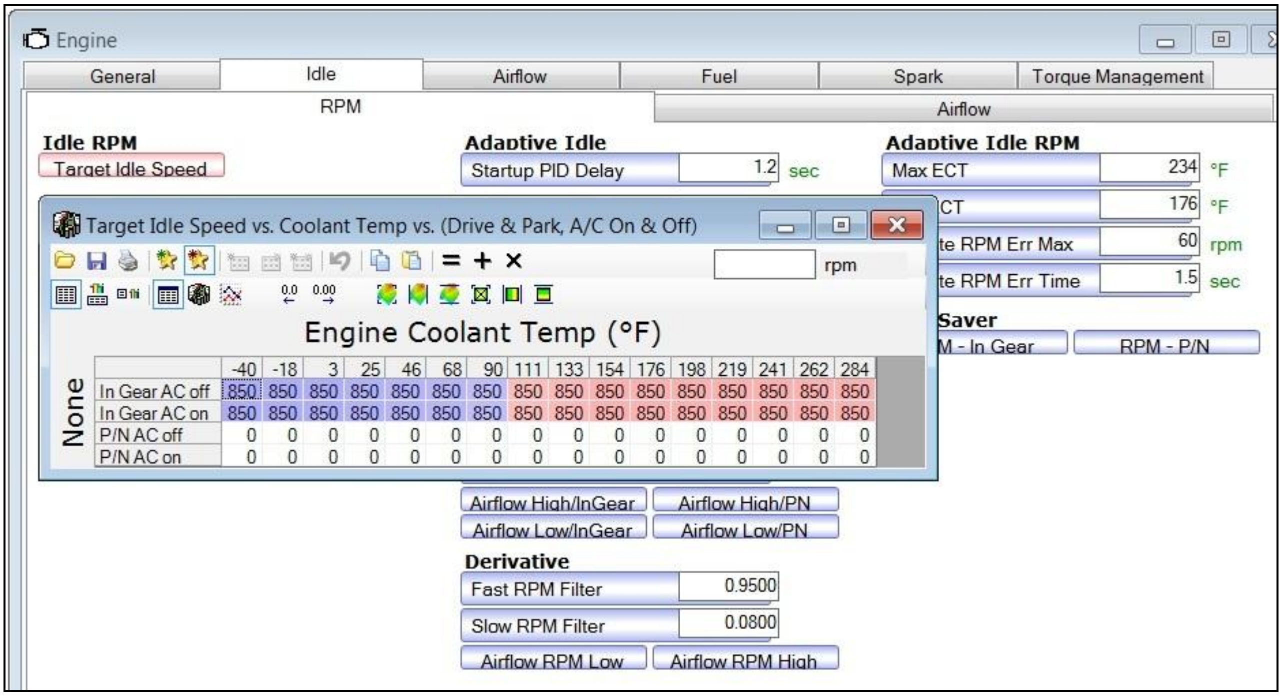
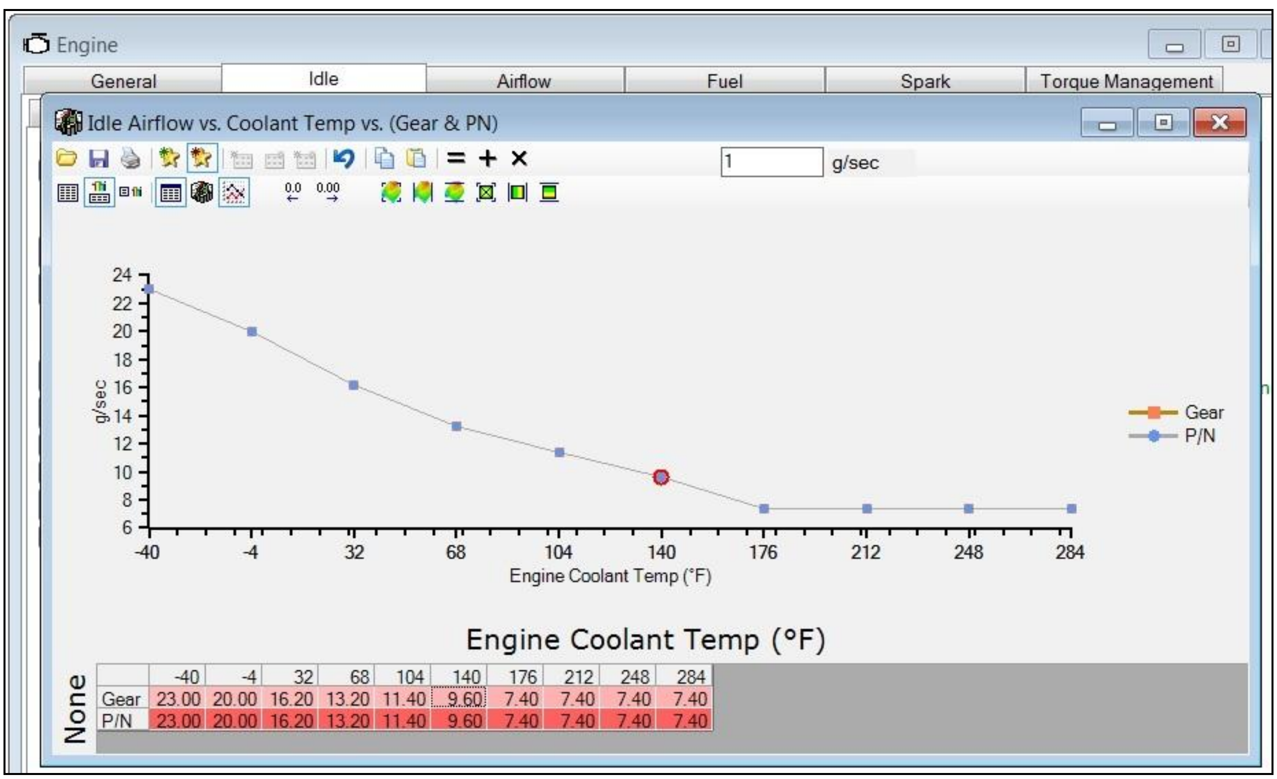
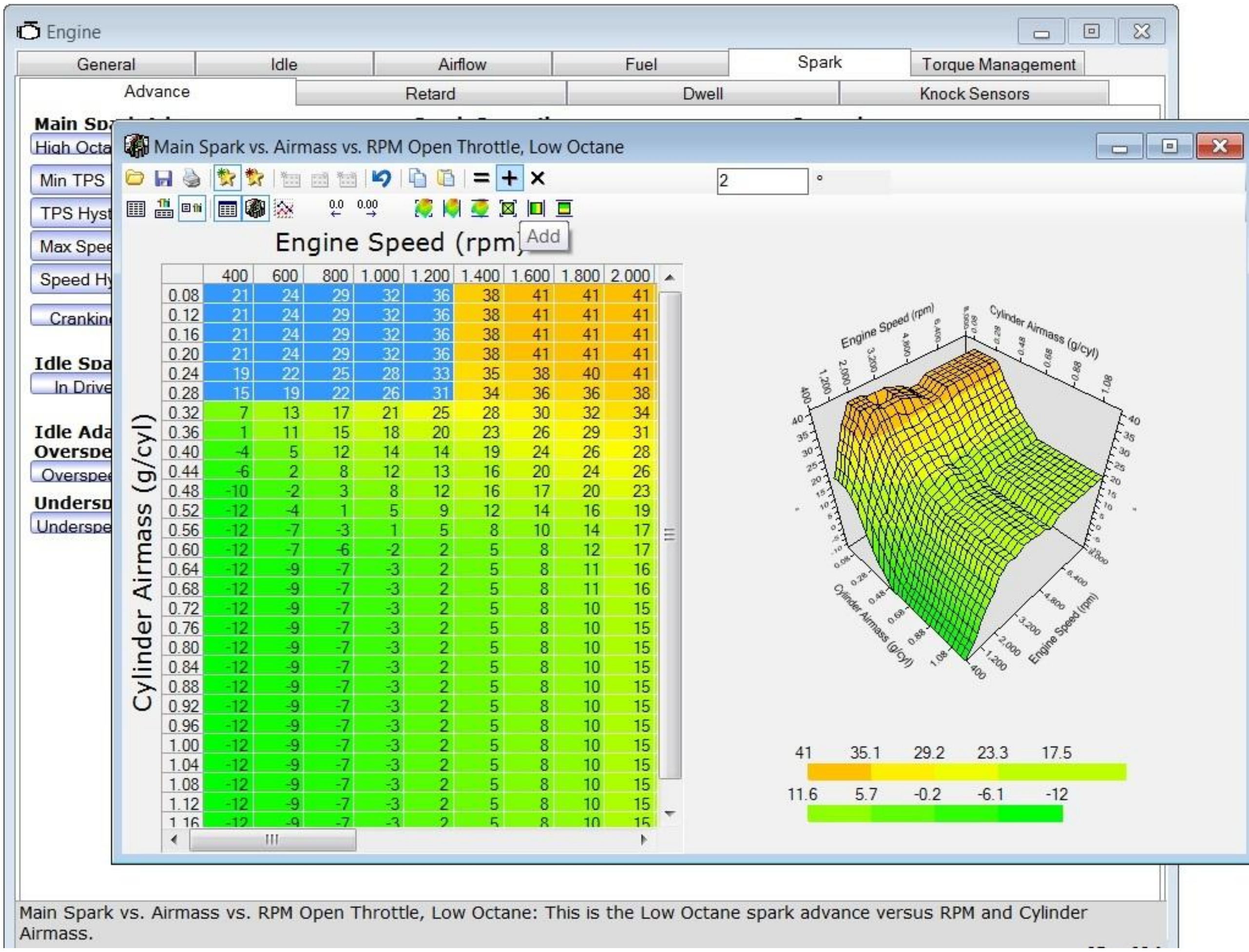
IDLE TUNING

Alright, you have your new cam installed, degreed and ready to fire. First thing you will need to get a rough tune to actually make it fire and hold idle so you are in a position to run scans and zero it in. As a GERNERAL guideline, you can follow this suggestion:

Cams with negative overlap up to zero, set idle to 850-900 all cells across the board, add 1 g/sec to idle airflow across the board both in P/N and in gear **(HPT > Engine > Idle > Idle Airflow > Base Running Airflow)**, add 2º of idle timing 1200 RPM and under and 0.08 – 0.28 g/cyl inclusive **(HPT > Engine > Spark Control > Spark Advance > Idle Spark Advance (in Park).**







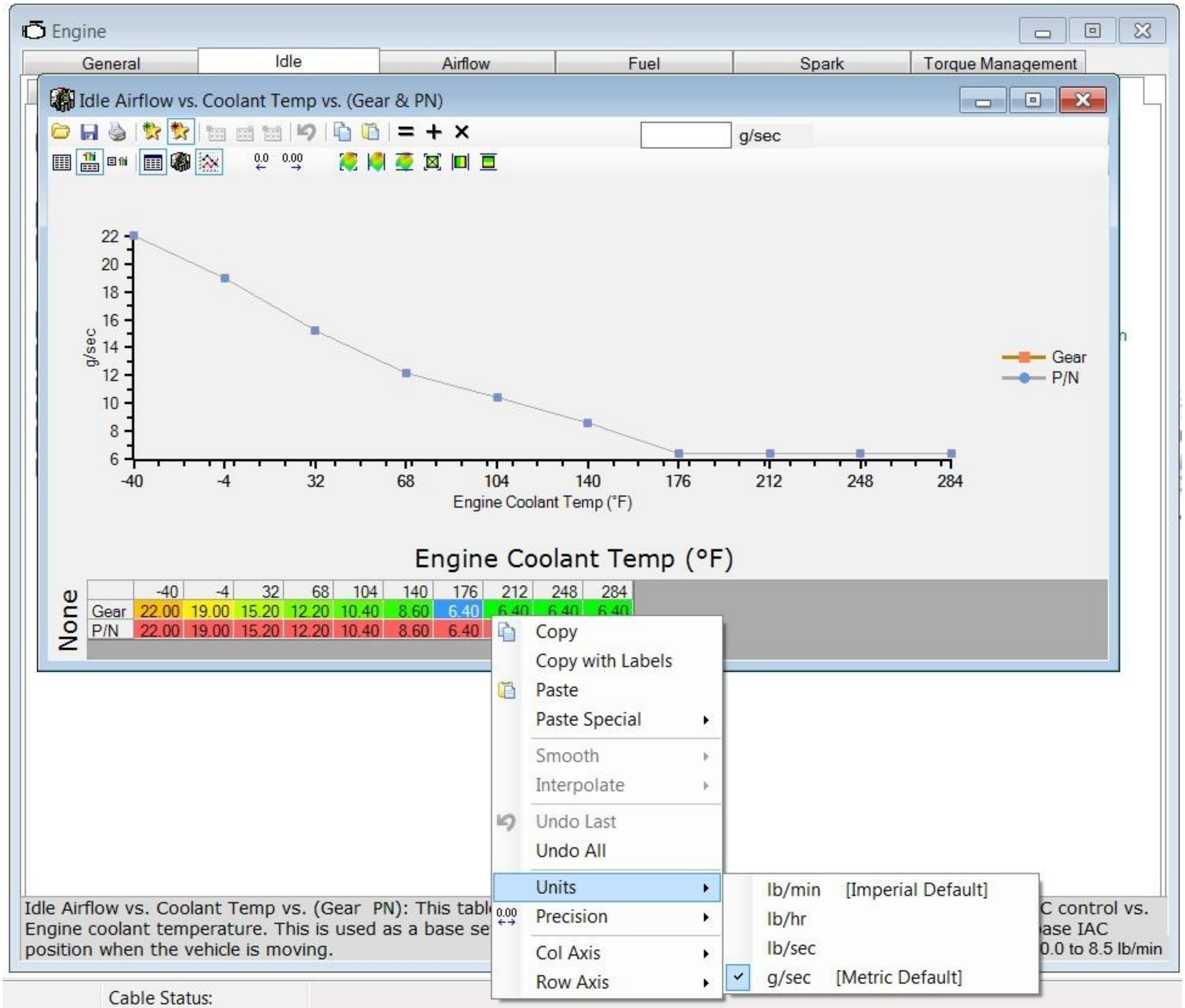
	400	600	800	1.000	1.200	1.400	1.600	1.800	2.000
0.08	21	24	29	32	36	38	41	41	41
0.12	21	24	29	32	36	38	41	41	41
0.16	21	24	29	32	36	38	41	41	41
0.20	21	24	29	32	36	38	41	41	41
0.24	19	22	25	28	33	35	38	40	41
0.28	15	19	22	26	31	34	36	36	38
0.32	7	13	17	21	25	28	30	32	34
0.36	1	11	15	18	20	23	26	29	31
0.40	-4	5	12	14	14	19	24	26	28
0.44	-6	2	8	12	13	16	20	24	26
