Solving the Problem of Ventilation

BuildingEnergy NYC
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Acronyms

- Cubic Feet per Minute (CFM)
- Air Changes per Hour (ACH)
- Energy Recovery Ventilator (ERV)
- Heat Recovery Ventilator (HRV)
- Outdoor Air (OA)
- Return Air (RA)
- Exhaust Air (EA)
- Supply Air (SA)
- Testing & Balancing (TAB)
- Dry bulb Temperature (DB)
- Wet bulb Temperature (WB)
- Indoor Air Quality (IAQ)

Learning Objectives

- When to use ERV vs HRV
- ASHRAE 62.2, Passive House and NYC mechanical code and how it affects dwelling unit ventilation
- Design and installation aspects of recovery ventilator units
- Central vs in-unit ventilation strategies

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Let’s get to know each other!

http://www.lib.rmit.edu.au/guides/images/inclusive/Getting%20to%20know%20each%20other.JPG

Agenda

1. Need for ventilation
2. Design
3. Installation
4. Maintenance
5. Passive House Specific Considerations

Need for Ventilation

Why Ventilate?

- ✓ Dilutes pollutants and maintains good indoor air quality
- ✓ Provides oxygen for breathing
- ✓ Controls odors

Design

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Code Requirements

NYC Mechanical Code

Private dwellings, single and multiple				
Garages, common for multiple units[b]	—	—	—	0.75
Garages, separate for each dwelling[b]	—	—	—	100 cfm per car
Kitchens[g]	—	—	—	25/100[f]
Living areas[c,i]	0.35 ACH but not less than 15 cfm/person	—	Based upon number of bedrooms. First bedroom, 2; each additional bedroom, 1	—
Toilet rooms and bathrooms[g]	—	—	—	20/50[f]

NYC Mechanical Code Table 403.3 – Comment (i)

i. For R-2 buildings less than 125 feet in height, outdoor ventilation air provided by mechanical means serving dwelling units designed to exceed 100 cfm per dwelling unit, whether intermittent or continuous, shall be required. For buildings 125 feet and greater, outdoor ventilation air shall be provided by mechanical means when the sum of the exhaust designed to exceed 75 cfm, whether continuous or intermittent, per dwelling unit. Manually operated openable exterior wall openings shall not be used to provide outside ventilation air except where calculations are submitted showing that such openings are located at or below the lowest calculated neutral pressure plane (calculated at the winter outdoor design temperature, and taking into account a composite mass flow air balance of the building including all mechanical systems).

Program Requirements

ASHRAE 62.2

Requires EITHER continuous OR intermittent ventilation of fresh air

Exhaust

- Bathrooms – **20 CFM** continuous or 50 CFM intermittent
- Kitchens – **5 ACH** continuous or100 CFM intermittent

Supply

- 0.01 x Area of the apartment + 7.5 x (No. of bedrooms + 1) CFM

PASSIVE HOUSE

Requires continuous, balanced, mechanical ventilation of fresh filtered air

Exhaust

- Bathrooms – **24 CFM** for full baths and **12 CFM** for half baths
- Kitchens –**35 CFM**

