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Engineering and Product Development
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BREAK-IN, CARE, AND USE of RED ARROW USA ENGINES

INCLUDING TROUBLESHOOTING AND FIELD TUNING TIPS

Thank you for choosing our custom built line of Zenoah engines. Even if you are an experienced modeler, pay special attention to the tips and instructions contained in this manual. The new G320 series engine is a powerful platform, and likewise it may behave a bit different than the smaller engines you may have had experience with.

This document appear long, but in reality it takes roughly 10 minutes to read. In reading this manual, you may pick up some useful tips and information. We work on many scales and types of engines, both two and four cycle. One tip from this manual may save you HOURS in the long run.

INSTALLATION

If your engine is equipped with a Walbro 1107 carburetor, the fuel flow has been modified for excellent performance in the low to upper mid range of the power band. For better upper end performance, a Walbro 990 carb is a good choice, but it lacks the convenience of a choke. We also recommend the installation of the DDM part #AV555 metering spring in the 990 carb in most cases. This, however, is an advanced mod, best performed by an expert tuner. Get used to your engine with the factory carb before upgrading.

IMPORTANT: Some vehicles have been coming from the factory, or from the previous owner, with the fuel lines reversed. Always make sure the fuel line that is attached to the tank filter, located at the **BOTTOM** of the tank, is connected to the **BOTTOM** inlet on the carburetor. The return line goes to the **TOP** inlet on the carburetor. Color can be deceiving, so ensure that the bottom filter line= bottom of the carb.

The **CLUTCH** that is included in the box will survive the breakin process only. It should be discarded and replaced with a durable clutch after breakin. These engines will eat a stock clutch alive in short order, and they will overheat a clutch spring, which will make the clutch “hang up” and appear that the engine is misbehaving.

Since we do not know what filter assembly each particular engine may be fitted with, our carburetor comes uninstalled with a blue gasket (used between the carb and the intake block) and a pair of bolts that may be either too **long**, or too **short** for your filter system. See a list below for our recommended filter choices AND filter maintenance for various vehicles.

You must also use a gasket between the filter system you choose and the carburetor as well. They are typically black in color, often called velocity stack gaskets.

We recommend the use of an alloy air filter base, because the factory plastic air filter bases usually deflect, and will ruin an engine in short order. Don't trust the plastic air filter base. The bolts we supply will typically accommodate most filter systems, but you need to fit them to your application. On that note, some of the long, heavy aluminum bodied air filter sets available are usually too heavy and will vibrate the assembly loose.

It is important that the bolts are long enough to engage into the intake manifold at least ½”. The intake manifold is the black, or alloy block, mounted directly to the engine. This block will be installed tight from the factory.

On the other hand, care must be taken so that the bolts are not too **LONG**. This will cause you to feel a false “tight” feeling in the wrench, as the bolts may be bottoming out in the intake manifold. If you need to shorten the bolts, clean them well before installation.

The “stack-up” of items should tighten down with **NO** leaks or gaps. **ALSO**, Make sure to always install a **NEW** exhaust gasket and firmly tighten the exhaust system to the cylinder head, and secure the exhaust pipe onto the vehicle as well. We have seen broken cylinders from “hanging” and unsupported pipes.

In short, the carb bolts will install thru first thru the filter base, next thru the black gasket, next thru the carburetor, next thru the blue gasket, and finally **LOCTITE** the bolts into the intake block

BREAK-IN is an extremely important step, patience will yield great benefits. Please follow these instructions carefully. These engines are nothing like the older engines, they are bigger, the ports are wider, and these engines are highly modified. The piston ring and cylinder need time to “mate” to one another.

IMPORTANT: Do not attempt to break in your engine in a cold environment. 50 Degrees F is the coldest temp we recommend. Why? These newer “big bore” engines have larger pistons that absorb heat and expand a bit faster than the cylinder does. This was an occasional problem with larger scale bikes and quads. We called it a “cold seize”

Even after break-in, **always** allow your engine to **warm up** for a few minutes before running it hard, especially in cold weather.

Note: DO NOT attempt to start the break-in process unless you have time to **finish** it. Initial carb settings are sensitive, and interruptions will cause unnecessary heartache. Do it all in one session. Many modelers get lost with interruptions.

This information has been gathered over the years from some of the most experienced tuners in the industry. Even if you learn only **ONE** new thing, you will be ahead of the game.

BREAK-IN OVERVIEW

The engine comes from the factory with the carburetor set to “break-in” settings. See the list below, as our engines come with several different carb model numbers. If you get “lost” in tuning, you can always reset the carb back to the factory settings.

The following is an OVERVIEW of the Break-In process. The first part of the process involves the vehicle sitting still and idling. This time will give you plenty of opportunity to read the “fine” print of the Detailed Break-in process listed below afterwards.

