

Get **COMFORTABLE**

A Thermo King publication for the mobile climate control industry

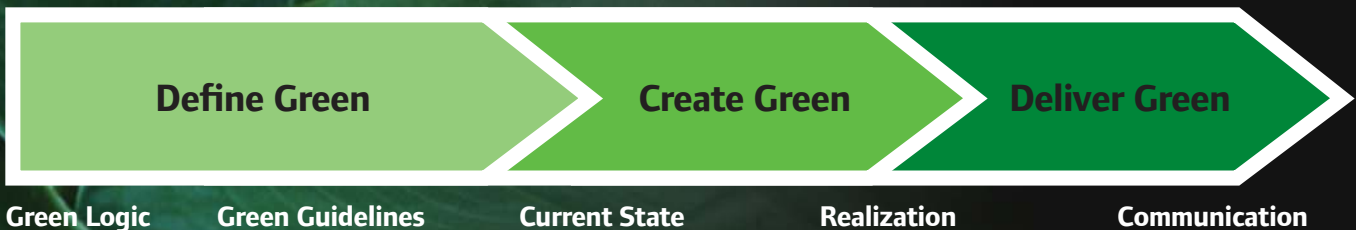
Green is **Good!**

Going green can save you some green

Today, businesses of all kinds are under pressure, both from legislative bodies and their own customers, to become more environmentally responsible, or “green.” At Thermo King, the challenge to become greener began almost 20 years ago with the signing of the Montreal Protocol, a global effort to reduce ozone-depleting refrigerant emissions into the atmosphere. Back then, global warming was accepted in theory only, but today the overwhelming scientific evidence has shown global warming to be a serious and legitimate threat to the planet.

Working with our parent company Ingersoll Rand, Thermo King and the other Climate Control Technologies businesses have developed a green strategy consisting of three main components: to define, create and deliver green solutions to our customers, from cryogenic transport refrigeration systems to all-electric HVAC systems for bus. So how green is your operation? Have you developed a strategy to deliver green to your customers? What is the best way to become more environmentally responsible while keeping an eye on the bottom line?

Ingersoll Rand Green Strategy: *The step-by-step process*



Green is Good!

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We're all becoming aware of the social responsibility to become greener, but getting there sometimes comes with additional costs. There are, however, some green initiatives (like emissions reductions) that can actually save you money. Thermo King has offered environmentally-friendly solutions for the past 15 years, and has several products that can help bus operators deliver green to their customers while reducing overall operating costs.

Hermetically sealed all-electric HVAC systems for Hybrid Electric buses reduce HVAC operating costs by eliminating engine-driven compressors, piping, fittings and hoses while decreasing emissions, and the Thermo King Screw Compressor with true unloading can save gallons of fuel per day while operating in the unloaded mode. Also, Thermo King's IntelligAIRE® II microprocessor controller can be used to manage HVAC energy consumption by applying intelligent logic to reduce parasitic loads when less cooling is required.

Social Responsibility Shades of Green

Where are you?



As we all continue to find ways to deliver green to our customers and improve our operations, you can count on Thermo King to continue to provide new green solutions that keep an eye on the environment and your bottom line at the same time.



IntelligAIRE® II Controller



Screw Compressor



T-Series All-Electric

Thermo King Rail Team Wins Second Siemens Award

For the second time in 3 years, Thermo King is the winner of Siemens Transportation Systems' Best Overall Supplier of the Year award. The award is expected to serve as a springboard for future business, especially as rail business increases in the Americas.

Presented during the Suppliers Day event held in Sacramento, California, the Thermo King European-Served Area rail team received the award in recognition of its outstanding aftermarket service support and nearly zero defects during the San Diego and Denver warranty periods. Also recognized was the special involvement of North American Division aftermarket parts, under the leadership of Tom Menas, which helped the ESA parts division support the U.S. rail customers.

"We look forward to further collaborate with Siemens on numerous critical contracts in the next few years. The light rail industry is expected to boom, particularly due to the high cost of fuel," said Magdi Sayegh, Thermo King global service manager. "We are positioning ourselves to be the best HVAC supplier in the growing rail market in North America and beyond."

