

Managing HVAC in High Performance Buildings

RESNET Conference

New Orleans, LA

February 26, 2019



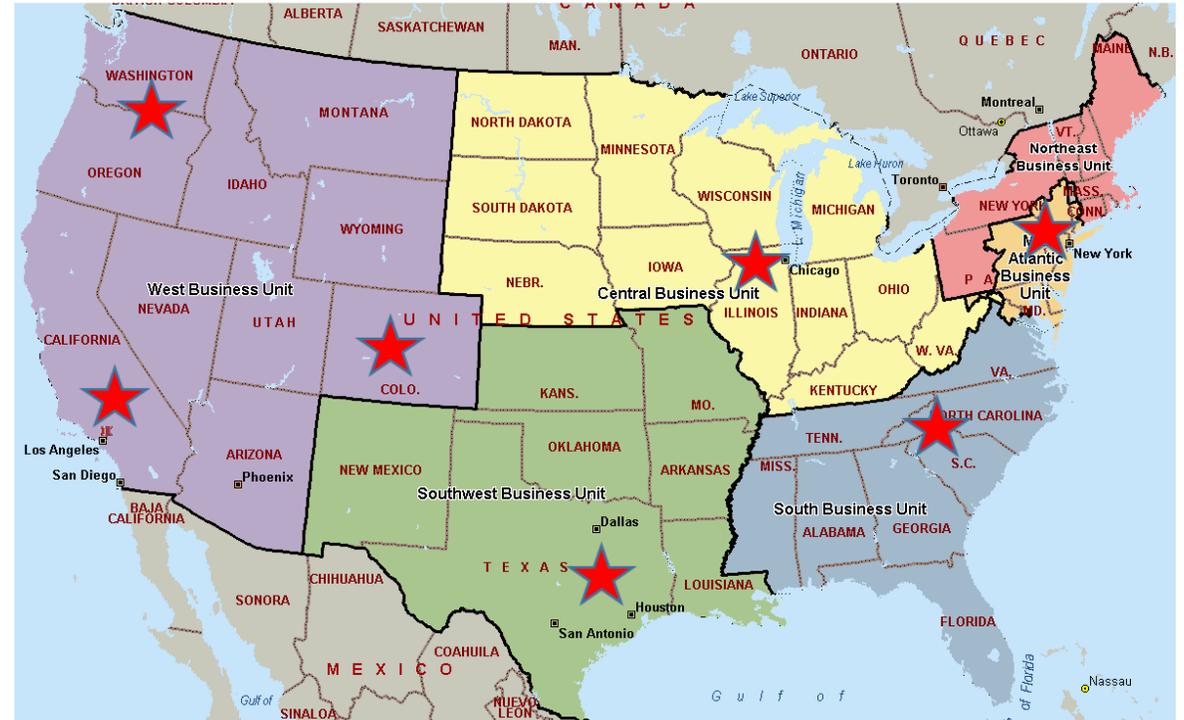
Hello my name is....

- 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

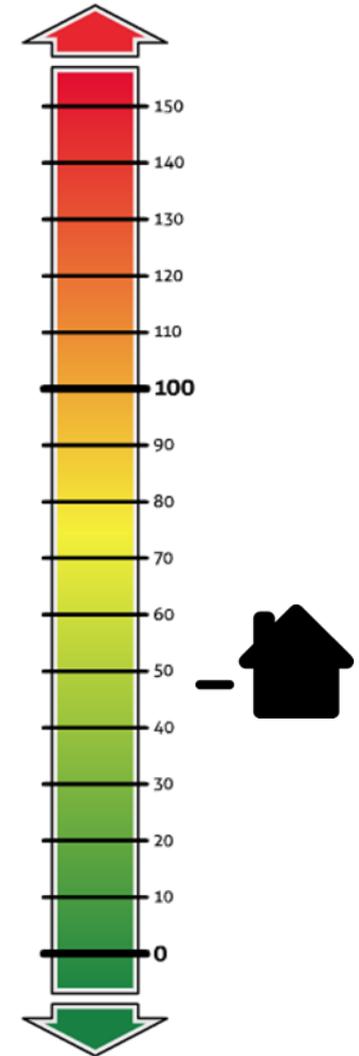


Performance Construction Goals

- Energy code compliance
- ERI performance path
- HERS score



Climates	2015 IECC HERS Index Scores
Zone 1 – 2	52
Zone 3	51
Zone 4	54
Zone 5	55
Zone 6	54
Zone 7 – 8	53



Performance Construction Goals

- Certification Programs
 - ENERGY STAR
 - EPA Indoor airPLUS
 - DOE Zero Energy Ready
 - Passive House
 - Net-Zero