0.48	-10	-2	3	8	12	16	17	20	23
0.52	-12	-4	1	5	9	12	14	16	19
0.56	-12	-7	-3	1	5	8	10	14	17
0.60	-12	-7	-6	-2	2	5	8	12	17
0.64	-12	-9	-7	-3	2	5	8	11	16
0.68	-12	-9	-7	-3	2	5	8	11	16
0.72	-12	-9	-7	-3	2	5	8	10	15
0.76	-12	-9	-7	-3	2	5	8	10	15
0.80	-12	-9	-7	-3	2	5	8	10	15
0.84	-12	-9	-7	-3	2	5	8	10	15
0.88	-12	-9	-7	-3	2	5	8	10	15
0.92	-12	-9	-7	-3	2	5	8	10	15
0.96	-12	-9	-7	-3	2	5	8	10	15
1.00	-12	-9	-7	-3	2	5	8	10	15
1.04	-12	-9	-7	-3	2	5	8	10	15
1.08	-12	-9	-7	-3	2	5	8	10	15
1.12	-12	-9	-7	-3	2	5	8	10	15
1.16	-12	-9	-7	-3	2	5	8	10	15

Cams with over 0º overlap up to 15º, idle 900-950 all cells across the board, add 2 g/sec to idle airflow across the board both in P/N and in gear **(HPT > Engine > Idle > Idle Airflow > Base Running Airflow),** add 4º of idle timing 1200 RPM and under and 0.08 – 0.28 g/cyl inclusive **(HPT > Engine > Spark Control > Spark Advance > Idle Spark Advance (in Park).**

Cams over 15º overlap, idle 950-1100 all cells across the board, add 3-4 g/sec to idle airflow across the board both in P/N and in gear **(HPT > Engine > Idle > Idle Airflow > Base Running Airflow),** add 6º of idle timing 1200 RPM and under and 0.08 – 0.28 g/cyl inclusive **(HPT > Engine > Spark Control > Spark Advance > Idle Spark Advance (in Park).**