Supply

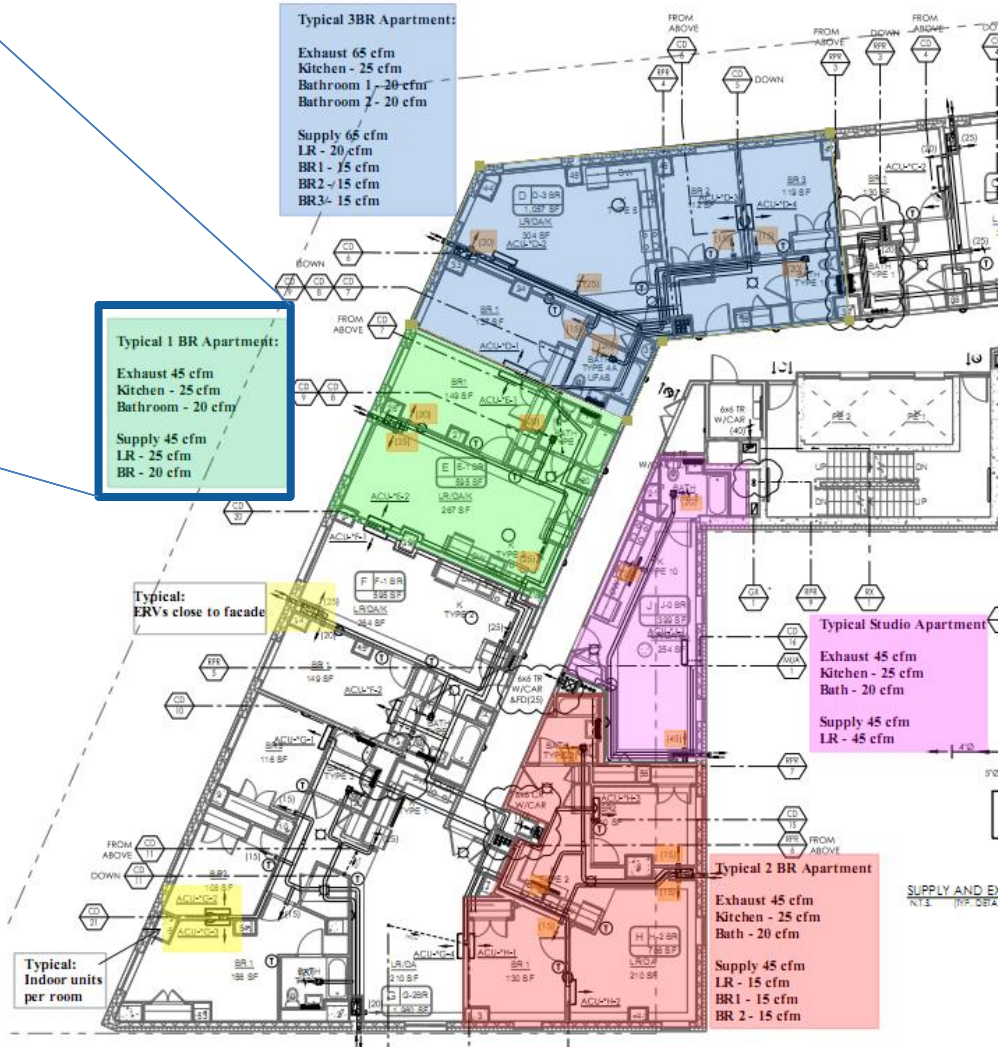
- 0.3 ACH

Typical Flow Rates

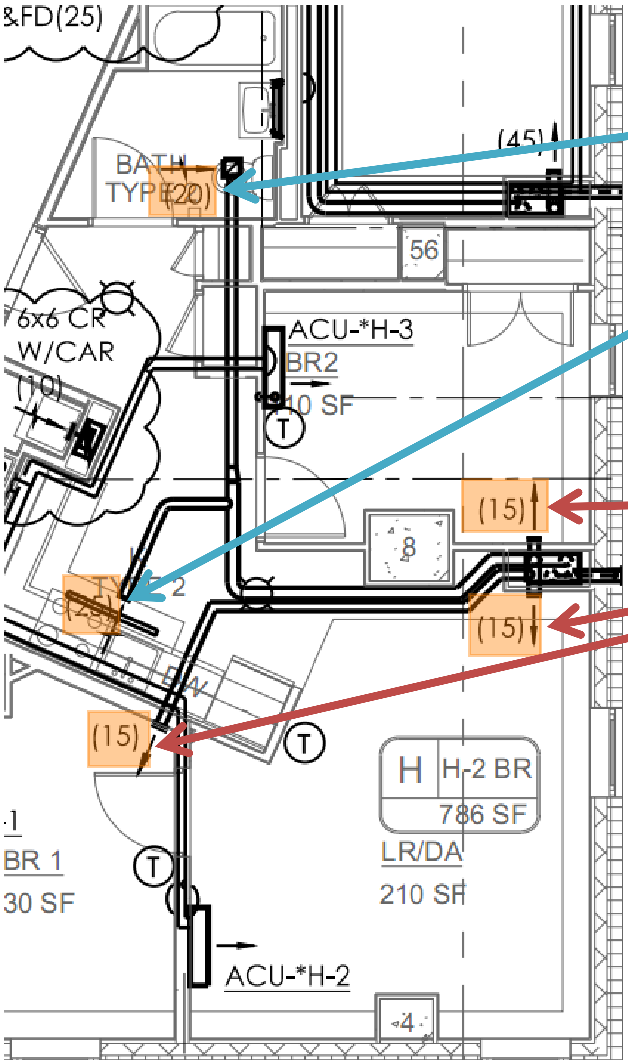
Typical 1 BR Apartment:

