

Cold-Climate Air Source Heat Pumps


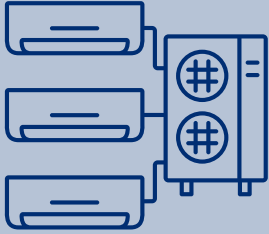


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Multi-Head vs. Single-Head Split Systems

Know the strengths and weaknesses of ductless heat pump configurations.

Multi-head and single-head ductless split systems can be used to heat and cool almost any home type. How these systems are configured and applied can have substantial effects on their efficiency, efficacy, and lifespan. **Learn more about the key differences between multi-head and single-head systems and how to know which one is right for the home.**

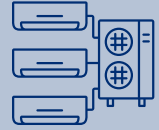
Single-Head (1:1) System	Multi-Head System
Application	
 <p>Smaller Scale</p> <ul style="list-style-type: none">• Viable option for supplemental or partial load heating and cooling• Viable option for full load heating and cooling when applying multiple 1:1 systems or in certain homes with compact dwellings• Typical for single family, individual dwelling units (e.g., apartments), or small businesses	 <p>Larger Scale</p> <ul style="list-style-type: none">• Viable option for partial load heating and cooling• Viable option for full load heating and cooling• Typical for single family, multifamily, and small commercial applications
Efficiency	
<p>+ More Efficient</p> <ul style="list-style-type: none">• Higher seasonal heating performance than a multi-head system heating in the same conditions• 2 to 2.5 times greater average seasonal heating performance compared to ductless multi-zone systems¹	<p>- Less Efficient</p> <ul style="list-style-type: none">• Incur an efficiency penalty when one outdoor unit serves more than three heads• Often higher annual energy usage• Efficiency penalty will be amplified by poor layout of indoor heads (installing heads in areas with vastly different thermal needs or usage frequencies)
Zone Design	
<p>- Less Complex Design</p> <ul style="list-style-type: none">• Easy design and installation to provide zoned heating and cooling• Greater risk of over-zoning a home or oversizing the heat pump for the space served with multiple 1:1 systems	<p>+ More Complex Design</p> <ul style="list-style-type: none">• More complex design and installation to provide zoned heating and cooling• All indoor heads must serve adjacent or connected zones when served by a common outdoor unit• Greater risk of efficiency penalties when the system serves zones isolated from one another (e.g., zones on different floors or on opposite ends of a home)

¹Residential Cold-Climate Air Source Heat Pump Study 2022 (e4thefuture.org)

Single-Head (1:1) System



Multi-Head System



Electrical Requirements



More Panel Space

- 15 to 25 amp two-pole circuit breaker typically required per outdoor unit
- Requires more breaker space for multiple 1:1 systems
- Homes may require a panel upgrade or sub-panel to power all units



Less Panel Space

- Fewer circuit breakers required with fewer outdoor units
- Feasible option for homeowners with limited breaker space
- Multi-head outdoor units may draw more power and require higher amperage circuit breakers (up to 40-amp breaker required)

Space and Visibility



More Space and Visibility

- More exterior wall, ground, or roof space needed to mount multiple outdoor units
- More noticeable and less visually appealing
- Greater risk of homeowners covering up outdoor units with shrubs, covers, etc. impacting equipment performance



Less Space and Visibility

- Less exterior wall, ground, or roof space needed to mount fewer outdoor units
- Less noticeable and more visually appealing
- Option for homeowners with limited outdoor space or homeowners especially concerned about unit visibility

Upfront Cost



Higher Upfront Cost

- Typically, higher upfront costs due to additional material and labor



Lower Upfront Cost

- Typically, lower upfront costs due to less material and lower labor required

Resiliency



More Redundant and Resilient

- Provides redundancy using multiple 1:1 systems to heat and cool the home
- Redundancy provides resiliency (the home still has partial heating and cooling if one of the outdoor units malfunction)
- A more resilient system means piece-of-mind for the homeowner



Less Redundant and Resilient

- Little to no redundancy if only one or two multi-head systems serve the entire home
- A greater portion of the home has no heating and cooling if the outdoor unit malfunctions
- Lifespan of system can be decreased by poor layout of indoor heads (installing heads in areas with vastly different thermal needs or usage frequencies)

Use the flow charts on the following pages to determine the best system to meet certain home conditions.

