Air Source Heat Pumps

Reduce Over Zoning

NEW YORK STATE | NYSERDA

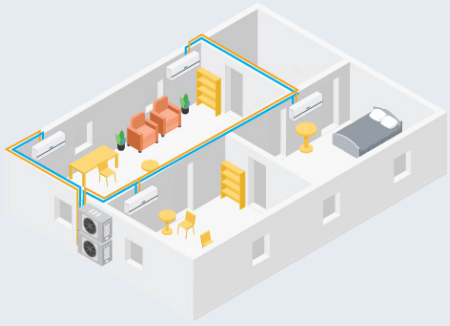
Over zoning may result in system over sizing, higher costs, comfort issues, and call backs

Zoning offers improved comfort, control and flexibility

Zoning can better accommodate occupants with differing temperature and humidity preferences. It can also provide uniform temperature and humidity throughout homes with varying heating and cooling loads.

Heat pumps allow for new and useful styles of zoning you can't get from traditional fossil fuel heating and split air conditioning systems. With heat pumps, zoning can be done using ductless, ducted, compact ducted, or a mix of each, offering greater flexibility to installers.

Ductless heads (1:1 or multi-split)



A small duct system, or compact system, per-zone

A large duct system, split into zones using dampers (follow traditional ducted zoning)

Mix and match

BE CAREFUL! With the ability to customize a heat pump system, it can be easy to over-zone, resulting in an oversized system. Proper zoning requires a careful look at the system as a whole and "right sizing" the heat pump and distribution system to meet each zone's heating and cooling loads. An improperly zoned and oversized system can lead to:

- Higher up-front cost
- Inefficient operation
- More call backs
- Reduced equipment lifespan
- Longer install time
- High utility bills
- More equipment failures
- Dissatisfied customers

12 Tips for Zoning with Heat Pumps

Applying these best practices when assessing the home, selecting zones, and installing indoor units will ensure even space conditioning while avoiding the need to install a unit in every room.

When assessing the home

1. Listen to the customer's needs - ask about hot and cold spots and spaces with unique temperature preferences.
2. Address the building envelope - recommend air sealing and insulation upgrades before installing the heat pump to ensure better comfort, reduce energy use, and reduce costs for customers
3. Collect accurate building take offs – a room by room load sizing analysis is required before selecting zones

When selecting zones

4. Use your tools – ACCA Standard Manual J, Zr, D, and S
5. Ensure multiple rooms within a zone are thermally connected – there should be clear pathways for heat/air to flow across the zone from the distribution point(s) across the zone. Avoid multi-floor zones.
6. Check that neighboring zones are not thermally connected - each zone doesn't have too much thermal communication to neighboring zones (open stairwells, large open archways between rooms, multiple heads in an open floor plan, etc.)
7. Make isolated spaces their own zone - a remote room (master bedroom, mudroom, etc.) or an addition without a clear connection to the rest of the house should be its own zone
8. Consider installing remote temperature sensors in rooms or spaces that share a zone but include walls, doors, or other obstructions that reduce the path of air and heat to flow
9. Make sure all the rooms in a zone have similar thermal needs - don't connect rooms into a zone that you don't plan to heat/cool fully into a zone (e.g., laundry room, utility room)
10. Slightly undersize a zone to avoid oversizing the overall system. Extra heating and cooling from one zone can play backup to another zone. Exceptions include thermally isolated rooms, such as an above garage apartment or master bedroom with three exterior walls, which may still require sizing to design load conditions.

Zoning Hint

Homes with large open floor plans or large spaces with high ceilings may require more than one indoor head to provide enough coverage and capacity for the space. However, most manufacturers offer products with large enough capacities to cover the entire open space with one indoor unit. Check out the products available before installing more than one indoor unit to serve the same zone.

When installing indoor units

11. Install ductless indoor units with a clear path and minimal obstructions for air to flow across and around the zone
12. Install ductless indoor units so manufacturer clearance requirements are met to ensure proper air flow

Zoning Hint

If a zone's heating or cooling load is less than the heat pump's minimum capacity, then the heat pump will short cycle. Refer to the Don't Oversize fact sheet to learn more about short cycling.

Common Mistake with Zoning

Contractors commonly over-zone by installing too many ductless indoor heads. Most homes do not require a ductless indoor head in every room. Heating and cooling flows within a home well, especially where interior doors are left open.

Rooms where you can skip ductless heads:

- Very small rooms with low occupancy - bathrooms, utility rooms, etc.
- Rooms with very little exterior wall exposure
- Rooms with good thermal pathways to other rooms that have heads (open doors, transfer grills, etc.)

Zone Design Example

Comparing Ductless Single Zone System Designs

Table 1 shows the design loads for all rooms on the first floor of a single-family two-story house located in Saratoga County, New York (heating season design temperature is 1°F). There are multiple zoning design and equipment selection approaches for this floor plan, this example compares only two zone designs that apply multiple ductless single head systems. Building weatherization/envelope upgrades would typically be considered before installing a heat pump for this household.