Before pulling the starter, it is a good idea to sit down and read the entire contents of this manual.

Have plenty of spark plugs on hand. A plug can look fine and be slightly fouled....more on this later. A few \$3 plugs are one of the best problem solving tools you should have in your box.

QUICK OVERVIEW

A) You will need to mix gasoline and oil for the vehicle as described below. Fill the vehicle tank. Also, FULLY charge both the vehicle battery and the radio battery.

B) Set the vehicle up with the tires off the ground. Upon start-up, you will be idling engine at a very rich setting for (2) 15 minute sessions.

C) You will then be instructed how to drive the vehicle for the first few tanks of fuel.

This was the QUICK overview. This gives you an idea what kind of time you need to set aside for a full break in. Do not start if you cannot finish in one session.

HAVE SPARE PLUGS ON HAND IN YOUR BOX AT ALL TIMES. I have seen fellows ruin a perfect tune over a plug that looked “good”. Keep this in mind: If your engine SUDDENLY begins to misbehave, it usually has nothing to do with the engine. Plugs can act up at a moment’s notice, air filters get clogged and change the engine’s dynamics, exhaust leaks, cracks, debris or rocks clogging the flywheel or the cooling spaces, etc. Try to identify what changed *before* you reach for your screwdriver. After decades in racing, I still have to remind myself of these rules.

Pull starts are cheap insurance as well. Keep a few in your box. Even the pricey starters can fail in the field.

IMPORTANT: Gasoline is **EXTREMELY** volatile, and its vapors are very explosive. ALWAYS start and operate your engine out of doors. Indoor operation is not an option. DO NOT smoke near gasoline, especially gasoline vapor.

Be a responsible modeler and have a method of fire suppression on hand. Gasoline is violent and harmful energy source.

FINAL VEHICLE PREP AND DETAILED BREAK-IN PROCESS

NOTE: NEVER RUN YOUR ENGINE **COMPLETELY** OUT OF FUEL, ESPECIALLY DURING BREAK-IN OR UNDER THROTTLE, even after break-in.

By stopping the engine with a small amount of fuel left in the tank, it will always be easy to start your engine, but more importantly, running the tank dry is a mistake can lead to an engine seizure. Remember, when the engine runs out of fuel, it ALSO runs out of **OIL!!**

Modded engines need fuel at all times, check fuel levels often.

Before starting your engine, no matter how much fuel you have left in the tank, shake and rattle the vehicle to remix any oil into the gasoline. Sometimes the oil will separate and collect at the bottom of the tank.

VEHICLE PREP: IMPORTANT: After the engine is installed, make sure the linkage and radio settings allow the carb throttle to FULLY return to the CLOSED position when the throttle trigger is released, failure to do so can cause a “runaway” at startup, and erratic engine behavior. Never adjust engine idle with the servo endpoints. Idle should be set with the tuning.

As for the throttle open position, set the servo and linkage so the throttle opens fully when the trigger is pulled, and then gently back the throttle throw off a small amount with the radio OR the linkage. This. A little bit of slack in the linkage will not hurt performance

TIP: You never want to bottom a servo out “solid”, it can overheat and fail. Servos do not endure solid load, and when they fail, they usually fail in the throttle open position. This will cause a high speed runaway.

Consequently, we recommend the use of a 3rd channel radio “kill” switch for added safety and auxiliary shutdown in the event of servo or battery failure. These switches are available thru DDM.

Next, Mix oil and gasoline in a separate container from the fuel tank. Never mix gas and oil in the fuel tank of the vehicle. The most convenient mixing container is a 1 Gallon gas can.

We recommend the following gas and oil selection: Fresh gasoline (last year’s fuel is best used in a weed trimmer) , octane rating of 90-91. We DO NOT recommend race fuel for this series of engines. Race fuel burns slower, these engines flourish on octane in the range of 90. (R+M/2). Save your money, if race fuel performed better we would recommend it.

OIL. This is a big one. Testing has shown that the best 2 stroke oil for these engines, by far, is Maxima Castor 927. It can be purchased at motorcycle shops or online.

This oil is the cleanest burning oil we have ever seen, the lubricity is second to none, and it will not give you a headache like many of the other oils will. Honda HP2 would be our second choice, but be warned, it will make your eyes water and it will burn “dirty”. Yamalube would be our third choice.

You have invested in a quality item, don’t cut corners on oil. Throw away the HPI and Losi oil bottles. We have tested this point at great length. So much so, we can often identify what oil has been used in an engine, and normally identify an engine failure or problem on sight.

MIX RATIO: These big engines make a lot of heat, so a little extra lube is a good idea. We run 6 ounces of oil per 1 gallon of gasoline. This is 20:1. Trust us here, there will be no noticeable loss of power, the bores are big and the strokes are long. This was an engineering decision.

