2026 Colorado Heat Pump Webinar Series

Best Practices for Selecting and Installing Heat Pumps in *Existing* Colorado Homes

Heat Pumps/Furnace Dual Fuel Systems

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Introduction

- Colorado Climate Zones
- Heat Pump Types

All Electric vs Dual Fuel

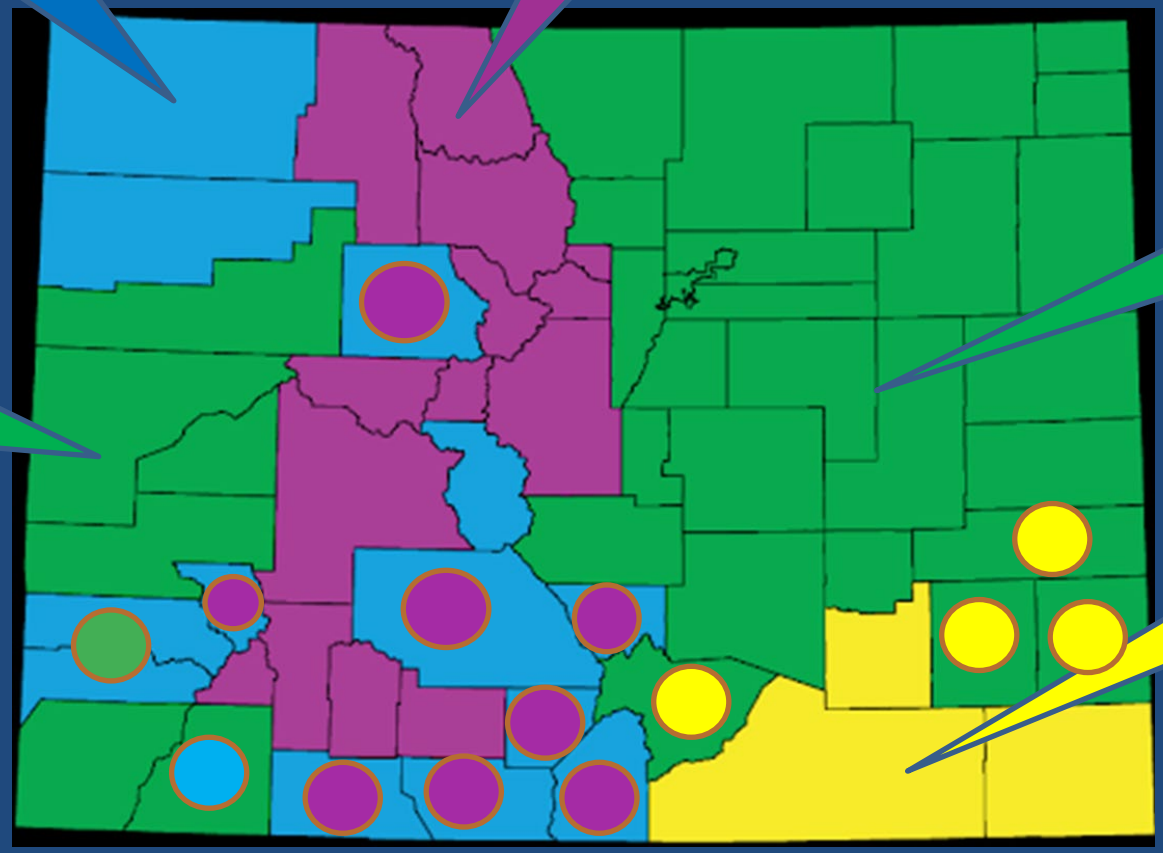
- Existing furnace or replace

Sizing Dual Fuel, Single-speed Multi-speed, and Cold Climate Systems

Airflow requirements and testing

Installation Best Practices

Colorado Climate Zone Map Is Too Simple



Zone	Elevation
5	Up to 7000’
5a	7000 to 8000’
6	7000 to 8000’
6a	Above 8000’