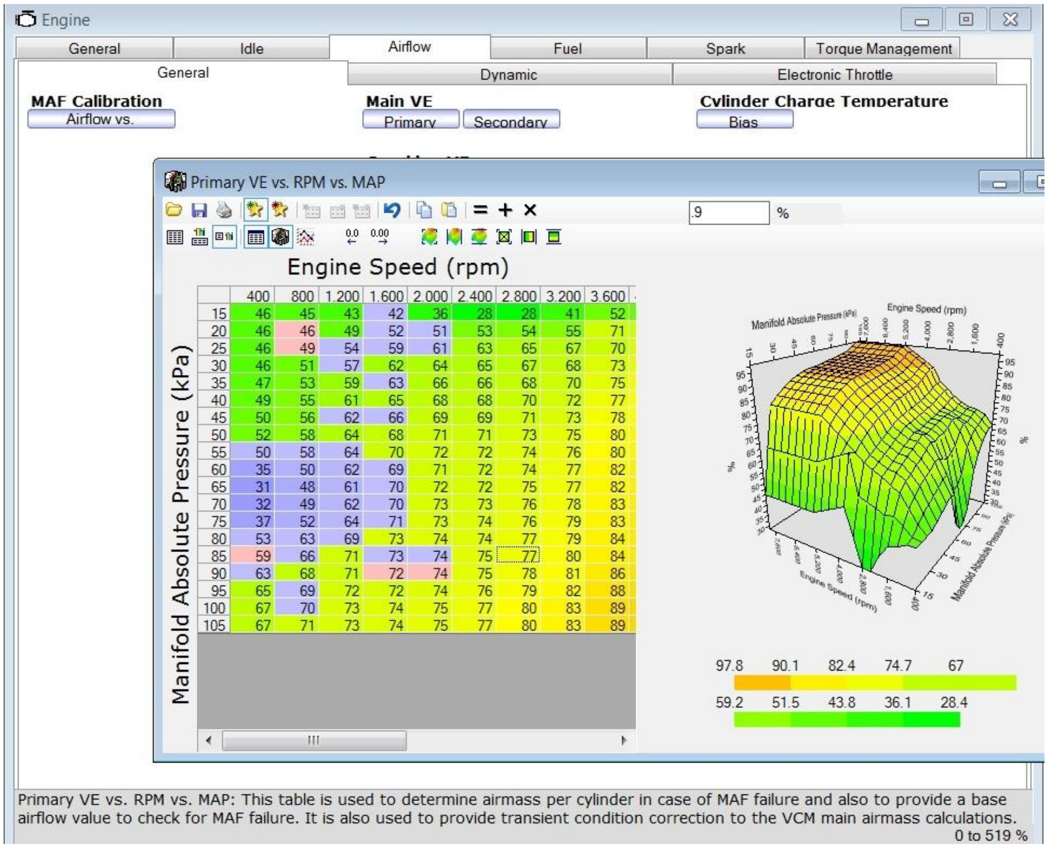
You can go to this link --> [Overlap Calculator] to determine your cam overlap. Have your cam card handy and follow the inputs in the calculator. My cam has a very healthy 27° of positive overlap which is on the very high end of any cam you will typically find on a street driven truck.

Confused already?...are your units as you want them to be? Are you stuck in lb/min or g/sec? Right click on the cells, scroll down to "UNITS" and select the way you want your data presented to you.