Hi load engines, such as our marine engines commonly run 16:1 or greater. DO NOT listen to the fellow who claims to run 30 or even 50:1, like he does with his “dirt bike”. Remember, his bike is water cooled, and has differing clearances and combustion principles. ALL the best modders of 1/5 scale engines recommend 20-25:1.

These big engines make enough power that the so called “extra” power one may gain from lean oil mixtures is NOT worth the risk. Testing has shown, in the long run richer mixtures make more power, mostly because the piston ring MUST stay wet to seal AND survive. 20:1, Castor 927, 90 octane fuel. Enough said.....

FIRST START-UP!

Turn on the radio and the vehicle battery/receiver. If your vehicle is equipped with a “Killer Bee” switch or equivalent, make sure the switch will allow the engine to start, or you WILL flood your engine.

Fill the fuel tank with pre-mixed gasoline. Push the carburetor primer bulb several times until the bulb is full.

- 1) If your engine has a choke (Walbro 668, 1107), place it in the ON (down) position.
- 2) Pull the starter a few times, the engine should attempt to start. Once you hear the “blurp”, stop.
- 3) Turn OFF the choke. Resume pulling the engine until it starts. Note: it is easy to get carried away by pulling the starter too far. Use short, quick pulls, otherwise you WILL break your pull starter. Sometimes a bit of “jockeying” with the trigger will allow the engine to get a bit more fuel or air to help it start, depending on the base settings.
- 4) Once the engine starts we advise you to observe the amount of smoke the engine is making out the exhaust. We want plenty of smoke, even a small puddle of oil starting to form on the ground.

NOTE: If you have little or NO smoke during idle, richen the low speed need (LSN) “out.....richer”, a small amount to get a noticeable amount of exhaust smoke.

TIP: You may also need to increase or decrease the IDLE speed using the idle adjustment screw (IAS: this is the screw with the “X” shaped screwdriver slot. As a side note, the carb is marked “L” for the LSN, and “H” for the HSN).

We want an idle that allows the engine to run, untouched at a low RPM for 15 minutes. Usually at startup the engine will need a little more/little less air, the idle air screw (IAS) is the best place to look right off the bat....

- 5) If your engine does **NOT** have a choke, (Walbro 990, 771), the first start can be a bit more tricky. The best method of starting is to give the engine one or two VERY SLOW pulls.

Next, very slowly pull the engine to top dead center (where the compression feels highest). Slowly ease the engine just PAST top dead center.

Next, pull the “trigger” a few times, give the engine a few full speed pulls (do not over extend the pull start). The engine should start. If you have pulled it 5-10 pulls or thereabouts, STOP, you WILL flood the engine.

- 6) In the case the engine will not start, with either type of carb, it is a sign the engine is: A) Getting too much fuel on the LSN (flooding), or perhaps: B) Not enough AIR. If the Idle Air Screw is not allowing the carb plate opening to let enough air into the engine, it will easily flood. C) It is also possible it is not getting ENOUGH fuel, or spark.

WILL NOT START?

- 1) First, observe around the engine area for a “gas” smell. If the engine is flooding, you may smell gasoline. Another quick test is to look at the spark plug to see whether it is “wet” or not. If the plug is wet the engine may be flooding. This is a great time to check to see if the engine is generating “spark”
- 2) First, make sure you have spark, if you have a “Killer Bee” switch, make sure it is allowing the engine to get spark. This will get you very crossed up, make sure all your radio equipment is on.

Most people who use an auxilliary safety switch WILL flood their engine at some point. You may get excited to run your car, you forget to power up the radio AND the car, and you start pulling the engine with no result. Usually you will flood the engine because of this.

MAKE SURE the vehicle and the radio are switched “ON” Trust me on this, in the excitement of running the vehicle you will forget to turn the radio on.....it happens, but that is the price you pay for safety. The good news is..... learning this lesson a few times will make you a better tuner.

- 3) To test for spark, remove the spark plug and re-install the plug wire. While carefully holding the boot (do NOT touch the plug or any metal on the engine, you will be shocked), touch the spark plug onto the top of the cylinder. Pull the pull start quickly and repeatedly. You should see the plug emit a spark.

DRY the top of the engine of any fuel BEFORE checking for spark. Exposed gasoline will ignite in the open air. A wet vehicle will catch fire.

It may be hard to see spark on a sunny day, so you may need to shelter light onto your view of the plug. Re-install the plug and the boot

MAKE sure the choke is in the OFF position when doing this test

- 4) The engine may not be getting fuel, if the plug is dry, and the engine does not smell of gasoline at all inside, it is lacking fuel and **lubricant**.

FLOODED?*

Pull the spark plug. If it is wet or smells of gasoline, you have flooded the engine, Flooding is very common on the first start up, do not be alarmed, you are not alone. We all have done it. However, it will require some patience to resolve.