Exhaust 45 cfm
Kitchen - 25 cfm
Bathroom - 20 cfm

Supply 45 cfm
LR - 25 cfm
BR - 20 cfm



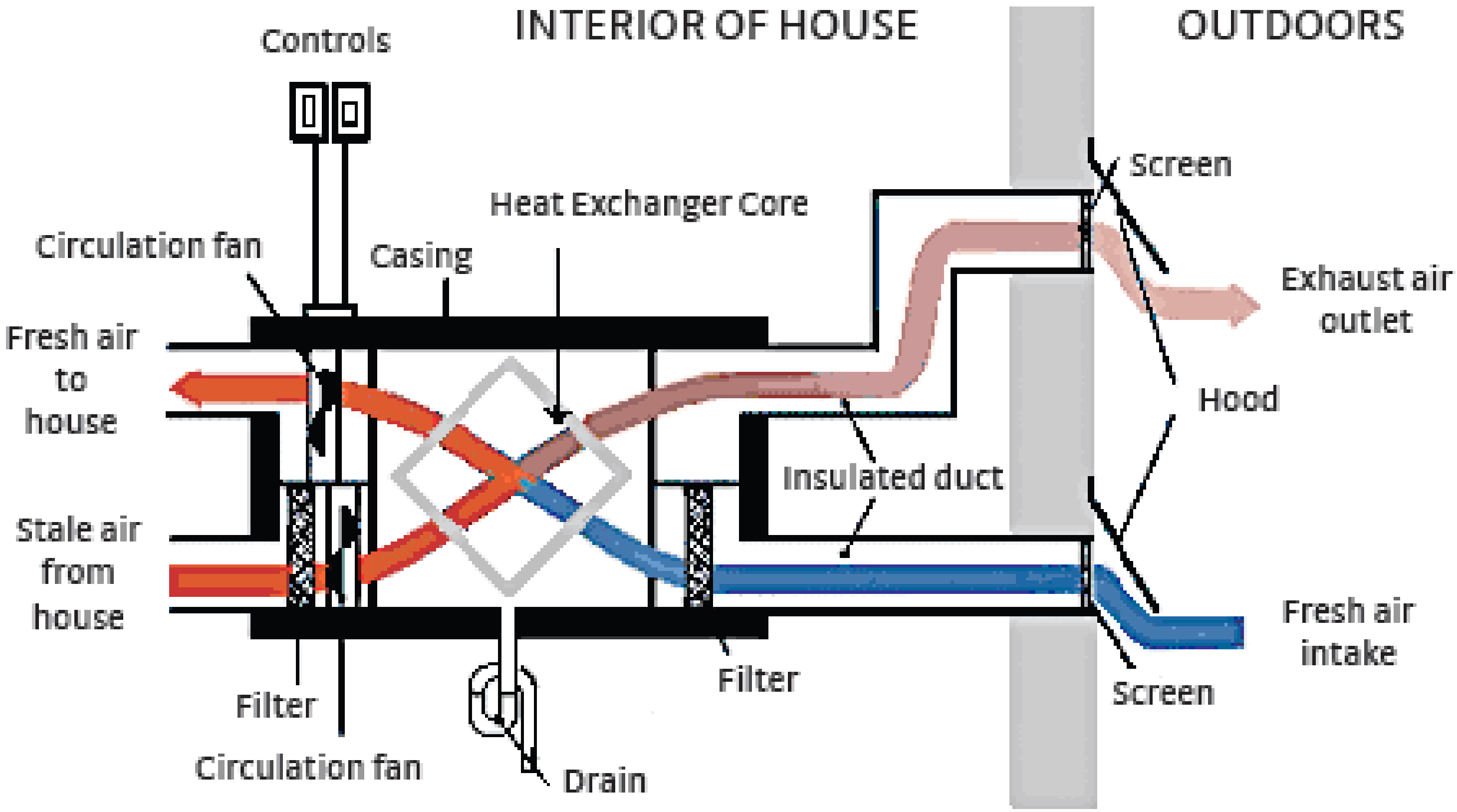
Balanced Flow Distribution



Exhaust stale air from kitchen and bathrooms

Supply fresh air in all living rooms and bedrooms

What is a recovery ventilator?