							Source Zero Renewable Energy System
							Balanced Ventilation HRV/ERV
							Balanced Ventilation HRV/ERV
						SOLAR READY <small>Depends on climate</small>	SOLAR READY ALWAYS
						SOLAR READY ALWAYS	SOLAR READY ALWAYS
						Eff. Comps. & H ₂ O Distrib	Eff. Comps. & H ₂ O Distrib
						Eff. Comps. & H ₂ O Distrib	Eff. Comps. & H ₂ O Distrib
						 EPA Indoor Air Package	 EPA Indoor Air Package
						 EPA Indoor Air Package	 EPA Indoor Air Package
						Ducts in Condit. Space	Ducts in Condit. Space
						Ducts in Condit. Space	Ducts in Condit. Space
						HVAC QI w/WHV	Micro-load HVAC QI
						HVAC QI w/WHV	Micro-load HVAC QI
						HVAC QI w/WHV	Micro-load HVAC QI
						Water Management	Water Management
						Water Management	Water Management
						Water Management	Water Management
						Independent Verification	Independent Verification
						Independent Verification	Independent Verification
						Independent Verification	Independent Verification
						IECC 2009 Enclosure	Ultra-Efficient Enclosure
						IECC 2012 Enclosure	Ultra-Efficient Enclosure
						IECC 2009 Enclosure	Ultra-Efficient Enclosure
						IECC 2012 Enclosure	Ultra-Efficient Enclosure
						IECC 2012/15 Encl./ES Win.	Ultra-Efficient Enclosure
						HERS 85-90	HERS 35-45
						HERS 70-80	HERS 35-45
						HERS 65-75	HERS < 0
						HERS 55-65	HERS < 0
						HERS 48-55	HERS < 0
 IECC 2009	 IECC 2012	 ENERGY STAR v3	 ENERGY STAR v3.1	 ZERH	 PHIUS+	 PHIUS+	 SourceZero

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?

