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Technical Bulletin - September 2014

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This is from Search Auto Parts, April 2012

COMPRESSOR KILLER

It's easy to blame the part, but the truth is it's usually the installation.

Punxsutawney Phil saw his shadow last Groundhog Day (Feb. 2, in case you forgot), and whether or not your neck of the woods really had six more weeks of winter or not, as the legend of the groundhog implies, finally spring is here and that means air conditioning season is well underway. As the cars come into your shop, some of those A/C jobs will require compressor replacement.

Unlike the movie "Groundhog Day" with Bill Murray, you don't want to see that same A/C job coming back day after day with repeat compressor failures. Fix it right and hope it stays fixed, right? In most cases, a compressor job goes well and the customer is happy for good. What about those times where "in most cases" doesn't seem to apply?

I've spoken with many good techs who have had compressor jobs come back to them. Almost without exception they blame the compressor manufacturer/remanufacturer. As a tech, I've seen all types of parts that failed long before their time. I even have seen parts that were bad in the box. On the other hand, for quite a few years I have worked for a company that manufactures compressors. I have friends who work for other compressor manufacturers and at conventions we get together and talk about everything including warranty returns and analysis.

One thing we seem to share is the common observation that the overwhelming majority of warranty return compressors don't die from factory defects or natural causes - they are murdered. Because none of us like to do a job over (for fee, anyway) and we all

want to keep our A/C service season as stress free as possible, let's cover some of the most common problems that lead to those "murdered" compressors.

Compressor Evolution

With the advent of the hybrid electric vehicle we can break compressors down into two major categories: mechanical and electrical. After that, we can break down the sub-categories into piston, vane and scroll. The latter two types are the lighter weight units seen on many imports. Electric compressors are primarily the scroll type, while the piston styles are evolving more and more into the variable displacement variety. Smaller is better as Corporate Average Fuel Economy (CAFE) requirements move toward the mid-30s MPG goal during the next several years, and that means more work is being done with less iron.

Everyone remembers the advertisement campaign that said "This isn't your father's Oldsmobile anymore." Well this isn't your father's A/C compressor anymore either. Remember when alternators shrank in size and amperage demands continued to increase? Remember what happened to some of those? If you answered heat damage, you answered correctly.

Ironically, the very thing a compressor does (compress a gas which create heat) is the very thing it hates. Improved aerodynamics brings a challenge to engine compartment breathing, and smaller engines equate to higher RPMs for the compressor. Compressors today are more like an exotic sport car's engine rather than the 350 small blocks of yesterday. On the Chevy small blocks, you could do all sorts of creative variations when it came to maintenance and that old engine would usually survive. Try doing that to a Ferrari's engine or for that matter a new Chevy Cruze with a turbocharged 1.4L.

Oil is Oil Right?

That leads me to the most important topic for avoiding premature compressor demise --proper lubrication. Now everyone out there wrenching knows that mineral oil simply won't move with R134-A through an A/C system so I won't beat up that old topic but I will say that every manufacturer out there building compressors has a reason for specifying a particular oil. Ford, Mazda, and Audi traditionally call for 46 weight PAG while Chrysler, Subaru, Nissan, Toyota and VW are split between 46 and 100 weight PAG oils depending on the compressor model used. GM has used 150 weight on some of its compressors, and Land Rover, Saab, Volvo, and Jaguar prefer 100 weight Ester oil.

For years, many refrigerant oil providers have made the case that their universal oil is fine for every compressor out there using R134-A. You may even have had years of success using a universal oil. While I can't argue with success, I can argue for OEM recommendations. All OEM and many aftermarket compressor manufacturers study, test and abuse their parts in ways unimaginable to most of us.

Testing with no oil, low oil, wrong oil, they do it all. They do this to their products to ensure warranty rates are extremely low. Extremely low in this case means less than

one failure out of 1,000 parts built. While you might never see 1,000 compressor R&R jobs in your career, a less scientific phenomenon called Murphy's Law says you might see that one bad compressor that slipped out of the factory. More likely than not though, we'll all see a compressor fail early because of an error on our behalf. We tell our customers that motor oil and regular service intervals for their engines is cheaper than insurance.

The same applies to compressors and OEM oil recommendations. One especially important oil recommendation for compressor oil is the one for hybrid electric vehicles with high voltage compressors. These compressors have windings inside them. If you use the incorrect oil (such as PAG oil) you could be looking at an expensive problem. Engineers have discovered that PAG oil is hygroscopic (attracts moisture), which in turn can cause the insulation of the electric compressor's windings to decay.

Honda is so adamant about using the correct oil in its hybrid electric compressors that it states in its service manual that if you accidently put PAG oil in one of their hybrid electric compressors you should promptly evacuate the system and replace the compressor.

If you ran the compressor before catching your mistake, Honda says you must replace the entire system. Ouch! Even the tiny bit of non-hybrid approved oil in your service hoses can prove to be damaging over time. When you are dealing with high voltage and systems that will shut down if the least bit of current begins to leak to ground, you don't cut corners. Look up, procure, and install the correct approved oil for your next hybrid A/C job to avoid a potentially shocking and expensive comeback.

Oil Balancing Act

Another common cause of early compressor failures is the lack of understanding regarding oil balancing new and reman compressors. These days, most compressors come charged with the correct oil type and amount. Since you want more than most vehicles you work on to be repaired correctly, treat every compressor as if it came out of the box empty of oil.

