

# Fast thinking and accurate tools keep hot and cold payloads running smoothly

## Application Note

### Testing Functions Case Study



**Tools:** Fluke 381 Clamp Meter, Fluke 561 Infrared and Contact Thermometer

**Operator:** Brad McCubbin, Shop Forman at Mountaineer Thermo King in Charleston, West Virginia

**Applications:** How temperature-controlled truck repairs and installations ensure temperature-sensitive freight arrives in prime condition

On any given day you can see dozens of them rolling down the highway, carrying everything from ice cream and produce to antique furniture and blood plasma. You might not guess it to look at them, but these trucks and tractor-trailer rigs are equipped with very sophisticated temperature control systems responsible for safely transporting all manner of temperature-sensitive freight in prime condition.

When you think of the contents that temperature-controlled vehicles carry, you probably immediately think of food products. Those of course do make up a large share of the payloads. However, these trucks carry a much broader range of temperature-sensitive items as well, including pharmaceuticals,

chemicals, blood plasma, and even high-end furniture and artwork.

The name you'll find on many of these temperature control systems is "Thermo King." Based in Bloomington, Minnesota, Thermo King Corporation is a unit of Ingersoll Rand Company Limited. The company manufactures transport temperature control systems for all kinds of mobile applications, including trucks, trailers, shipboard containers, and railway cars. It also designs and builds HVAC systems for buses and passenger rail applications.

Thermo King Corporation operates 10 manufacturing facilities and 17 parts distribution centers worldwide. Sales and service is provided by a global dealer network of more than 800



McCubbin uses a Fluke 381 Clamp Meter to check the starter cranking current, the health of the starter, and the on-board battery system. The Hazard-Risk Category of this setup is 0.

independently owned companies in 75 countries, including Mountaineer Thermo King in Charleston, West Virginia. All Thermo King service technicians are trained and certified by the Thermo King Corporation.

Mountaineer Thermo King Shop Foreman Brad McCubbin has worked as a service technician for the company for the last eight years. He and two other technicians cover both in-shop and emergency road repair work and installations and rotate on-call duties to make sure that one technician is available 24 hours a day, 7 days a week.

### Keeping things moving at the right temperature

The Thermo King systems heat as well as cool and are capable of temperatures from  $-20^{\circ}\text{F}$  ( $-29^{\circ}\text{C}$ ) to about  $85^{\circ}\text{F}$  ( $29^{\circ}\text{C}$ ) on average. Some loads are worth millions of dollars, so keeping the vehicles moving and the contents at the correct temperature is critical to the survival of many companies.

“Many people don’t realize how sensitive the products they use daily are, and what goes into keeping them safe and delivered in good shape,” says McCubbin. “We work day and night in all weather conditions to take care of our customers because we know a product loss can be devastating to them. Downtime can cause spoiled product, late delivery times and surcharges, higher insurance rates, and even loss of life if it’s a critical load.”

During the storms that swept through West Virginia and surrounding states in the summer of 2012, diesel power refrigeration units were lifesavers for some communities. “Countless trailer loads of ice and food for emergency shelters were hauled into these areas, and it was up to us to keep these units maintained and running while the power was off for days or weeks in some areas,” says McCubbin. “Without this equipment and the wonderful volunteers who worked at the shelters, many people wouldn’t have had meals or drinks available to them.”



Brad McCubbin uses his Fluke 561 thermometer to check the running temperatures of the internal components of a Thermo King refrigeration unit mounted on a 53-foot (16-meter) tractor trailer. The Hazard-Risk Category of this setup is 0.

### No time for downtime

The Mountaineer Thermo King field service shop covers the entire state of West Virginia, but its primary territory is the central area surrounding Charleston. McCubbin and his crew repair a broad range of equipment—from small automotive-size vehicles all the way to 53-foot (16-meter) over-the-road tractor trailers. They also repair air conditioning systems in mass-transit buses and in mining, construction, and agricultural equipment. And they work on seagoing containers as they are transported cross-country by truck to and from the ports.

