



Tech Tip for Servicing Heavy-duty Mobile HVAC

## **Don't Let Low Voltage Zap the Life Out of Your Compressor**

One reason heavy trucks repeatedly experience short A/C clutch or compressor life is low voltage at the clutch coil lead wire.

On a 12-volt system, the compressor's clutch needs at least 11.5 volts to create the electromagnetic field necessary to engage the clutch pulley so refrigerant can flow. Otherwise, the clutch hub will slip against the face of the pulley, generating friction and heat in excess of 1,000 degrees F. It can quickly melt the clutch bearing seal as well as the epoxy potting-compound that seals the coil. Often, heat generated during this type of failure is transmitted to the elastomers in the shaft seal. In any case, the loss of lubricant is bad news.

Poor ground wire connections are an obvious suspect in voltage-related problems. But another source of low voltage is more difficult to diagnose and becoming far more common.

"Truck owners are tapping into the electrical system to power radios, marker lamps, communications equipment, and household appliances," says Norman Baker, manager of aftermarket sales for Red Dot Corp., which designs and manufactures climate control systems and all-makes replacement parts for commercial vehicles and off-highway equipment. "When they do, they risk stealing the voltage the A/C clutch needs to do its job."

Consider the workday of a long-haul commercial truck. Despite logging all those highway miles, the average rig will spend 30% to 40% of its operating hours idling, primarily to keep the driver comfortable.

"Drivers want the comforts of home: crock pots, coffee makers, microwave ovens, televisions, hair dryers, laptop computers—you name it," Baker says. "They also want to stay cool, so they're running the A/C while they're popping popcorn and watching a movie."

Trouble is, most heavy-truck alternators have an output of 70 to 85 amps. When the alternator is required to supply more than its capacity, the extra power comes from the

batteries. As the batteries drain, power to components like the compressor clutch can drop from 13.5 volts to less than the required minimum of 11.5 volts.

This causes the clutch to not fully engage. “You get slippage, friction, and heat,” Baker says. “Eventually, the clutch fails.” So does its replacement.

Then it’s an expensive job. Clutches and compressors are such a tightly integrated package now that when one component fails you’re faced with replacing the entire assembly, says Baker. Furthermore, you’re replacing a part before the end of its expected usable life. The compressor didn’t fail; the system failed the compressor because of insufficient voltage. Finally, replacing the compressor involves pulling down the system, which adds refrigerant recovery and recharge to the repair cost.

If the truck owner is lucky, he’ll lose only the air conditioning. A seized clutch and locked-up compressor can snap a double-V or multi-groove belt that drives other important components, like a fan, water pump, or alternator.

Troubleshooting electrical problems is never easy, so where do you start? Take these steps:

### **1. RE-CREATE THE PROBLEM**

Recreate the demand for voltage when you make your diagnosis. “With the engine and air conditioner running, turn on lights, wipers, radios—anything that draws from the truck’s electrical system. Then take a reading,” Baker says. “Ideally, we want 13.5 volts but not less than 11.5 volts at the clutch coil.” Also look inside the cab or sleeper for an aftermarket power inverter with 110-volt AC outlets, evidence that the driver may be drawing power the truck’s electrical system is unable to handle.

### **2. TAKE A PROPER READING**

An improper ground connection will short-circuit your efforts. “Many clutches are grounded through the compressor casing, as evidenced by a single wire on the power side of the clutch,” Baker says. “Technicians will pick up a ground on a bolt or bracket, but sometimes that bolt or bracket is the source of the bad ground due to corrosion or even resistance that comes from paint. With a case-grounded clutch, measure the ground at the compressor body.”

### **3. PROTECT THE SYSTEM**

The cost of electrical bugaboos helps make the case for integrated compressor protection devices. “If you can add a device that prevents a compressor failure, that investment will more than pay you back in reduced maintenance costs and downtime,”

says Baker. An example is Red Dot's ProTecht, which monitors refrigerant pressure and shuts down the system in case of refrigerant loss, excessive overcharge of refrigerant, or low voltage. The system is comprised of a compact, electronic control unit; electronic high-side pressure transducer; and a refrigerant charge sensor.

If you're working on a truck equipped with ProTecht or some other type of compressor protection system, remember that these devices prevent the clutch from cycling at a high rate. "If the clutch shuts off, it might wait 10 or 12 seconds before cycling on again," Baker says. "You need to be patient. That's just the system working to prevent heat from building up."

#### **4. ASK FOR HELP**

Commercial trucks are complex pieces of machinery, but the needs of the driver are simple: he wants to feel comfortable or the rig won't roll. Vista windows, cavernous sleeper compartments, and the desire for "hotel"-type electronics have placed significant demands on the most critical comfort item onboard: the factory-installed HVAC system and the clutch that allows the refrigerant to flow.

"Properly cared for, the compressor and clutch assembly should last for the life of the vehicle," Baker says. "If you're seeing premature component failure, ask your suppliers for help diagnosing the problem. Training and product should be part of the package when you buy replacement parts. Red Dot has a team of that's devoted to helping people specify and maintain heavy-duty HVAC systems and components. Chances are, we've seen the problem you're working hard to resolve and can help you get that customer back on the road."

#### **ABOUT RED DOT:**

Red Dot is a worldwide leader in the design and production of heating, ventilation, and air conditioning (HVAC) systems and replacement parts for commercial trucks, buses, and vehicles used in construction, mining, agriculture, fire and rescue, and military service. In 2007, Red Dot received the prestigious Climate Protection Award from the EPA for its work with refrigerants that reduce greenhouse gases.

Based in Seattle, the company has 430 employees at three locations in the United States and Europe. Visit Red Dot at [www.reddotcorp.com](http://www.reddotcorp.com).

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