



PARIS
RACING
PRODUCTS

ENGINE TUNING TECH TIPS

Rob Paris

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Engine Tuning Tech Tips

We get dozens of tuning questions from around the world at Paris racing daily. The number one question is, where do I set my needles on the carb? Unfortunately there is no such thing as a definitive universal setting for any engine! Every application will have its own unique requirements, even two IDENTICAL set ups can and most likely will have at least slightly different settings.

I would like to address what seems to be the # 1 mistake we encounter in engine tuning:

Carburetor Needle balance:

It has come to our attention some racers are making the mistake of setting the idle speed opening too wide [high idle] and setting the bottom end too rich! This will give a false normal idle speed even though the speed is set to high because it "loads up" the engine with excess fuel causing the idle to be lower than set!

The end result is a very unstable idling engine that surges and may cut out as full throttle is applied because the over rich bottom end can disguise a too lean TOP end setting!!!

Let's address this a little more in depth.

Idle speed opening set too wide:

It is possible to set the idle screw adjustment in too far but yet the idle speed is not high. Even though the air regulation [carb barrel or slide] may be set to a position that would normally equal a very fast idle, the idle is low because the low speed mixture adjustment is set so rich that the engine loads up with excess fuel and the engine goes into what's commonly called a four cycle idle.

One tell tail sign of this is if after revving up the completely warmed up engine it tends to idle fast for a few seconds then drops to lower idle speed. If you start leaning the bottom end a little at a time [then repeat the revving up and idle test] and it takes longer before the idle drops your going in the right direction.

Eventually as you keep leaning the bottom the idle will stay too high, now it is time to lower the idle to where it belongs by re adjusting the idle screw!

CAUTION!!!!

Now that you have the idle set correctly the top end may be too lean!!! Keep in mind the fuel does not

directly enter the cylinder area like a 4 stroke engine; it enters the crankcase area first then is transferred or pumped up to the cylinder area by the piston movement. Simply put, the crank case volume can hold much more capacity than the cylinder so it takes some time to burn off the residual fuel. In other words if the bottom end is too rich the engine will be supplied by this residual fuel briefly and depending on the demand you may be actually be experiencing a lean condition on the top end that can range from:

1. Seems to run well but engine life is short
2. Seems to run well but car continues to get hotter the longer you run to the point of overheat!
3. Seems to run ok on the bottom but sputters starves or strains to gain rpm
4. Seems to run ok on the bottom but when I give full throttle it cuts out or stalls

An overly rich top end can act the same as 3 & 4 but excessive smoke and oil are usually present with a distinct blubbering sound. There is no reason for an engine to continually get hotter unless the tune is wrong [classic #2. symptom] or there is a mechanical problem causing more load or drag on the engine as the run continues. Exception Note: if the weather or track conditions change DRAMATICLY.

Examples

A light drizzle starts and the off road track goes from a very dry loose to high traction condition, or during a race a rapid weather front like a ten degree change! It is very important to fully warm up your engine, clutch and chassis before making finale adjustments. The chassis in most applications also works like a heat sink to the engine so it is important to fully saturate the chassis!!! I like to start the engine at least 3 or 4 minutes before our qualifier to get some heat in the engine. [Operate the throttle by hand until you have radio frequency clearance] It still takes at least 2 to 3 minutes of hard running on the track to fully saturate the chassis! There is a series of restrictions to control fuel flow at different throttle/air flow positions called needles .

These are the five basic parts of the carb to concern yourself with:

1. ***The slide or barrel***
[regulates the amount of air to enter the engine controlled by the servo]
It simply blocks off the airflow to the engine proportional to how far it is open or closed.
2. ***The idle/air speed screw***
[sets the absolute minimum air the barrel/slide can control to maintain idle speed] It simply is an adjustment screw that comes in contact with the side at the nearly closed/idle position.
3. ***The high speed needle***
[regulates maximum fuel flow allowed to enter the engine at any throttle position] It simply is a tapered needle that screws into the fuel flow orifice [an adjustable restriction] This maximum fuel flow ideally is adjusted to the correct mixture ratio for the surrounding conditions at WIDE OPEN THROTTLE or WOT There are two more devices' the low speed or minimum spray bar and the mid range needle that restrict or control the fuel further at less than full throttle.
4. ***The low speed needle***
[regulates fuel to engine at idle]

