the information source

"POS" TECH TIP

ALUMINUM HEAT EXCHANGERS • HEATER CORES / RADIATORS

HOW TO LOSE A CUSTOMER - THREE EASY STEPS!

WARRANTY RETURN

Once you have accomplished these three steps, don't worry, you have definitely alienated and lost a customer. Not only have you lost the heating and cooling business, but you have also lost them as a customer for all of their automotive service needs.

STEP ONE – Don't inspect the returned product and don't ask questions, such as, did you flush the system, install new coolant, inspect the hose connections, was this a repeat failure after the original heater core was replaced?

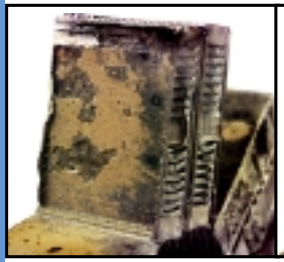
STEP TWO – Just give the customer a replacement unit and send them on their merry way, don't offer advice as to how to get to the root of the problem. Don't suggest the various tests and steps that they can take to solve the cooling system deficiencies that have caused this premature failure!

STEP THREE – Just repeat Steps One and Two when the customer once again enters your place of business with yet another failed heater and /or radiator.

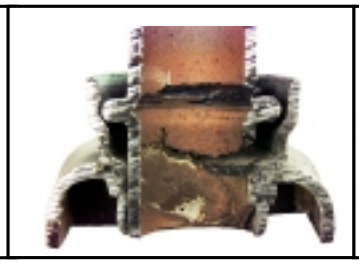
How common is this problem? Repeat aluminum heater core/radiator failures will occur: 1) Failure to use distilled or deionized water **as stated in the vehicle's owner's manual!** Tap water should never be used! Most municipal water contains chlorine, resulting in the formation of chlorides in the coolant. Chlorides are aggressive to aluminum. Tap water also contains oxygen that contributes tremendously to metal corrosion and the depletion of coolant inhibitors that are designed to protect the cooling system. Deionized water does not contain oxygen. "Experiment" - Aluminum heater/radiator (new) tubes placed into a container of untreated "tap water" will begin to corrode in a matter of days without the inhibitor protection found in automotive coolants. 2.) When the system has been neglected and has not been properly serviced. 3.) High mileage can increase the potential for repeat failures. Most failures of this type occur out of warranty on vehicles four to five years old with mileage in excess of 70,000 miles.
4.) When aftermarket accessories are added and not properly installed (grounded) i.e., stereos, lighting, etc. 5.) Due to debris within the system that could have been inside the system from the OE manufacturer or may have accumulated inside the system as the coolant protection package has been depleted. The first failure would usually occur within a year or two and at a lower mileage level.

CASE HISTORY: *Installer* – Dear Heater Guy, I have a customer with a 1996 Chevrolet Tahoe, 5.7L engine with air and 95,000 miles on it. The heater core is leaking again! I feel that the problem is due to "electrolysis" based on the location of the leak(s), small pin holes in the center of the core. I have tried the OE heater core replacement, as well as three other aftermarket brands, all with the same result – a repeat heater core failure. I have also seen this problem on three other customers' vehicles over the past six months. I have replaced this heater core four times. The last one failed in two weeks. We have flushed and refilled the system each time, and we added a ground strap to the heater core and replaced the radiator cap. What are we missing?

The Installer has not eliminated the "Electrolysis" problem that exists in this vehicle's cooling system. In



Examples of "pin hole" core leaks caused by contaminated cooling system.



Examples of failures caused by a combination of "Electrolysis" and "Acidic" coolant.

fact, he has made the problem worse by "grounding the heater core', thereby providing a path for the stray electric current in the cooling system to go to ground through the heater core to cause the damage to the heater core. What should he have done? The following diagnostic procedures should lead the installer to a properly serviced system, and restore the vehicle's cooling system to an acceptable condition to allow the vehicle to return to normal service.

The following diagnostic procedures should allow the installer to identify and correct the problems causing the repeat failures, as well as catch the problems at the time of the first failure!

