

The TE Series Heat Pump



The TE Series Heat Pump keeps buses on the road longer in cold and moderate climates.

Battery electric buses are decarbonizing transportation, but inefficient electric resistance heating systems in use today may not be ideal in locations where heating is required. Generating heat by drawing energy solely from the battery significantly reduces bus operating range. Thermo King's TE Series Heat Pump can help solve this problem.

Maximize the battery charge

Heat pumps are up to 2.5 times more efficient than electric resistance heaters.

Maintain rider comfort

Our heat pumps keep passengers warm when outside temperatures drop to approximately 20°F without backup heating.

Drive longer in cold weather

The TE Series Heat Pump is calculated to significantly extend driving range in moderate and cold temperatures.

Advance your decarbonization goals

Thermo King has been a leader in transport temperature control solutions since 1938.

By nature, heat pumps extend vehicle battery range

Heat pumps are ultra efficient because they extract heat from the outdoor air, instead of generating new heat by drawing from the battery charge. Ultra-efficiency translates to more miles per charge compared to electric resistance heaters.

Based on Thermo King calculations*:

- **Over 50% longer range** at moderate (40°F) temperatures
- **Over 30% longer range** at cold (20°F) temperatures

* Estimates are based on a complete route running at static conditions, actual percentages will vary.

Achieve the lowest-carbon bus HVAC

Battery electric buses can achieve their lowest emissions when heat pumps are used.

- **COP > 1:** For every kW of energy it consumes, Thermo King's heat pump generates more than a kW of heating across a broad temperature range. Heat pumps are up to 2.5 times more energy efficient than traditional electric resistance heaters, which translates to more miles per charge.
- **Reduces indirect emissions:** By reducing battery energy use, heat pumps reduce the need for battery recharging — resulting in less emissions at the power source.
- **Lowens direct emissions:** Heat pumps can eliminate or reduce the use of diesel fuel heaters on the bus.





Meet rider and community expectations for comfort and sustainability

Heat pumps make lower-carbon transportation more viable in moderate and cold climates.

- Run longer bus routes with an extended battery range.
- Riders stay warm in ambient temperatures down to approximately 20°F without backup heating.
- Colder climates may require backup heat, but heat pumps still provide benefits on milder days.

Take the sustainability benefits of battery electric buses even further

Heat pump heating makes public transportation more eco-friendly with the lowest-carbon bus HVAC.

- Minimize emissions by addressing the auxiliary systems, including HVAC.
- Meet decarbonization regulations and goals by tackling overall emissions.
- Reduce energy use and cost by charging bus batteries less during heating seasons.

Simplify the deployment of new technology

Familiarity with Thermo King TE Series products makes this transition exceptionally easy. By maintaining consistency with our existing HVAC product line, Thermo King gives you a remarkable new approach that is easy to adopt.

- Minimal technician training is required, because maintenance is virtually the same as our other TE Series products.
- Operation is simplified by familiar Thermo King controls. The TE Series Heat Pumps apply the same control strategies as our cooling-only products, with additional operational modes for heating, auxiliary heating and defrost.
- Automated comfort systems mean operating modes are changed internally by the Thermo King controller, virtually eliminating manual steps that may be distracting to drivers.