“We take care of the maintenance for three fleets comprising about 60 pieces of equipment on a regular basis, and handle emergency repairs for transient customers and six or seven other local fleets,” says McCubbin. “We are the only certified Thermo King dealer service shop in West Virginia so we stay pretty busy.”

Maintenance on refrigeration transport equipment is extremely important because breakdowns can be costly both in terms of repairs and lost product.



The external refrigeration unit might seem to be running correctly, but the output of the unit needs to be sufficiently cold. Brad uses a Fluke 561 Infrared and Contact Thermometer to check temperature.

However, because many fleets have units traveling the country on a very tight schedule, it can be challenging to schedule maintenance. Emergency repairs are inevitable.

Most roadwork is done by a single technician, and many times emergency repairs are only temporary fixes until the customer can get the rig into a major facility to be checked out. “Most of the time when we are servicing a vehicle on the road, our job is to get it up and running as quick as

we can, keep the products cold, and get the load delivered,” says McCubbin. “Many times we have to improvise repairs without the exact part we need, so good test tools and accurate measurements are even more important.”

### **Accurately pinpointing problems**

Among McCubbin’s most indispensable tool is the Fluke 325 True-rms Clamp Meter, which he uses to check charging systems, voltage drops on circuits, and component current draws. “The amp clamp is outstanding; I use it to test component and circuitry operations and compare those results to ‘known good’ operating characteristics so I can design a plan of attack,” says McCubbin.

Among the most common problems that McCubbin and his crew encounter are charging system issues, such as alternator and battery failures. In those cases, the technicians first boost-charge the battery and, if that doesn’t work, they replace it. Then they start the unit and use the 325 Clamp Meter to verify alternator charge rate, circuit voltage drops, starting current, and draw.

“By checking individual component inputs and outputs we can determine if a part—such as the alternator, relay board, or microprocessor controller—has failed, or whether there are wiring circuitry issues,” says McCubbin. “Our equipment spans a trailer that has 53 feet of wiring and we have to be accurate on our voltage, resistance, and other measurements for the sensors, so we do a lot of voltage drop and continuity tests. Many times the ac amp function of my clamp meter has made my life easier by helping me prove to customers that the issue isn’t the refrigeration unit, but actually their power supply.”

### **AC electric standby**

The Mountaineer Thermo King field support crew also deals with many portable storage units that have ac electric standby

features. The units are powered by a diesel engine when being hauled over the highways and have an auxiliary standby electric motor to provide shore power. They also maintain convenience equipment called auxiliary power units (APUs) that are mounted to an over-the-road tractor and call on a small diesel engine to provide heat and air conditioning for the driver when the truck is parked. This eliminates the need to idle the larger truck engine, thereby saving fuel. These units also provide the driver with ac shore power to provide for their creature comforts in the sleeper cab.

“Many times a customer will call us and complain of unit faults, and I can quickly diagnose problems such as low voltage or excessive current draw due to wiring issues in their shore power supply,” says McCubbin. “This helps us rule out actual equipment faults quickly and simply and enables us to show the customer what’s going on by showing them the meter display.”

### **Maintaining an even temperature**

In addition to troubleshooting electrical problems, McCubbin obviously pays a lot of attention to the temperature of the refrigeration systems. He uses a Fluke 568 Infrared and Contact Thermometer in both modes as required to verify load, evaporator, condenser, radiator, and engine temperatures. “The accuracy of the thermometer is essential for proper diagnosis and verification of refrigeration systems,” says McCubbin. “My next purchase will be a thermal imager so I can show customers the energy loss on trailers and trucks due to poor seals and structural quality.”

McCubbin has been using Fluke instruments for the last eight years, and he admits that he doesn’t handle them with kid gloves. “My clamp meter has been subjected to all types of weather conditions and drops from the roofs of trailers, and it

still works as reliably as the day I bought it,” says McCubbin.

“That’s very important because I have to be able to rely on my diagnostics. Good quality, reliable tools are a must in keeping equipment running and perishable products safe.

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