DIAGNOSTIC PROCEDURES:

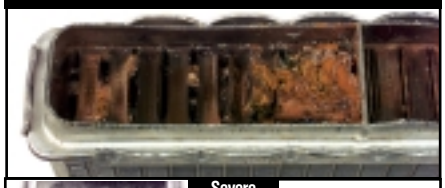
HOW SHOULD YOU HANDLE THIS WARRANTY RETURN?

The purpose of this TECH TIP is to update you, the Re-seller and the Installer, with the knowledge that is truly required to properly diagnose each failure, to determine the root cause of the failure and enable you to do a complete and proper repair. Too often, the heater fails, the coolant "looks" OK, and the heater is replaced, only to have the customer return to the shop in a few months with a repeat heater failure. What was missed? In the following paragraphs, the necessary steps to investigate the root cause of the failure will be discussed. In addition, some helpful suggestions will be offered for some of the more troublesome applications that seem to fail more often and in less time than other applications. The information that follows has been gathered from numerous "expert" sources and is provided to you and the installer with the intention of assisting in the complete diagnosis and repair of the customer's vehicle. The aim is to satisfy and keep your customer, and to prevent another repeat failure.

WHAT STEPS SHOULD YOU FOLLOW WHEN A WARRANTY RETURN IS PRESENTED?

STEP ONE - Once you have determined that the heater (or radiator) has failed, don't stop! Ask the customer for the facts. Is this the original equipment component, or has it been replaced before? How long ago? What is the condition of the engine coolant? Do you see any residue in the radiator filler neck? What is the color of the coolant? Check the PH! If the coolant checks out (clean, a minimum 50/50 mix and an acceptable PH level of 8.5 - 10.5) then check for "Electrolysis." In the case of a repeat failure, a laboratory analysis of the coolant is recommended, and may save you an additional failure/comeback! If the reading is within the acceptable range and you have determined that there are other contaminant's in the coolant, you should flush the system before removing the failed part (if possible). Once the failed part is removed, determine the type of failure. Test the unit, if possible, to determine the actual failure. Does it appear to be an expected failure due to the age, mileage, or condition of the vehicle? If the failed unit is not good for anything, why not cut the unit open (hint, a band saw or hack saw is all that is required in most cases) and inspect the condition of the inside of the unit. You may find contamination from the coolant, debris, silicate drop out from the coolant, evidence of electrolysis, eroded or corroded tubes, etc. It is important to know this, because it will enable you to put the system back into acceptable condition. The procedures to do this are included later in this Tech Tip.

Example of plugged tubes due to contaminated cooling system leading to pin hole core leaks and failure.



Severe damage (tubes eaten away) by corrosive and acidic coolant leading to failure at the tube to header joint.

Severe damage caused by a combination of corrosive coolant and the effects of "Electrolysis".

STEP TWO - If you have determined that the system is OK, the recommendation is that you flush the system and refill it with new coolant (minimum 50/50 mix). A flush machine is preferred. However, at the very minimum, flush the system to the best of your shop's ability. Coolant Recommendation - when replacing aluminum components, the experts recommend replacing the coolant with the same type of coolant that was installed at the factory. **NEVER MIX DIFFERENT TYPES OF COOLANT!** Mixing coolants in the system can have very adverse effects on the protective inhibitors within the system. Chemical reactions can vary due to the makeup of the various types as well as brands of coolant. These changes may lead to inhibitor depletion and premature failure of the various components. Never fill a cooling system with just **WATER!** A minimum of (coolant/water) 50/50 and a maximum of 70/30 is recommended. Check the vehicle's owner's manual for specific vehicle recommendations from the manufacturer. Other coolants can be used, such as DEX Cool, a long life coolant (a licensed GM Trade Mark) or similar brand product made with carboxylate technology (organic composition). Remember that the use of the long life coolants as a replacement for the ethylene glycol, propylene glycol, and mixtures of both does not extend the recommended coolant service requirements as specified by the original equipment manufacturer. The truly extended life of the long life coolant only applies to new vehicles when the new coolant is used initially, and maintained through regular service. For GM vehicles, refer to GM Bulletin NO. 73-62-13 issued July 1997 in Section 6 - Engine, and follow the specific instructions. To recap this bulletin, GM states that vehicles with suspect coolant must be flushed. Flush procedure "A" specifies GM's flush machine. If a flush machine is not available, then a minimum of three (3) complete flushes with water is recommended. Each flush is to be a complete cycle. Drain the coolant, fill the system, start the vehicle and run it up to normal operating temperature. Stop the vehicle, allow it to cool to the point that it can be drained fully, and then refill the system and repeat the procedure a minimum of three times. It then goes on to recommend the use of the DEX Cool in a minimum of 50% and a maximum of 65% DEX Cool/Water mix. It is also a good idea to recheck the coolant

