Minimized Space Conditioning Distribution Strategy for Low-load Homes

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Overview

What distribution strategy should be used in a low-load home?

- Context
- Technical Approach
- Recommended Guidance
- Value
- Market Readiness
- Pros and Cons
- References

Context

- Improving the resistance of the thermal enclosure increases construction/retrofit cost
- Improving space conditioning system efficiency increases construction/retrofit cost

- These costs must be offset by reduced operational cost

Context

What if the thermal enclosure improvements could assist in reducing the mechanical system first cost?

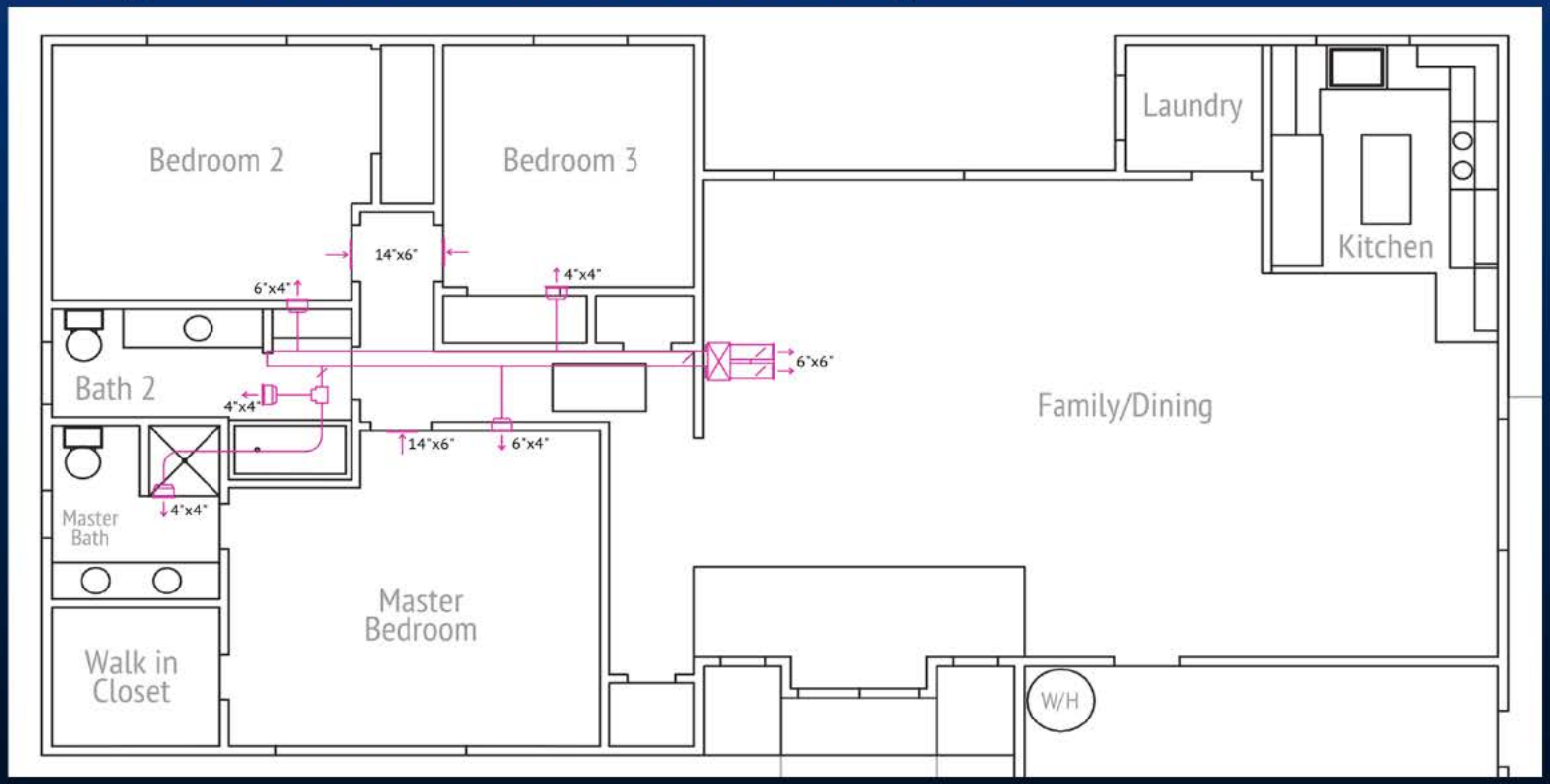
Technical Approach

- HVAC systems should meet:
  - ACCA Manual RS
  - ASHRAE 55 (5.2.5 Temperature Variations with Time, 7.3.2 Temperature Cycles and Drifts, and 7.4 Measuring Conditions)
- Houses meeting BA 50% will be "low-load," meaning:
  - total system capacity of less than 2 tons

    OR
  - a load density per unit floor area of less than 10 Btu/h per square foot of conditioned floor area or (1 ton/1200 sq.ft.)

Technical Approach

- In low-load houses, multiple distribution duct runs can be eliminated to living areas that are in the same air space.



Technical Approach

- In low-load houses, multiple distribution duct runs can be eliminated to living areas that are in the same air space.

Recommended Guidance

- Install a single point of space conditioning in the main living space.

Value

- Energy Cost: *Acceptable* – Provides equivalent energy efficiency to other options
- Installation Cost: *Improved* – Enables lower installed cost due to reduced quantity of duct runs
- Systems Integration: *Improved* – Works with standard furnace/air handler units, while enabling the use of other space conditioning technologies such as mini-split heat pumps
- Comfort: *Acceptable* – Meets the ACCA guidelines as required

Market Readiness

- Market-ready equipment is available and on sale currently to enable the installation distribution strategies using only a single point of distribution to the main living space.

- IBACOS has experimented with small levels of distribution reduction with large production builders and large levels of distribution reduction with small builders. In both cases, the corresponding reductions have been successful.

Pros and Cons

Pros:

- Substantially less expensive while achieving equal or better energy efficiency
- Enables the distribution system to be more easily placed inside conditioned space
- Is minimally invasive aesthetically – no dropped ceilings or bulkheads
- Is compatible with existing technology while accommodating alternatives

Cons:

- Unclear threshold of how many interior partition walls is too many
- May require additional thought about exactly where to place the single point of supply

References

- ASHRAE (2010). ANSI/ASHRAE Standard 55-2010, Thermal Environmental Conditions for Human Occupancy. Atlanta, GA: American Society of Heating, Refrigerating and Air-Conditioning Engineers.

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- Rutkowski, Hank (1997). Manual RS—Comfort, Air Quality, and Efficiency by Design, 1st ed. Washington, D.C.: Air Conditioning Contractors of America Educational Institute, pp. 1–9.

- Stecher, Dave (2011). NREL/SR-5500-52160 Final Expert Meeting Report: Simplified Space Conditioning Strategies for Energy Efficient Houses. Golden, CO: National Renewable Energy Laboratory, July 2011.