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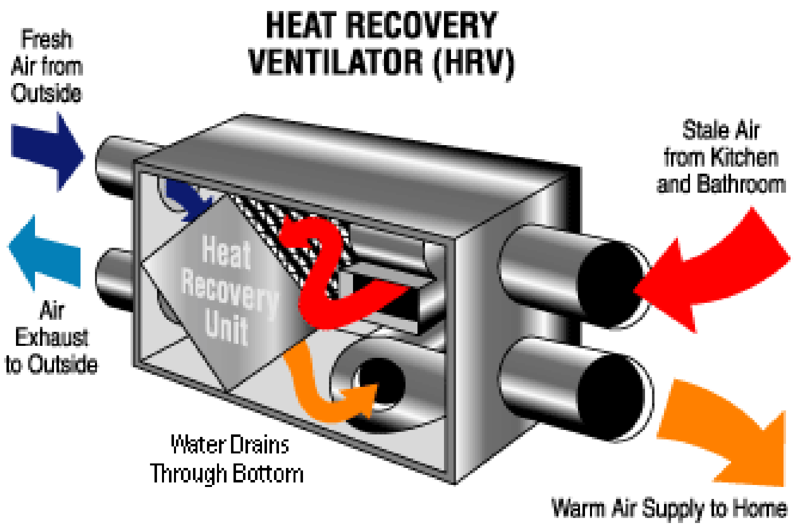
Why Recovery?

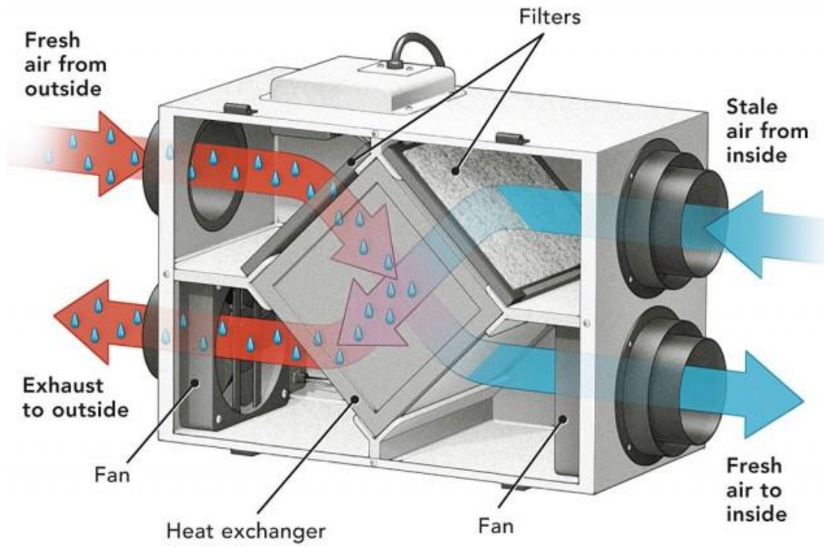
- Reduces load on heating and cooling system
- Possible downsizing of heating and cooling system
- Recover first cost of ERV/HRV units through operational energy savings

ERV vs. HRV?

