Managing HVAC in High Performance Buildings

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Hello my name is....

• Performance Construction Manager, Mitsubishi Electric Trane HVAC US LLC
• Former Director of Construction, Habitat for Humanity of Catawba Valley
• Former Sustainable Building Specialist, Habitat for Humanity International
• Licensed General Contractor
• HERS Rater
Performance Construction Team

- Chad Gillespie, Senior Manager
- Ryan Flynn, Northeast
- Rob Howard, Southeast
- Mike Schaefer, Central
- Kimberly Llewellyn, Southwest
- Greg Davenport, Northwest
- Ken Johnson, California
- Shawn LeMons, Colorado
Performance Construction Priorities

- **Comfort**
  - Individual room control
  - Quiet operation

- **Health**
  - Ductless (or less duct)
  - Filtration
  - Ventilation
  - Dehumidification

- **Efficiency**
  - Inverter compressor
Performance Construction Goals

• Energy code compliance
• ERI performance path
• HERS score

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<th>Climates</th>
<th>2015 IECC HERS Index Scores</th>
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Performance Construction Goals

- Certification Programs
  - ENERGY STAR
  - EPA Indoor airPLUS
  - DOE Zero Energy Ready
  - Passive House
  - Net-Zero
Energy Code & Construction Trends

• All homes are getting tighter and better insulated
• Small homes are very popular
  • Multifamily
  • Tiny Homes
  • Modular
• We spend most of our time indoors
• Can a house be too tight?
Issues With Oversizing

• What is the problem with oversized HVAC equipment?

Photo courtesy of Energy Vanguard
Residential HVAC Design Process

- Manual J
- Manual S
- Manual D
- Manual T
- Manual DHP?
- Manual LLH
Low Load Homes

• High Performance Homes have extremely low *sensible* loads (1000-1500 square feet/ton)
• Latent loads remain fairly constant
• HVAC equipment selection is more difficult
• Mechanical ventilation is now required
• How do we handle the ventilation load?
• Supplemental dehumidification may be required
Horizontal Ducted

- Low static (SEZ)
- Mid static (PEAD)
Ductless Options

• Floor mount
• Wall mount
• Ceiling mount
Designing with Ductless

• Room by room load calculation
• Creating comfort zones
• What about small bedrooms and bathrooms?
HVAC Without Borders

• Tear Down the Walls movement
HVAC With Borders

• Interior walls divide us and make HVAC design really challenging
Air Distribution Strategies

• Exhaust fans (-)
• Transfer fans (+)
• Inline fans (+)
Mechanical Ventilation

• Supply fans
• ERV or HRV
Whole House Filtration

• MERV 13 or HEPA
• 150-240 CFM Fan
• Supply and Return
mylinkdrive.com
Diamond System Builder

Indoor Units: 1 / 1 to 1
Capacity: 12 / 6 to 12 (100.0%)
* Connectable capacity is not actual capacity.
Total Pipe Length: 32.9 / 65.0 feet

Correction Factors:
- Temperature: 0.97 / 1.00
- Piping Length: 0.98 / 0.99
- Defrosting: - / 1.00
- User Derate: 1.00 / 1.00

Total Derate: 0.95 / 0.99
Additional Refrigerant: 0.1 lb
Total Refrigerant Amount: 2.7 lb

Conditions (°F)

Cooling
- Indoor DB 75.0, Humidity 59.0%
- Indoor WR 64.9
- Outdoor DB 97.0

Heating
- Indoor DB 70.0
- Outdoor DB 90.0, Humidity 50.0%
- Outdoor WB 6.9

Pipe Dia. Liquid / Gas
Pipe Length (Elbows)
Model Number
Clg. Total (Sens.)
Htg. Total

System 1
1/4 / 3/8
30.0 ft (3)
N/A / 1

MUZ-FH12NA
MSZ-FH12NA

11,350 BTU/h (8,501 BTU/h)
13,521 BTU/h
Diamond System Builder

Indoor Units: 3 / 2 to 3
Capacity: 30 / 15 to 30

* Connectable capacity is not actual capacity.
Total Pipe Length: 100.0 / 230.0 feet
Furthest Actual: 40.0 / 82.0 feet
Furthest Equivalent: 40.0 / 82.0 feet

Correction Factors
Outdoor Unit Capacity: 1.00 / 1.00
Temperature: 0.97 / 0.99
Piping Length: 0.99 / 1.00
Defrosting: - / 0.95
User Derate: 1.00 / 1.00
Total Derate: 0.96 / 0.94
Additional Refrigerant: 0.0 lb
Total Refrigerant Amount: 8.8 lb

Conditions (°F)
Cooling
Indoor DB: 75.0 Humidity 59.0% Indoor WB: 64.9
Outdoor DB: 95.0

Heating
Indoor DB: 70.0
Outdoor DB: 21.0 Humidity 72.8% Outdoor WB: 19.3
Comfort Zones

• Main Level

Rest of House Heating 28201 Cooling 25002

Recommend 2.5 ton air handler

Master Zone Heating 9815 Cooling 5510

Sez-KD12NA4R1.TH

N/A / 2 / Master Bedroom

11,048 BTU/h (7,729 BTU/h)
10,700 BTU/h

SVZ-KP30NA

N/A / 1 / Great Room

25,912 BTU/h (20,920 BTU/h)
30,913 BTU/h

Recommend 1 ton horizontal ducted unit for master zone

Living Zone Heating 5339 Cooling 3852

MSZ-FH06NA

N/A / 3 / Living Room

5,529 BTU/h (4,858 BTU/h)
5,444 BTU/h

Recommend 1/2 ton ductless heat pump for living zone
Comfort Zones

• Second Floor

- Recommend 1 ton horizontal ducted unit for upstairs zone
- Upstairs Zone Total Heating 10500 Cooling 8836
- Bed 2 Zone Heating 3649 Cooling 3529
- Bed 3 Zone Heating 3041 Cooling 2753
- Bed 4 Zone Heating 3810 Cooling 2554
- SEZ-KD12NA4R1.TH
  - N/A / 4 / Second Floor
  - 10,947 BTU/h (7,687 BTU/h)
  - 10,680 BTU/h
Zoned Comfort Solutions

• Customized comfort
• Healthy Indoor Air Quality
• Multiple points of filtration
• Mechanical ventilation
• Moisture management
• Controls integration
• Energy efficiency for lower utility bills
Performance Builder Program

• Loyalty program for builders including:
  • Training and technical assistance
  • Marketing support (case studies, spotlight videos)
  • Equipment discounts (based on volume)
  • Model home program
  • Rebates (coming soon)
Performance Contractors Wanted

• We are seeking Performance Contractors for design, installation, and commissioning of Zoned Comfort Solutions in high performance homes

• Our team will provide the training and technical support to help you succeed
What’s in it for HERS Raters?

• No ducts = no duct testing & zero duct leakage
• Help your builders achieve
  • lower HERS scores
  • energy code compliance
  • certification goals
  • fewer call backs
  • happy customers
Thank you!

What questions do you have?

Rob Howard, Performance Construction Manager
rhoward@hvac.mea.com