Attending the event and accepting the award for Thermo King were Magdi Sayegh; Tom Menas, aftermarket parts manager and Michael Klisz, Thermo King sales, Prague, Czech Republic.

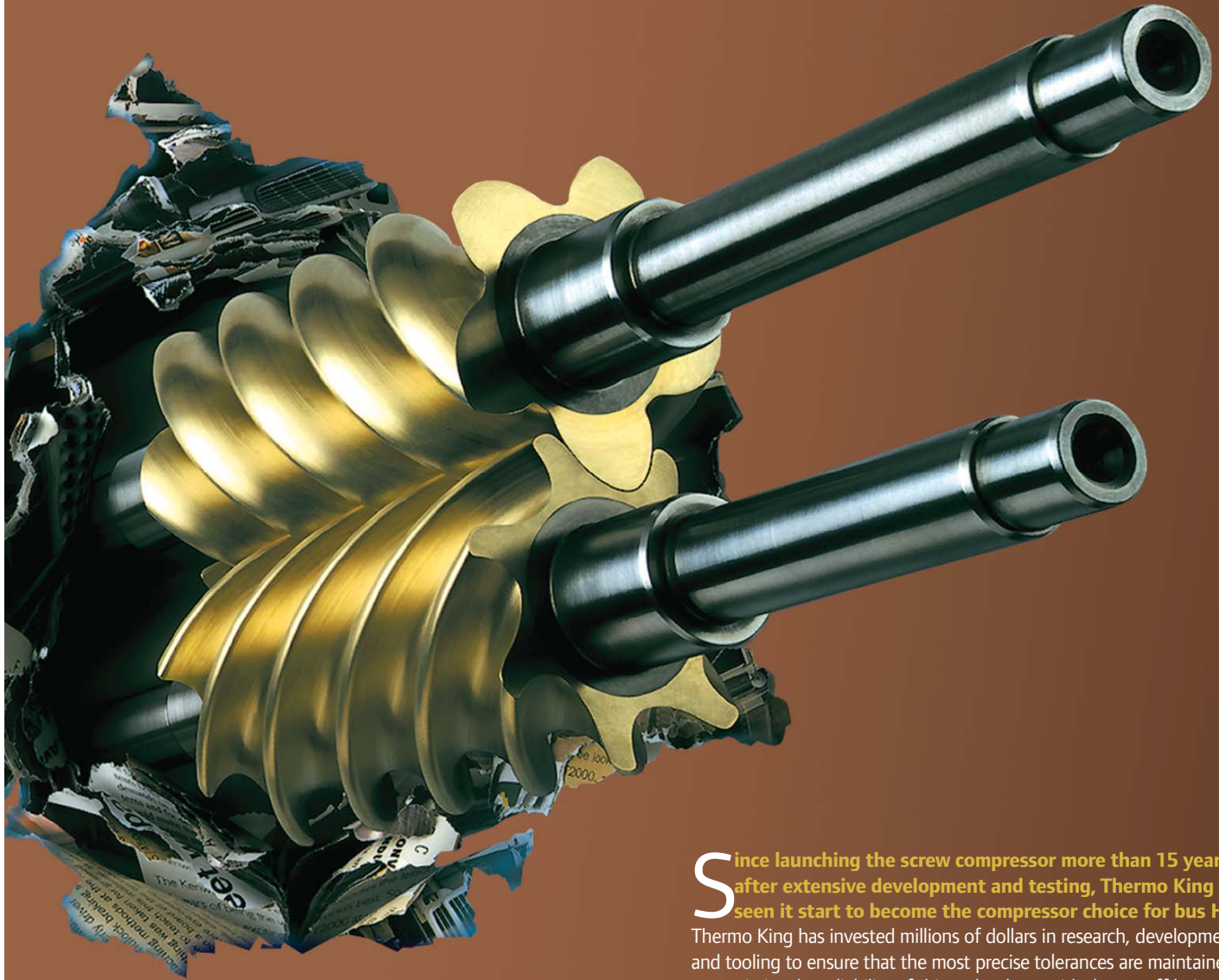


Accepting the award are (L-R): Tom Menas, aftermarket sales and marketing manager, bus parts, Thermo King, Oliver Hauck, CEO, STS Siemens Transportation North America, Kevin McGrew, general manager, quality control, Siemens Rolling Stock, Magdi Sayegh, global service manager, rail, Thermo King, Dr. Jurgen Wilder, vice president and general manager, Siemens Rolling Stock and Michael Klisz, sales account manager, Siemens and rail products Europe.