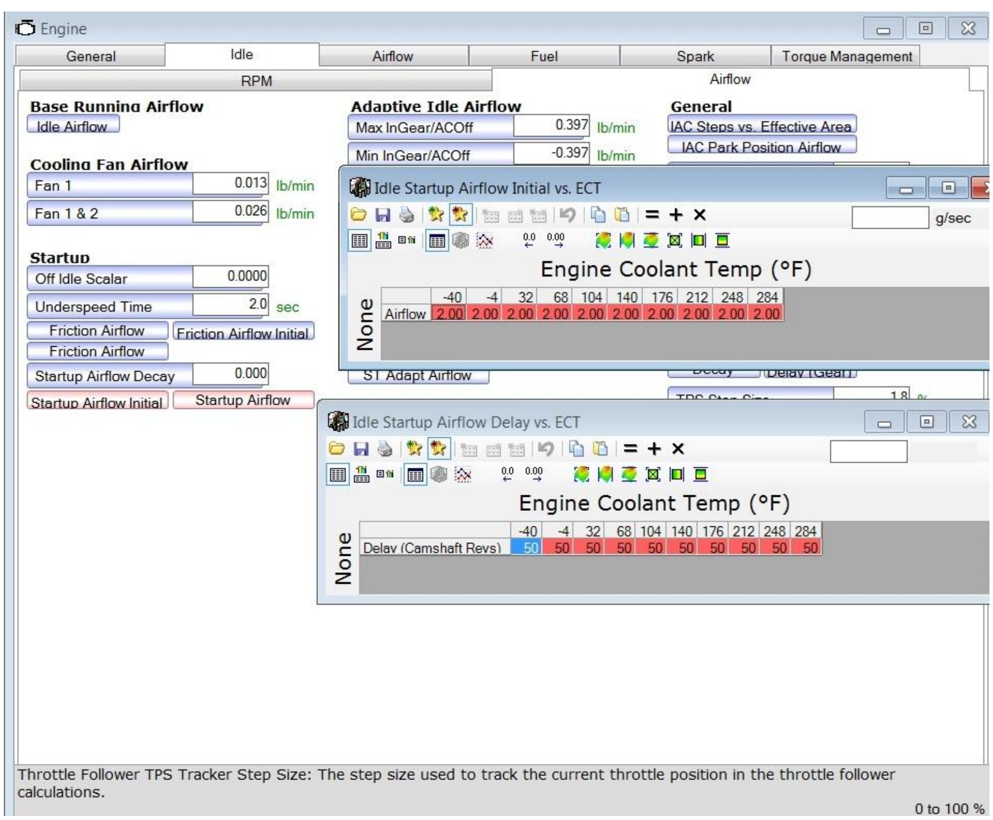
Next item to address is general idle fueling reduction, done by decreasing idle areas of the VE table. Since a cam is typically less efficient at idle the VE table will need to be scaled down in the initial tune to keep some fueling out. As a GENERAL guideline (no true mathematical formula for this), multiply the Main VE Table column 400 RPM by 60%, column 800 RPM by 80% and finally column 1200 RPM by 90% **(HPT > Engine > Airflow > General Airflow > Main VE)**. Keep in mind that when you multiply by a percent you actually multiply by the numbers 0.6, 0.8 and 0.9 respectively. Do NOT multiply by 60, 80 and 90!

Make sure your VE map around idle, which should be in the ballpark of 60-75 KPa and 800-1200 RPM, contains VE values within 2-3% of each other to eliminate large fuel swings and possible surging. Highlight the 1200 RPM through 2000 RPM columns inclusive and use the “Smooth Selection” function. This will give a nice curve and should avoid surging due to fueling. In my opinion, take this part of the guide as a wake-up call to expect that less fuel will be needed with a big cam down low. If cutting down to 60%, 80% and 90% prevents the engine from starting because it doesn't have enough fuel now, add fuel back. On smaller cams you don't have to cut as much fuel as big cams. Small cams may be able to simply start right up using the factory VE cells around idle. Take note if your operating system uses a primary and a secondary VE table in case you find yourself in Speed Density mode, which then your secondary VE table is referenced. Whatever changes you make to the primary VE table will have to be manipulated in the secondary VE as well.