Major deciding factors:

1. Climate
2. Air tightness & insulation





ENERGY RECOVERY VENTILATOR (ERV)

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ERV Performance Data – Winter

(Apparent sensible η 99%, Latent η 70%)

25° F DB/
23° F WB

69° F DB

15° F DB

70° F DB/
56° F WB
(40% RH)

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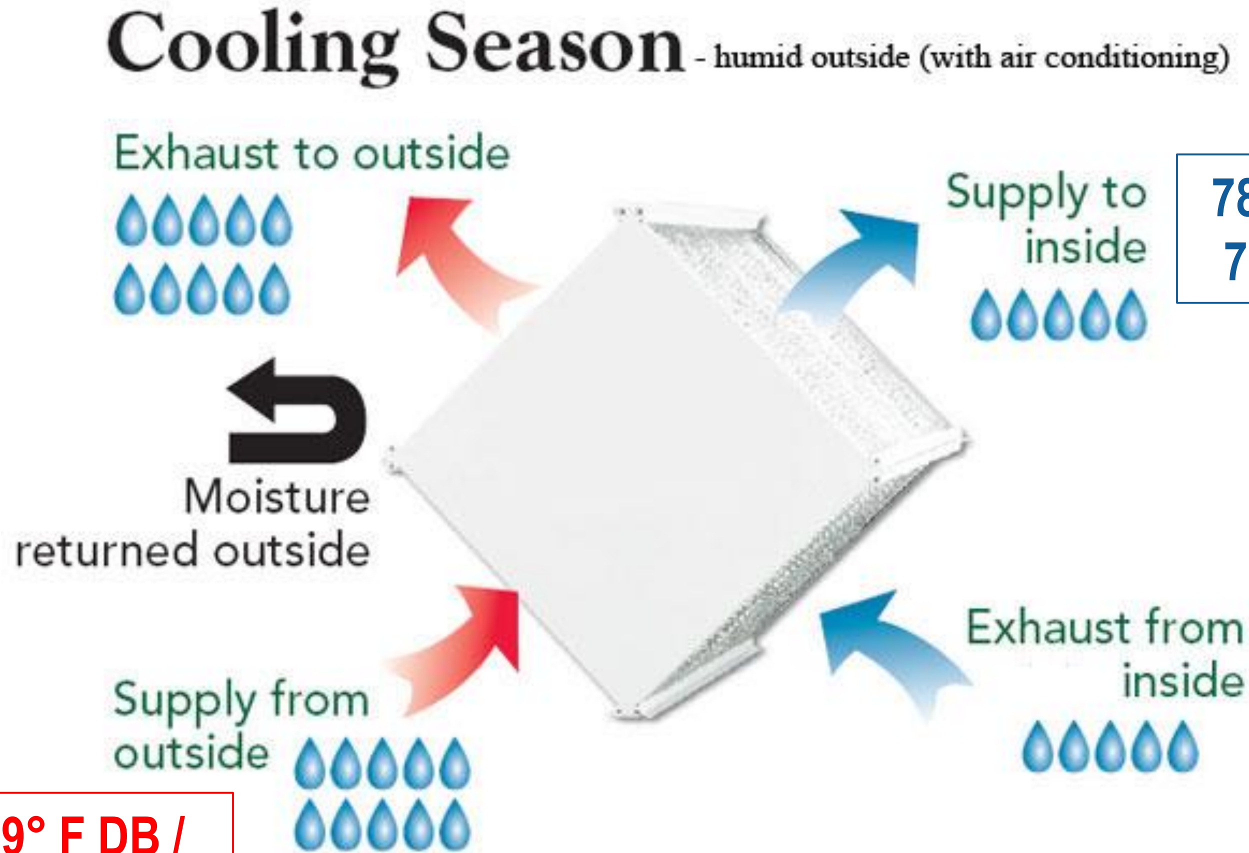
ERV Performance Data – Summer