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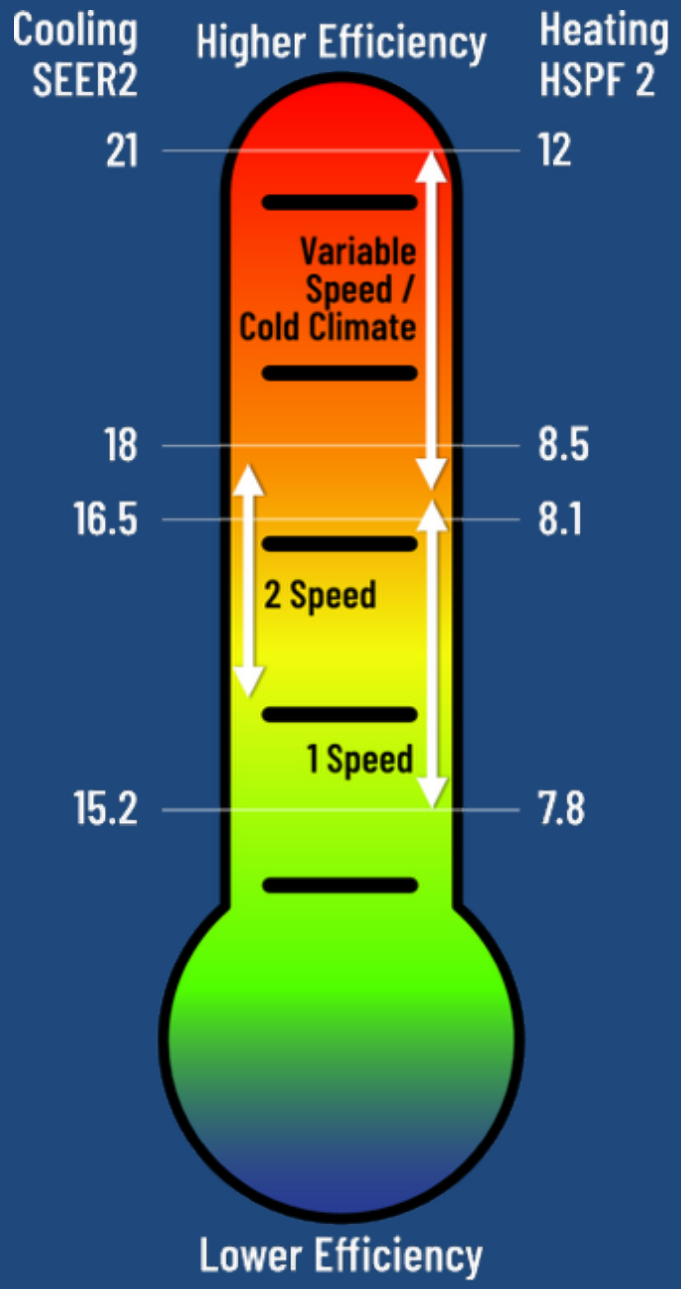
Air Source Heat Pump Levels



Cold Climate Variable Speed/Capacity (inverter systems)

- Good for all electric or dual fuel heating in CO → Climate Zones 5, 6, 7
- Hold Capacity at low outdoor temperature → 5F capacity is 70%+ of 47F
- Heat down to -13°F; often lower in specific cases
- Meet requirements for Colorado Utility and Government Cold Climate System rebates

Note: On manufacturers websites some heat pumps are labeled as *cold climate* and other units are labeled only as *inverter/variable speed* or *high efficiency* even though their specifications do meet Colorado cold climate rebate requirements

Multi-stage/speed (2 or 3 speed) / Single speed

- Good heat pump/furnace dual fuel option
- Simple installation, commissioning and setup
- Compatible with some older furnaces
- Good option to overcome electrical and ducting constraints

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Cold Climate System Comparisons
Existing Homes Summary

System Characteristics	Cold Climate All-Electric	Cold Climate Dual Fuel	Single/Multi-Speed Dual Fuel
Colorado Climate Zone Recommendation	Zones 5 and 6	Zones 5, 6 and 7	Zone 5
First Cost HP system	*Higher* before rebates	Higher before rebates	*Lowest* before rebates
Electric upgrade/Duct upgrade	Electric in most cases Notable to Significant Duct changes often required	Ducts moderate to notable changes	Minor or no duct upgrades
Annual operating costs in general	Comparable or slightly higher than CC dual fuel	Lowest	Can be comparable or slightly higher than CC dual fuel
Natural Gas use reduction	100%	90%+	80%+
Expected System Lifespan	Maybe 1-2 years less than dual fuel systems	15-20	15-20

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Dual Fuel System → Replace Existing Furnace?

General Criteria for Pairing with Heat Pumps

- *Do not* keep the furnace if it compromises the performance of the heat pump
- Existing furnace must minimally meet the following
  - Controls communication compatibility
  - ECM motor
  - Evaporator coil match → the heat pump should be from the same manufacturer as the furnace to ensure controls compatibility
- If old furnace is not adequate, the new system (furnace/heat pump) must be a matched set from the same manufacturer
- Some utilities require/recommend AHRI matched system

Specifics on Pairing with Cold Climate Heat Pumps

- It is unlikely that any furnace greater than 5 years old and less than the top of the line will meet the above criteria
- Evaporator coil match → if the existing coil is size for cooling it is likely that it also will need to be replaced

Specifics on Pairing with Two Speed Heat Pumps

- Potentially, furnaces up to ~12 years old will meet the above criteria when paired with 2-speed heat pump
- If the furnace is greater than ~12 years old, it is best to replace it