First, make sure you have turned the choke to the OFF position. (the lever will be parallel with the carb) The choke is ON when the lever is pointed downward. If you have been pulling the starter with the choke on, you are most likely flooding the engine with fuel.

Next, DRY the spark plug. Flip the vehicle over, upside down, and give it several pulls on the starter to “air” the engine out, you may see fuel drip out of the plug hole. You may even want to let the engine sit for a few minutes with the plug out to clear the air.

TIP 1: Popular teaching has always dictated that you should never “pull” the throttle trigger when an engine is flooded. Sometimes that is the case.

In reality, 90% of the time that an engine is flooded, it needs more AIR.....holding the throttle open for a few pulls on the starter is usually enough to allow more air into the engine to fire up. Place the vehicle off the ground to where it cannot runaway if the engine starts.

It is true that the throttle will let some fuel in the engine, but the amount of air let into the engine usually far outweighs the small amount of fuel the carb will deposit when it is not running. Be PREPARED for the engine to start and rev high. Be prepared to push the **RED** killswitch on the engine.

If and when the engine starts, simply let go of the throttle. You are making progress. Never hesitate to push the killswitch. Restarting is much easier than repairing.

TIP 2: Here is a SECRET that we use, it is an effective and fairly unheard of for starting an engine that is being “un-flooded”. You can tell your friends that you invented it!

Take the cap off of your 2 cycle engine oil bottle and fill it ½ way with engine oil. Pour some of the oil into the spark plug hole. Re-install the plug,

Give starting another try. NOTE: The cap and oil must be CLEAN, you do not want and dirt or grit to fall into the engine. Be very careful on this point. Lack of patience with a flood will make you cut corners you will wish you hadn’t. Slow up a bit.....you will catch on to this. It takes time.

The oil does two things, it seals the piston ring (very important), allowing the engine to “suck” like it does when it is running. Secondly, it protects the engine from all the pulling that was done without the oil.

You can do this trick as many times as you want, sometimes it may take a few times. You are safe to repeat it many times. In fact using this method will allow you to get a mixed up tune back in order.

Oftentimes an engine can be brought to life with the use of the oil and a little knowledge of the tuning the engine is looking for.

The final method, should you have a SERIOUS flood condition, is to remove the plug, remove the filter, and remove the carb from the intake manifold. Let the engine sit a few HOURS. Reinstall the carb with Loctite, and the gaskets in their original orientation. It is easier than you might think to flood the engine severely.

It is possible the carb is to blame. Occasionally a new carb can be faulty, and even a fully functional carb can “stretch” a metering diaphragm. Call the above tech support numbers for details.

A stretched diaphragm will not let you get, or hold, a tune at all. It is an advanced diagnosis but an easy repair.

99% of the time, startup issues can be blamed on either 1) The throttle plate: It may need to be opened a small amount with the idle air screw (IAS). The engine may need more air to go with the fuel it is getting, or 2) The engine is simply not getting fuel. 3) a spark plug that looks good, but is lightly fouled, however, this usually happens after a full break-in, or running the vehicle after a while after break-in)

FLOOD RECOVERY CONTINUED

With the Idle screw turned IN a small amount (clockwise “in” opens the throttle, counterclockwise “out” closes the throttle) 1 “hour” at a time, try starting the engine again.

NOTE: When we speak of “hours”, imagine a clock. A change from 12 o’clock to 2 o’clock would be “2 hours” of adjustment. These engines DO NOT need large adjustments, all adjustments should be done in “hours”, or as some call “pinches”)

If you have a choke, turn it ON, pull until the engine attempt to start. STOP. Turn OFF the choke and start the engine.

- 7) When doing this procedure it is IMPORTANT to make sure that car is off the ground to prevent a “runaway” condition, being READY to push the kill switch if the engine surges or runs too fast.

A surge or HI “rev” will starve the engine for lack of fuel, risking damage.....High idle=KILL switch. If your engine exhibits this behavior, stop, richen the LSN and turn out the IAS a few “hours”.

- 8) Once the engine starts, and the idle is high QUICKLY return the IAS back to where it started, the idle will slow a bit. We only adjusted items to clear a flood condition, we want to be back to the factory carb settings at startup.

Only occasionally, the flood is the result of a LSN that is too rich. Sometimes turning the LSN “in” a few hours will allow the engine to start. BUT, once the engine starts, return the LSN “out” to where it was, to make sure it is getting enough fuel, however, the engine may “like” the settings it has, and it usually does.

- 9) The LSN should be set so there is a good amount of smoke, possible even a small puddle of oil collecting out of the exhaust pipe. This is a great test, we like to see a small puddle of black oil collecting under the pipe outlet during the 15 minute cycles.