Extreme damage to inlet tubes caused by "Electrolysis and Acidic" coolant.

PH of 8.5 to 10.5 level when the refill is completed. Since many areas of the country experience high mineral content in their tap water, and varying degrees of hardness and other factors, it is recommended that the installer use distilled or deionized water when refilling the cooling system.

STEP THREE - Investigate for other "ROOT CAUSES" of the failure. If the Coolant and Cooling System appear to check out OK. Then "ELECTROLYSIS" may be the root cause. This condition can occur when electrical current travels through the coolant. The Coolant and cooling system act the same as a "battery". Coolant comes in contact with the engine components made with different alloys and metals. If the voltage potential between the coolant and battery ground is high, coolant becomes the electrolyte, and "galvanic action" leading to premature failure begins. The least noble metal component(s) that comes in contact with the coolant will be oxidized and may result in coolant loss, if sufficiently degraded to the point of leaking. (Pin Holes develop in the aluminum inlet and/or outlet pipes and tanks of radiators or heaters. The removal of metal from the interior of the inlet and outlet pipes is also sometimes noted.) Electrolysis will also lower the coolant PH and accelerate cooling system corrosion. To locate and correct this condition, using a digital D.C. Voltmeter, connect the negative lead to the battery ground and place the positive lead into the coolant in the radiator filler neck (avoid touching the lead to metal). Leave the leads in place for several minutes and note the readings. The test must be done with the vehicle at rest, and again with the engine and accessories operating. If the voltage stays below 0.10 Volts, then Electrolysis is not the cause of failure in the vehicle. If the reading exceeds the maximum expected reading, the source of the voltage must be determined. To begin, remove one fuse at a time from each circuit, and note the voltage reading at the same time. If you locate the problem circuit with this method, the voltage will drop into the normal reading range when the fuse is removed. For other electrical systems, you may also have to operate the vehicle's various accessories, while monitoring the voltage meter. The starter, charging system, radiator cooling fans, etc. are examples of the accessory systems that may have an inadequate ground that allows the electrical current into the coolant only while the accessory is operating. Other hints regarding Electrolysis - don't attach a ground strap to the heat exchanger, (radiator or heater.) This will only amplify the problem. You must find the defective circuit. There have been some successful reports of the use of aluminum foil to line the blower motor cavity of the heater case where "static electricity" was the suspected cause of an Electrolysis problem.