The Solution

Thermo King's Screw Compressor delivers reliability, efficiency and fuel savings



Since launching the screw compressor more than 15 years ago after extensive development and testing, Thermo King has seen it start to become the compressor choice for bus HVAC.

Thermo King has invested millions of dollars in research, development and tooling to ensure that the most precise tolerances are maintained to maximize the reliability of this technology, with the payoff being an 80 percent reduction in moving parts as compared to a reciprocating compressor.

This reduction in moving parts greatly reduces the chance of breakdowns and helps make Thermo King's HVAC systems the most reliable on the market. Today, there are more than 40,000 screw compressors in service in North America, and one early installation of 20+ compressors have operated for more than 28,000 hours each without a failure.

Big Power in Demanding Climates

Given the reliability and performance benefits the screw compressor provides, more and more customers are choosing to go with this technology for their fleets. Valley Metro, located in Phoenix, Ariz., provides bus service in one of the most severe climates in North America and requires efficient and reliable HVAC systems to keep the customers cool. Operating buses in temperatures exceeding 110 degrees Fahrenheit, day in and day out during the summer, has made Dave Hyink, Valley Metro fleet and facilities supervisor, impressed with the performance of the screw compressor and R-407C refrigerant. "It's the best cooling unit that's ever been in the valley," reports Hyink. The unique combination of the S391 screw compressor and the high performance refrigerant R-407C used by Valley Metro is a solution offered only by Thermo King.

While the S391 with R-407C provides an excellent solution, some former R-22 customers have decided to use the refrigerant R-134a exclusively. However, because these customers still need the higher cooling capacities you get with R-22 and R-407C at engine idle speeds, these customers have chosen to go with the Thermo King S616 compressor. Former R-22 customers, like Sky Harbor Airport in Phoenix, who use this combination of the S616 with R-134a, have not experienced any decline in cooling performance.



Valley Metro - S391 Screw Compressor with R-407C



Sky Harbor - S616 Screw Compressor with R-134a

Built for Fuel Savings

With fuel costs at all-time highs, the screw compressor can save gallons of fuel per day for customers using reheat. "Reheat is a mode of operation that introduces heat into the refrigeration cycle to stabilize the temperature as it reaches set point", says Don Nielsen, engineering manager, Thermo King. "Most North American transit operators use reheat to balance the cooling load during light load conditions and also to keep the windows from fogging up." The screw compressor can stabilize the load by "unloading" some of its pumping ability during these conditions. This reduces the amount of energy used during reheat, resulting in less horsepower required from the engine to drive the compressor. Less horsepower means less fuel used, which in turn means big savings.

Just how much fuel can you save with the screw compressor? That depends on how much reheat you use. An operating profile of your fleet that includes local climatic conditions, light and peak load conditions, number of days per year that air conditioning is used, hours of operation per day and engine data will provide the fuel savings you can expect. The chart to the right is a summary of the data used to profile a large Midwestern fleet. While testing a bus from this fleet in the Thermo King Testing Center, the bus operator was able to witness the reduction in engine horsepower load when the compressor unloaded, and the results were quite impressive.

What about operators who don't use reheat in their operation? Is there another solution to get fuel savings with the screw compressor on their transit bus? The answer is yes! For operators that cycle the clutch off when the temperature reaches set point, the most efficient solution available is the screw compressor with the high performance refrigerant R-407C. The bus will cool down faster and the temperature will recover faster after door openings, which adds up to the compressor running less, using less horsepower off the engine and saving money!