ENGINE FINALLY STARTED

- 10) Now that we are started, and running with good smoke, allow the engine to idle for 15 minutes. Leave the vehicle off the ground, able to idle on its own without outside manipulation.
- 11) After 15 minutes of idling, shut the engine off. Allow the engine to fully cool to the touch.
- 12) Once the engine has cooled fully, check the fuel level, and re-start the engine, allow the vehicle to idle, once again, for 15 minutes.
- 13) After 15 minutes, again shut the engine off and allow it to cool to the touch. You have come a long way!

FLOODED OR BROKEN STARTER?

The MOST common problems experienced with a new engine are flooding and broken pull starts. Patience in this regard will yield great benefits. It is easy to get carried away with the anticipation, or the frustration of a new engine not starting.

Remember, new carbs have never seen fuel before, and a very small amount of misadjustment can cause a huge change. Once tuned these engines will hold a tune rock solid, but the initial “tune” of the carb is the biggest hurdle to get over.

Everybody has flooded an engine, it is very easy to do, and a bit of a pain to undo. See tips* above for un-flooding an engine.

BREAK-IN "DRIVING" TANKS, and TUNING OF YOUR ENGINE (FINALLY!)

- 1) I will offer you this advice: When tuning these engines. You will have plenty of power "on tap". I advise you to leave the engine a bit rich on both needles, you really have little to gain from leaning them to the hairy edge, and these bigger engine likes to make more heat.....after all, it is bigger.
- 2) The days of squeezing every last bit out of an engine are unnecessary and ultimately cause the engine to run hotter. Higher HP engines like to make more heat, and hold the heat longer. Trust us here. We have had clients tune an engine "on the money", or so they believed.

.....They might bring the car into the shop for service on something else. I usually take the vehicle out and run it, and find out that his "perfect" tuning was a bit lean, and richening the HSN added great power to the engine. This couldn't be "heard" in the tune, but the performance was improved and the temps were improved. The lesson here is this: There is hidden horsepower with a richened condition

ALSO, please see below* for advice regarding "Temp Guns" below.

FIRST (2) DRIVING BREAK-IN TANKS

First, fill the fuel tank. Next, in a wide open, safe location, give the vehicle some "throttle" on the controller. If the engine bogs or takes off and "surges", the low speed needle will require initial tuning.

Be ready to shut off the engine if it "revs" or surges. This indicates a lean condition. You will need to richen the LSN a few "hours", and turn the IAS out a few hours.

Before starting, remember to turn on the radio!

Here is another tip that is typically not spoken of often: The LSN and the HSN are "connected" in fuel flow during the operation of the engine. Basically, when you adjust one needle, you can affect the tune of the other needle in a small, but important fashion. Remember this when you are close to the "sweet spot".

FIRST TANK: With the engine in a stable running condition, drive the vehicle slowly, with "ups and downs" on the throttle, NEVER exceeding ½ throttle on the trigger. You should have a large amount of smoke coming from the pipe. If not, a pinch more rich on the LSN will not hurt.

Continue this process, with patience, until the fuel tank is nearly empty. Again, DO NOT run the vehicle out of fuel.

Next, allow the engine to cool to the touch

SECOND TANK: Drive the vehicle with longer "ups and downs" on the throttle (time wise, not throttle opening amount). After ½ of a tank has been consumed, you may increase your throttle opening to ¾ throttle but never for extended periods of time, 4 to 5 seconds is plenty.

NOTE: As the engine starts to break in, it WILL start to idle **higher**, this is common, if you need to, simply turn the idle screw out a few hours to bring the idle down. Leave the LSN alone, unless richening seems necessary. The engine will naturally want to pick up speed as it breaks in.

Continue this process, with patience, until the fuel tank is nearly empty. Again, DO NOT run the vehicle out of fuel.

Congratulations, you have survived the break-in process!

TUNING METHOD

There are several methods of tuning. I will describe what I call the "wet" method: The engine runs, but is ALWAYS rich on both needles, and the tune is gently crept up on.

ALSO NOTE: The RICHER an engine setting is, the **lower** the engine will want to **idle**. Conversely, the **leaner** the mixture, the **higher** the **idle** will be. Some adjustments of the idle air screw (IAS) will be required during the tuning process.

These engines DO NOT require nor tolerate large needle setting changes. ALWAYS tune the carb using "hours" or "pinches", as described above.

If the engine bogs and picks up slowly with the application of some throttle, that is a good sign: you have broken-in your engine at a good carb setting. This is also the best place to start tuning! Be warned, however, that a bog and a violent takeoff is usually signs of a LEAN condition. You normally only hear this type of bog in a "tuned" condition. Be gentle with the "bog" condition, as it can indicate a rich or a lean condition. Always start out by richening the mixture to eliminate the bog.