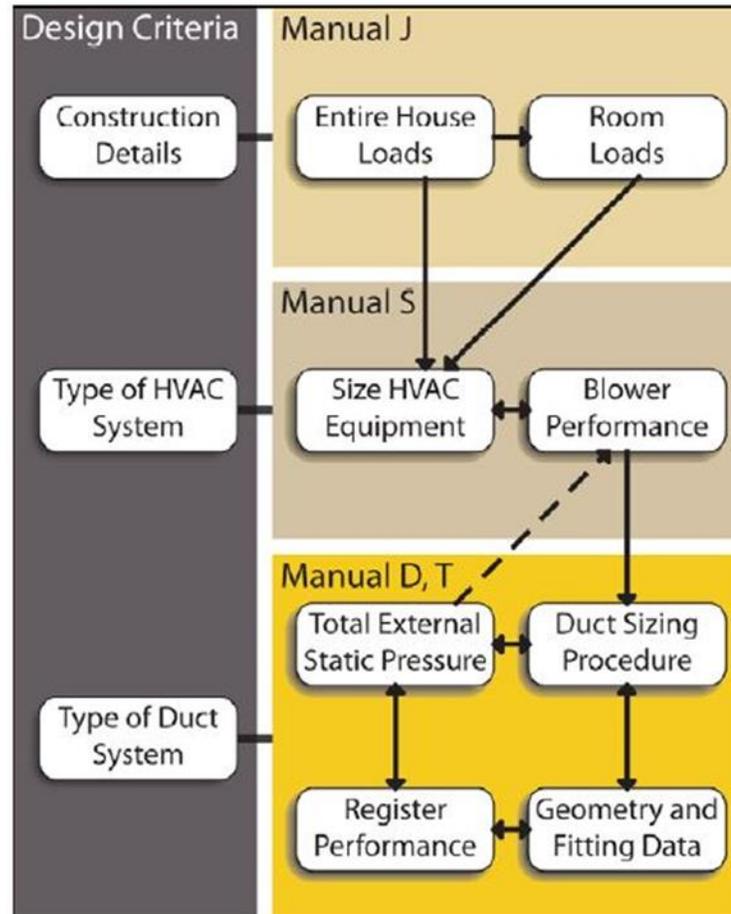


Photo courtesy of Energy Vanguard



Residential HVAC Design Process

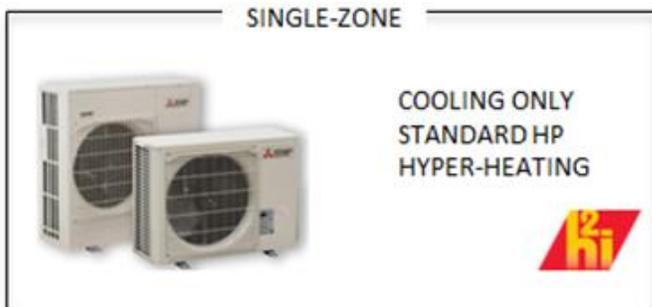
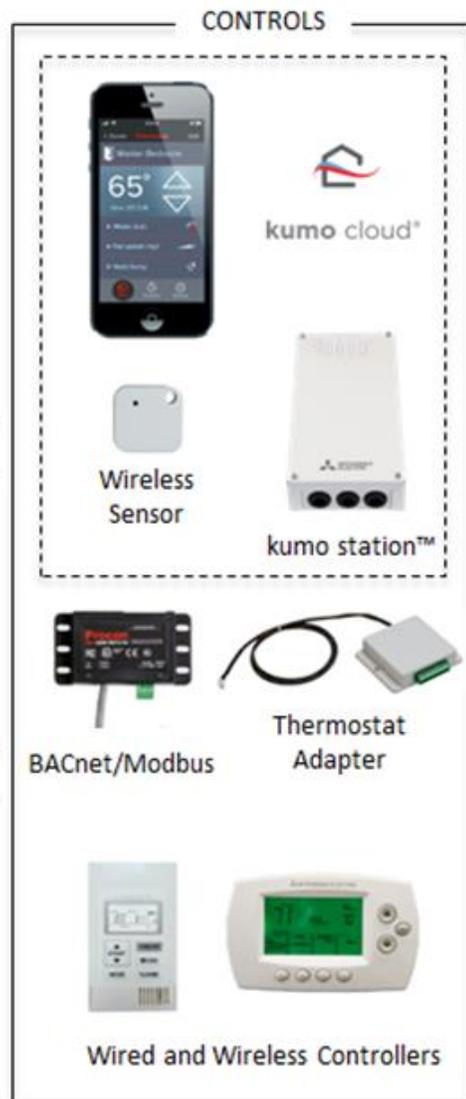
- Manual J
- Manual S
- Manual D
- Manual T
- Manual DHP?
- Manual LLH



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



**MLZ SERIES
ONE-WAY
CEILING CASSETTE**

**MITSUBISHI
ELECTRIC**
COOLING & HEATING

FITS BETWEEN 16" JOISTS

Earn a \$50 SPIFF
for each MLZ included on
an applicable job!



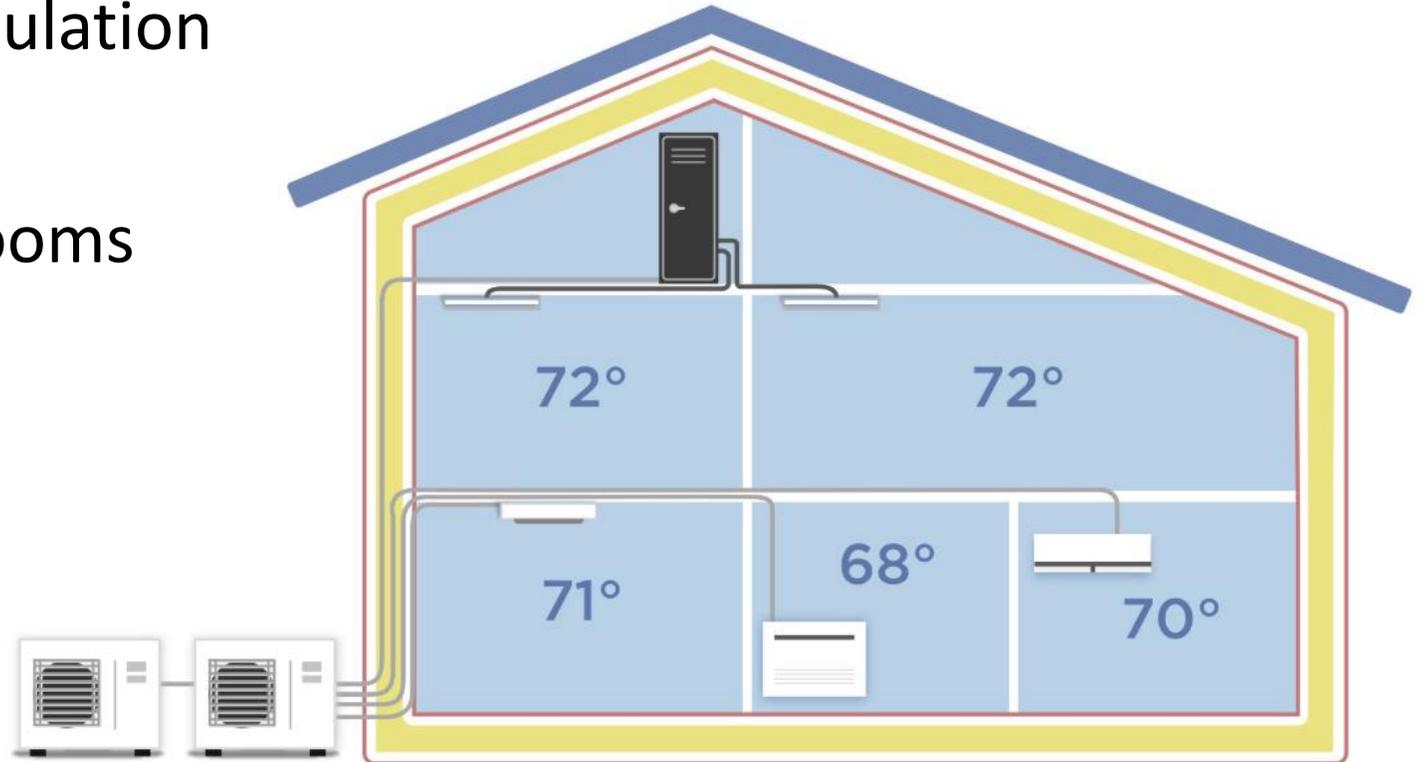
- ▶ NOW available as a 1:1 connection
- ▶ Available capacities in kBtu/h: 9, 12, 18
- ▶ Built-in condensate lift mechanism (21")
- ▶ Flexible air flow direction: left/right and up/down
- ▶ Four fan speeds plus Auto mode