The low speed adjustment simply restricts the flow at idle speed. If you look down the bore of the carb you will see a long tapered needle [except for Picco torque carbs] When the carb barrel/slide is closed the larger part or diameter portion of the long tapered needle is inserted into the spray bar, this is what's adjusted when you turn the low speed/minimum adjustment. It literally moves either the tapered needle OR spray bar farther in or out changing the restriction independent of the barrel/side position. This leans [more restriction] or richens [less restriction] the flow from the spray bar at idle. NOTE: some carbs the spray bar is moved and others the needle assembly is moved, both have the same effect.

5. *The mid range needle*

[regulates fuel to engine after idle and before full fuel position]

Notice as you open and close the carb the tapered needle [mentioned above in item 4.] enters into a small tube this is called the spray bar/jet. This spray bar is where ALL the fuel enters the airflow stream regulated by the high speed, mid range and idle/minimum adjustments!

Normally somewhere between ½ and ¾ throttle open position the needle is completely out of the spray bar, This is what is called full fuel position or FFP [at this point 100% of the mixture is controlled by the high speed needle.

On many carbs the low speed and midrange are not independently adjustable so the mid range is a factor of the needle taper and is engineered by the factory. On some SLIDE carbs there is both independent spray bar and mid range needle adjustments. CAUTION: be very careful with these type carbs!!! You can identify them easily because there are four adjusting screws!

One each for the:

1. High speed/top end [normally sticks up some what vertical]
2. Idle/air speed [normally a much smaller screw entering the carb at an angle]
3. Low speed/minimum [located in the end of the slide OR on the opposite end of the carb body]
4. Midrange [also located in the end of the slide OR on the opposite end of the carb body]

Note: if there are adjustments on both the slide and the carb body one is an adjustable mid range and the other the low speed!!! Check with the engine manufacture before attempting to adjust these types of carbs! It is very important not to use the mid screw to adjust the low end by mistake; it is very easy to get the carb way out of sync.

Normally I recommend not attempting to adjust the mid range even if your carb is so equipped, the gains are VERY small and mostly limited to minute midrange drivability/economy changes that only the most sophisticated driver will recognize! The negative is a carb that is so screwed up only an expert can get it back in tune! Please note the above descriptions will apply to 99% of the modern car carbs being manufactured as of this writing with the exception of the Picco TORQUE carb that use's no mid range needle at all. It utilizes a fuel management ramp built into the slide; the carb also has two completely independent fuel delivery spray bars/jets. I wish I could tell every one exactly how to tune their engine but I cannot!

My hope with this article is if I can help racers to more understand How your carb works, all the other instructions and guides will make more sense!

Should I seal the carb with silicone?

Many racers find this a must! [Particularly in off road] Here are a few tips.

1. Be sure to use ONLY non-volatile silicone [it should say oxygen sensor safe on the tube!] you can find it at any auto parts store.
2. Use sparingly, apply a thin bead on the carb neck just below the main carb body [even if there is an o-ring present. Do not put it in the engine case bore or all around the carb neck. [That would glue the carb into the engine for good!] You just want a thin bead to squish out from between the engine case and carb body just as you fully insert the carb.
3. After positioning the carb were you want it tighten the pinch bolt assembly that holds the carb very snug! Then add a dab of silicone to both ends of the pinch bolt assembly.
4. Let fully cure before starting engine.

Optimal carburetor settings:

There is no such thing with any size or brand engine that has a predetermined optimal carb. Setting! If there were, all engines would come without adjustments. There are many variables that must be taken into consideration. Glow plug, fuel type and nitro, manifold type and length, pipe type and were the pressure filing is, clutch adjustment, gear ratios, tire size, ambient humidity, temperature and altitude etc, etc, etc. The point I'm trying to make is no one can tell you were to "set the Carb" only someone they're with you can fine-tune it!

BUT IT IS NOT THAT HARD IT ONLY SOUNDS COMPLICATED.

95% of all problems are that the directions were not followed correctly.