- 1) Locate the LSN, and turn it in an hour. You should notice an increase in throttle response. NOTE: for all needle adjustments, clockwise is "in" for LEANing the of the needles, while counterclockwise is "out", for RICHENING of the needles.

As noted above, as you lean the LSN needle, you may need to lower the Idle air screw (AIS)

Creep up on the LSN setting so the engine will take off and run, yet sound a bit “rich” in tone. A “RICH” tone is indicated by a small “drowning” or hesitant sound.

It should be noted that a “LEAN” tone is indicated by surges and pops, high idle, high heat and shutdown on throttle, either at low or hi speed. The engine will idle high and often surge on a pass after the throttle is let go. A surge or erratic idle after a high speed pass is nearly always due to a lean condition. Richen the HSN and creep back up on it.

We want the engine to be able to accelerate, yet seem a bit “down” on power. We are starting with the LSN “wet”, so we are sure we are safe on fuel delivery. Since we do not yet have a grasp on the setting of the HSN., we need to be patient and creep up on the HSN as well.

NOTE, It is safer to bring the idle DOWN with the IAS than it is to re adjust with the LSN, as we are now very close to having our tune set.

As the needles are richened, the idle air screw WILL need to be turned out to bring the idle down.

Once the vehicle is able to get up and move with relative ease, bring it back around for the next “wet” tuning setting. We now know the engine is slightly rich on the LSN, indicated by the plumes of smoke emitted from the exhaust.

Now, we want to make sure the engine is on the rich side for the HSN.

Run the vehicle around so that it will run with relative speed, yet seem sluggish on the throttle. We have now got the engine in the “ballpark” for the final tune. We STILL want to be rich at all driving conditions at this point.

You may now begin to run passes with small, incremental changes on the HSN needle tuning.

Then gently lean the HSN in very small increments to get the engine to “run out” better. Good smoke at all speeds, a temp rating, not to exceed 240 Degrees F* taken at the cooling fins nearest the exhaust exit. *(see the temp gun note below)

TIP: A surge or erratic idle after a high speed pass is nearly always due to a lean condition. Richen the HSN and creep back up on it.

2) REMEMBER...The LSN and HSN work together. Once we start leaning the HSN, we may take some fuel from the LSN settings, and vice versa. This is important.

Your vehicle spends most of its time IN the LSN circuit, or in the transition from the LSN to the HSN. The LSN is VERY important. It is NOT just for clean takeoff and wheelies.

I will take this opportunity to point out the possible flaws of “high speed pass” tuning. Most engines live at variable RPM loading speeds. Usually this “everyday driving” range is in the mid to upper RPM level. The LSN/HSN handshake is VERY important at these speeds.

“Speed” testing is okay, because we will learn what the engine needs at full throttle/high loads, but we also need to pay attention to the vehicle under normal “driving conditions”. (grass, dirt, etc) You may have a great tune on “hi speed” passes, yet in normal driving conditions, the engine may overheat or misbehave, because we assumed the LSN was only for the initial takeoff.

I do not advise people to “live or die” by temp gun readings* (see below), but if you have used a temp gun in tuning with success, and you trust your gun, you may check to see that the engine temp is consistent in normal operation.

This is a good stopping point to identify the characteristics of a rich “smoke” trail given off during an engine tuning session. What we really want, is an engine that performs very well, while emitting a reasonable stream of smoke at ALL RPM ranges of the engine. This may be difficult to see on a Hi Speed pass going **AWAY** from you. Instead, try to bring the car back “past” you from further away to observe the smoke emission as it passes back past you.

In times past, a good tune may emit barely noticeable smoke trails, but with these big engines, we want to see smoke at all times.

A good tune will give a good “smoke signal” AND sound consistent and strong, without misses, pops, or surges. Many old tuners will not touch a temp gun, but it is a useful tool.

Learn to tune without the temp gun, using it only as a reference for extremes of temp or engine behavior. It is a useful piece for reference, and consistency, but your eyes and your ears are your **first** line of decision making.

Back to tuning, we are nearly finished!

Never be afraid to re-richen a needle (in small increments) When we are satisfied with both the performance, sound, and smoke signal the engine is giving off, I like to take the opportunity to richen each needle ONE at a time and look for differences.

I start with the LSN, I will pinch it rich and see if the car “picks up” or stays the same. If it picked up, try another pinch. If the first pinch does not improve the engine performance, and the smoke level is good, you are very close on the LSN

Next, I perform the same procedure to the HSN. 9 times out of 10, when I think I have the tune “dead on”, a pinch in the rich direction on the HSN finds a bit more power. Do not hesitate to run the engine on the rich side, you have plenty of power at your disposal.

Once I have max power, good smoke, good sound and reasonable temps, I pinch both needles a tiny bit in the rich direction, and “test” the pickup like we did in the LSN test.