For more information please contact your local distributor.

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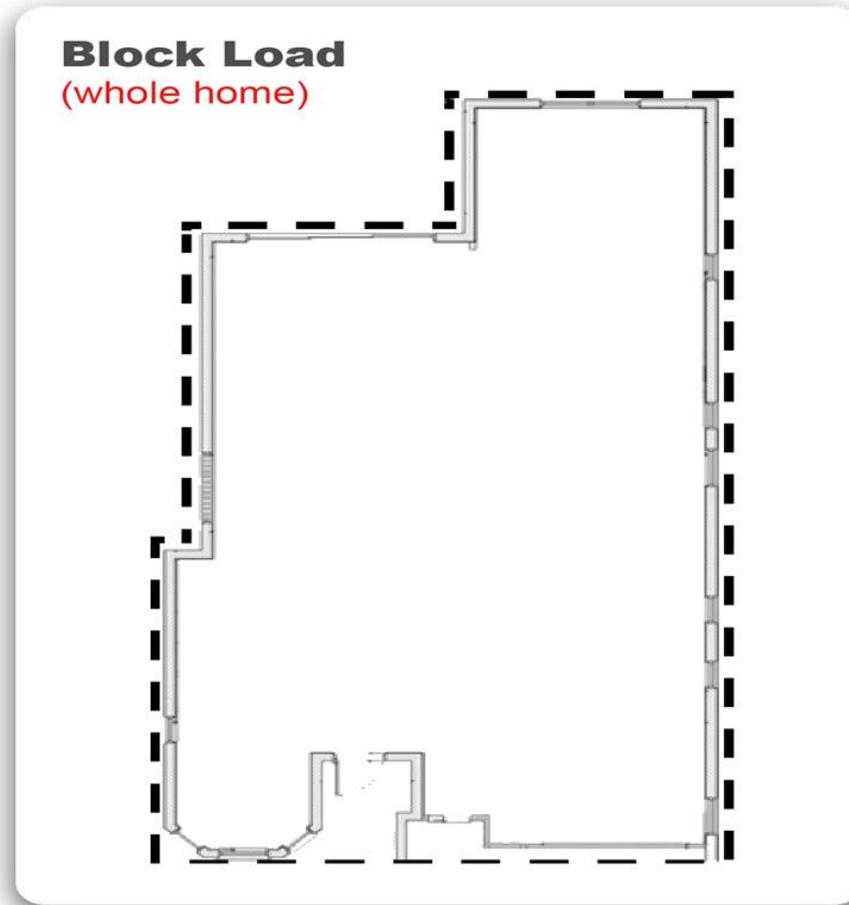
Designing with Ductless

- Room by room load calculation
- Creating comfort zones
- What about small bedrooms and bathrooms?



