

# Tuning Checklist!

Special Thanks to Jeff at Evans Tuning for graciously allowing me to hijack portions of the following information.

## Miscellaneous

Bring CASH. We do not have a credit card terminal at the dyno shop, nor do we accept checks.

I have a Dynapack dyno. I take the wheels off of your car to tune the car. Do not come to the appointment without the wheel lug key if you have locking wheel lugs.

Make sure all fluid levels are up to par. No oil, no engine. No coolant, overheating issue.

Bleed the coolant system before you come for the appointment. If your car is overheating, DO NOT come for the appointment. I cannot tune a car that is overheating.

If after reading this you still don't have the answer you are looking for, send an email to [info@locashracing.com](mailto:info@locashracing.com)

Our job is to tune your car, not fix everything that is wrong with it. If you come to an appointment with a car that is not working properly you may be asked to leave depending upon the severity of the issue. If the problem is minor enough to be fixed at the shop during the day, we can fix it, but NOT FOR FREE. You wouldn't work for free and neither should we!

We have had so many bad experiences with customers coming for tuning that have cars that are just not ready. This results in having to spend the majority of the day fixing mechanical/electrical issues, and not spent tuning the car. Here is a list of things that should be checked before coming for a tuning appointment:

Electrical:

### 1. Wiring

The engine's wiring harness should not have any exposed wires. **NO wires should be twisted together and taped!** Make sure all wire connections are soldered and heat shrunk together. This ensures that you have good continuity in the wire, as well as adequate shielding. Some of the most common wiring issues are injector clips being twisted together (huge no-no), improperly installed resistor packs, de-installed VAFC controller wiring exposed and not being taped.

### 2. Check engine lights

If you are using a stock ecu (i.e. hondata, Neptune, EcTune) and have a check engine light, you need to find out the codes that are tripped. Depending on what codes are tripped, it can make it virtually impossible for a tuner to tune your car. In order to see what codes are being thrown, you need jump the service connector. The service connector is located above the factory ecu. Its a two wire plug, located in a green boot. You have to pull the plug out the green boot. Once its out, in order to "jump" the connector you need to use a paper clip or piece of wire. You simply put both ends of the wire or paper clip into service connector, completeing the circuit. If you have a complete circuit, the check engine light will now start to blink. It will be a series of long and short blinks. For example, two long blinks and two short blinks. The long blinks would represent 2x. The two short blinks would represent x2. Putting both together you would get a code 22, which would be vtec oil pressure switch. Now if you jump the service connector, and you dont get the CEL to blink at all, there is an issue with the stock ecu. If you are using a chipped ecu, there is something wrong with either the chip, or the external chip circuit that was installed into the ecu. A list of obd-1 ecu codes:

- 1 Primary Oxygen Sensor (HO2S).
- 3 Manifold Absolute Pressure Sensor (MAP).
- 4 Crankshaft Position Sensor (CKP).
- 6 Engine Coolant Temperature (ECT Sensor).
- 7 Throttle Position Sensor.
- 8 Top Dead Center Position Sensor (TDC).
- 9 No. 1 Cylinder Position Sensor (CYP).
- 10 Intake Air Temperature (IAT) Sensor.
- 13 Barometric Pressure (BARO) Sensor.
- 14 Idle Air Control (IAC) Valve.
- 15 Ignition Output Signal.
- 16 Fuel injector.
- 17 Vehicle Speed Sensor (VSS).
- 20 Electric load detector.
- 21 VTEC Solenoid Valve.
- 22 VTEC Pressure switch.
- 30 A/T FI signal A.
- 31 A/T FI signal B.
- 41 Oxygen sensor heater.
- 43 Fuel supply system.

### 3. **Battery**

I have experienced many tuning appointments that were cut short due to failing alternators or weak batteries. Before a tuning appointment you should verify that your alternator is in good working condition. An easy way to verify that your alternator is in working condition is multi-meter the battery and make sure that the voltage is staying around 12-13 volts. If over time at idle it starts to drop below 12 volts, and gets progressively worse your alternator is going bad. If your engine cranking is weak on engine start-up, your battery is weak. You can do one of two things. One, check each cell

on a "wet cell" battery to make sure the distilled water level is up to full. If not fill it, and put a deep cycle battery charger on it to bring it back up. Two, just get a new battery!