Once we are satisfied, a very small pinch in the rich direction is a smart move. We will discuss changing weather conditions below, and adjusting for them, in the mean time, especially in cold weather, a bit rich is a wise play.

Have fun, keep your ears and eyes open.

Important. CHECK the end of this article for adjusting for different...**OPERATING TEMPERATURES**

NOTES AND TIPS

- 1) **TEMP GUNS** : Useful, but oftentimes misleading. I have seen two different guns give readings 50 degrees DIFFERENT when tested at the same time. The \$20 “shooters” do not compare with a true laser type gun. If you have a gun you trust from times past, it can be a useful tool.

It is difficult to identify a true “temp” with all the styles of guns out there. 240 degrees F is a safe limit, but remember, smoke, sound, and performance are the best indicators of a proper tune. NOTE: A good hard, long session may bring temps up, but they should return to normal quickly at rest.

- 2) **CARBURETOR “BASE” SETTINGS**. These are STARTING points only.

Walbro 990, LSN 1 1/8 turns out, HSN, 1 5/8 turns out.

Walbro 668, LSN, 1 ¼ turns out, HSN, 1 ½ out.

Walbro 1107, LSN 1 ¼ out, HSN 2 out

NEVER overtighten the needles when re-setting the base setting.

- 3) **FILTRATION AND DEBRIS MANAGEMENT (VERY IMPORTANT)**

As noted above, plastic factory intake filter bases are unacceptable for use. The filter base mounts the filter to the carburetor. Try to get an aluminum filter base for your filter and vehicle style. Below is a list of the common vehicles, and the filters we recommend.

- A) HPI Baja: Factory HPI filter assembly (white inner, grey outer), BUT, throw away the plastic base that mates with the carb!

Buy several spare filter elements, especially the grey ones. They grey element should not be oiled. The white, inner filter is the correct element to oil. As noted above, these engines will fill up an air filter FAST, especially in a dusty environment.

We DO recommend an Outerwear brand pre-filter, but bear in mind, they are designed to keep mud and water off the filter elements. Fine dust will go right thru them.

Your grey outer filter is the first line of defense. They are cheap, we recommend buying a handful for the tool box. CHANGE the outer filter every tank. Take them home and wash them for re-use.

If this seems excessive, I will describe below why we recommend this method.

- B) Losi 5IVE: DRY, replaceable outer filter, oiled, reuseable inner filter. BUT, throw away the plastic base that mates with the carb!

Buy several spare filter elements, especially the dry outer ones. The inner filter is the correct element to oil. As noted above, these engines will fill up an air filter FAST, especially in a dusty environment.

We DO recommend an Outerwear brand pre-filter, but bear in mind, they are designed to keep mud and water off the filter elements. Fine dust will go right thru them.

Your dry outer filter is the first line of defense. They are cheap, we recommend buying a handful for the tool box. CHANGE the outer filter every tank. Take them home and wash.

The filter does not have to be the Losi filter, but it should have a dry outer filter (quickly replaceable in a dirty environment) NOTE: the DT1 sinle stage foam elements have proven to be an engine killer. You need DRY outer, wet inner. The tighter the foam the better.

- C) Losi DBXL : The entire factory filter assembly has to go. Buy an alloy “short” velocity stack (NO CHOKE version), a TGN filter (Shortstack keeps the filter inside the body better)

Oil the TGN filter. Cover the filter with stock Losi 5ive grey outer filters (dry) or TGN Redneck prefilters.. Change the grey or Redneck filters with each tank as described above for other vehicles. No sinle stage, DT-1 type filters.

Because a good filter typically requires cutting of the body to fit in the vehicle, we strongly advise the use of an Outerwear pre filter, as the filter will “stick out”, and be subject from dirt and mud from the tires. This vehicle requires the MOST filter maintenance.

The TGN Shortstack helps with the length issue.

D) **WHY SO MUCH FILTER CHANGING?**

I have seen vehicles with these engines run in a dusty environment and fill a filter up quickly. The engine suddenly starts to misbehave....why?

Once the filter is FULL, the engine still “pulls” on the carb, wanting air, but gets large doses of fuel, because the filter is clogged.

The operator suddenly decides the engine needs re-tuned. Bad choice. Now he will spend time, possibly damaging his engine, re-tuning to a clogged filter.

By changing the grey outer filters often, you give the engine fresh air all the time. Have fun all day, change your filters often.

Remember, an Outerwear is mostly for mud and water protection. We recommend the use of a replaceable dry outer filter UNDER the Outerwear.

NOTE: A sudden need to re-tune is usually an indicator that something ELSE is wrong, even a clutch malfunction (see below).