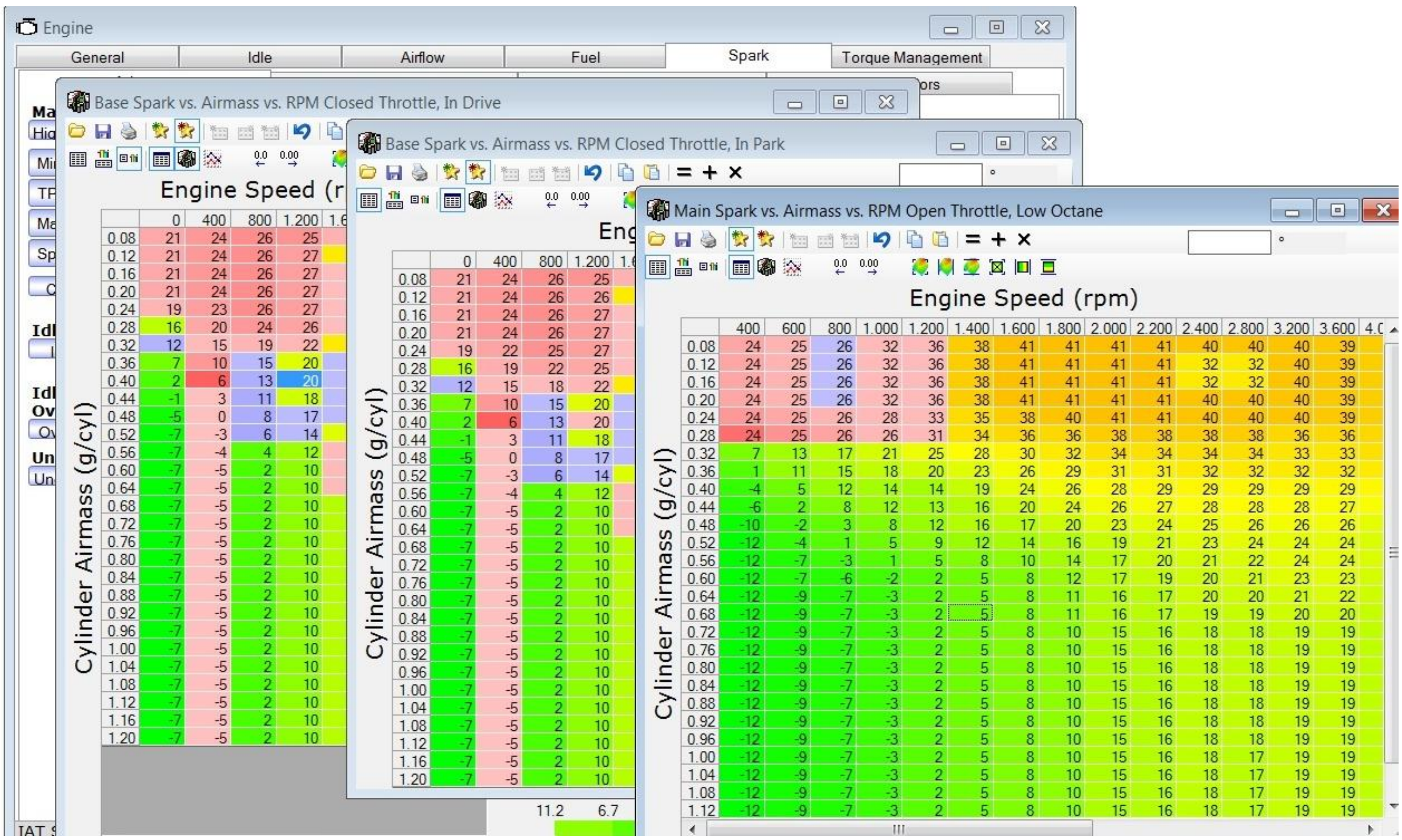


Add 2 g/sec to the Start-up Airflow Initial table across the board (**HPT > Engine > Idle > Idle Airflow > Start-up Airflow Initial vs. ECT)**. <<You'll want to revisit this table once you have your base running airflow dialed in fairly well to avoid start-up flairs. Look at an LS6's table for reference.