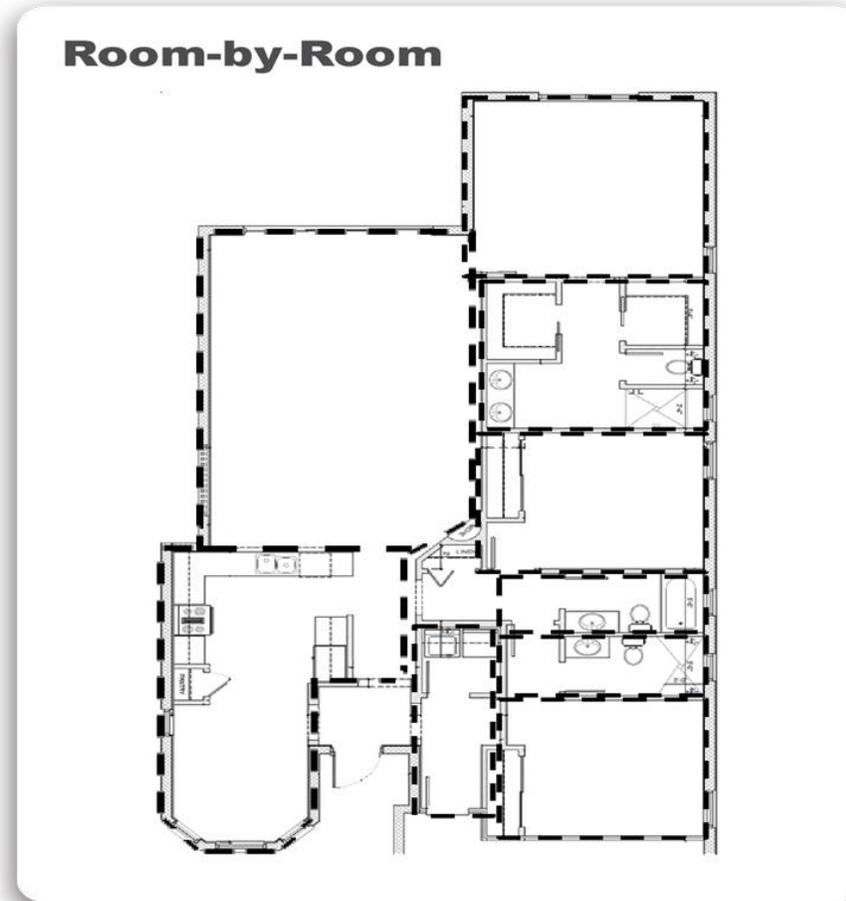
HVAC Without Borders

- 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



The graphic is split into two diagonal sections. The top-left section is black with a fine, white, diagonal line pattern. It features the Mitsubishi Electric logo (three red diamonds) and the text "MITSUBISHI ELECTRIC" in white, with "COOLING & HEATING" in smaller white letters below it. The top-right section is solid red. It features the "LINK DRIVE" logo in white, where "LINK" is stylized with arrows forming a square and "DRIVE" is in a bold, italicized font. Below this is the Mitsubishi Electric logo and "MITSUBISHI ELECTRIC" in white. At the bottom of the red section, the tagline "Now you have everything you need" is written in a white, italicized font. A small white symbol is located in the bottom right corner of the red section.

MITSUBISHI ELECTRIC
COOLING & HEATING

LINK DRIVE™
MITSUBISHI ELECTRIC

Now you have everything you need

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

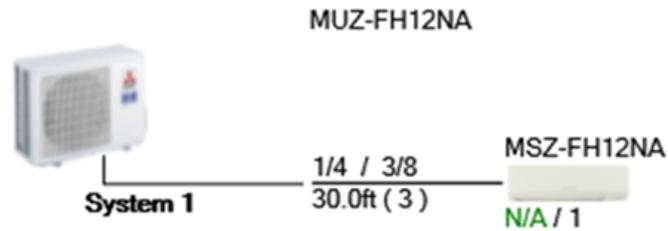
Conditions (°F)

Cooling

Indoor DB 75.0 Humidity 59.0% Indoor WB 64.9
 Outdoor DB 97.0

Heating

Indoor DB 70.0
 Outdoor DB 9.0 Humidity 50.0% Outdoor WB 6.9



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

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 Equiv.: 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

