From the Bench July 27, 2008

# Engine Start – Part 1

**(or how to bet your new motor on everything being perfect)**

Ok, what's the one thing that gives you nightmares during the buildup of your new kit (turnkey or showroom buyers need not apply)? It's typically when you get you ride put together and have you new motor set, plumbed and wired in place ready for that first turn of the key. A myriad of questions flash through your head: Did I remember to put oil in, is the timing set on TDC, do I have a spark, and will the starter turn over the motor? This is the point where your ride becomes either a ride or a paperweight.

No matter how well you think you did everything up to this point the only way you'll survive engine start is to assume nothing and verify everything. Start with the basics and work toward turning the key.

First – Mechanical

Yeah, I know you put it together so everything is there, torque to spec so why bother you ask? Interesting things happen when we put together kits. Not everything fits right the first time so how many times did you install and remove the headers? How about the starter? Remember that bolt you loosened to install the alternator bracket that runs through your water pump? Exactly, stuff happens so here's your validation step. My process is to verify every fastener in the drive train I can for proper torque and verify every hole that it's really supposed to be empty. I start at the bottom end and at the back of the car and follow thru a sequence toward the front. If you get interrupted, place a piece of tape at the point you completed last and since your following a methodical sequence you'll know where to pick it up after the games over. Follow the torque specs for the fastener you're checking. Don't just lean on it – verify it using your handy motor manual or you can look up the specs for standard fasteners online as long as you know the size and it's "grade" of construction – I'll assume you know something of Grade 5 versus Grade 8 fasteners and how to tell the difference.

- Drive Shaft attachment to rear end
- Drive shaft attachment to transmission
- Transmission frame cross member – to the frame and the transmission
- Transmission to bell housing (It's too late to verify the clutch plate, throw out and pilot bearing so we'll assume those are perfect – you did install the dowel pins on the flywheel right?
- Bell housing to block
- Oil Pan – drain plug in? Pan attachment bolts to spec? Dip stick holes either have a dip stick or are plugged?
- Oil Filter installed – if you are running lines to an external mount are the AN lines tight on ALL of them?
- Motor mount attachment
- Damper on the crank including whatever fancy pulley you installed to it
- Headers both at the heads and the collectors – gaskets in place?
- Water pump bolts
- Alternator, Air Compressor, Power Steering and associated pulleys
- Intake manifold – make sure the bolts are correct, no lock washers and put some thread sealant on the threads to make sure you have no water leaks (where they might go into a water passage) or vacuum leaks. Thermostat housing, tempo sensors, heater hose connections
- Valve covers
- Carburetor mounts and throttle connections including the dual return springs

Ok! At least nothing should fall off or roll away during start up. Feel better yet?

Second Step – Fluids

Now's the time to make sure you've got your engine's lifeblood in. Since this is a new setup and not stock, most of us would like to also like to keep track of how much went in and when. I stick a piece of paper up on the wall in the garage and as I add fluids I track it by how much and when. DO NOT ASSUME that your kit cars motor takes only 5 quarts of oil like the family truckster. If you've got a different oil pan on it, and depending on remote oil filter locations, coolers and ACCUSUMP's your car could take a lot more oil than you think – mine took 11 quarts with a 2 quart ACCUSUMP and a road race pan. Again I tend to be methodical so I start at the back and work my way forward.

- Verify all hoses, pipes, clamps, back to front. If your using a mechanical oil gauge make sure the tube is connected and tightened both at the motor and gauge. You really don't want any leaks.
- Gas! Put at least 5 gallons in for run in purposes. If you're also trying to calibrate a fuel gauge adjust that amount to whatever makes sense for the calibration effort.
- Rear end – typically it's a 90 weight gear oil with possibly a positraction additive
- Transmission – depends on manual or automatic. Manual you can pretty much fill it and you're good. Automatics will have a an initial fill but will need more as you start it up – the torque converter gets pumped up with the engine spinning. The transmission maker should be able to tell you the total amount required.
- Motor Oil – Lot's of good choices, synthetic or conventional, multi grade or single weight – Follow the recommendations of the motor builder for start up. I usually pop the valve covers off and put 2 quarts over each set of rockers – slowly and carefully as it will smoke badly if it drips over onto your nice new headers. Also add a pint of a good break in Lube to make sure your giving your motor the best chance for break in. To make sure you've got oil everywhere, prime the oil pump (now you know why I didn't mention checking the distributor in step one!). I actually took an old distributor and stripped the shaft out which allowed me to use an electric drill to access the oil pump down under. Turn the drill in the same direction of the distributor – my Ford was clockwise – until you feel resistance and then do it for another minute. This should pre-oil all your bearings and set you up for the least wear startup. Depending on how long you wait to start the motor you might need to do this again to be sure.
- Coolant – unless your racing or your motor demands something different the most common is a 50/50 mix of coolant and distilled water. I also add a pint of Red Line's Water Wetter. This takes a while as it takes time for it to reach all the little nooks and crannies of your block so fill it and walk away. When you come back in 15 minutes you'll need to add more. Keep doing this until it stays full.
- Misc. fluids like power steering

Check for leaks. Fix them if you have them and don't wait. You don't know what might happen after startup when everything will be under pressure and very hot.

This gets you through the physical checks. Just so you don't think it's a waste of time, here's what I found on the Coupe - and I thought I was being very methodical and careful during the build.

Mechanical:

Main bolt holding the alternator was loose by about 3 turns
Missing 2 bolts on the bell housing at the very bottom

Fluids:

Leak from the fan temperature switch on the water pump – needed to reseal it with thread seal
Leak from a water pump bolt – cleaned debris from under the flat washer
Leak on the oil pressure gauge tubing at the engine fitting – wasn't tight

More next month with Electrical verification, Initial setup and possibly start up!