

## Clean Air Car Check is now recruiting...

### Automotive Diagnostic Technician

Envirotest Systems is seeking a customer service-oriented ASE certified repair technician to provide repair guidance to motorists and serve as a liaison to the repair industry for Indiana's Clean Air Car Check vehicle emissions testing program. Specific duties include addressing emissions-related repair questions from customers and technicians, delivering technical training for area automotive repair technicians, and administrative responsibilities including producing reports, newsletters, etc. This is a full time, hourly position.

Minimum qualifications include L1, A6, and A8 ASE certification, high school diploma or equivalent, five years of automotive diagnosis and repair experience, and previous customer service experience. The ideal candidate will have advanced computer skills including MS Office products and excellent communication and presentation skills.

We offer a competitive benefits package including medical, dental, vision and life insurance, 401(k) plan, and paid vacations and holidays. If you are interested in pursuing a career outside of the garage or dealership, send a resume with salary history to:

E-mail: [hr.dept@esph.com](mailto:hr.dept@esph.com)  
Fax: 219.661-8409

EOE • Drug Free Workplace

## Temp guns are useful tools, but not necessarily for the diagnosis of converter function - **continued**

Conversely, if an engine is running full rich, a discernable difference in temperatures may be seen even though the converter is relatively inefficient. The variable at that point is the amount of HC's being fed to the converter. This is why a propane enrichment test is the only reliable way to measure a catalytic converter's true ability to convert exhaust gases to benign gasses; in a propane test, the amount of HC's fed to the converter is constant and consistent.

My goal is not to devalue temp guns. There are certainly indications where their use is appropriate. A temp gun is invaluable when looking for bearing issues, dead cylinders, cooling system and HVAC work. I have also done some studies of catalytic converter temperatures and efficiency correlations. I have seen good, brand new converters with little temp difference front to back, bad converters with a substantially hotter outlet than inlet temp and even a good converter with a higher inlet temperature than outlet temp. Though I do see the value in temp guns, I do not believe they are a reliable way to measure the efficiency of a catalytic converter. 🌐

For more information contact John Yelkich, Clean Air Car Check Diagnostic Technician, at 219-661-5456.

# technicallyspeaking.



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## Temp guns are useful tools, but not necessarily for the diagnosis of converter function

Measuring the inlet and outlet temperatures of catalytic converters with a non-contact thermometer has become a popular way of determining whether a converter is functioning or if it has been compromised and not working efficiently. This test, known as the exothermic test, has many limitations.

Any converter temperature that can be taken with a temp gun should be viewed with a critical eye. The typical temp gun only measures the surface temperature of its target. If one target is a double wall, stainless pipe on the inlet end of a catalytic converter and another target is a thin wall, such as a galvanized pipe thinned by corrosion on the outlet end of the same converter, the temperatures taken can vary widely based on those conditions alone. The distance the target is from the actual converter brick on either the inlet or outlet end may skew the temp readings as well.

the front face of the inlet end. This is probably the most useful temp reading that can be taken, but, because of a lack of reliable data it will have little meaning.

The amount of time the vehicle has been running will also play a huge role in the accuracy of the temp readings. If the converter temperature is taken while the vehicle is operating in an open loop, slightly rich strategy, the readings on the converter, if it has lit-off, will differ front to back with the front temp being lower. If the converter has not lit, the temperature difference front to back may be negligible. Once the vehicle goes into a closed loop, slightly more lean condition and is in fuel control, even with a functioning converter that has lit-off, the temp difference front to back may not be more than a few degrees. This is due to the fact that with little or no fuel being put through the converter there are no HC's available to "feed" the converter fire.

Typically, a converter brick will be the hottest roughly two inches down stream from

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## Follow a Diagnostic Path to Correcting NOx Failures

NOx forms in the combustion chamber of the internal combustion engine above 2500 degrees Fahrenheit. A certain amount of NOx is a normal by-product of engine combustion but elevated levels become problematic due to the role oxides of nitrogen play in the formation of ground level ozone.

When a vehicle has failed the NOx portion of the emission test and the standard that needs to be attained has been determined, the next logical step would be to test the vehicle with a five gas analyzer to determine what the NOx level is in parts per million. This can be difficult since NOx normally does not form until a load is placed on the engine. With an automatic transmission vehicle you would need to warm the vehicle to operating temperature, place the gear selector in reverse, where trans pressures are usually higher, and apply the throttle while watching the NOx level. This is more challenging on a manual trans vehicle. Manual vehicles may need to be driven with a portable analyzer to truly load the engine.

Once a load has been placed on the vehicle, cylinder temperatures will rapidly climb and NOx levels will increase. Without putting too much heat into the torque converter, note the NOx levels so that a base line can be formed. If the NOx level standard on the VIR is 3.00 grams per mile and the vehicle failed the emission test with a 4.00 gpm, we can safely say that a minimum reduction of 30% would be needed to get the vehicle to pass the emission test. So, if under load the vehicle showed a NOx level of 1000 ppm, it would also be safe to say you would need the same 30% reduction in ppm to pass. This 30% reduction would require the NOx level be no higher than 700 ppm. You now have a target number to shoot for. Of course, the lower the number, the better the chance of passing. The target number should not be the final goal, only the smallest reduction acceptable. Once we have a target, we can begin diagnosing the vehicle to determine what may need to be done to get the NOx reduction necessary.