(Apparent sensible η 79%, Latent η 40%)



78° F DB/
70 F WB

75° F DB/
62 F WB
(50% RH)

89° F DB /
73 F WB

Effect on HVAC System Sizing

The reduced (Delta T) & (Delta ω) should be taken into consideration while calculating the outdoor air sensible and latent load on the HVAC system

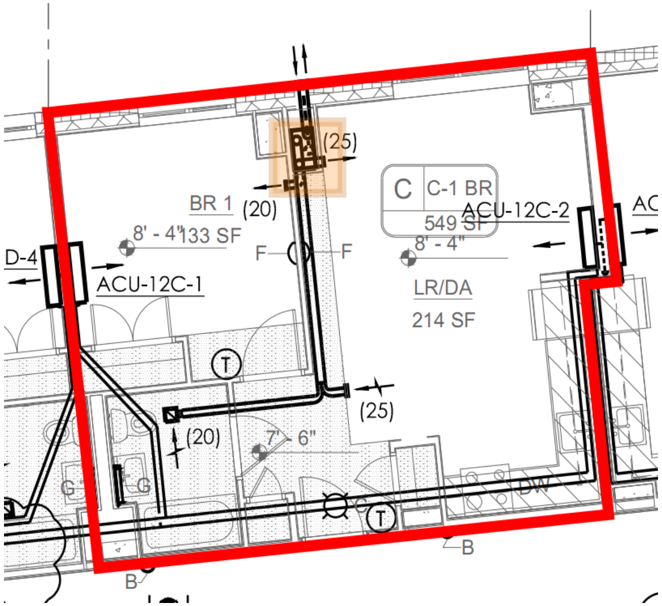
- Delta T is temperature difference
- Delta ω is humidity ratio, i.e. mass of water vapor per unit mass of dry air

Installation

ERV Ducts

Important factors to minimize thermal losses & eliminate exhaust condensation potential -