Ideal engine temperature:

First let me say that there is no IDEAL temperature for any engine. There are many variables that affect it; Ambient temp, fuel type and nitro content, altitude & barometric pressure, Pipe/manifold type and setting, clutch setting, glow-plug, gear ratio, available traction, How hard your driving, on road or off road Etc. Etc. All information is based on the Paris/Exergin probe; it is the only probe designed for model engines and has worldwide patented Emisivity compensation. We tested dozens of devices before we started working with Exergin and introduced infrared tuning to the model industry. All of the following conditions MUST be met before any temperature can be considered correct, the engine is assumed to be in good shape.

1. There must be a visible trail of smoke when accelerating from EVERY corner.
2. The idle is stable.
3. The glow plug wire stays somewhat shiny and the coil stays round [UN-distorted]
4. The performance is good.

Picco on road average conditions 20 to 40% nitro 205 to 230 degrees f
Picco off road average conditions 20 to 30% nitro 215 to 250 degrees f
Nova on road average conditions 20 to 40% nitro 220 to 260 degrees f
Nova off road average conditions 20 to 30% nitro 230 to 270 degrees f

How to “READ” your glow plug:

OS and Turbo glow plugs go gray sooner [easier] than McCoy plugs; this is not necessarily bad. Actually when A new plug wire just goes slightly gray after a 5 or 10 minute hard run it means your very close to an optimal horsepower tune, but be careful the next step is TOO LEAN!

My rule of thumb

1. Wire and surrounding bottom of plug wet, with like new shiny wire = rich side of optimum power 85%
2. Wire and surrounding bottom of plug starting to dry and wire starting to gray = Very close to optimum power 95%
3. Wire and surrounding bottom of plug dry, wire totally gray but not distorted optimum power 100%
4. Wire and surrounding bottom of plug dry, wire distorted = slightly lean DANGER!
5. Wire and surrounding bottom of plug dry, wire broken and distorted or burnt up = extremely lean possible engine damage!

Note: You can only “Read” your plug in a nearly new state [Wire like new and shiny] A gray plug can still operate well. After it has totally gone gray, performance can start to fall off. To test just put in a new plug and if there is no difference in performance save the gray one or put it back in. If your engine does not feel or run right try a new plug before making major tune changes

Effects of changing manifold to pipe length:

Rule of thumb:

- Longer manifold = more bottom end torque. [At the expense of some rpm]
- Shorter manifold = more top end rpm [at the expense of some torque]

BUT you can go to far with either direction causing the engine to run erratic or HOT! You must keep it in the “sweet spot” Bottom line: there is no set length for every engine or pipe, experiment with the length to suit your driving style or track needs.

Does it matter where you put the pressure fitting in your pipe:

If you’re talking about a single chamber pipe like the Associated or Paris AL12T no big deal.

But if you’re talking a two-chamber pipe, and you go from one chamber to the other you will have to re

tune the engine. Even then it is not a big deal once it is tuned for that location there is little if any performance difference. [It is all relative to available pressure Vs needle setting] I recommend tapping into the first chamber on two chamber pipes [the intake side] where the pipe is at its largest diameter. The second chamber has more constant pressure but can be more difficult to tune in high altitude or fast changing weather conditions

How to shut off you engine and stop runaways:

If the engine is out of control and at high RPM DO NOT USE YOUR HAND on the flywheel! Some guy's flip the car over and stick the toe of their shoe on the flywheel! I have seen it work but 50% of the time the engine lets go before you can stop it!

The method I like is as follows:

1. Try and hold the car down hard so the wheels can't spin [this may waste the clutch shoes but it is cheaper than an engine!] Yank the body if you can't get to the air cleaner, then yank the air cleaner and put your finger on the carb intake. It is kinda like handling a wild animal but it is a good method.
2. Do not just push your finger down on the foam air cleaner, which will suck all the dirt into the engine! Holding a rag on the exhaust works too [if you happen to have one handy] but, Be sure there is several layers of rag it will take more than a few seconds to choke it And it will be HOT HOT HOT!
3. If the engine is idling normally, I just touch the flywheel with the handle of an old screwdriver!

Ron's tips for healthy Fuel:

I always shake my fuel because some oil separation is common especially with higher nitro but I mostly shake it to re oxygenate the nitro [old habit from topfuel/funny car days] Water absorption is the #1 reason for "Bad" fuel! And is little affected by any nitro or oil/additive package. The methanol is what's so hydroscopic <Spelling? > [Water magnet] My advice as always.