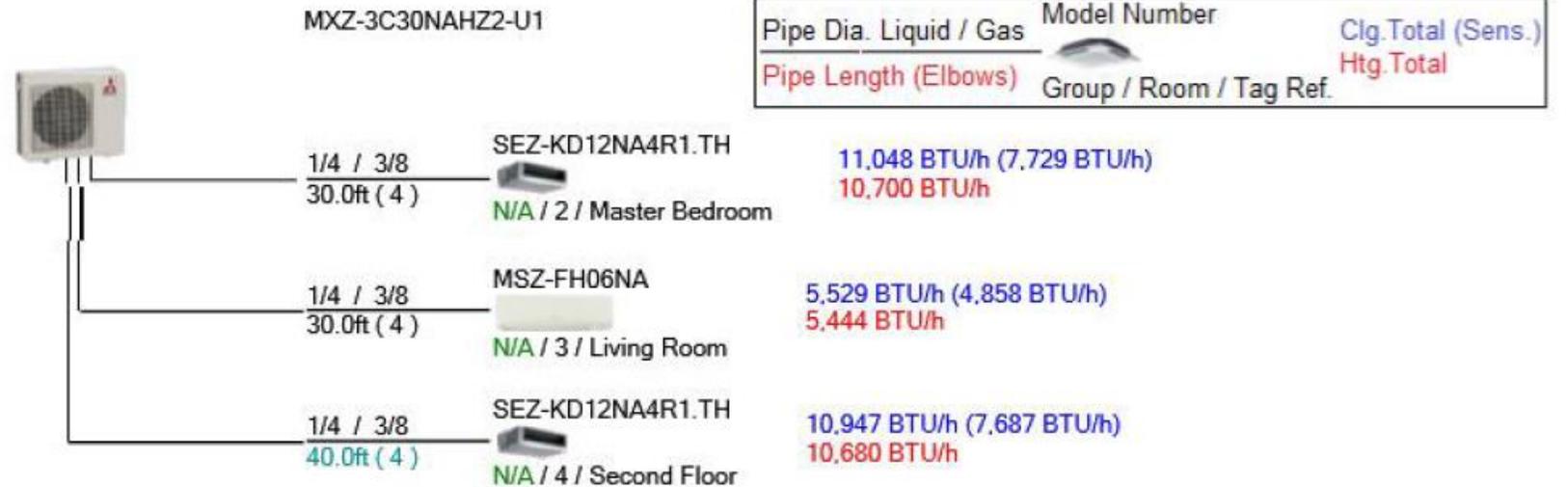
Conditions (°F)