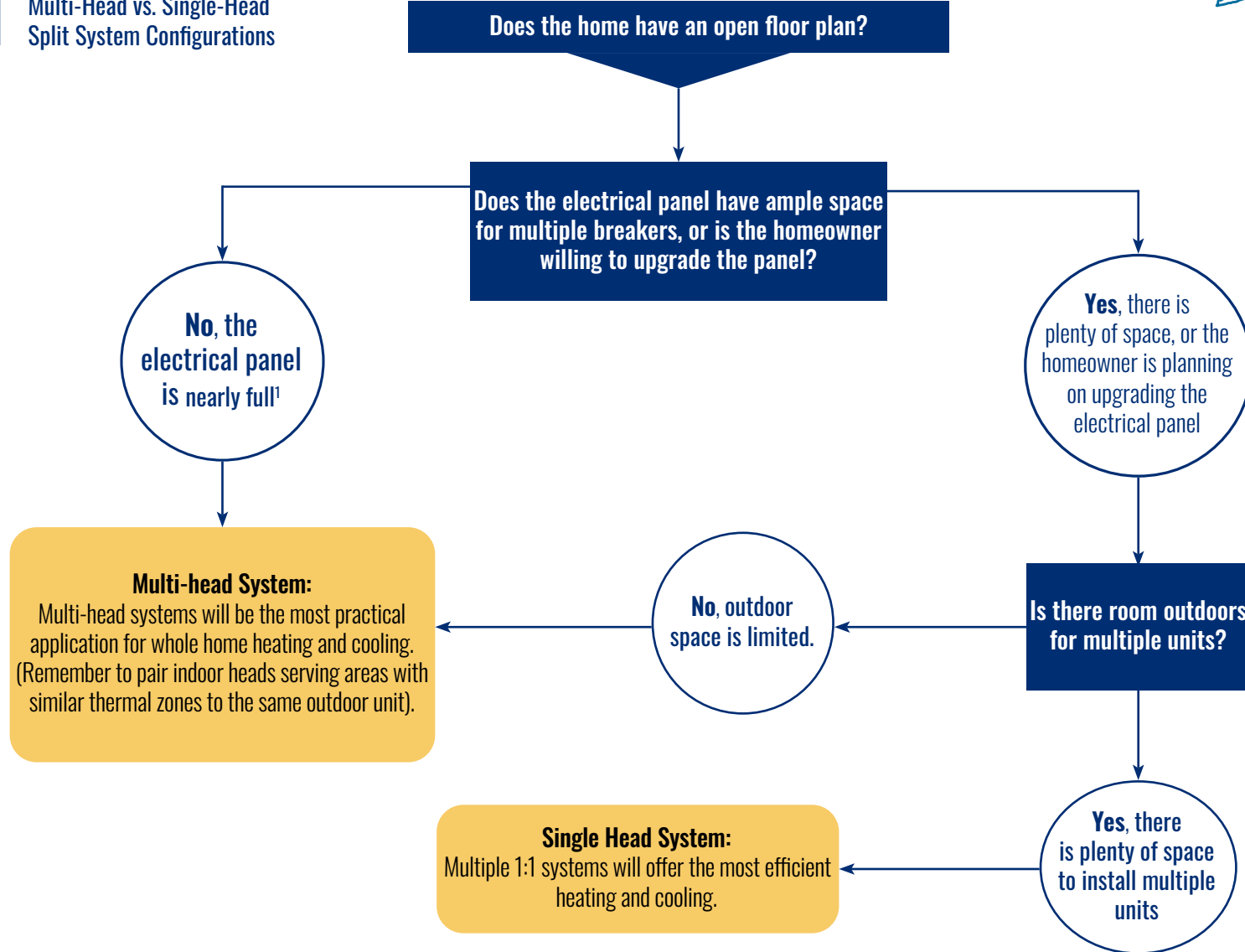


Cold-Climate Air Source Heat Pumps Whole Home - Open Floor Plan

Multi-Head vs. Single-Head
Split System Configurations



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¹ Even with *breaker space* for one system, some homes may require an upgrade to their electric *service capacity*.