STEP FOUR - "EXTRA PRECAUTIONS" Many of the vehicles that you will encounter will have a "restrictor" somewhere in the cooling system. Some restrictors were inserted into the inlet heater hose prior to the heater, or in the manifold fitting that feeds the heater. For many of the systems in use today, the heater control valve has been eliminated and replaced by electronic and/or manual HVAC (Heating Ventilation, Air Conditioning) systems, controls, doors, etc. We are not aware of any way to determine by year, make, model, etc. if the O.E. utilized a restrictor in the system. In many cases the vehicle really doesn't require the flow and pressures that are present in the O.E. setup. A prime example of this is the GM Chevrolet and GMC "CK" pickup trucks that have experienced premature failures due to the "velocity" or speed of the coolant through the heater core. As the velocity of coolant is accelerated, erosion will also be accelerated. That is why the accumulation of debris in the coolant that becomes lodged in a heater or radiator tube may experience premature failure of that tube, due to erosion to the point of a tube or core face leak. A number of installers have reported that the use of a restrictor in the inlet heater hose on this model has met with some success when used in conjunction with the flush and refill procedures outlined by GM. It appears that depending on the geographic location, the flow can be reduced up to 40% and still attain satisfactory heater performance. Ford offers a restrictor fitting that can be spliced into a 5/8" heater hose through their Dealer Parts Department (Part No. F1UZ-18D406-A). In lieu of a restrictor you may wish to consider a "by-pass" system that will divert a portion of the coolant flow back to the engine cooling system without circulating through the heater core. Ford has a cooling by-pass kit that was developed and added to the Dealer Parts Department to solve a specific problem affecting certain Ford Taurus models. This kit is fairly inexpensive and provides all of the necessary hose, tees, clamps, etc. to install into the Taurus. Most likely, this kit could be easily modified for installation in most vehicles with 5/8" heater core inlet/outlets. This may be one additional tool that you can use in cooling system problem solving. The Ford Part No. is F7DZ-8522-AB. Once you examine one of these kits, you will be able to create your own modifications and accomplish similar results. One additional suggestion to restrict coolant flow to the heater core is to select a manual heater control valve from the Four Seasons aftermarket heater parts catalog with the appropriate size fittings. Splice the valve into the inlet side of the heater core coolant circuit, and adjust the valve manually until you attain a satisfactory heating level inside the vehicle. Keep in mind the necessity to educate the vehicle owner as to his cooling system problems, and that this is one means of trying to circumvent the next premature failure. In setting the valves operating position, instruct the customer that the valve should be adjusted seasonally for the best performance. The flow can be severely restricted for eight months of the year, and the flow will most likely have to be increased for the late fall and winter seasons. Of course some of these actions and installer fixes have been done at the discretion and the responsibility of the installer. In many cases, these fixes as an attempt to prevent some of these repeat failures on high mileage, out of warranty vehicles with contaminated cooling systems have been successful. Use your own discretion.

OTHER - The new long life organic coolant is the factory fill for all '98 and newer vehicles in Europe. In the U.S.A., all '99 and newer GM vehicles, most '99 and newer Ford vehicles and some Chrysler vehicles began using the new coolant in mid 1999. All coolants provide metal protection by "coating" the internal metal surfaces. The organic coolant protective coating is thinner than the traditional glycol coolant coating, and therefore heat transfer is more efficient with the organic coolant. With the increased use of aluminum engine, heating and cooling components, new service problems and failure complaints have risen. When the coolant mix drops below 50% due to lack of service or other causes such as overheating,

continued from page 3

coolant loss, etc. the probability of aluminum oxides forming increases. An underlying contributor to this condition is the aeration of the coolant due to the low level, which accelerates the loss of the coolant protection package. Aluminum flakes break off of metal surfaces to travel through the cooling system as "hard" grains (acting much like sandpaper) that erode metal surfaces to the point of failure (pin holes). The grains can group together forming larger abrasive particles that may accelerate the failure of the radiator, heater and other components such as water pump seals, etc. In extreme cases on some high mileage vehicles, this aluminum oxide buildup can get to the point that sufficient removal of the aluminum oxides to return the vehicle to normal service is not possible. The only solution in this case is replacement of the engine block (short or long block).

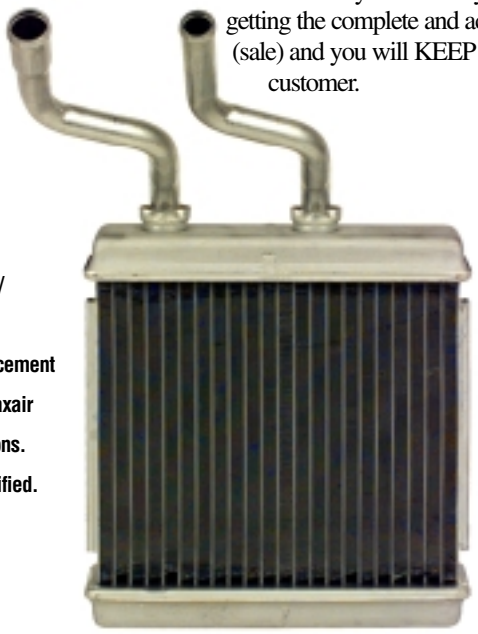
FINAL OPTION – If you have exhausted all of the diagnostic procedures above and still feel that the problem has not been solved, a coolant change to "WATERLESS COOLANT" may restore the vehicle to normal operation. Visit the website www.evanscooling.com to look at this option.