1. Never leave the bottle open any longer than it takes to fill your fuel bulb.
2. never leave the FUEL BULB uncapped any longer than it takes to fill the car.
3. always rinse out you fuel bulb at the start of each day with a little fresh fuel.
4. NEVER draw fuel back into your bulb or put it back in the jug.
5. keep your fuel out of direct sunlight and off the ground.
6. store your fuel in a stable temperature.
7. I like to squeeze the extra air out of the bottle before tightening the lid.
8. Sometimes it is handy to save some 1/2 gallon or quart bottles to transfer to as you the Gallon remember to rinse them out with a little fresh fuel first.

If you follow these simple steps your day will never be ruined by bad fuel.

Will it hurt my engine to run it out of fuel:

My opinion is if your engine was tuned correctly, to start with it will not harm it running out of fuel!

I have done this hundreds of times with no damage even in our killer engines.

If just before running out of fuel the car was tuned:

1. Tuned Slightly rich, it will speed up for a brief moment just before it dies as you pass through the "Ideal performance" mixture stage.
2. Tuned for ideal performance, it will fall off in power just before it dies as it passes through the too lean stage.
3. Tuned too lean to start with, it will bog down noticeably and may blow the plug as it pass though the "way to lean you just screwed up stage". This can cause some damage to the piston and sleeve if the element wire breaks and falls in to the engine.

However, the brief lean moment should not hurt the bearings, bushings, rod, crank etc. if you're using high quality fuel [especially a high castor blend like Bluethunder race formula]

Is it ok to switch nitro content or brands of fuel?

There are many opinions on this subject; I feel there are no problems doing either! The most important thing is to use a good quality fuel! Personally, I break our engines in on the same nitro we race with, but have had equally good results either way!

The only recommendation I would make is, if you do switch brands it would not hurt to:

1. Let the engine idle a few minutes before you go out on the track.
2. Run ½ to 1 tank of fuel on the rich side.
3. Check your glow plug and if it looks good fine tune and go for it.

The reason I say to check the plug is that different fuels have different oil additives and detergent packages. This may wash away some of the built up oil deposits and platelets or bonding agents [As the oil companies call them] and foul the plug. After a few runs your new fuel will leave deposits of their own, some brands you can see the residue because of its blue or red color. Other brands you can't see because they're a light yellow or amber color but rest assured it's there! It is normal to have these build-ups and it cause's no harm!

What is the best Fuel?

Blue Thunder Race Formula [Paris/Blend] Has a High castor to synthetic ratio. Castor oil is simply the best lube available for model engines [Alberto Picco and Mario Rossi agree] but not all castors are the same! We use the finest ultra Pure Triple A refined castor. Then we add a synthetic supplement package, which includes anti foaming and rust properties. There is also a wetting agent to aid in

Lubricity and reduce storage dry out. The fuel is manufactured with the latest high tech computer controlled mixing equipment; using the freshest lab tested and certified USA made nitro and methanol by the largest manufacture of model fuel in the world.

Should I use after run oil:

Race Formula Blue Thunder is a high castor blend that includes 3% Synthetic with anti gumming agents. It is always a good idea to use some after run oil. First let the tank run completely empty at idle until it runs out of fuel [try re-starting it several times] Next put a few drops down the carb [open] and a few drops down the glow Plug hole [leave the plug out and put a rag over the top of the engine] And spin it over for 5 seconds on the starter box. Last put a few more drops down the carb re install the glow pug and spin The engine over 5 more seconds. That will do it! We May be releasing a after run oil but in the meantime Marvel Mystery oil works great and can be had at any automotive or hardware store. Other substitutes would be automatic Trans fluid, 3in1 oil or Mineral oil from the drug store! NEVER USE ANY OILS THAT CONTAIN SILICONES!!!

Cleaning your Engine:

1. First, follow the after run oil instructions above!
2. Remove the engine from the car, you can then wash it off just be careful not to wash dirt into the front bearing [even if it has a rubber sealed type]
3. I brush it off behind the flywheel then rap a strip of cloth around the crank, "wedging" it between the front of the engine and back of the flywheel.
4. I then plug the carb and exhaust [be sure there is a glow plug installed] then squirt it off with methanol or denatured alcohol [Not Isopropyl it is 30% water] I do not recommend brake cleaner or motor spray.
5. Then blow of off with compressed air if you do not have compressed air shake the engine vigorously and blow it off until dry with a hair dryer, being careful not to get it HOT just warm to the touch.
6. Last I remove the strip of cloth let the engine come to ambient temp [so there is no condensation formed inside] and put it in a zip lock bag or re-install in your car!

