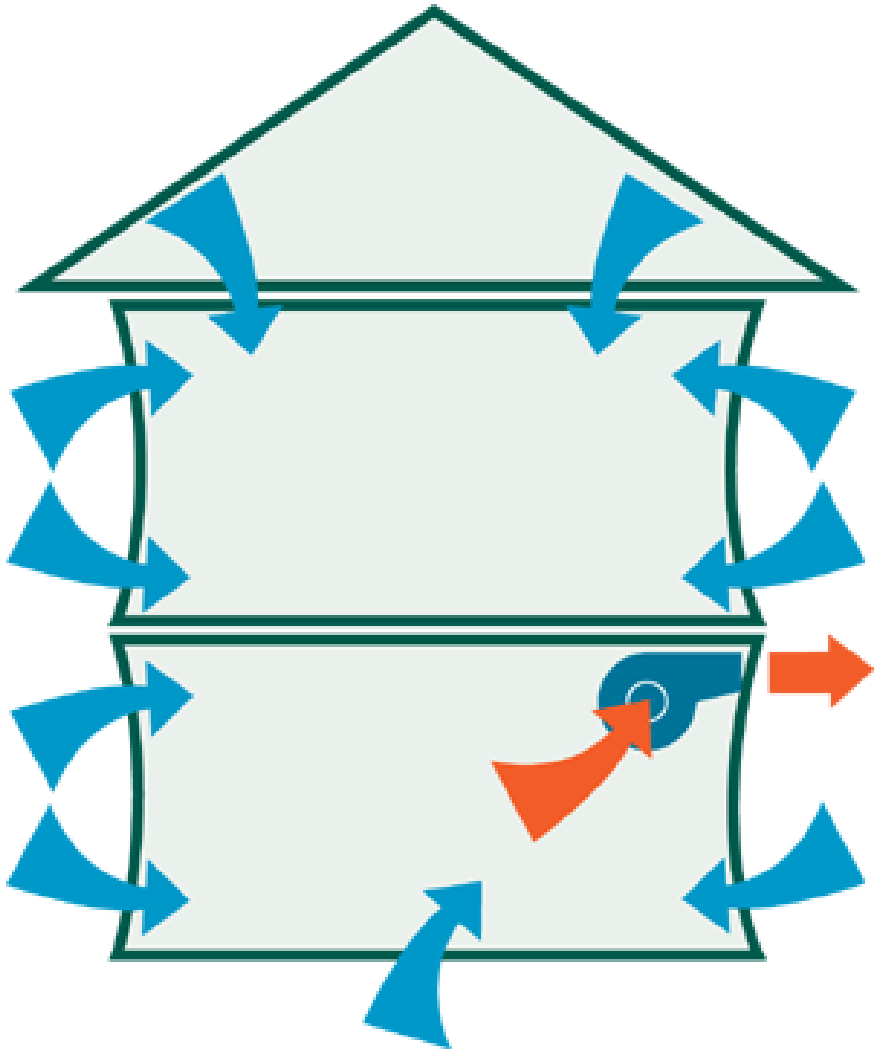


Self balancing … do not need manometer

What If System Is Not Balanced ?