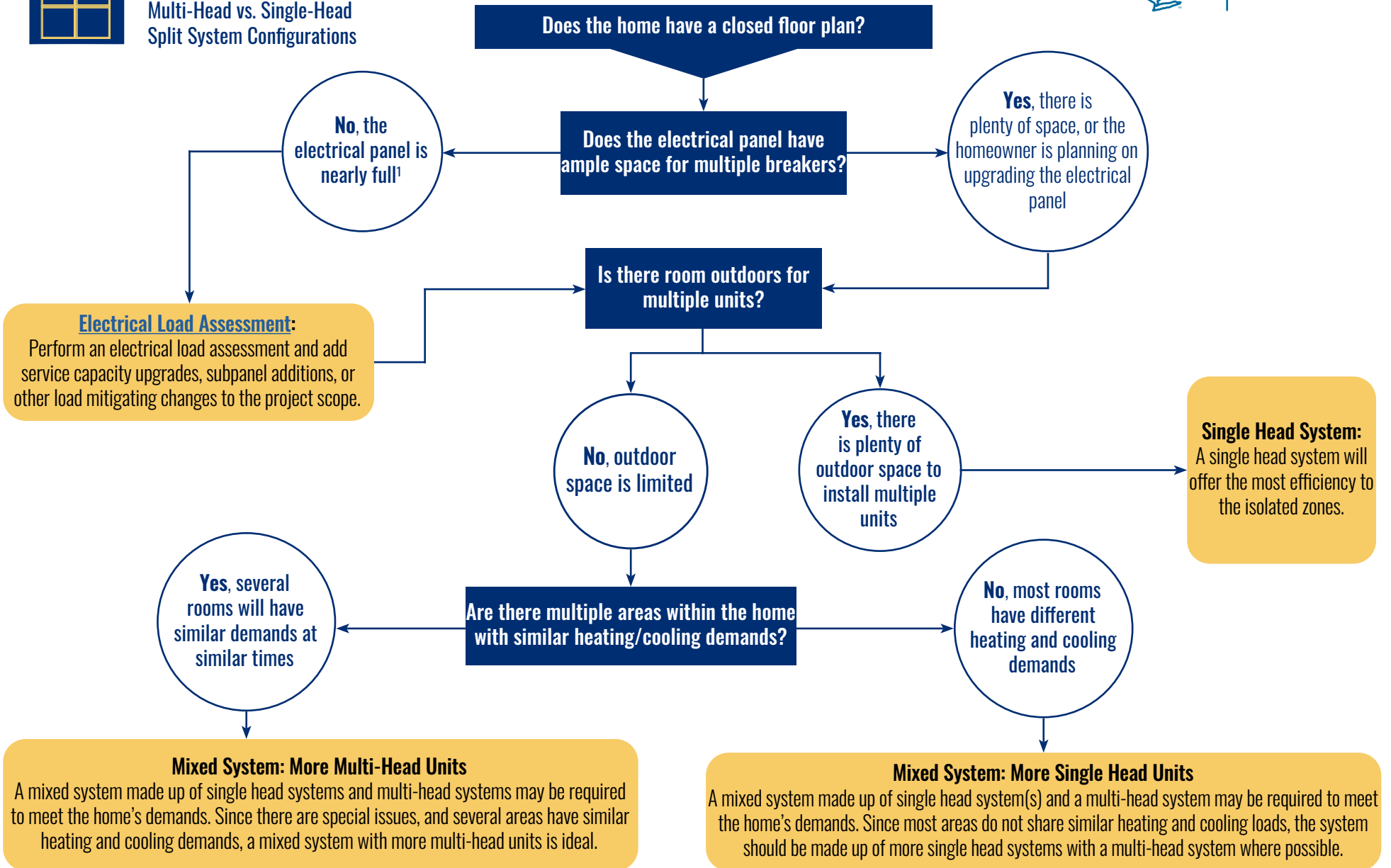


Cold-Climate Air Source Heat Pumps Whole Home - Closed Floor Plan

Multi-Head vs. Single-Head
Split System Configurations



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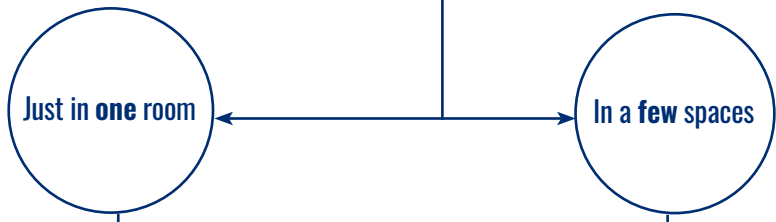
Cold-Climate Air Source Heat Pumps Partial Home

Multi-Head vs. Single-Head
Split System Configurations



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Will the system be used in a single space or in a few spaces?



Can a single indoor head provide all heating and cooling load for the space?



Single Head System:
This area can be served with a single indoor unit, so a single head system will make the most sense.

Multi-head System:
Using a multi-head system will be the most cost-effective option without incurring much of an efficiency penalty.

How separated are the spaces?

They are on the same floor and have unblocked airflow between them

Yes, they all have similar heating loads and will be used at similar times (ex: all exterior walls)

Very separated (on separate floors, or in isolated rooms with doors that are often closed)

Do these areas have similar heating and cooling demands?

No, they have very different demands and usage schedules. (ex: finished basement and living room)

Single Head System:
Because these areas have very different demands, installing a few single 1:1 head systems will offer the best efficiency and minimize short cycling.