You can see many other useful tech tips at the Paris web site

<http://web.archive.org/web/200104290...risracing.com/> [go to tech tips on third page]

Good luck and enjoy your new Paris Racing Engine,

Ron Paris

Engine Break In And Tuning For The New and Experienced Racer:

Revised 12-30-99

Engine Break in for the for the New Racer:

I was honored when the gang at R/C Car magazine asked if I would collaborate on a tuning article geared to the new and hobby racers! With the continued growth of 1/10 off road and Explosion of sedan racers, there was a need for a generic tuning guide. Well here it is, it was very informative as written by the gang at the magazine, I simply added a few tips and clarifications based on the hundreds of tech questions we receive.

Enjoy,

-Ron

How to Break In your New Engine

Patience is the secret to success!

If you've read a few issues of this magazine, you've probably noticed that we devote quite a few pages each month to nitro-powered vehicles and accessories. Critics might say that we prefer nitro over electric powered, but the truth is that we are simply covering what's going on in the R/C industry—nitro is hot at the moment, and we'd be failing you if we didn't provide comprehensive coverage! Surely, one of the reasons for nitro's popularity rests in the quality of the engines themselves. Most of today's engines are manufactured to be easy to use and to maintain, and many sport-level powerplants have been designed to be incredibly user-friendly. For absolute novices, we still recommend electric power over nitro, but if you should decide to take the plunge, you'll find that most engines are quite easy to get running. Above all else, your success or failure with a nitro engine depends on how well it's been broken in—and this is entirely up to you and the amount of patience you have. The more time you take to properly break-in your new engine, the better it will run. A well broken-in engine will develop more power and higher rpm, and will run much more consistently than an engine that had been rushed into race settings.

IT'S ALL IN THE CARB

Everything that's needed to ensure your engine's long life is contained in its carburetor. Most carbs have three adjustments that you'll need to familiarize yourself with: The first, and most important, is the high-speed needle setting. This needle valve controls the mixture of fuel and air that enters the engine's combustion chamber during high-rpm running. More fuel in this mixture causes a "rich" condition, while less fuel (more air) causes a "lean" condition. A richer high-speed needle setting will actually help keep the engine running cooler as it reduces rpm, and because there is more fuel passing through the combustion chamber, a bit of "liquid cooling" actually takes place. A leaner setting will allow the engine to achieve higher rpm, but will also cause it to run hotter.

A properly set high-speed needle will provide a compromise between a cool temperature and high rpm. Needless to say (but we'll remind you anyway), extremes in either direction aren't good, but nobody ever blew up their engine by running it too rich! Many racing engines also have a secondary needle-valve adjustment that is used to control the engine's low-speed fuel/air mixture. This needle is used to adjust the way the engine makes the transition from low to high rpm. It also helps control the fuel mixture when the engine is idling. A low-speed needle setting that is rich will reduce throttle response at low rpm, and may make the car sluggish coming out of tight turns. A leaner setting will allow the engine to make more power during low rpm operation.

Many modern sport-type nitro engines have eliminated the low-speed needle entirely. While this doesn't allow for the highest level of tuning for the experience racer, having one fewer needle to fuss with does make these engines much more user-friendly to the beginner, who only need set the high-speed needle.

Finally, there's the idle-stop screw. Basically, this screw is used to keep the carb's slide or barrel from becoming totally closed (which would stop the engine from running). A small opening of the carb allows just enough air and fuel to mix and keep the engine running. Setting the idle is usually done after you've properly set both the high- and low-speed needles.

WHERE TO BEGIN? READ THE BOOK!