#### 4. **Fuel pump**

This is somewhat related to electrical aspect since its part of the electrical system. If you are replacing your stock fuel pump with an aftermarket fuel pump, while you have the gas tank open make sure there is no rust or sediment in the tank. I have several customers car that have had dirt, rust and other debris in the tank, and have caused fuel starvation during a tuning appointment. If rust is present, replace the tank! Do not install the new fuel pump, you'll ruin the seals pumping the rust through it. If dirt is present, drop the tank and clean it out with alcohol.

### **Mechanical:**

#### 1. **Engine**

The internal combustion engine is a very complicated machine. Due to this nature, before a tuning appointment its necessary to check the engine vitals to ensure that the engine is in a healthy state. This includes doing a compression and leak down test. Listed below is a estimated engine static compression vs compression test results that you should see:

8:1~8.5:1 compression: 150-170 psi per cylinder

8.5:1~9.5:1 compression: 170-210 psi per cylinder

9.5:1~11:1 compression: 210-275 psi per cylinder

11:1+ compression: 250+ per cylinder (highly depends on cams being used)

This is an estimate. What the goal is to have no more than 20 psi variances between each cylinder. Ideally you want to see as close of compression between cylinders as possible. If you see a large variance in one of the cylinders (more than 20psi+), there are a few more steps that should be taken:

- a. Put a cap full of oil down the spark plug hole. Redo the compression test. If the compression goes up more than 15-20psi, your rings aren't sealing and need to be replaced. The oil temporarily seals the damaged part of the ring, and gives higher compression.
- b. Do a leak down test. While doing the leak down test keep your radiator cap off of the radiator. Get each cylinder up to TDC at the piston, as well as TDC at the valves. The firing order is 1-3-4-2. Its easiest to check what cylinder is at TDC with a long rod touching the top of the piston, at the peak of its travel you are at TDC on either 1 and 4, or 2 and 3. With the leak down test you should see less than 10%. If you are seeing more than 10%, listen to where the air pressure is escaping. Put your finger over the oil dipstick

hole on the block. If the rings are shot, or you have a hole in the piston the dipstick hole will get pressurized, and you'll feel the pressure on your finger tip covering the hole. Watch the coolant with the radiator cap off. If while doing the leak down test you see bubbling on a specific cylinder, the head gasket is tore or the sleeve sunk in that cylinder (those with sleeved blocks). The air pressure is getting past the head gasket and pressurizing the coolant jacket, causing the bubbling.

If you getting white smoke it indicates you are burning coolant. This can happen with a bad head gasket, sinking sleeve or cracked sleeve. The leak down test should confirm this by the bubbling in the radiator. If you are getting blue smoke you are burning oil, this can be from worn rings, bad valve guides or valve stem seals, or turbo seals are shot (if you are turbo). If you are getting black smoke you are running rich. You should be able to smell a rich condition, if you are getting black smoke.

Valve lash on the engine should be set before the tuning appointment. Its a good idea to check the last every 20,000 miles with a stock engine, and even more with a higher revving modified engine, especially with aftermarket camshafts installed. If you are using OEM camshafts, set the valve lash to stock with the engine bone cold. If you do it while the engine is hot, the metal expansion rate is much different, and you are set the valves to loose. If you are using aftermarket camshafts, set the valve lash to the manufacturers suggestion. This is typically a little looser than OEM settings. I have seen pretty drastic power gains with forced inductions engines having the valve lash not being set properly.

Thermostat.

With the OEM ecu, or aftermarket, its critical to allow the engine to operate at a minimum of 175-180 coolant temperature. If the engine is not coming up past 175 degrees, the ecu is still in warm up temperature trim for the fueling. This means that the engine will run overly rich condition. I have tuned cars on the dyno that have colder thermostats (160 degree) and no thermostats, and are able to get up to operating temperature (above 175) due to the poor airflow condition that a dyno has. While street tuning the engine tune is thrown off greatly (ie: very rich) due to the radiator getting adequate airflow, and causing the engine to operate at 150-160 degrees coolant temperature. The thermostats have to be taken out, or added (in the case of not having one) in order to get the car to have any consistency from the tuning on the dyno. If you have a cooling issue, colder thermostats or no thermostats are masking the issue and will make the tune have no consistency!!!

## 2. **Turbo system**

Some of the more common issues that occur with turbo components are the following:

a. Piping blowing off during the tuning session. Make sure that you have the ends of the intercooler/charge piping with a ridge so that the clamps can bite into coupler material. I prefer to use t-bolt clamps. These provide a much higher and more even clamping force over the entire piping area. Having piping blow-off during the tuning session will make it

impossible for the tuner to tune the car.

b. Exhaust manifold bolts being loose. One of the most critical aspects that is often overlooked is loose exhaust manifold bolts. If you have loose exhaust manifold bolts, exhaust pressure is getting bleed off. This does two things:

1. Causes slower spool depending on how bad its leaking.
2. Causes power loss due to lack of exhaust pressure in the exhaust manifold. Turbines apply work to the compressor through the exhaust pressure. Having a lack of the pressure makes the compressor less efficient, and therefore a power loss. I have measured 10-30whp gains by fixing leaks and tightening exhaust bolts down.

