Working Under Pressure – Hydraulic Compressor Drives Save Space and Cost on HD Equipment

Many specialty and off-road vehicles already have hydraulic systems on board, and it is often more efficient to drive the air conditioning compressor from the same system. An investment in learning to install and repair these systems can add to your bottom line.

by Bill Kerr, Product Manager, Visionaire Inc.

The words "hydraulic air conditioning" send many service companies running. Visions of complexity and unfamiliar controls come to mind. But there is no need to shy away from these systems; there are many fleets of vehicles across the country that have or need these systems. A little knowledge in this area can lead you to new customers and expand your business.

Air conditioners on off-road equipment have their own unique difficulties to overcome. Often the cab is located much further from the engine than in a typical automotive application, leading to long hose runs and possible oil migration. Engine compartments on some equipment are cramped, with little access to service or install components. Long work days and constant vibration wear on all components. Most importantly, operators can tolerate very little downtime on these critical machines.

Refrigerant leak detection can be very time consuming, particularly with hose runs exceeding 20 feet and bundled with numerous other hydraulic hoses and wire harnesses. Less-than-rugged installation of components can lead to early failure of fittings, tubing, and even steel condenser housings. These factors left OEMs, operators, and service companies looking for more durable A/C solutions.

Into this market came air conditioners with hydraulically powered compressors. Hydraulic power allows components to be located close to the cab where they are needed or even all mounted into one self-contained package. Hydraulic powered compressors can be regulated to provide constant performance whether the engine is at idle or at full speed. They are often cleaner, more accessible, and easier to service than engine mounted compressors. Above all, they are very durable.

Would you rather leak-check a pair of twenty foot refrigerant hoses running from the truck engine to the crane cab or work on the self-contained A/C wall unit?

Vehicle hydraulic systems may seem foreign at first but they operate on principles familiar to us all. The engine drives a pump, not unlike a compressor, but it pumps incompressible oil. That oil travels through heavy duty, steel-wrapped hoses and various flow controls to do work by moving cylinders or (in our case) turning motors. Having done this work, the

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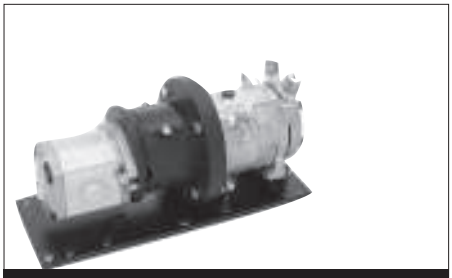
Simple and straightforward, the hydraulic motor is connected to this compressor by the drive belt. Controlling the oil flow allows compressor regulation independent of engine speed.

oil is now warmer and travels through a heat exchanger and filter before returning to the oil tank.

Hydraulic motors have three ports; one in, one out (to the heat exchanger), and the case drain which goes directly back to the oil tank. Various flow dividers can split hydraulic flow from one pump to go to two or more separate circuits. Relief valves act as a safety to prevent excess pressure from building up. Solenoid valves work to control oil flow or switch it between circuits. A large vehicle may have several hydraulic pumps and dozens of circuits. The whole system is designed to stay within the power limits of the engine and not produce so much heat as to overwhelm the heat exchanger and overheat the oil. Care is taken whenever an air conditioner circuit is added to not upset the hydraulic system's balance.



Direct-drive compressors can save space and weight in tight-fit locations. Fewer moving parts means extended longevity and reduced maintenance costs.

Don't let the word "hydraulic" scare you away...

Oil flow is measured in gallons per minute, and pressure in PSI or bar. Special training is required to service the hydraulic portion of any machine, and you should leave the hydraulic plumbing to the experts. The oil is often very hot (140-180° F) and may be under pressures exceeding 3000 p.s.i.

Servicing a hydraulic driven compressor, or installing one, can be pretty straightforward. The most common type is the hydraulic belt drive.

Belt-driven systems typically use a Sanden or Seltec heavy duty compressor connected to a hydraulic motor by stan-

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Special vehicles bring special problems. This rail ballast vehicle requires a compact and robust air conditioner that will withstand severe vibration and heavy dust. The self contained, roof-mounted A/C unit uses a hydraulic compressor.

dard automotive belts. The clutch circuit is wired like an engine driven system. Often a valve turns the hydraulic motor on and off with the air conditioner system.

Never work on the compressor or belts with the vehicle engine running, even if the hydraulic motor seems to be off. If the hydraulic motor is leaking, won't turn or is otherwise damaged, have it replaced with a factory-approved one. Many motors look the same but the internal components (gears, bearings, and seal material) can vary dramatically. Use of incorrect parts can sometimes cause dramatic results!

Direct-drive compressors connect the hydraulic motor directly to the shaft of a specially prepared compressor. Since there is no clutch, the compressor must be cycled on and off with a hydraulic control valve. To find the control valve, trace the "clutch" circuit back from the thermostat. These valves generally have a replaceable electromagnetic coil which functions much like a clutch coil.

Since there is no clutch to slip, clutch coil, or bearing to ruin the compressor, these compressors tend to be extremely durable. To check for a seized compressor on a direct drive system, it is necessary to separate the coupling between the compressor and motor to see which is at fault. A clattering noise inside the coupling housing may indicate a worn "spider," the cushion between the metal parts of the coupling. As with other hydraulic components, it is critical to use factory-approved replacement parts.

Don't let the word "hydraulic" scare you away – other than the compressor drive, these air conditioners work like any other. Most repairs involve the simple refrigerant leaks, failed switches, worn fans and blowers (not to mention the effects of deferred maintenance) that we commonly see on commercial vehicles.

There are some systems on the market that have hydraulically powered fans and blowers. Due to their complexity and specialized parts they are generally not repaired in the field but are returned to the factory for refurbishment.

There is a significant opportunity in aftermarket sales of hydraulic drive systems. They make it possible to cool vehicles where it was difficult or impossible before. Often these specialized machines are in fleets, and one successful service call or sale could lead to other opportunities.

Many cranes, for instance, have no other way to cool the operator since the cab is separated from the engine by a 360° swivel. Forestry, rail maintenance, waste handling, marine, and mining are all fields that make good use of this technology.

Self-contained air conditioners have the compressor, condenser, and evaporator all in one package. Since they are already plumbed and charged with refrigerant, they are very straightforward to install. Usually it's just a matter of mounting the unit on a cab wall or rooftop and running the appropriate ducting. Equipment fleet owners typically have qualified hydraulic mechanics available, and the final hydraulic connections should be made by the hydraulic technician.

Where self-contained systems are not appropriate, individual heavy duty air conditioning components can be mixed and matched with hydraulic compressors to create a custom installation. The compressor vendor is a good source of information on appropriate component combinations.

There are good sources of information available. System manufacturers will supply the range of hydraulic flows and pressures recommended for their components. Vehicle manufacturers document their machines with hydraulic schematic diagrams and OEM's often offer specific guidance on the attachment of accessories such as hydraulic drive compressors. If you become interested in performing the hydraulic work yourself, most hydraulic component suppliers offer training.

As you see, hydraulic compressor drives are not that different from the ones we are used to working with every day. With a little patience and study you can open up new markets for your service, and new avenues of profitability. ■

Bill Kerr has been with Visionaire for ten years. He supervises the development of ventilation systems for off road equipment OEMs.

Founded in 1994 in Grand Prairie, Texas, Visionaire Inc., focuses on air conditioning, heating, and cab pressurization solutions for heavy duty off road vehicles. They were early innovators in the development of self contained hydraulic powered air conditioning systems for rail and oilfield applications.

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