Before you even place your nitro car on a starter box or yank its pull-starter, read the instruction manual that came with your engine or car kit. Most nitro kits' manuals have a section that will tell you approximately where the carburetor's needle settings should be for initial start up. We have found that higher-end (more expensive) engines tend to follow the instructions settings more closely, which means that when the manual says to set the high-end needle at three turns out from closed, this is almost exactly where the engine will run best for break-in. For sport-type engines, the needle position that allows the engine to fire and run may be quite different from what's recommended in the manual. In our experience, if a sport engine won't fire, leaning the high-speed needle in small increments will get it going. Once the engine fires and runs consistently, we will usually richen the needle back to where the instructions recommend. Never run a new engine, or even an older one, too lean!

YOUR NEW ENGINE'S FIRST RUN

We know that you want to go out and do some hot laps the instant your new engine fires to life—but don't! The first few runs of your new engine are critical. Once your engine starts, place the car on a stand so that its wheels can't touch the ground. Let the engine idle at low rpm for a few minutes (two or three minutes will do), then shut the engine down and let it cool. During this procedure, it's also important that the piston not be at the top of the cylinder while the engine is cooling. Part of what's taking place during break-in is that the engine's mating parts are being heat-cycled—they're expanding when the engine is hot and contracting when it cools. Heat cycling stabilizes the metal and allows mating parts to fit better against each other. Keeping the piston out of the upper portion of the cylinder

(which is smaller in diameter than the lower portion in order to create a better seal during combustion) will allow the cylinder to properly contract as it cools—without interference from the piston. To figure out where the piston is in relation to the cylinder, just turn the flywheel—it will become difficult to turn when the piston is at the top of the cylinder, where the fit between the piston and cylinder is its tightest. Just turn the flywheel until the piston is in the middle of its rotation.

Now you're ready to lay down some horsepower, right? Wrong! Repeat the above steps three or four more times.

YES, YOU CAN DRIVE IT NOW

After you've heat-cycled your engine, you can finally put it on the track. But don't get too excited yet—you must run it with a very rich high-speed needle setting. Some engine experts recommend that, during break-in, the engine be set rich enough so that it will actually four-cycle instead of two (our nitro engines are two-cycle, which means that the fuel/air mixture is ignited once for every two strokes of the piston). Four cycling means that the engine is actually only firing one time for every four strokes of the piston. In this condition, all of the unburned fuel passing through the combustion chamber takes heat (and any tiny metal particles created during the breaking-in process) right out to the exhaust pipe! Do you really need to run the engine this rich? Well, the experts know their stuff, but we have broken in dozens of new engines without actually allowing them to four stroke. Whether or not to four-stroke your engine during break-in is entirely up to you—just make absolutely certain that the highspeed needle is set very rich: lots of blue smoke should be coming from the exhaust, and the engine should sound "blubbery." During this procedure, it's vital that you avoid prolonged use of full throttle, which could strain the engine. You should instead "blip" the throttle as you drive the car to avoid spending too much time in one particular rpm range.

Run the engine using these settings for three or four tankfuls of fuel, allowing the engine to cool in between runs.

NOW COMES THE GOOD PART!

Once you've put about six to eight tanks of fuel through the engine (as outlined above), it's time to begin leaning the high-speed needle and making some power! Begin by leaning the high-speed needle (by turning it inward, or clockwise) by about one-hour (if you imagine the needle as a clockface, one full turn of the needle would equal 12 hours). Run the car for a minute or so, then bring it back in and lean the needle by another one hour increment. Repeat this process until the engine begins to achieve good rpm, but it shouldn't be allowed to "scream" quite yet. The engine should still be creating lots of blue smoke from its exhaust. Before you achieve that screaming race setting, we recommend that you run your engine for a few more tankfuls in this "almost race" setting. Once you get the needle set to where your engine is making good rpm, richen it (by turning the needle counter-clockwise) by about a quarter of a turn—this is your final setting.