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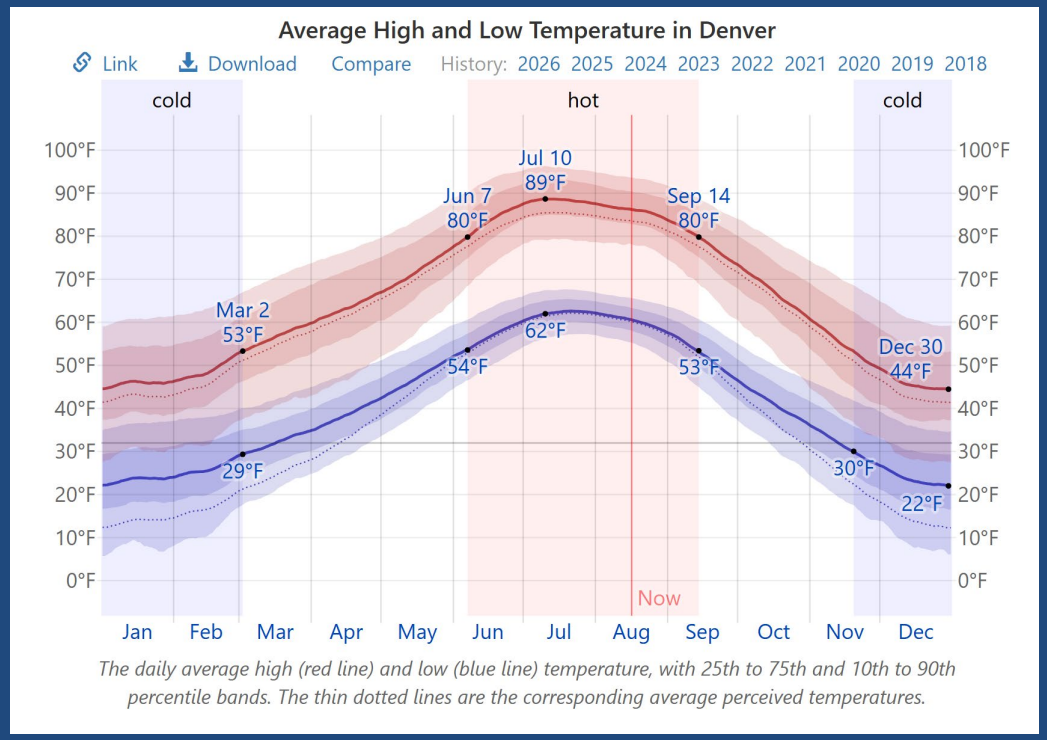
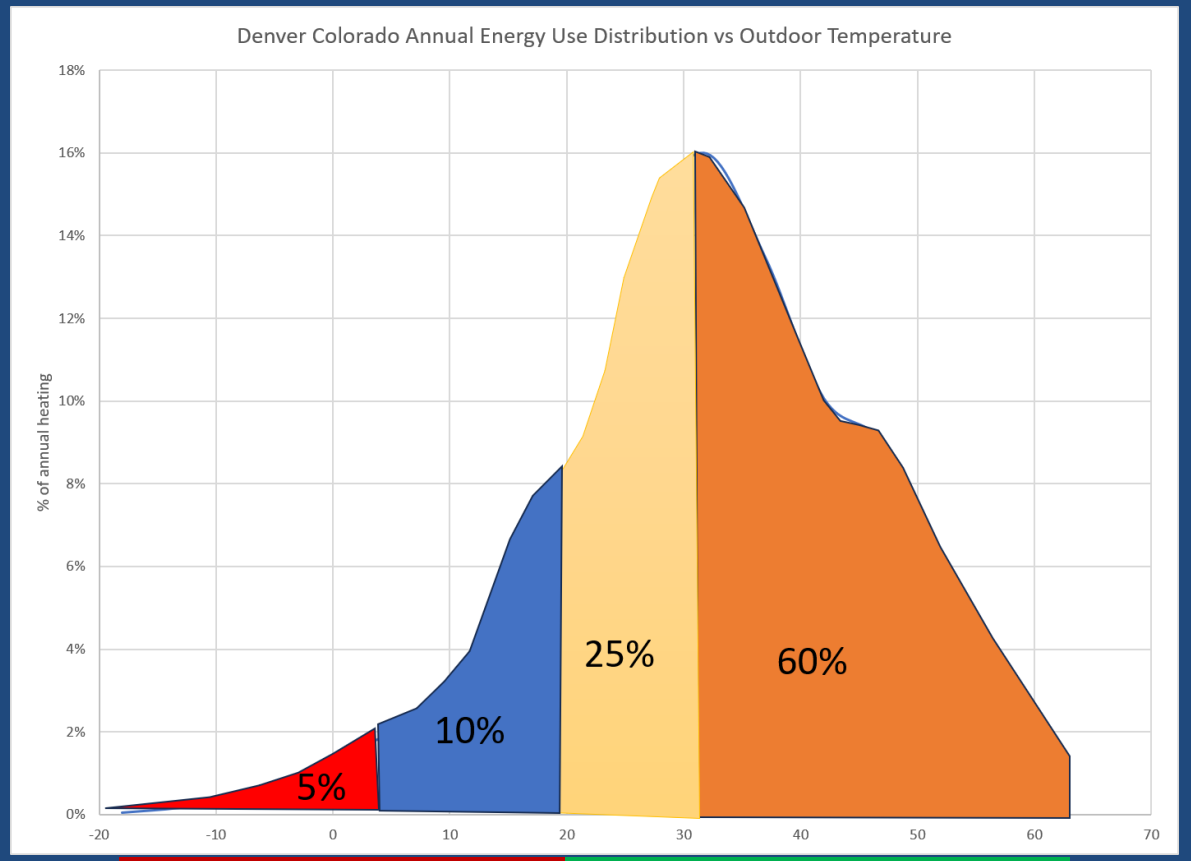
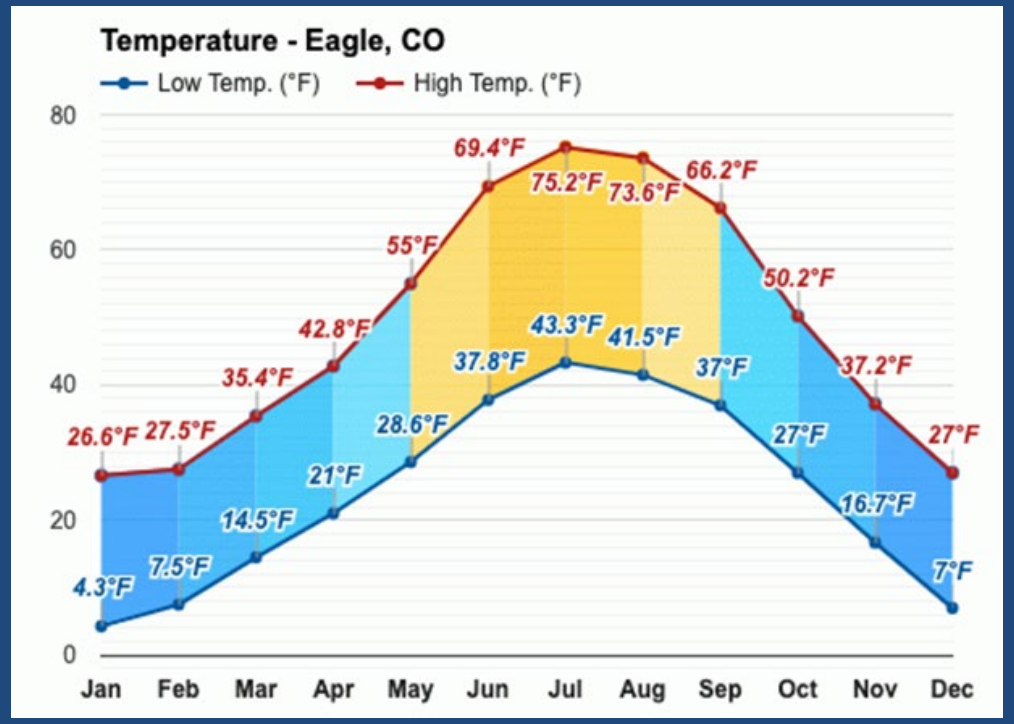
Denver Heat Pumps → Heating Comparisons