E) **WHY IS MY ENGINE RUNNING HOT?**

Hot temps are caused by lean carburetor settings. But most often, if your vehicle WAS running fine, and begins to heat up, chances are the fan covers and cylinder covers are filled with debris.

Grass and leaves will fill the cooling fins up on your engine, check this often, our engines have a small cutout around the plastic cover to help with this practice.

The engine pulls air from the back, lower portion of the engine AND the pull start area. Outerwears prefilters on the pull start and crankcase are great, but keep this in mind:

They clog with debris just as quickly! They are designed to keep rocks and sand out of the fan side of the engine.

You can overheat an engine USING Outerwears. They will fill with dust just like any other filter.

Keep the engine clean, check this often.

F) **MISBEHAVING?**

CLUTCHES: One of the first things we noticed with this high powered engine, was that clutches were “fading” fast, and turning solid blue, in short order.

The engine makes enough low speed torque that the clutch slips much easier, raising the temps in a hurry.

I have seen clutches with less than a gallon on them, solid blue, and the SPRING stretched from heat. The result was a vehicle that behaved like a “tuning” issue.

In reality, the clutch had no “off switch” b/c of the ruined spring. This is something to watch for.

Clutch maintenance is VERY important. Do not mistake engine oddities for clutch problems.

KILL-SWITCH MISBEHAVIOR:

Always run with the small, red rubber kill switch boot. Why?, I have seen the factory buttons become lodged with dust, and they will not “pop” out. The LOOK popped out, but they are hung up.

INTAKE MANIFOLD AND GASKET ISSUES:

Alloy intake manifolds are nice, the problem is, they come with thick, Teflon gaskets that collapse with time and heat.

Stock intakes can distort in time as well. Keep an eye on the intake gaskets for leakage, intake gasket failures kill most engines that fail.

CHANGING WEATHER AND OPERATING TEMPS.

Generally, operating the vehicle in very hot or humid conditions is a two edged sword.

First, the engine temp is raised by outside temps. Richening the mixture is nice BUT, the higher the outside temperatures are, the less available oxygen there is for proper burn properties.

High temps can sometimes make an engine run a bit rich. Live with it. Give the engine frequent breaks. The higher the temps outside, the less air is available to mix with fuel. Most desert events do not start until later in the season.

Its okay to enjoy your vehicle in hot weather, just use your head and give the vehicle frequent breaks to cool down. Don't expect the engine to run at peak power in , hot, humid air.

TIP: Spark plugs are cheap, keep them on hand. Hot engines run richer, and if they aren't, you will want to add some fuel via the HSN. Hot engines are not good. If the engine is running rich in the heat, let it, if it is not, make it richer.

The flip side of the coin is cold weather. There is much more available oxygen in cold air to mix with fuel. If you run in cold weather, you WILL need to richen your settings.

Also, give the engine time to warm up before running it. It is easy to seize an engine by not allowing the parts to "grow" together. Trust me.

LOOSE OR CRACKED EXHAUST EQUIPMENT

This will really mix things up, even a leaky gasket or loose mount bolts. I have seen certain brands crack around the flange area. Keep this in mind, it will ruin a good tune.

A NOTE ON "PIPES", OR HEADERS

This new line of large CC/HP engines does not perform as well with the pipes designed for the smaller CC engines. We understand that it is tempting to skip expense of a new pipe, but you will rob your engine of power, and quite possibly, cause heating problems with your engine.

Even some "big bore" pipes are only good for 30CC.

There are a few new lines of pipes specifically designed for these large engines (32cc+), Bartolone offers 32+ pipes and the OBR Victory pipe still works well for the Baja. NOTE: not all "Victory" pipes are the same. The OBR version of the Vic side pipe does perform best all around of all of the Vic Baja style pipes. BoosterPipe exhausts work well, but some models like to crack in the neck area just outside the exhaust outlet

For the Baja line, we recommend the Bartolone 32CC Side pipe, for the Losi 5ive, we recommend the Bart 32 pipe, and as of this writing, the DBXL only has the Victory Big Bore pipe available.

The Dominators are a great pipe, they make great torque, but they are designed for smaller engines.

These big engines NEED to release their large exhaust charge, and the "resonator" of the pipe must be designed to match the pulse characteristics of the bigger CC.

Sell your existing pipe and get the recommended "resonator". It was carefully designed and it serves its purpose well. There is no substitute for time and testing.

AGAIN, Misbehavior is usually signs of: Lightly fouled plug, don't be afraid to switch plugs often. Loose intake, loose exhaust, Filthy air filter, a smoked clutch that has ruined the spring. It will hang up and not allow the clutch to disengage.

Look around for sources of sudden engine misbehavior. Take your time, think clearly, and try to discern what the ENGINE wants.

A surge or erratic idle after a high speed pass is nearly always due to a lean condition. Richen the HSN and creep back up on it.