There are five areas that need to be examined when looking for a NOx reduction; EGR, converter, base engine and ignition timing, fuel trim and engine cooling system integrity and capacity. Arguably, the EGR system has the most drastic effect on NOx. And, please, notice the term EGR system. There are typically more parts to EGR than just the valve. Also keep in mind that just because there is no code does not mean that there is no fault. A plugged EGR passage can cause a vehicle to fail an emission test long before a fault code is set. If the vehicle has EGR, diagnose that system extensively if no other obvious fault is present. Fuel trim and engine cooling system can be observed while doing scan tool diagnosis. If the vehicle is running lean, cylinder temperatures can spike causing an increase in NOx overall. Check your fuel trims to see if the vehicle has a tendency to run lean.

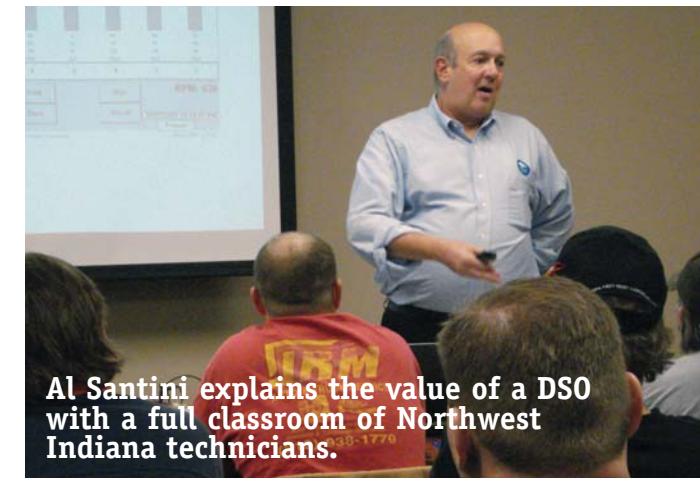
Engine cooling system integrity is important because, while it may not necessarily have a linear relationship to cylinder temps, it can still play a role. If the cooling system as a whole or in part is compromised, hot spots can occur around the cylinders and combustion chambers causing an increase in NOx. While checking fuel trims it is a good idea to make a quick check of the ECT to see if the engine temp is where it is expected to be. If it seems high, do a quick visual to determine if the coolant level is low, the radiator is blocked and the cooling fans are operational. (This is the exact reason a cooling fan fault is considered an emission failure on OBDII vehicles.)

Once EGR, fuel trims and cooling system have been eliminated, checking base engine and ignition timing may be necessary. Most vehicles over the last twenty years have not allowed for ignition timing adjustments, but, if the vehicle you are seeing for a NOx failure has a distributor, check the timing! Many years ago, when dinosaurs roamed the earth, one way to make some subtle, and some not so subtle, changes to a vehicle's emission output and performance was to adjust the timing.

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## Seminar Gives Techs Need to Know Info on DSOs

Al Santini, an independent automotive trainer and retired educator at the College of DuPage presented a four-hour seminar covering the use of Digital Storage Oscilloscopes within an emission repair, including using a DSO with a scanner for OBD-II diagnosis and repair. The course also covered the use of a current probe to look at ignition and fuel injection patterns. Case studies involving testing sensors, and



analyzing various emission repair patterns were also emphasized.

As Al Santini demonstrated, any shop that uses a digital storage oscilloscope to diagnose emission failures knows that it is an invaluable way to check the condition of an O2 sensor, determine injector state of health and pinpoint a misfire to the primary or secondary side of the ignition system.

This seminar taught some techs to better utilize the scope they already have or persuaded others to consider purchasing a DSO to add to their arsenal of emission fighting tools!

This seminar was the final "Tech Night" for 2008. Watch upcoming issues of Technically Speaking for information on free classes offered by the Clean Air Car Check vehicle emission testing program. 🌐

## Follow a Diagnostic Path to Correcting NOx Failures - continued

Even today on pre-OBDII vehicles, changing the vehicle ignition timing can reduce NOx to a large extent. If somebody who does not understand OBD capabilities of pre-1996 vehicles sees a distributor and an opportunity to move it, it is a safe bet the timing has been changed. If this is the case, reset the timing and check the NOx output again. You might get lucky. If the timing has not been changed, it is still possible to retard the timing slightly to reduce NOx. I would not suggest changing the timing more than a nominal two degrees. It may not give much of a reduction, but coupled with other repairs, it may be enough to allow a troublesome vehicle to pass.

Base engine timing is a bit more difficult to check but if the vehicle has recently had repairs that may have involved the timing

chain or gears, it may be worth the time devoted to confirming that the relationship of the crank to the cam is correct.

If everything else checks out, the converter may be the only way to repair some NOx issues. There are a number of vehicles, (the early nineties Jeep straight six-cylinder, some GM 3800's and small displacement Dodge V8's to name a few), that may have NOx failures that can only be addressed with a new converter. But, keep in mind if you do decide to change the converter on a vehicle that is failing an emission test due to high NOx, you may want to talk to your converter supplier to determine if the new converter is loaded to mitigate a high NOx level. Some manufacturers have converters that are loaded differently and they may be able to steer you toward a better converter for your intended purpose. 🌐

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