Table 1: Room by Room Design Loads

Room	Living Room	Kitchen	Dining Room	Bedroom	Bathroom	Laundry Room	Total
Design Load (Btu/hour)	15,641	3,535	14,690	8,416	3,018	1,356	46,656

Figure 1: First Floor of Upstate NY Single Family Two-Story House

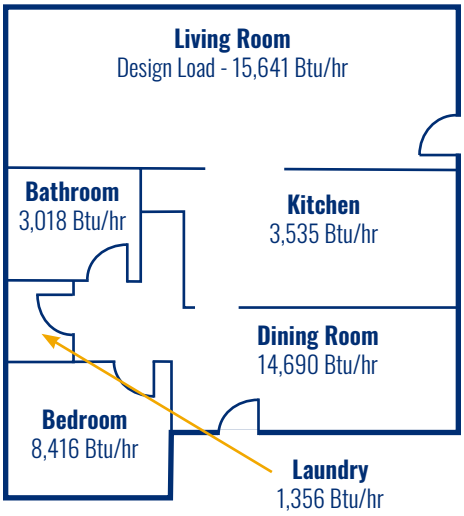
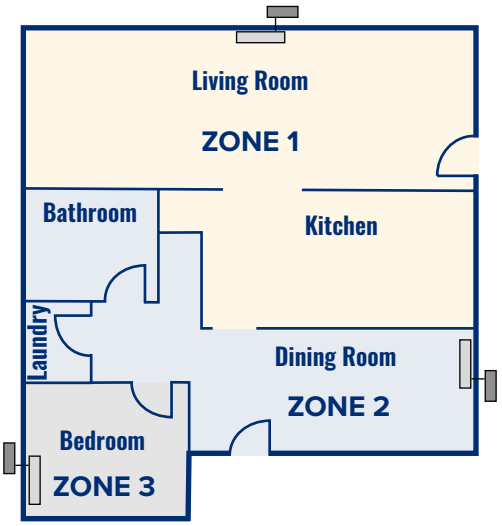


Table 2 and figure 2 shows the expected performance of a three-zone system. Clear air pathways between rooms will allow this system to provide sufficient comfort.

Table 2: Proper Zoning Design Equipment Performance

	PROPER ZONING			
	Zone 1	Zone 2	Zone 3	Total
	Living Room Kitchen	Dining Room Bathroom Laundry	Bedroom	
Nominal Capacity (Btu/hour)	15,000	18,000	6,000[1]	39,000
Max. Capacity at Design Temp. (˚F)	18,258	21,689	9,778	49,725
Percent Design Load Served[2]	**99.6%**	**113.8%**	**116.2%**	**107%**
Percent Annual Heating Load Modulating[3]	**75.2%**	**79.6%**	**86.8%**	-
Percent Annual Heating Load with Low Load Cycling[4]	**14.7%**	**12.7%**	**6.2%**	-

Figure 2: Proper Zoning



[1] A 6,000 Btu/hr indoor head and the 9,000 Btu/hr indoor head will perform similarly during the heating season, but the 6,000 Btu/hr indoor head will perform better during the cooling season.

[2] Indicates the percentage of the home's design heating load met by the heat pump operating at maximum capacity at the design temperature.

[3] Indicates the percent of the annual heating load supplied by the heat pump in its modulating zone.

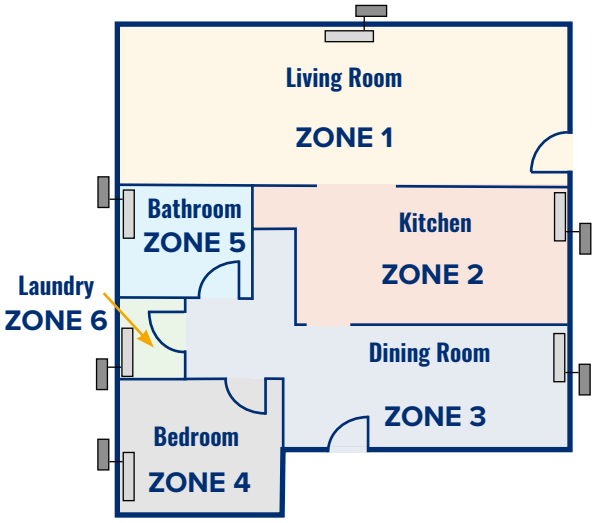
[4] Indicates the percent of the annual heating load where the home's load is below the heat pump's minimum capacity thus potentially causing the compressor to cycle.

Table 3 and figure 3 shows the expected performance of a six-zone system. The six-zone system is an example of how over zoning a system may lead to system oversizing. Table 2 shows the equipment serving the kitchen, bathroom, and laundry room in the six-zone system are substantially oversized for the zones served. Implementing the six-zone system will result in poor equipment performance, more callbacks for the contractor, and customer complaints.

Table 3: Over Zoning Design Equipment Performance

	OVER ZONING						
	Zone 1	**Zone 2**	**Zone 3**	**Zone 4**	**Zone 5**	**Zone 6**	**Total**
	Living Room	Kitchen	Dining Room	Bedroom	Bathroom	Laundry	
Nominal Capacity (Btu/hour)	15,000	6,000	15,000	9,000	6,000	6,000	57,000
Max. Capacity Design Temp. (˚F)	18,258	9,778	18,258	10,792	9,778	9,778	76,642
Percent Design Load Served[5]	116.7%	**364.7%**	124.3%	128.2%	**324%**	**721.1%**	**134.4%**
Percent Annual Heating Load Modulating[6]	74.1%	**53.1%**	70.9%	88.2%	**60%**	**21.4%**	-
Percent Annual Heating Load with Low Load Cycling[7]	18.7%	**44.6%**	22.8%	6.2%	**37.6%**	**77.1%**	-

Figure 3: Over Zoning



The performance data listed in the tables are based on equipment specifications from ductless single zone products listed on the NEEP ASHP Product List. ***The three-zone system will perform more efficiently than the six-zone system.***

[5] Indicates the percentage of the home's design heating load met by the heat pump operating at maximum capacity at the design temperature.

[6] Indicates the percent of the annual heating load supplied by the heat pump in its modulating zone.

[7] Indicates the percent of the annual heating load where the home's load is below the heat pump's minimum capacity thus potentially causing the compressor to cycle.