Other things to check are the wastegate bolts, as well as the turbo to manifold bolts. Any leaks will cause a pressure loss in the manifold, and therefore a power loss.

c. O2 sensor hole not being open up enough for the wider/larger bosch sensors common with PLX/AEM/Tech Edge/etc widebands. This seems like a no brainer, but we have had to uninstall many customers downpipes and headers to dremel out the hole larger. This takes 1-2 hours out of the tuning appointment to take out the material. When installing your downpipe, feel with your finger to make sure there is no extra metal flashing inside of the o2 bung hole. If there is, dremel it out as it will most likely cause an issue with your tuners wideband sensor.

d. Make sure your blow off valve is tight enough. Most aftermarket bov's have an adjustment screw on them. You want to tighten down the adjustment screw so that you can hear the bov working, but no loose enough that its going off prematurely out of boost. It's easiest to watch your boost gauge. If you in vacuum, and the bov goes off, it is too loose. You want the bov to open up coming out of boost pressure only.

e. Oil feed and return lines. With the oil feed lines, use a -3 A.N feed or restrictor fitting if at all possible. The goal is to make sure that you don't get too much oil pressure built up against the turbo seals. With the return line you want to make sure that the fitting is welded high up on the oil pan to ensure proper drain. The line should descend downwards to the pan. It should not be level, or go uphill. If it does you risk improper drain back, and getting too much oil pressure built up against the oil seals and blowing them out. Typical symptoms are blown turbo seals is a lot of blue smoke from the exhaust with a healthy engine. Check the return/feed lines.

f. Turbo shaft play. Before the tuning appointment check the turbo shaft play. You should not be able to move the turbo shaft more than 1/16" in any direction. If you can, your turbo thrust bearings are probably shot and you need a rebuild. Tuning the car with shaft play will give very poor power production since turbine/compressor efficiency goes way down.

### **OBD-2 to OBD-1 Conversion:**

1. What you'll need to go from obd-2 to obd-1 are the following:

- a. OBD-2 to OBD-1 conversion harness
- b. OBD-1 ECU such as p28/p30/p72/p75/p06/etc
- c. OBD-1 injector clips if going with aftermarket fuel injectors

Essentially its plug and play. I have had many tuning appointments end before they even begin from customers not realizing they need obd-1 injector clips for their aftermarket fuel injectors. Often overlooked, but definitely very important!

### **Misc**

Some miscellaneous things that we would like to add are the following:

1. If you have locking wheel lugs, make sure you bring the wheel lug key to the tuning appointment! This is critical, since we have to take the wheels off of the car with the Dynapack dyno. It is a good idea to bring the locking wheel key to the appointment if you are using a roller type dyno, just incase something happens.

2. Bring extra spark plugs or money for new ones that we have in stock for \$10 per set! This is so overlooked, but very, very, important. Bringing a set of spark plugs is just insurance in case something happens to the current set in the engine, or the tuner feels they need to be replaced. I personally like a fresh set of plugs in the engine when i tune. It allows me to accurately read the plugs since they are super clean.

3. Make sure coolant and oil levels are full! I have seen customers ruin their engines from lack of oil, and engines overheat due to lack of coolant.

4. Bleed your coolant system before the tuning appointment! If you are having overheating issues, it is possible that you have an air pocket in the radiator/coolant system. The easiest way to bleed the coolant system is to start the car with the radiator cap off. Let the engine idle for 10-20 minutes with the heater motor on full blast, and the heater control setting to high. You should see bubbling coming from the radiator cap opening for awhile if you have an air pocket. Until the thermostat opens you wont see bubbling typically. If the air pocket is in the coolant jacket, this will get rid of it.

I am sure that I am overlooking some things, but for the most part that this is a good guide for an enthusiast looking to have his car tuned by a tuning shop, is to have the least amount of issues during the tuning session as possible. I will say that mechanical/electrical or other issues take awhile from the amount of time that we can spend on the car during the tuning session, as well as breaking our concentration on doing the tuning. The tuners job is optimize the performance parts on your engine, not repair and fix all the issues.