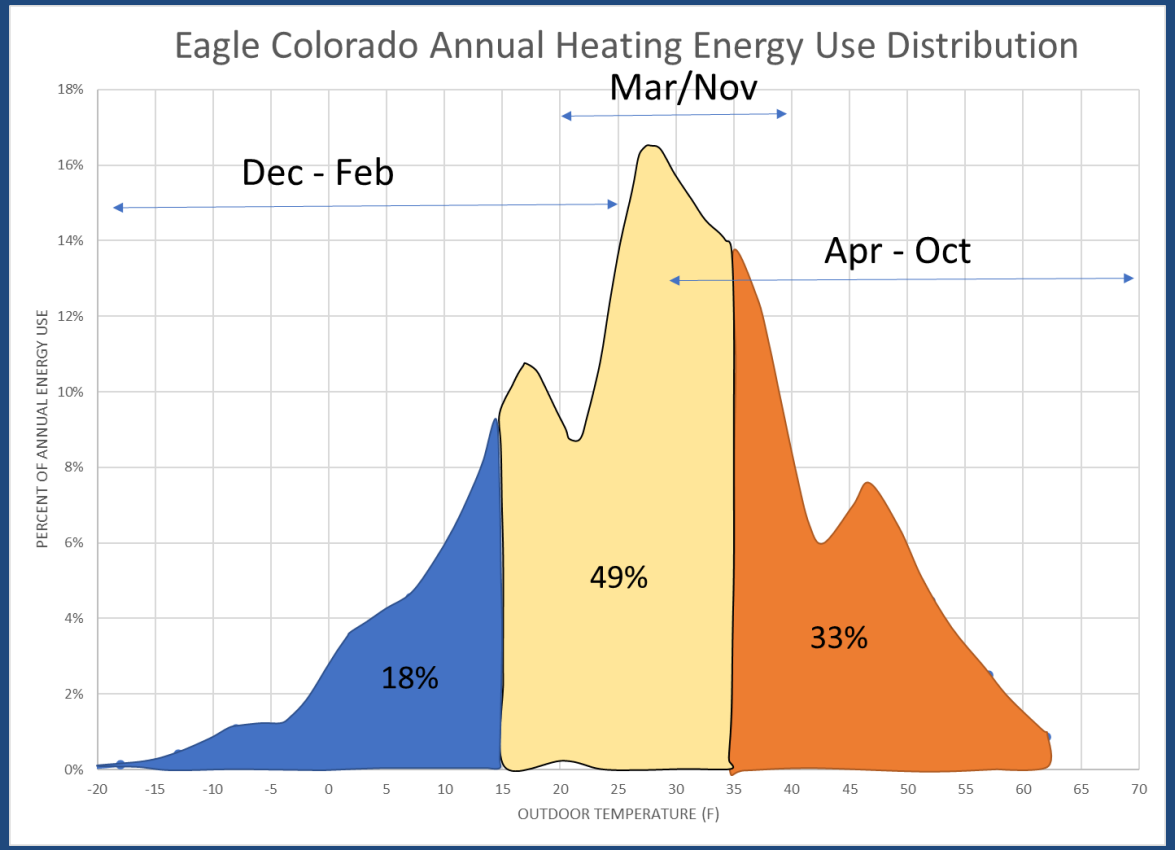




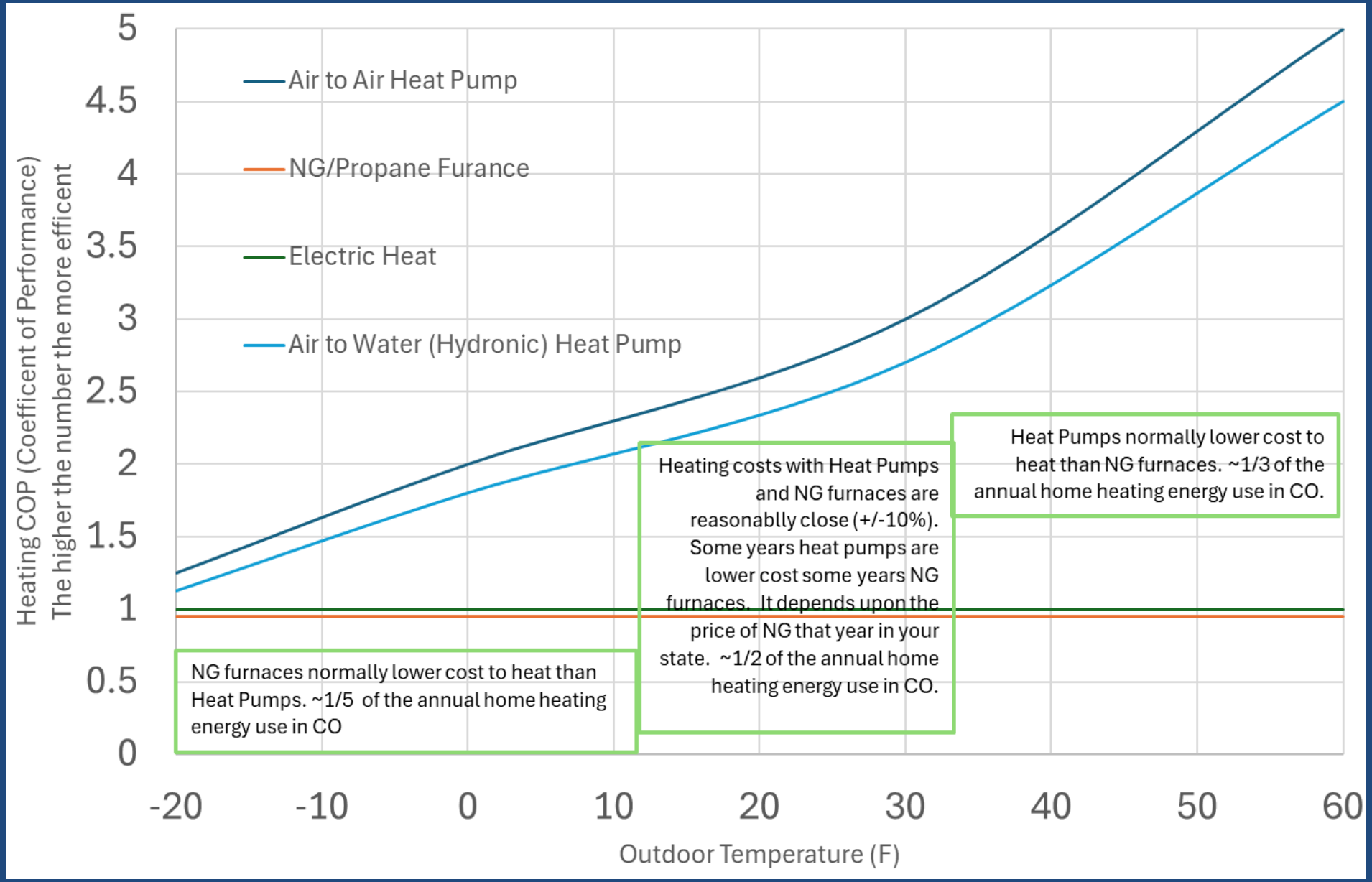
Furnace | Muli-Speed HP

Eagle Heat Pumps → Heating Comparison