To learn more about what the screw compressor can do for you, call Thermo King at (952) 887-2241 or contact your local Thermo King representative.

Fuel Savings Calculation (based on a fleet operating profile)

Hours of operation/day	14
HP saved during unloaded operation	4
Total Hp*Hr	56
Fuel consumption (Gr/Hp/Hr)	170
Fuel savings (Gr/Day)	9520
Fuel density (Gr/Gal)	3211
Fuel savings (Gal/Day).....	2.96

Data calculated for a 270 HP Cummins running 144 days/year

An Independently Powered All-Electric HVAC for Bus: From Paper to Pavement

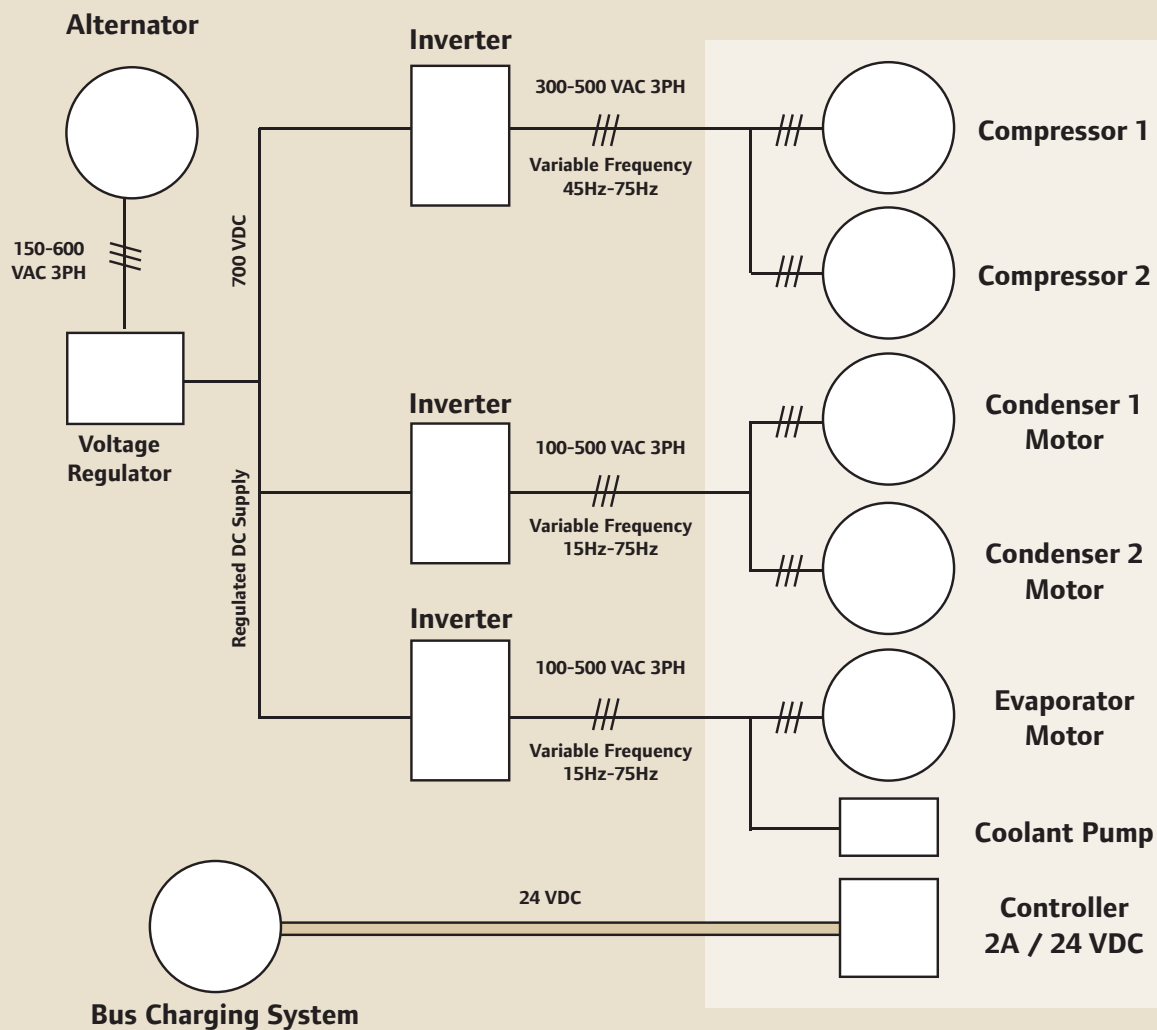
To get great ideas from the drawing board to the street takes commitment, time, and lots of research and testing, which is what Thermo King has done with the alternator-powered all-electric bus HVAC system. By creating a one-piece, hermetically sealed system, Thermo King has eliminated the compressor on the engine and all of the hoses, piping, valves and fittings required to connect it to the system. Essentially, this system is sealed, charged and tested at the factory like a home refrigerator — all you have to do is plug it in and turn it on.