1. Duct runs
2. Insulation and vapor barrier

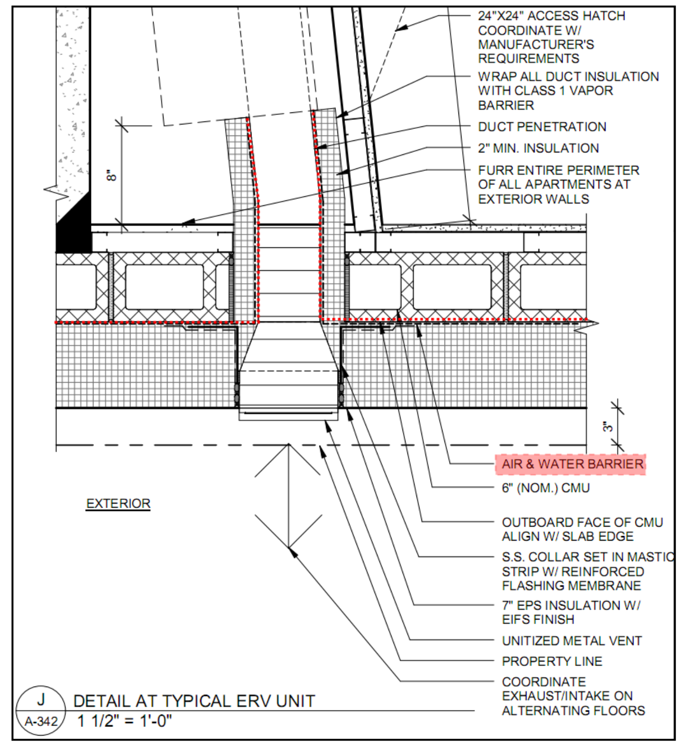


Address the holes in the wall

Each in-unit ERV = 2 holes in the wall

The thermal and air tight layer transitions

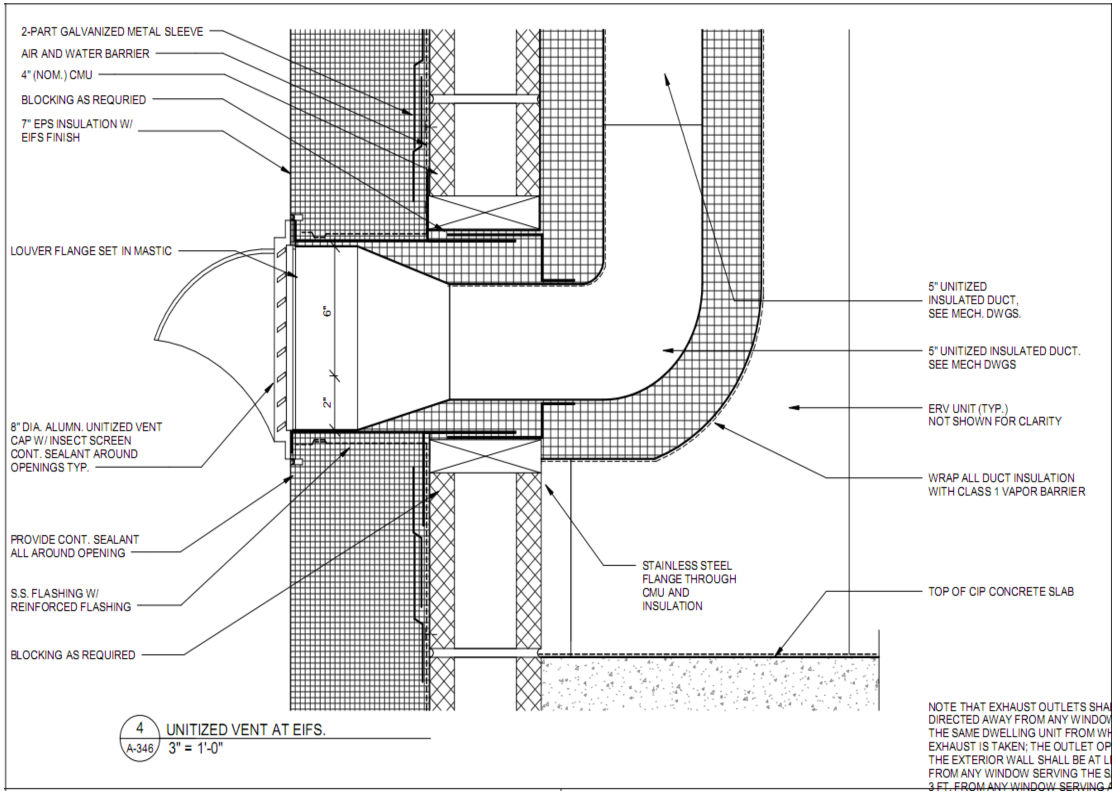
CONTINUOUS INSULATION



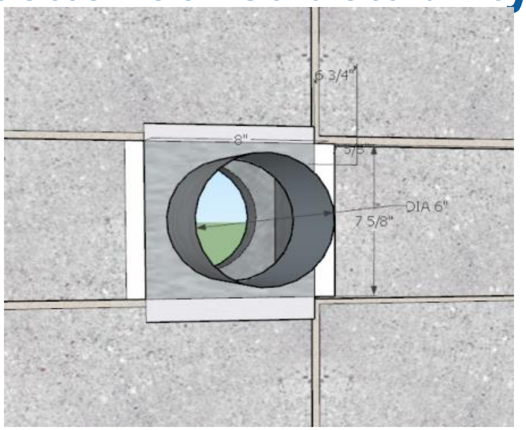
CONTINUOUS AIR BARRIER

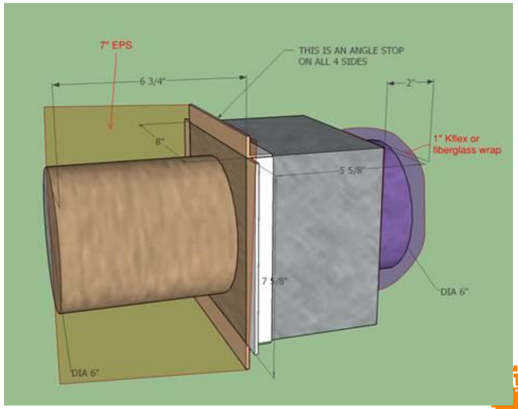
Example ERV Duct Insulation

Design Detail



Suggested alternate for better constructability





What's the Problem With the Alternate?

25° F DB/
23° F WB

69° F DB

15° F DB

70° F DB/
56° F WB
(40% RH)

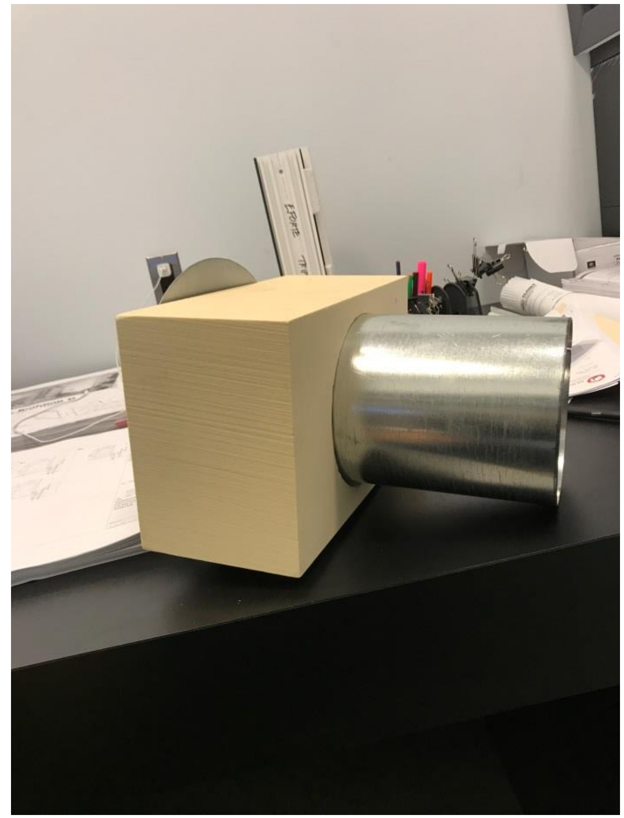
Image Courtesy: http://vanee.edenenergy.com/hrv-or-erv.php

What's the Problem With the Alternate?

- Indoor conditions would be at 70°F and 40% RH which corresponds to dew-point temperature of 55°F!

24.8°F < 55°F = CONDENSATION!

Solution by Contractor!



Use structural grade thermal blocks around ducts which the mason can then place perfectly in the 8” CMU rough opening

Maintenance

Points to Consider for Maintenance

1. Access

2. Filter replacement

3. Frost protection

Passive House Considerations

Design/ Install Items

1. Electric ranges and code minimum ventilation rates with boost capability
2. Balanced ventilation throughout building
3. Stack effect and TAB
4. Motorized louvers
5. Simple ductwork design and install
6. Blower door testing

Panel Discussion with Contractor & Architect

Central vs. In-unit ventilation

1. Energy Usage
2. Façade Penetrations
3. Balancing and noise
4. Unit Placement
5. Ductwork
6. Maintenance
7. Passive House Testing
8. Cost
9. Metering
10. Fire/ Smoke considerations

Code Considerations

1. 10’ distance between exhaust and supply

2. Kitchen and bathroom exhaust risers for central ventilation

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Questions?

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