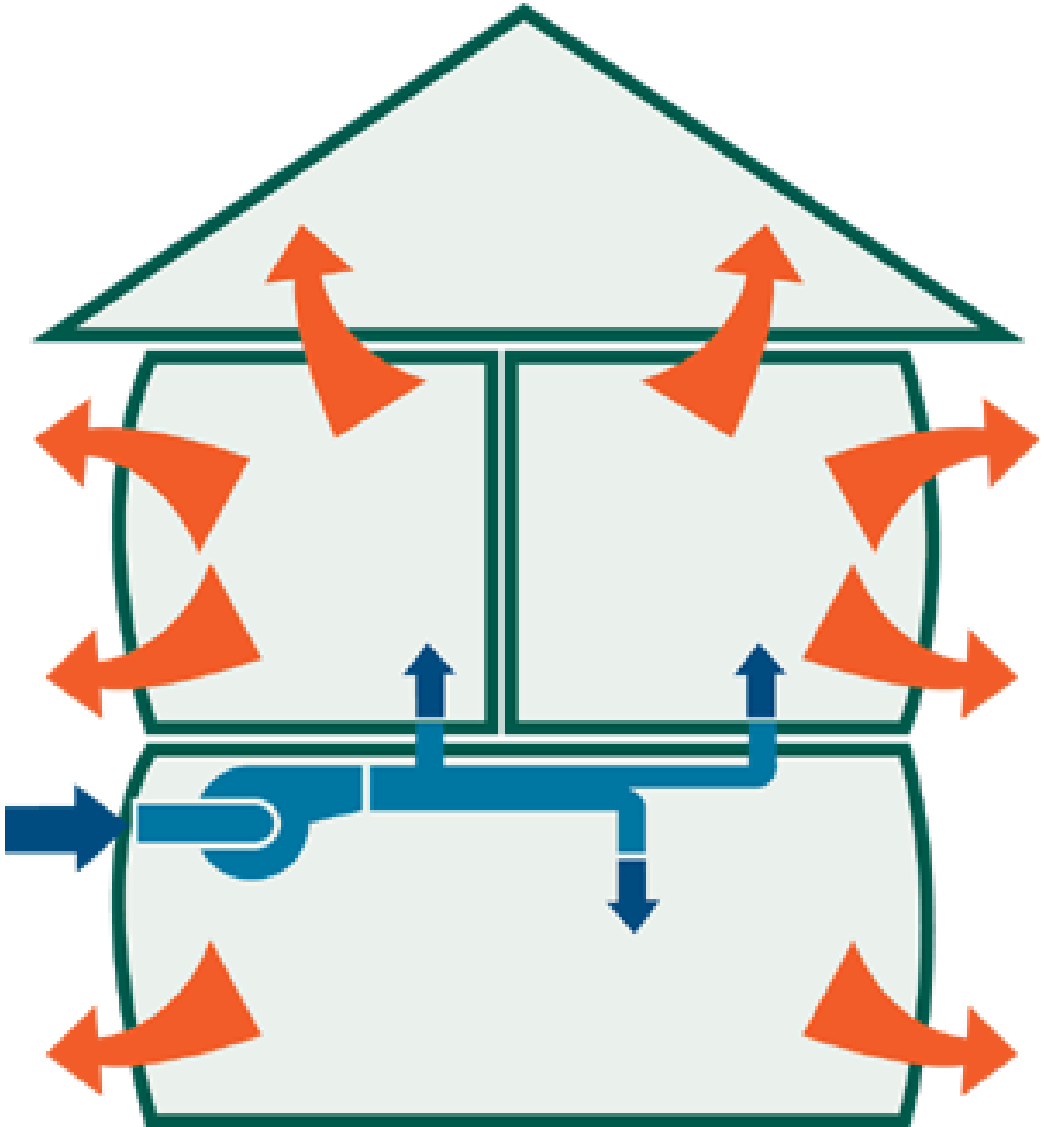
- Comfort complaints, call backs
- Core freeze up and blockage
- Waste of energy
- House can get to dry in winter, to humid in summer
- Building pressure issues

NEGATIVE PRESSURE



- Cold air inflitrates house.
- Increase of energy cost
- Negative pressure may cause combustion exhaust drawbacks.

POSITIVE PRESSURE



Hot and/or humid air infiltrate walls and condensate on insulation.

Heat loss.