Evans Cooling Systems has been providing a waterless coolant for racing, the trucking industry, and others for the past fifteen years. According to Evans Cooling Systems, electrolysis is eliminated by using their product, since "water" is the conductive property of the coolant and water is eliminated with the use of their product. The drawback is in both the cost of the coolant, approximately $25. per gallon at dealer net, and the requirement to completely drain all water from the system. This could entail more than one fill and drain with 100% glycol based coolant, draining the block, etc. to prepare the system for the Evans waterless coolant. NO Water is allowed, thus the flush(s) with 100% glycol. Once the system is prepared, a small amount of glycol left in the cooling system is acceptable and will mix with the Evans waterless coolant. Although this changeover is expensive initially, it is much more desirable than an additional component (heater/radiator) failure.

CONCLUSION - The modern cooling systems utilizing aluminum components must be kept within OE specifications and receive the recommended services at the specified times. When the coolant protective properties are depleted, the coolant's PH changes and the aluminum components are attacked by the resulting acidic coolant. Other contributing factors within the cooling system that can accelerate erosion and/or corrosion are debris, foundry casting sand, gasket material, silicone, (sand) etc. suspended in the coolant that may block or partially block tubes to cause accelerated velocity which could lead to premature failure. Electrolysis is also a possibility and is easily confirmed. Do a complete analysis and get all of the facts prior to replacing an obvious failed component. Water quality, hardness, mineral deposits and other contaminant's also play a roll in the coolant makeup. In geographic areas where water quality is a problem, adding bottled water to the mix may increase the serviceability of the coolant mix. The time and money that you save may be your own. By being meticulous in your diagnosis, you will most likely maximize your profits by getting the complete and accurate repair (sale) and you will KEEP a satisfied customer.

PN 94484

Maxair Division of Four Seasons / Standard Motor Products, Inc. High quality GM aluminum replacement heater cores manufactured by Maxair to meet or exceed OE specifications. Maxair is QS9000 / ISO9002 Certified.



PN 94496

SOURCES FOR TECHNICAL INFORMATION AND SUPPORT, ALUMINUM HEAT EXCHANGERS:

Thanks to Maxair Division of Four Seasons / Standard Motor Products, Inc. and Four Seasons for their invaluable assistance in preparing this Technical Tip. All of the picture illustrations of samples of failed OE and assorted Aftermarket heater cores were provided by the Four Seasons Technical Staff. Picture illustrations of the new GM aluminum heater cores manufactured by Maxair provided by the Four Seasons and Maxair Technical staff. Maxair is a QS9000/ISO9002 Certified manufacturing facility.

NARSA, The National Automotive Radiator Service Association. NARSA publications - monthly magazine, the Automotive Cooling Journal, NARSA Service Reports. Special publication on the subject of Aluminum Cooling Systems: Is the Technology a benefit or a headache? For further information contact NARSA at 215-541-4500 or narsa@narsa.org P.O. Box 97, Greenville, PA 18041 (215) 541-4500

THE RADIATOR REPORTER – An industry publication owned by NARSA that does not accept advertising. This publication is well known in the cooling system industry. It has an up to date database of cooling system problems, questions and answers. The most detailed and complete service information regarding failed aluminum components have been written and published by The Radiator Reporter. For information, contact NARSA at 215-541-4500 or narsa@narsa.org

Cool Profits Magazine, John R. Hess, 9 Natalie Circle, Petaluma, CA 94952 800-883-8929

COOLANTS – Contact any of the major Coolant Brands for additional information on the chemical proprieties of the various types of coolants available in the marketplace today.