Furnace | CC Heat Pump



Energy Efficiency & Relative Heating Cost of Home Heating Sources

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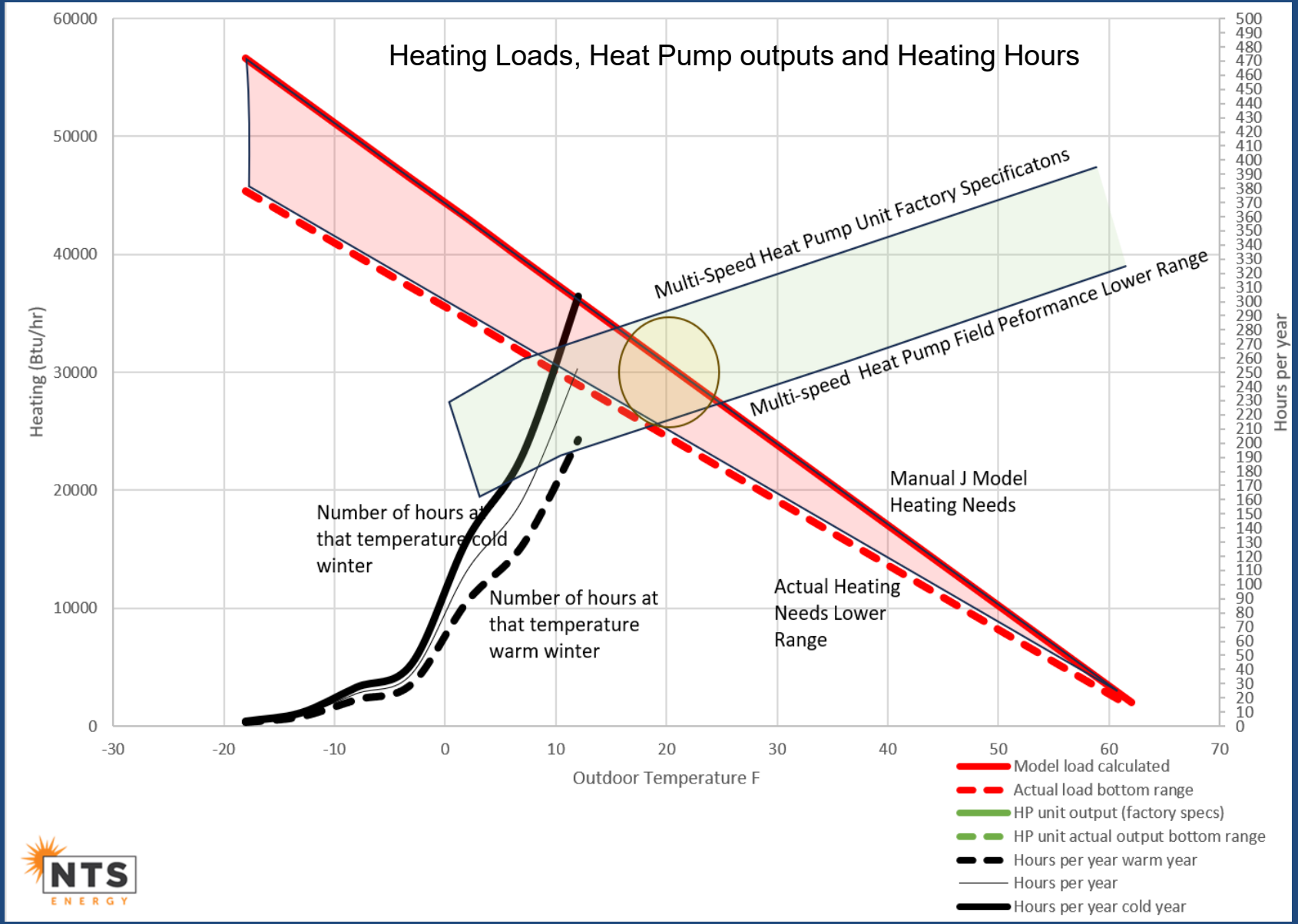
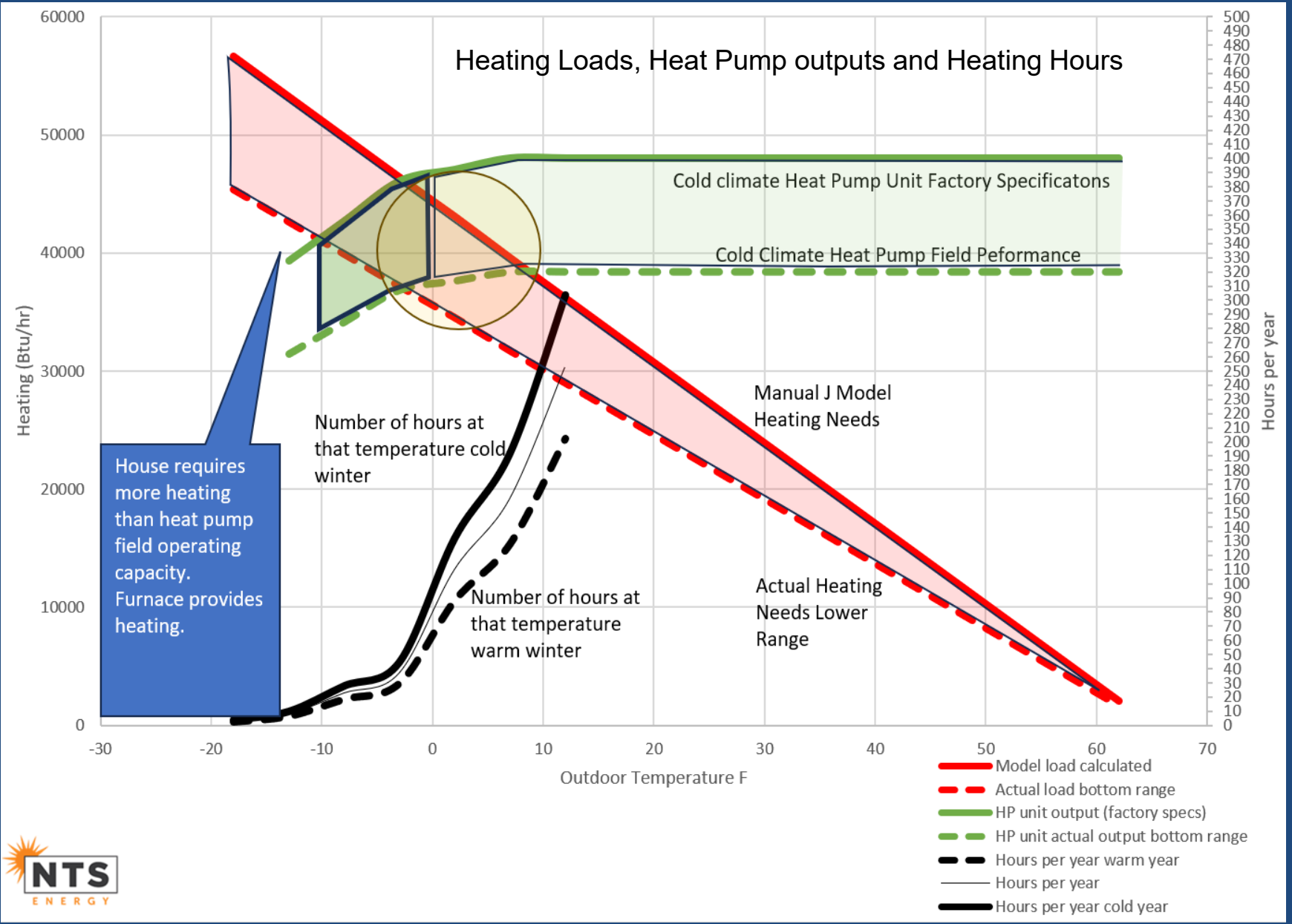
Sizing → Multi-Speed Dual Fuel