Do not pressurize a house in a cold climate

Balanced ventilation effects

- IAQ
  - COVID
  - Dust and fine particles
  - odors
  - Fresh air in home
  - Allergies

- HUMIDITY
  - Winter – to high or to low
  - Summer – to high

Balanced Ventilation Reduces- Dust, Gases, and Viruses

Ventilation and Relative Humidity RH%

Winter

- Ventilation will reduce window condensation
- Ventilation will reduce RH%

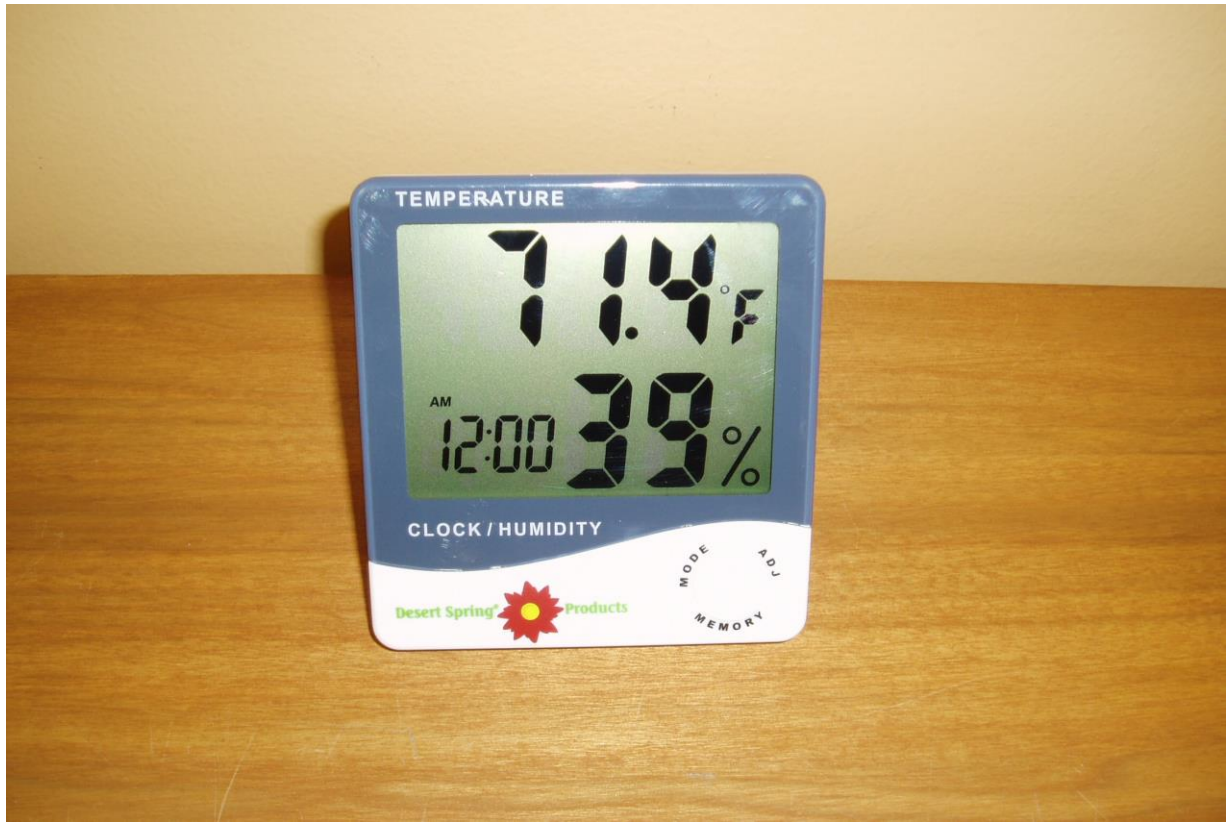
Summer

- Ventilation will increase RH%

Keep in mind Indoor RH% is highly dependent on

- Ventilation Rate
- Weather conditions
- HVAC equipment installed
- Home owner understanding and operation of HVAC

Humidity gauge a must !