Cooling

Indoor DB 75.0 Humidity 59.0% Indoor WB 64.9
 Outdoor DB 95.0

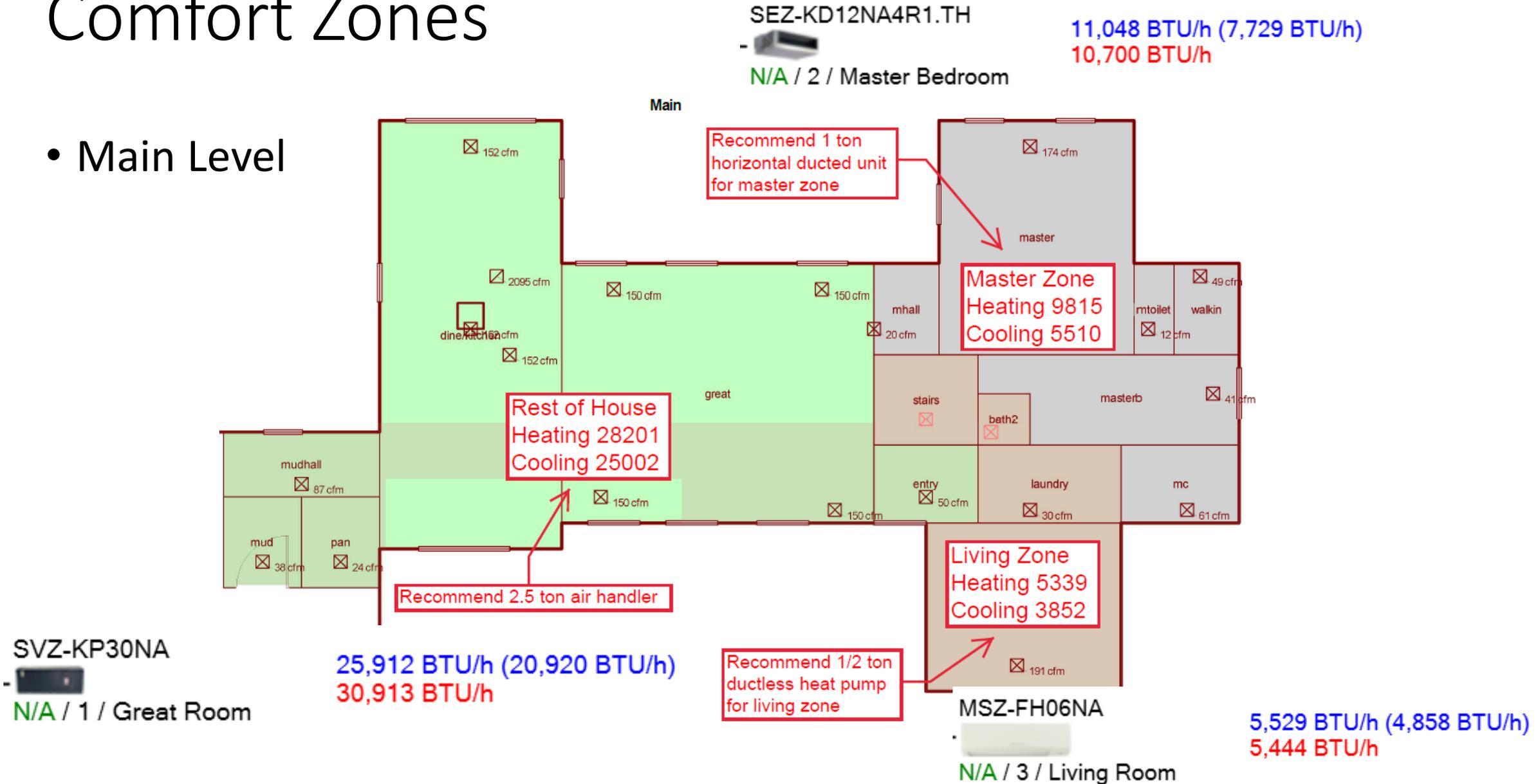
Heating

Indoor DB 70.0
 Outdoor DB 21.0 Humidity 72.8% Outdoor WB 19.3



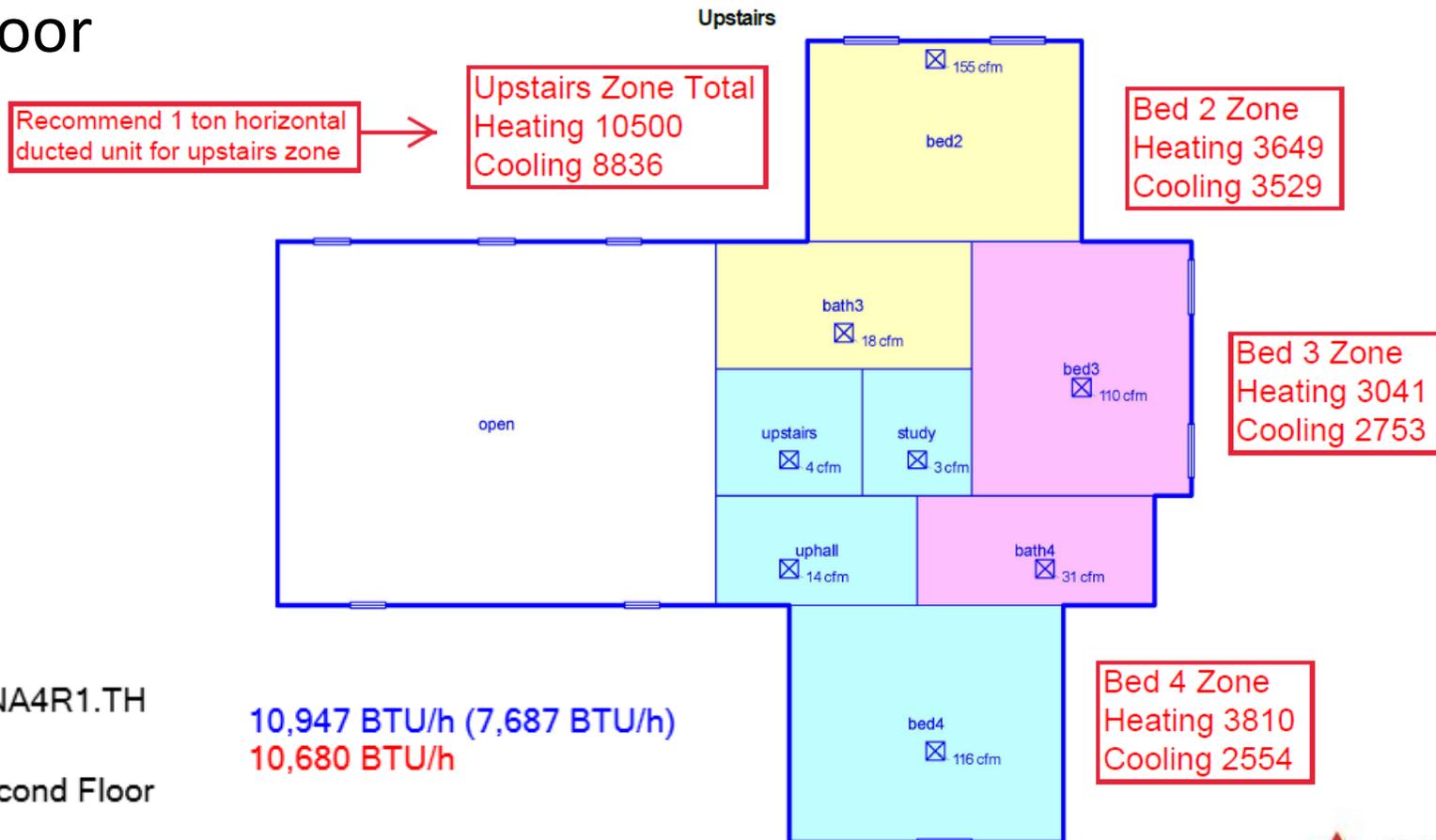
Comfort Zones

- Main Level



Comfort Zones

- Second Floor



10,947 BTU/h (7,687 BTU/h)
10,680 BTU/h

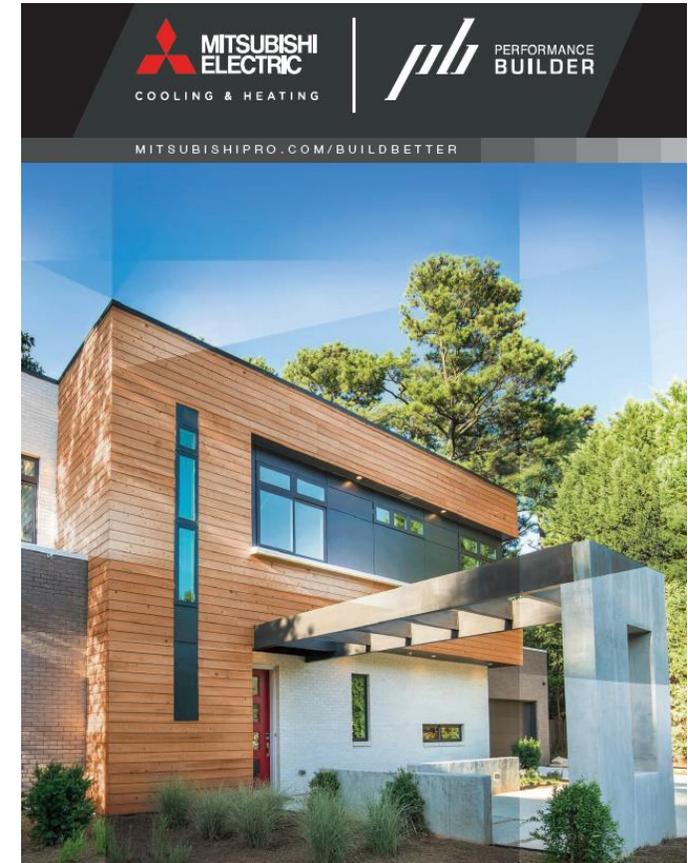
Zoned Comfort Solutions

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



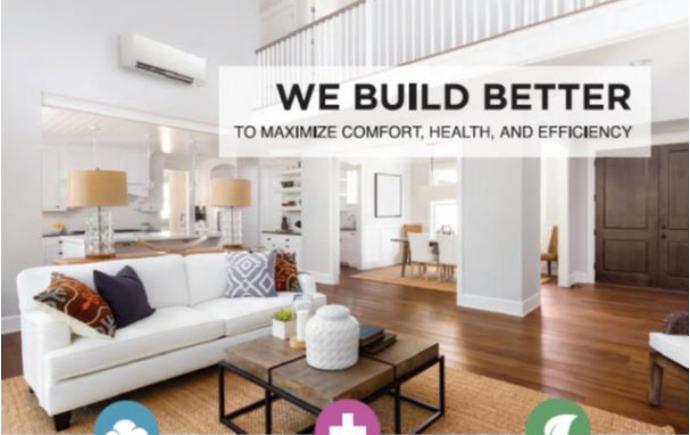
Performance Builder Program

- 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



WE BUILD BETTER
TO MAXIMIZE COMFORT, HEALTH, AND EFFICIENCY

COMFORT

Unlike conventional central systems, our Zoned Comfort Solutions™ provide individual cooling and heating to each zone. This means better airflow distribution and balance, greater temperature and moisture control, and the ultimate in personalized comfort.

↓67°
optimal sleeping temperature is below 67 degrees

HEALTH

Conventional central systems force a large volume of air through long duct runs and one main filter. Our Zoned Comfort Solutions offer smaller air handlers for each zone which also means multiple points of filtration. Room air circulates constantly while filters capture allergens. Units are extremely quiet which contributes to a more tranquil space and healthier environment.

EFFICIENCY

Adding comfort zoning also adds efficiency, at least 40%. Our Zone Comfort Solutions allow homeowners to adjust the system's operation to match their busy lives. If they aren't home or only occupying one or two rooms at a time they can turn off the other rooms so they save money.

37%
LESS ENERGY CONSUMPTION

MITSUBISHI ELECTRIC
COOLING & HEATING

PARAGON
HARRISVILLE MISSOURI



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

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