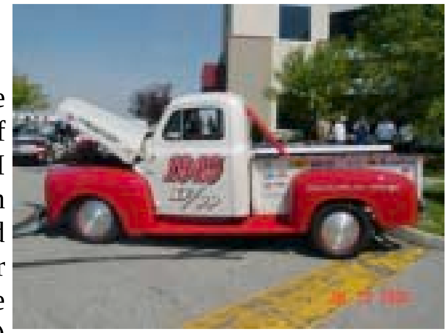
*LINDER TECHNICAL SERVICES*

# *Networking*

***Newsletter***

**JULY 2005**

# Bonneville Salt Update…



Here it is getting closer to our September "World of Speed" Bonneville Salt Flats record attempt and I am down to a printed single page list of stuff to do. It seems like every time I cross off an item, I add 2 more. I recall the way to eat an elephant is to do a chunk at a time, but they seem to grow overnight. We finished the paint and assembly of the vehicle and added all the decals of sponsors etc, and took it on a trailer to a local car show to show it off. The truck is looking very good. If you remember the 1949 Ford F100 runs in XF/PP class (Flathead Ford v8/production pickup) and the record is now 101 mph. My personal goal (a perfect day for me) would be to unload the truck, pass technical inspection, warm it up and run 110+ on the first run. That followed by a backup run the following day would exceed my expectations. I noticed another truck ran at Speed Week and could only do 96 mph, so my dream day may be difficult to do!

The engine (one of three we have all different colors) is the **red** engine and is equipped with a 3-carb intake manifold using a single Stromberg 97 series carb and two Scott fuel injector units. The engine sounds really good and we have now driven it down the street a couple times with the single carb and it appears to be jetted just about right (after taking it off three to four times). The injectors are ready to try but we will do that on a actual road test next week sometime. The valves have been adjusted a of couple times and it appears (based on an idle pop) that we need to do it again after a short road trip to break in the new camshaft etc. All in all, it runs down the road better than we had expected for a first drive.

Production class requires headlights (bright and dim) , tail lamps, as well as horn and brake lamps. I just finished (with lots of help) wiring the lighting systems and they do look and work very well if I do say so myself! Bonneville rules require a lot of different stuff just for safety sake and we have a few days in the roll cage, fire ext system, door safety locks (can't lock), fuel lines, anti-roll over valves, safety shields (flywheel area) and the door nets and harness restraints which still aren't finished. The wheels are steel welded on the backside with steel valve stems and rated tires. We have gone over the technical inspection sheet 3-4 times and really are getting close to being done with just a few more chunks to do.

The actual logistics of taking this vehicle for a 1600 mile trip, setting up pits and getting the truck on the salt is also a major planning event as well. We have 2 large enclosed trailers being pulled by 2 diesel trucks staffed by volunteers from the gasolinealleysshops.org group. Just the thought of the cost of fuel in today's prices is somewhat an issue to say the least. But it is getting done through a group effort and sponsorship dollars from lots of friends and business associates.

Our spare yellow engine is on the stand with final adjustments being made so that we can add flywheel, clutch and transmission and is a couple of days away from fire-up on our test stand. Our goal is to have it ready to bolt in if needed in a ready–to-run condition complete with distributor, trans, starter, water pumps etc. Four bolts hold a flathead in the chassis and we have practiced removing our truck dog house a couple of different times. I even painted all removal bolts yellow and trial fitted the unit just for ease if need be on the salt.

We plan on having the truck for show and tell at our annual technician conference in September so many of you can view our progress then. Also I plan on making the September issue of our newsletter a Bonneville issue complete with the results of this ever growing adventure. We will also have a web site update each day on the salt during the actual event September 14-17, 2005. Jim Linder, WWW.GASOLINEALLEYSHOPS.ORG

# Resistance Calculated Oxygen Sensor Heater Temperature (RCOHT)

This information comes from a recent General Motors publication…………

More and more GM vehicles are now using a relatively new oxygen sensor temperature control strategy called Resistance Calculated Oxygen Sensor Heater Temperature, or RCOHT.

**How does RCOHT work?**

The RCOHT strategy will learn the resistance of the oxygen sensor heater circuit at start-up after a cold soak has occurred. At start-up, the engine controller briefly samples the oxygen sensor heater current; it then calculates the resistance of the oxygen sensor heater based on the sampled current and the measured supply voltage (system voltage). Once the initial resistance is known, a resistance-to-temperature model can be followed as the calculated resistance changes during operation. From this model, the engine controller can very accurately control the temperature of the oxygen sensor heater.

An expected range of oxygen sensor heater resistance characteristics is stored within the engine controller for that specific package. The engine controller must know the initial resistance of the heater in order to determine which resistance model to follow. The initial resistance calculation can be made only after an extended soak period, so the engine controller can accurately determine the equivalent "room temperature resistance" of the oxygen sensor heater. This "room temperature" is based on the engine coolant temperature sensor (ECT) and intake air temperature sensor (IAT) values. In other words, the engine controller can safely assume that when the extended soak conditions have been met, the oxygen sensor will be at the same temperature as the ECT and IAT.

Although not specific to any particular platforrm, an extended soak can be roughly defined as:
-The engine has been off for more than 10 hours AND
-The ECT and IAT are within 8 degrees C or 14.4 degrees F of each other at start-up

**Why use a new strategy?**

RCOHT provides much more accurate control of the oxygen sensor heater temperature. Other temperature control strategies attempted to "predict" the oxygen sensor temperature by using some form of temperature prediction model.