For an all-electric HVAC system to function, power needs to come from somewhere, so the application of this technology has been limited to electric rail cars, trolley buses and, most recently, hybrid electric buses. However, if the HVAC could have its own

power supply, you could have an all-electric HVAC system on a conventional diesel engine-driven bus, and even plug it in when the bus engine isn't running. What an exciting concept that would be, right?

Well, after many years of research and development, laboratory testing, field tests and operation in refrigeration applications, Thermo King has made this concept a reality for conventional diesel engine-driven buses. Why so much testing? "You have to get it right," says Steve Johnson, bus HVAC product manager at Thermo King. "Creating electric power from an alternator or generator is not a new concept. The primary obstacle when your alternator or generator is driven by the bus engine is maintaining clean, stable voltage throughout the speed range of the engine."

Typical Power Circuit of an Alternator Powered Electric Unit



So how long did it take for the unit to go from theory to practical application? The initial project began in 1999. "Actually, we've had this technology in the field on truck refrigeration systems for more than five years," says Don Nielsen, bus HVAC engineering manager at Thermo King. "There are approximately 300 systems operating worldwide."

Thermo King's first field application of this technology for bus HVAC began in June of 2004 in Prague, Czech Republic. Prague is also the home of one of Thermo King's advanced R&D centers, and having the unit operating locally made for easy monitoring by the research engineers. The bus operates an average of 18 hours a day from Kladno, a town about 60 kilometers (about 37 miles) outside Prague, into the city. This route provides a good mix of both freeway and stop-and-go driving.

"The bus is driven by the same drivers everyday and in an interview with one of the drivers this past summer, he commented that the bus stayed cooler than with a conventional system and got better fuel mileage as well," reports Nenad Johanovich, European marketing manager, Thermo King. Johanovich also reports that the bus has been in revenue service for four summers, traveled more than 300,000 kilometers (more than 186,000 miles) and has operated for nearly 8,000 hours. A second unit has been operating in Florence, Italy since May of 2005 and has operated for 5,000 hours.

While these units were operating in the field, testing and development continued in Minneapolis and Prague to further refine the units. In the United States, transit authorities have been adding more hybrid-electric buses to their fleets and have shown a high level of interest in running an all-electric HVAC on conventional diesel engine buses. Thermo King began partnering with North American transit authorities and completed the first installation in