- Manual J to determine how much heating/cooling a home needs yearly, based on outdoor temps
- Multi-speed heat pump sized to carry the entire heating load to ~20F outdoor temperature range
- Must adjust capacity* for ALTITUDE
  - Zone 5 below 7K: 5-10%
  - Zone 5/6, 7-8K: ~10-15%
  - Zone 7 – Muti-speed not adequate
  - * Somewhat mfg dependent

Note: Heat Pump Size → There are not infinite size choices; for any given home, choices are between just a few sizes

Sizing → Cold Climate Dual Fuel



- Manual J to determine how much heating/cooling a home needs yearly, based on outdoor temps
- Cold Climate Heat Pump should be sized to carry the entire heating load down to ~5ºF.
- Must adjust capacity* for ALTITUDE
  - Zone 5 below 7K: 5-10%
  - Zone 5/6, 7-8K: ~10-15%
  - Zone 6/7, above 8K: 15-20%
  - * Somewhat mfg dependent

Note: Heat Pump Size → There are not infinite size choice; for any given home, choices are between just a few sizes

When Heating Load is Between Unit Size Capacities → *Upsize*

Issue	Impact on System Capacity in the Field
Manual J load (tends to overestimate with perfect model)	+/- 10%
System Specification	Tested under *perfect* factory conditions
Systems as shipped from the factory	+/- 1%
High-quality field installation – slight deviation from the *perfect* factory conditions	0 to -2%
Field operation under harsh winter storm conditions	-5 to -10%
Annual performance degradation; excellent annual maintenance; median solar panels (~0.95%)	0 to -1%
Annual performance degradation; sporadic maintenance (most common)	0 to -5%

Upsizing a system by ½ ton does not increase initial cost; efficiency difference at milder temperatures is insignificant due to inverter compressor system

Turndown is ~33% for Two Speed heat pumps and for Cold Climate ~65+%

Impact of Future Warming → To ensure system provides cooling under warming conditions, pay attention to cooling sizing in Multi-speed Heat Pumps Dual Fuel Systems in Zone 5

- Zone 5 – Current Mean Extreme for Denver 100°F; Projected Mean Extreme 110°F next 15 years
- Zone 6/7 - Current Mean Extreme for Eagle 93°F; Projected Mean Extreme 103°F next 15 years
- Indoor design temperature: 77°F (Note: Productivity drops above this temperature)

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Airflow Heat Pumps vs NG Furnace

When using the existing duct system, at what lowest outdoor temperature can the heat pump still handle the full heating load? The Conservative Approach:

- Assume 400 cfm/ton for heat pump and 350 cfm/ton for furnace; ~15% more ducting required for heat pump
- For Cold Climate Heat Pump Dual fuel, determine equipment size at ~0°F outdoor from Manual J; based on specific heat pump capacity specified and cfm/ton, determine if the duct trunk supply and return are adequate for full heating at ~0°F
- Common situations
  - Main supply trunk generally adequate in the 0°-10°F outdoor temperature range
  - The number of supplies will be short, typically 2-5,especially at the end of long trunk runs or in uncomfortable rooms
  - Return air registers are often undersized for heat pumps and need expanded capacity

Heat Pump: Typical output temp ~100°-105°F, ~375-400 cfm/ton Refer to equipment manual for specific value at elevation

Furnace: Typical output temp ~125°F, ~300-350 cfm/ton

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Customer Friendly Thermostats

- Programmable third party – at least day/night setback but as simple as possible
- Manufacturers fully communicating integrated thermostats.
- Emphasize no more than 4-degree nighttime setback

Teach ***customers*** how to adjust the changeover temperature, if they are uncomfortable

- Customers can increase installation setting (~20°F for multi-speed, ~5°F for Cold Climate) changeover temperatures by 5°
- If the system requires more than 5° increase for comfort, they should call for service evaluation

Why Correct Airflow is Critical for Heat Pump Performance

Heating Mode

Airflow too high or low – can reduce air temperature leaving the coil hurting efficiency and potentially comfort

Cooling Mode

Too high or low can affect humidity control

Temperature Rise

Affects efficiency and comfort; possible temperature protection faults

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Measuring Static Pressure and Airflow

Good Outdoor Installation → Good Performance (1 of 2)

Best location is on the south side your home; sun helps defrost

- East and West are fine; avoid the North side if possible
- If practical, install soft or hard landscaping to protect from west winds

Assess and mitigate noise impact around patios, bedroom windows

- Vibration impacts: Wall mounts need damping
- Review all equipment noise specifications

Do not locate unit under the edges of overhangs

Mount at height above the avg snow depth at max month (Jan)

- Vail – 31” Feb
- Rifle – 4” Jan
- Front Range – 12”

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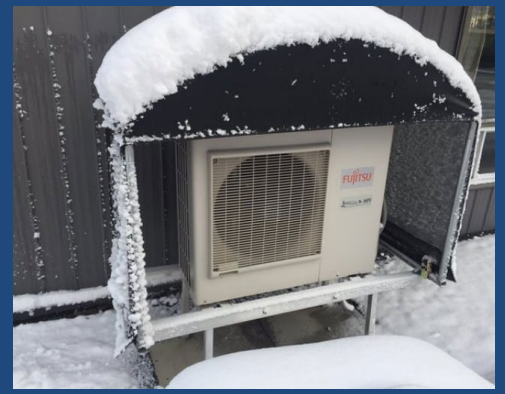
Good Outdoor Installation → Good Performance (2 of 2)

Erect a snow shelter over the unit

- For Side Flow Units → the shelter can be close to the top of the unit
- For Top Flow Units → need 24” clearance



Effective drain pan heater and drain to safe location

Crankcase heater wiring

Protect condensate line

Lineset Best Practices

Layout → no sharp bends or kinks, curves instead of 90 bends

Insulation

- Closed cell foam
- Attach with zip ties not tape
- UV protection (south side)
- Insulate outdoors and in unconditioned spaces
- No gaps
- Seal penetrations with sealant that meets minimum temperature requirements

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Duct system checks and improvements

Check ducts in unconditioned/partially conditioned spaces

- Attic, crawl space, basements
- Check duct joint sealing
  - Duct leakage test, if not accessible
  - Note: Some rebates for duct sealing are available
- Ensure ducts are well insulated

Evaluate duct sizing to ensure efficient heat pump performance

- Add supplies and returns in uncomfortable rooms if possible
- Returns can generally be installed near the air handler/furnace unit and relatively easy to locate
- Small return lines can sometimes be added in finished basements

Consider adding duct system zoning to the main trunk to create 2 zones

- Increased comfort
- Improved overall efficiency

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Other Installation Considerations

Nitrogen Purging during Brazing → Failing to do this creates internal scaling which later clogs valves

Incorrect Refrigerant Charge → System shutdown/failure

Miswiring Communication Controls → Incorrect gauge, cross wiring or wire nuts; results in lockouts

Summary (1 of 2)

- Size systems for the correct climate and altitude
  - Cold Climate, single or multi-speed dual fuel for Climate Zones 5/6
  - Cold Climate for Zone 7
- If furnace is not technically compatible with the new heat pump → *replace it*
- Size for changeover appropriately
  - Size Multi-Speed for ~20°F changeover
  - Size Cold Climate for ~5°F changeover
- Ensure ducting is adequate for Cold Climate; if needs upgraded and can not be upgraded, then go with Multi-Speed option

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Summary (2 of 2)

- Keep the controls as simple as possible → *Teach the Customer*
- Follow installation best practices for the specific system for all phases of the project → sizing, air flow, outdoor unit, linesets, ducting, electrical, refrigerant

Finally → Know all the requirements of your equipment *before* installation

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  - Facility wide energy monitoring system
  - Energy saving upgrades on large industrial production
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- **Lead, Technical Sales** – RMS Electric → Solar & Energy power systems
- **MS in Geophysics** – Washington University, St. Louis

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