Homeowner Perspective On Ventilation

- How does the control work
- IAQ and filtration
- Comfort, temperature and humidity RH%
- Operation in winter
- Operation in summer
- Maintenance

Explain to the homeowner… how it works and maintenance

Check List For Service Tech HRV/ERV What To Look At

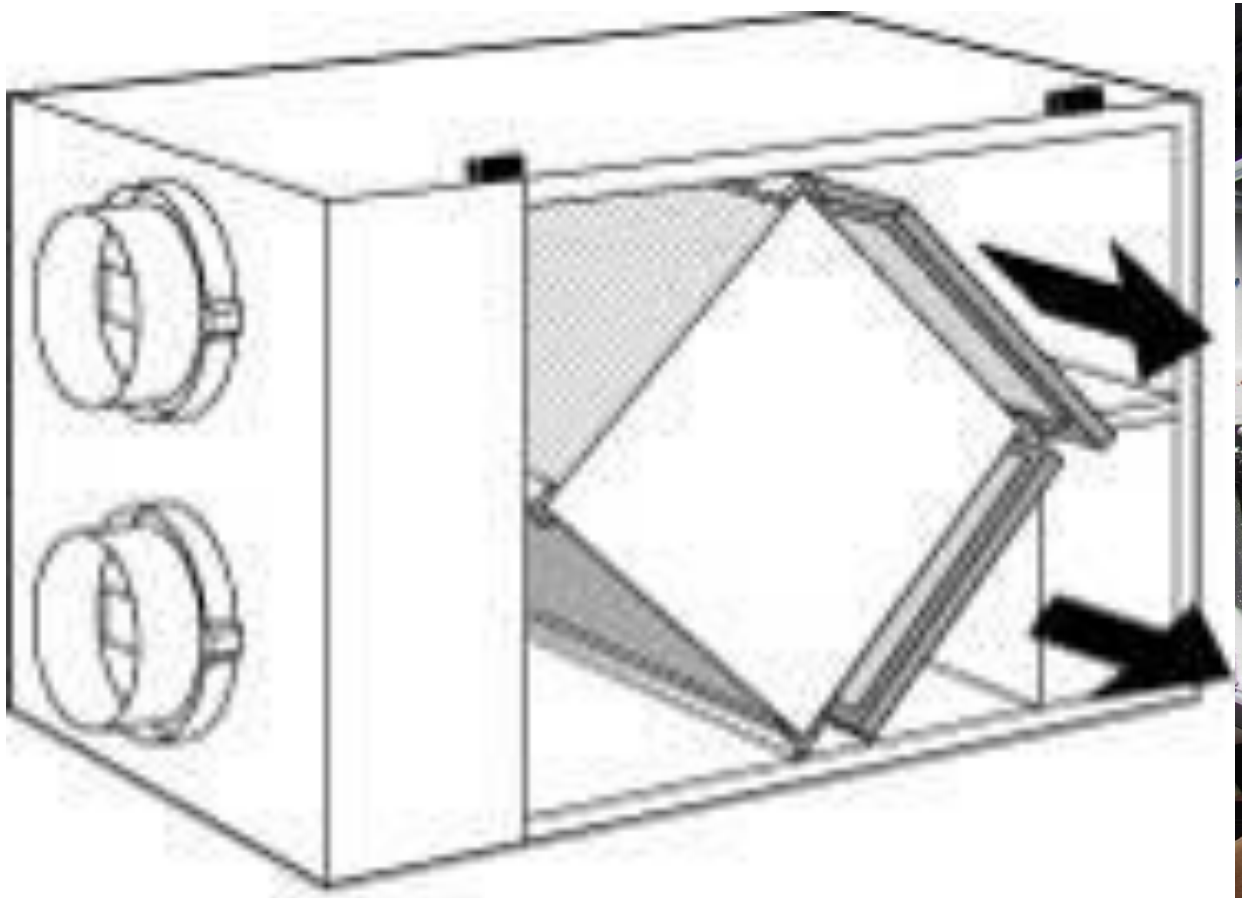
1. Hoods
2. Filters
3. Core or heat exchanger
4. Vibration and noise
5. Ducting
6. Dampers for balance and to the outside
7. Drain
8. Controls
9. Balancing (verification of cfm flow)

Air intake needs to be cleaned

Shelter Supply

BALANCED - HRV/ERV

FILTERS




FRONT / DEVANT
ENTRETIEN
MAINTENANCE
AIR FILTER
FILTRE À AIR

Thank you for your time

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