THE FINAL STEPS

Once you've found a good setting for the high-speed needle that allows the engine to make good power yet still push plenty of blue smoke from the exhaust (especially when the car exits a turn), it's time to set the low-end needle and the idle-stop screw. Most engine manufacturers recommend a specific setting for the idle-stop screw, and they're usually well within the ballpark. For now, set the idlestop screw so that the engine will idle at a moderate rpm without stalling. Bring the engine up to operating temperature by driving it for a few minutes. Now stop the car and listen to the engine's idle speed. If the engine idles fast but then slows down in just a few seconds, the low-speed needle is probably set too rich. Lean the low-speed needle (by turning it clockwise in one-hour increments) until, after running a few more laps, the idle stays high for about twenty seconds or so when you stop the car. Once you've done this, use the idle-stop screw to make the final adjustment of the idle speed. For sport engines which lack a low-speed needle, the idle-stop screw is the only method of adjusting the engine's idle speed. For these engines, simply turn the idle-screw clockwise to increase idle speed, and counterclockwise to reduce the idle speed. Setting your engine's idle speed isn't a contest to see how low you can get it without stalling the engine! Your goal when setting the idle should be to allow the engine to run at moderate rpm without the clutch being engaged whatsoever. Your car should be able to sit at a standstill when idling. If you have to hold the brake, the idle is too high. If you have to blip the throttle to prevent stalling the engine, the idle is too low.

ENJOY YOUR NEW ENGINE!

Nitro powered R/C vehicles can be tons of fun, or they can cause tons of frustration. The difference between success or failure lies with the break-in process. If you follow these steps, have patience, and use your noggin, you're assured of success. Rushing through the break-in procedure or worse, forgetting it altogether, is a recipe for disaster. Tuning your engine is the hardest part of nitro racing. But once you've learned how the carburetor works, and which screw does what, it will all become second nature. So when you're running your car, you'll always know exactly what to adjust to gain the highest level of performance possible. (sidebar)

THE FOUR RULES OF ENGINE TUNING

1. Rich is good. Blue smoke should always be coming from the exhaust.
2. Always set the high-speed needle first
3. Never try to tune a cold engine—wait for it to get up to operating temperature.
4. Always begin your engine tuning from a rich high-speed needle setting. Never start out with a lean setting.

Tuning all carburetors and Engines for the experienced racer:

1. When starting a new engine follow the set up instructions first! Start the engine and let idle at a moderate speed for two or three minutes. Then shut it down and let it cool for a few minutes. Be sure the piston is not at the top. Repeat this procedure three or four times.

2. Now run the engine on the track, making sure the engine is rich. You should hear a “four cycle” sound. Be sure to let off the throttle going down the straightaway once or twice so the engine is not straining in its rich condition. Repeat this procedure for three or four tanks of fuel, letting the engine cool several minutes between tanks. Also, check the glow plug often. It should look new (shiny wire that is not distorted).
3. You can now start leaning [turn clockwise] the maximum needle a little at a time in one hour increments [imagine the needle like the hour hand of a clock] checking the glow plug often. [I use a glow igniter with a meter on it] I recommend running a few more tanks a little on the rich side before “Race tuning” When tuning for maximum performance [Race tune] adjust until engine will reach Good RPM then open needle 1/8 to 1/4 turn.
4. Set the low end or idle. After getting top end set close, bring model in, listen to the idle. If it is idling fast then it slows down in a few seconds, it is probably too RICH on the bottom (minimum spray bar). In that case, make it more lean (turn clockwise ¼ turn), then run another lap and bring the car in again. Repeat this procedure until the idle stays high for at least 10 to 20 seconds; at this point readjust the aircrew so the idle is at a moderate speed. The wheels should not turn, and the clutch should be fully engaged. If you had to turn the minimum spray bar in more than two or three more turns recheck the slide adjustment! [Picco Torque carburetor only]
5. You may need to repeat steps 3 and 4 several times to achieve the “perfect tune” Be patient. Tuning is the hardest part of gas racing, and is the first secret to race winning results. If you are a beginner, it is highly recommended that you ask your hobby shop or an experienced modeler for help.

Three last tips

1. Be sure engine is warmed up before tuning
2. always tune from rich to lean. When in doubt, richen up the maximum needle (top end)
3. If you have to turn minimum spray bar (low end) in more than three to four turns from flush, it is a indication the slide adjustment is too loose and needs resetting (Picco Torque carburetor only).

Good Racing,
Ron Paris
Paris racing

Formatter's Note

I have taken this from the RCTech Forums located at <http://www.rctech.net/forums> from within the Nitro Offroad forum. The URL to this specific location is <http://www.rctech.net/forum/nitro-off-road/295490-tuning-bible.html>

IT IS NOT MY WORK – ROB PARIS did this! All I have done is some basic cleanup for spelling and formatting, and I am making it available to everyone just because it is easier than reading standard text formatting!

If you have any questions, let me know at orcusomega@gmail.com