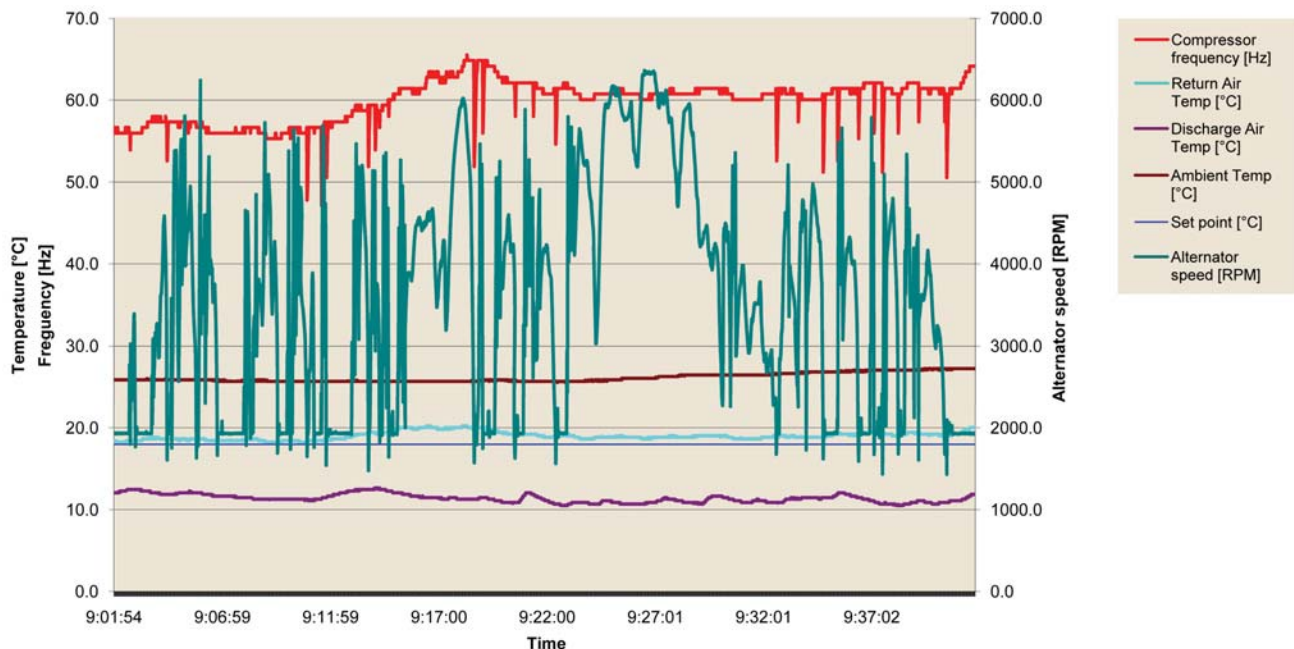


July of 2007. The customer is very excited about having the electric compressor in the unit to remove parasitic loads from the engine for fuel and maintenance savings.

As the trial unit operates and produces more data, Thermo King is continuing to pursue opportunities to place this technology in US fleets. "We have already received an order for 16 units to be retrofitted as part of a mid-life bus rehab project," notes Johnson. "Our goal for this year is to not only launch this product, but to be in serial production by the fourth quarter of 2008."

If you would like to learn more about this exciting new "green" technology, please call Thermo King headquarters at 952-887-2241 or contact your local Thermo King representative.

Athenia A-800 Road Test 06 June 2007



Note: The compressor speed (frequency) changes with cooling demand while the alternator speed changes with engine RPM.

PM TIP

Tightening Your Belts

Belt tension directly affects the life of the pulley and clutch. That's why you should check the belt tension as part of every preventative maintenance inspection.

For new nylon core belts, the belt tension should not exceed 220 pounds (979 newtons). For used nylon core belts, the tension should not exceed 180 pounds (800 newtons). Kevlar belt tension is recommended not to exceed 180 pounds. "We encourage the use of Thermo King brand belts because we know their quality and that they're compatible with Thermo King parts," said Sidney Gnewikow, manager, bus product service.

To inspect the clutch, check the pulley and armature mating surface condition. Using a straight edge and 0.010-inch feeler gauge, check the armature and pulley mating surfaces for warping. If no more than 20 percent of either surface is warped more than 0.010 inch, the components may still be used without the need for any surfacing machining.

If warpage exceeds 0.010 inch from 20 to 50 percent over the face of the armature and/or pulley, the armature should be replaced. Warpage exceeding 0.010 inch over more than 50 percent of the armature and/or pulley surface means the armature should be replaced and the pulley may have to be replaced. Check the mating surfaces of both components for excessive grooving. A slight amount of grooving is acceptable. However, if the galled portions on the mating surfaces project more than 0.010 inch, replace the armature and attempt to restore the pulley mating surface by using a machining operation.

FOR ADDITIONAL INFORMATION,

Call the Thermo King Service Department at 866-494-8270.

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