RCOHT allows accurate oxygen sensor heater control even if there is a resistance variation between newly manufactured oxygen sensors or if the resistance changes as the sensor ages. One problem faced in the past was the possibility of over-predicting the heater temperatures of a high resistance oxygen sensor and the possibility of under-predicting the heater temperatures of a low oxygen sensor. Because the engine controller is now calculating the resistance of the oxygen sensor after each extended soak, the temperature of the sensor heater can be more accurately controlled throughout the life of the sensor.

**What happens if there is a failure with the heater circuit or the engine controller does not learn the sensor resistance?**

A gross failure (open, short to ground, short to voltage) on the heater circuit should set a heater driver Diagnostic Trouble Code (DTC) and/or a heater current monitor code. If there is a high resistance condition within the heater circuit, it is possible the engine controller will learn the incorrect heater resistance value and not set one of the above DTCs. On some applications, a failed learn or an incorrect learn will cause other DTCs to set. The service information diagnostic tables for these DTCs have taken this possibility into account and will provide appropriate testing procedures. Some vehicle applications do not report a failed or incorrect resistance learn. In these applications, additional DTCs may set in the event of a heater degradation or failure. On certain applications, starting in the 2005 model year, there will be specific DTCs for a failed learn or a learned resistance that is out of range.

# Fuel Injection Update from the "Wizard", Doug Garriott

We get a lot of car magazines at the shop. Greg is always looking through the performance magazines to see what is out there that looks pretty cool. The other day he showed me an advertisement for some fuel injetors. The heading read "ADJUSTABLE HIGH IMPEDENCE INJECTORS". A little further down in the ad it said, "Flow rates are adjustable with fuel pressure". I thought to myself, what a marketing statement! Of course if you increase fuel pressure, the injector is going to deliver more fuel. I wonder how many Do-It-Yourselfers read this ad and thought they found something new? I wonder how many of them have tried to find an adjustable regulator?

We get phone calls all the time from guys that are modifying their engine and want to know if their stock injectors will work. In most cases they have not installed an adjustable regulator or worked through a formula to determine the size of injectors they need. So I can see where this ad could appeal to the DIYers.

I set up a rack on the ASNU fuel injection flow bench to show the flow increase as pressure was increased. Four different Bosch pintle style injectors were used: 14 Lb / 19Lb / 24Lb / 30Lb (2 of each flow rating). Pressure was increased in 2 psi intervals and the increase in flow was calculated.

Here are the results at 3 different pressures. The first picture shows the flow at 40 psi, the second at 50 psi and the third at 60 psi. The testing showed that flow volume increased approximately 1% for every 1 psi added up to 70 psi, where I stopped. I want to mention that ball and seat style injectors (GM Multec) have a tendency to shut down (stop spraying) when pressure is increased over 70 psi.

In most cases if mild modifications have been made, an adjustable regulator can accommodate the fuel requirements, but if major engine overhaul has been done or a turbo/supercharger has been installed, a larger flow injector is required.

$$\textbf{Flow Rate} = \frac{\textbf{HP X BSFC}}{\textbf{\# of Cyl. X Max. Duty Cycle}}$$

- **HP** is your projected horsepower, be realistic!
- **BSFC** is Brake Specific Fuel Consumption in pounds per horsepower-hour. Calculated values are used for this, 0.4-0.8 lb. In most cases. Start on the low side for naturally aspirated engines and the high side for engines with forced induction.
- **# of cylinders** is actually the number of injectors you are using.
- **Max. Duty Cycle** is considered at 0.8 (80%). Above this, the injector may over-heat, lose it's consistency, or not work at all.

**Example: 5.7 Liter V-8** **<u>240 hp x 0.65</u>**

LINDER
TECHNICAL
SERVICES

4-D GASOLINE ALLEY
INDIANAPOLIS INDIANA 46222

Phone: (317) 487-9460
Fax: (317) 487-1868
Toll Free: (888) 809-FUEL (3835)
*out of the (317) area code only*

LINDER TECHNICAL SERVICES

***AUTOMOTIVE SOLUTIONS FOR TODAYS TECHNICIANS!***

www.lindertech.com

# RCOHT (Cont. from page 2)

**What to do when an oxygen sensor is replaced?**

When a new oxygen sensor with the same part number is installed, it may have a different heater resistance than the previous sensor. In most cases, an extended soak does not occur, nor is it realistic to expect it to occur immediately after oxygen sensor replacement. However, the engine controller should not control the new sensor based on the calculated resistance of the old sensor. This may cause under- or over- prediction of the heater temperature of the new sensor.

Therefore, it is important to perform a reset procedure after replacing an oxygen sensor on a vehicle using RCOHT. The reset procedure is required to prevent the possibility of heater damage (high temperature) to the new oxygen sensor. This will allow the vehicle to be returned to service as quickly as possible. To reset the oxygen sensor learned resistance, a code clear is required. The re-set procedure is required after the sensor is replaced REGARDLESS OF WHETHER OR NOT ANY DTCs ARE PRESENT!

When a reset procedure is performed, a default resistance value will be used until an extended soak occurs. This default resistance will allow the new sensor to operate without the possibility of heater damage until an extended soak occurs.

More and more engine applications will incorporate the use of the RCOHT strategy. Refer to the appropriate service manual oxygen sensor diagnostic information and replacement procedures for the vehicle you are servicing. This will provide you with a notice about whether to perform a code clear or use an available scan tool feature to reset the learned resistance after sensor replacement.