Compressors vary in their recommended balance procedures but as a rule of thumb most tell you to drain the oil from the old compressor into a measuring container and then add that amount of new oil into the new/reman compressor that you've drained as well. Many will add to that advice not to go below or exceed a specified amount of oil. Remember that too little oil results in a lack of lubrication, while too much causes higher than normal pressures. Gas laws of thermal dynamics tell us that when pressures go up so do temperatures.

When temperatures go beyond acceptable limits, the oil in the compressor behaves much like engine oil that exceeds temperature limits and fails to lubricate. I'm not aware of any quality compressor suppliers that ship compressors without a detailed instruction sheet that tells you exactly what to do.

Surely I'm not lecturing on something as basic as reading directions that come in the box? If we are honest, we could all probably share some confessions for getting out of the habit of reading directions. On top of compressor oil balancing, there is adding oil

to other components you replace along with a compressor. There have been charts out there for years giving ballpark numbers similar to the following example.

Accumulator – 3 ounces
Condenser – 2 ounces
Evaporator – 3 ounces (Chrysler calls for 2 ounces)
Receiver drier – 1 ounce
Sudden hose failure – 2 ounces

When you are performing major component replacements, always be sure to check your service information for the oil balancing procedure recommended by that particular manufacturer. Don't guess!

More Parts to Replace?

On the subject of replacing other components along with the compressor there is, of course, the accumulator or receiver drier. No one will argue the point that even the most effective vacuum pump can't get moisture to leave the desiccant in the drier or accumulator. Desiccant last just so long. Have you thought about what else is inside an accumulator?

There is a small mesh screen at the bottom of the accumulator internal tube that could be plugged with debris. In that case, the small amount of liquid refrigerant that needs to bypass the accumulator's normal boil off process and enter the compressor will not happen.

That might sound contradictory, but this small amount of liquid refrigerant is not nearly enough to slug (hydro-lock) the compressor. This cold liquid refrigerant will enter the compressor and literally quench the hot surface of the compressor to help lower the compressor's operating temperature. If the compressor runs cooler, it last longer.

Next in our discussion of compressor R&R would be the orifice tube (if equipped). Most every tech doing A/C work has seen what a great post condenser "junk trap" an orifice tube can become in a system that has contamination. The question now becomes where did the contamination come from? There is more than one reason to replace an accumulator other than aged desiccant. Was it from a compressor failing? If so, it will be aluminum. If you see brass on the tube it also came from the compressor. Some variable displacement compressors use a brass brushing on the guide rod that allows the plate that varies its angle for displacement control to move.

Is the contamination black? "Black Death" occurs when temperatures kick up high enough to oxidize the oil (think abused/non maintained engine crankcase). Was the contamination from excessive sealants from that shade tree mechanic the customer last visited?

Flushing – Friend or Foe?

It's not that uncommon to find the orifice tube melted/destroyed from a chemical reaction to an unapproved flush. Should you flush? If so, what kind of flush? Most of us stock some kind of liquid flush in our shops for A/C work.

We even might use it without checking the manufacturer's recommendations. Some OEMs say don't flush, recommending instead that you replace parts if there is a restriction. Others say flush with refrigerant only, while yet others say flush with their recommended solution.

There are flushing tools out there that simply push the flush with shop air and others that reverse flush the component in a pulsing action that breaks loose debris. While the party line varies from OEM to OEM, one thing remains certain; condensers are getting harder to flush. As manufacturers seek to reduce vehicle weight, condenser tubes are becoming smaller and smaller to the point where their internal passageways are not only too small to give up the debris of a failed compressor, they won't give up the flush you shoot into them to try to rectify the situation.

The end result is a vicious circle of the trash that left the failed compressor gradually getting through the condenser and wrecking the new compressor. If you've discovered extreme metal debris in the system, don't just change the drier and compressor and throw an orifice tube on the vehicle. Add a screen to the compressor inlet if needed and an in-line filter on the liquid line. I'll offer an installation tip here: After you cut the line and debur the openings (remove those metal chips), go ahead and assemble the filter and tighten without the O rings in place. Then loosen the compression fittings. Lubricate and add the O rings to the fittings and tighten again. This helps keep the compression fitting from damaging the O rings as it seats the first time.

Chattering Clutches

Finally, because heat is a compressor's worst enemy, look for signs of a chattering clutch. If the clutch is on its way out or there is a resistance problem to the electrical circuit to the clutch you may hear really rapid cycling. Resistance drops voltage and limits current and if the current/voltage is insufficient; the magnetic strength of the coil may not be enough to hold the face of the clutch in completely.

The result is a "click-click-click" sort of like a starter motor when the battery is too low to crank. There is usually a good indication in the form of burnt paint on the clutch surface or gooey surfaces around the coil itself. Connect a substitute load tool in place of the clutch coil winding and perform a voltage drop test across the tool. Voltage drop should be no more than 0.5 volts when the PCM turns on the relay.

Reducing compressor comebacks requires being a stickler when it comes to following OEM service procedures and becoming a crime scene investigator of sorts when it comes to those murdered compressors to prevent your replacement compressor from dying an untimely death as well. Do these things and you can avoid the "Groundhog Day" nightmare of repeat compressor failures.

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