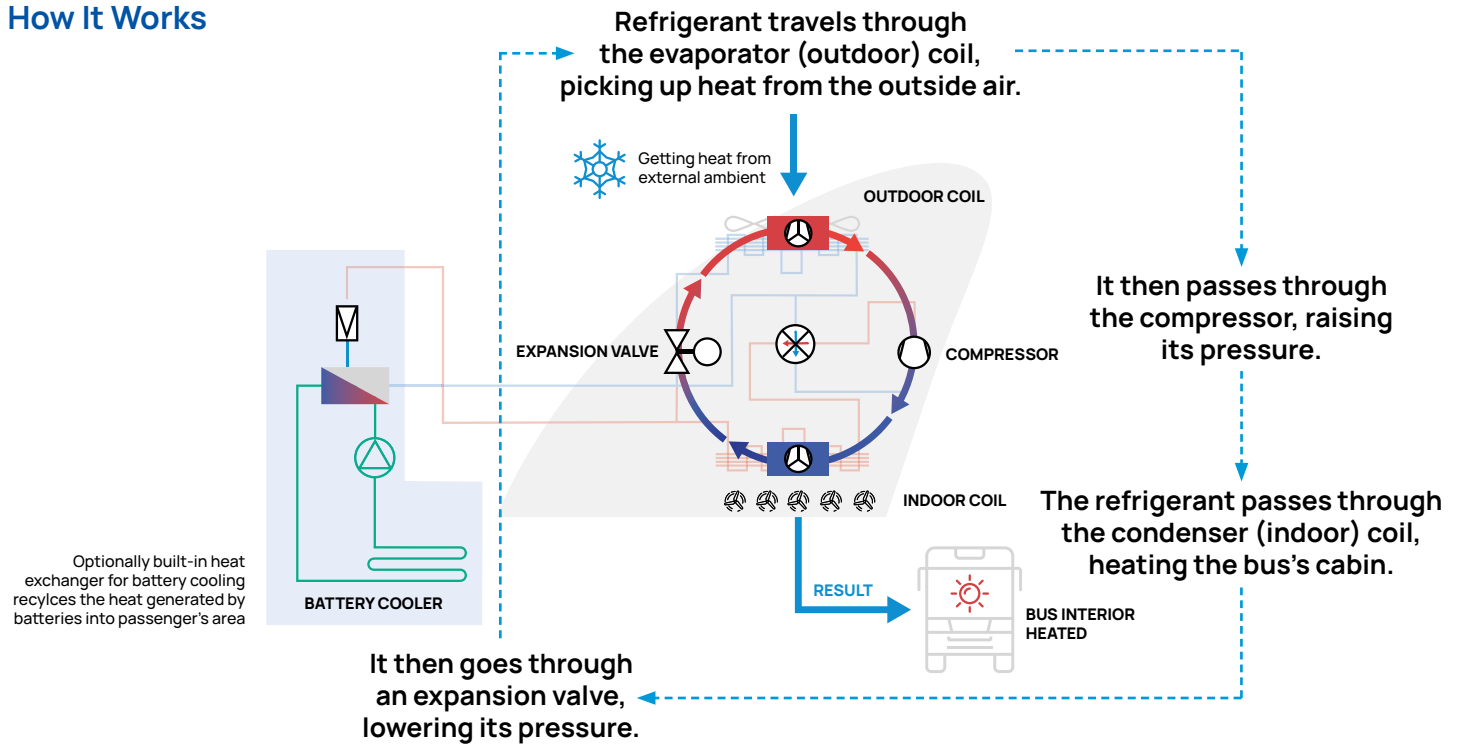
Engage with the experts

As part of Trane Technologies, Thermo King is applying our company expertise in heat pump heating for commercial buildings and homes to buses. The TE Series Bus Heat Pumps are part of Thermo King's evolve® portfolio of products that are designed to help take carbon emissions out of transportation.

Heat Pump Mode

Heat pumps utilize a reversing valve, causing the refrigerant to move through the system in the opposite direction compared to air conditioning mode.

How It Works



Thermo King's TE Series Heat Pump is also tied into the battery thermal management loop, allowing it to make informed decisions about when to draw heat from the battery as a secondary heat source to heat the cabin.



THERMO KING

Thermo King – by Trane Technologies (NYSE: TT), a global climate innovator – is a worldwide leader in sustainable transport temperature control solutions. Thermo King has been providing transport temperature control solutions for a variety of applications, including trailers, truck bodies, buses, air, shipboard containers and railway cars since 1938. For more information, visit thermoking.com or tranetechnologies.com.

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