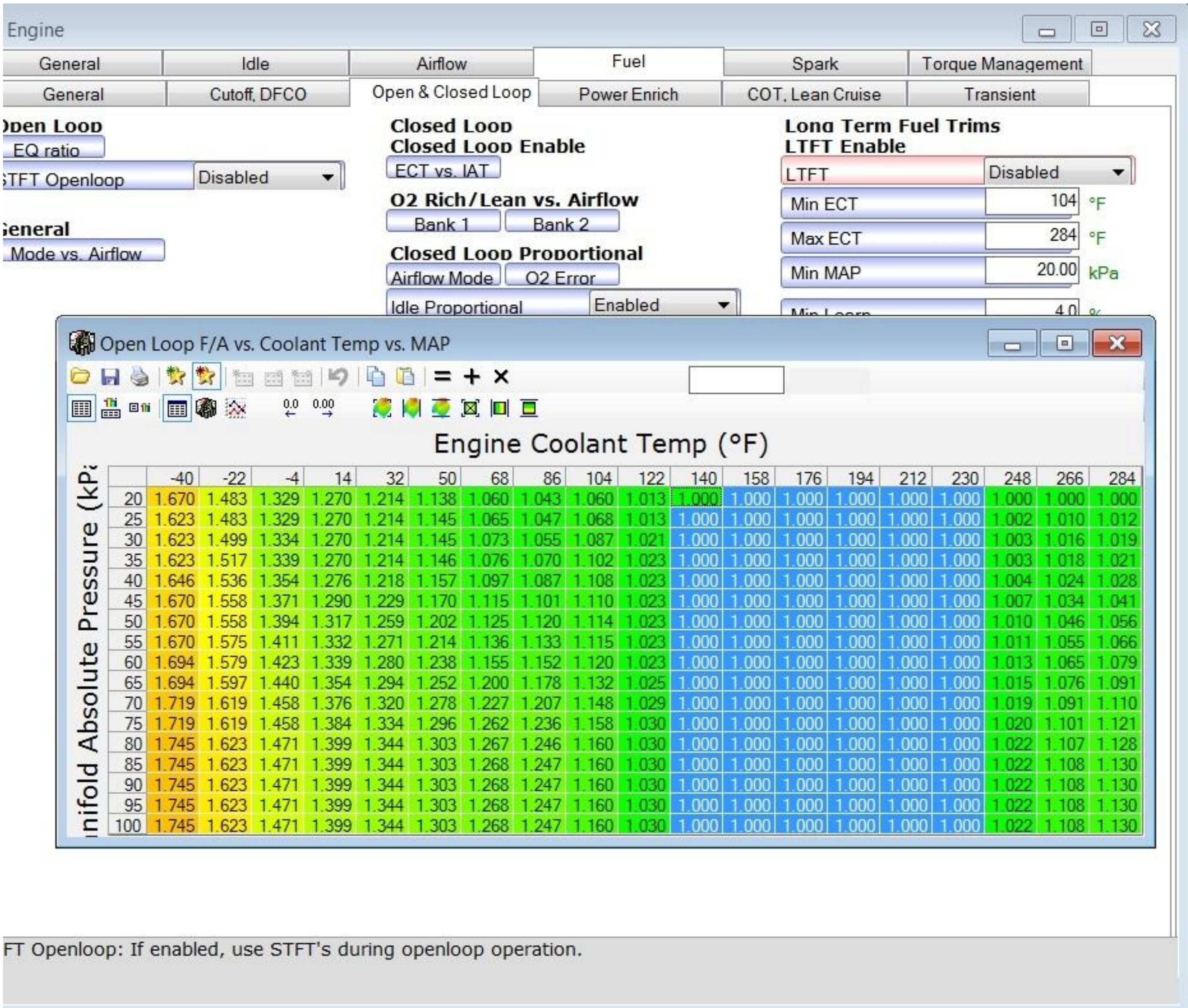
Add 50 camshaft rotations to the Idle Start-up Airflow Delay vs. ECT **(HPT > Engine > Idle > Idle Airflow > Start-up Airflow Delay).**



Make sure that your Idle Spark Advance table (both "In Drive" and "In Park") match your High and Low Octane Table for all columns up to 1200 RPM **(HPT > Engine > Spark Control > Spark Advance > Idle Spark Advance (in Park, in Gear), Hi and Lo Octane).** Blend the timing numbers into the 1600 RPM+ columns so there are no huge numerical transitions. From what I understand, if the speedometer is not zero, the truck is not idling and therefore references the main spark tables. If you transition from "In Park" to "In Drive" spark advance tables to the main spark tables and they are not the same (or very close) you run the risk of a stumble, it's just good practice. You'll have to come back to these tables once you find exactly where your cam likes to idle for spark...there's a part in this guide explaining how to find the "strongest" map value using the spark advance in the bi-directional controls of the VCM scanner. Once you figure that value out you can come back to these 3 or 4 tables. See picture



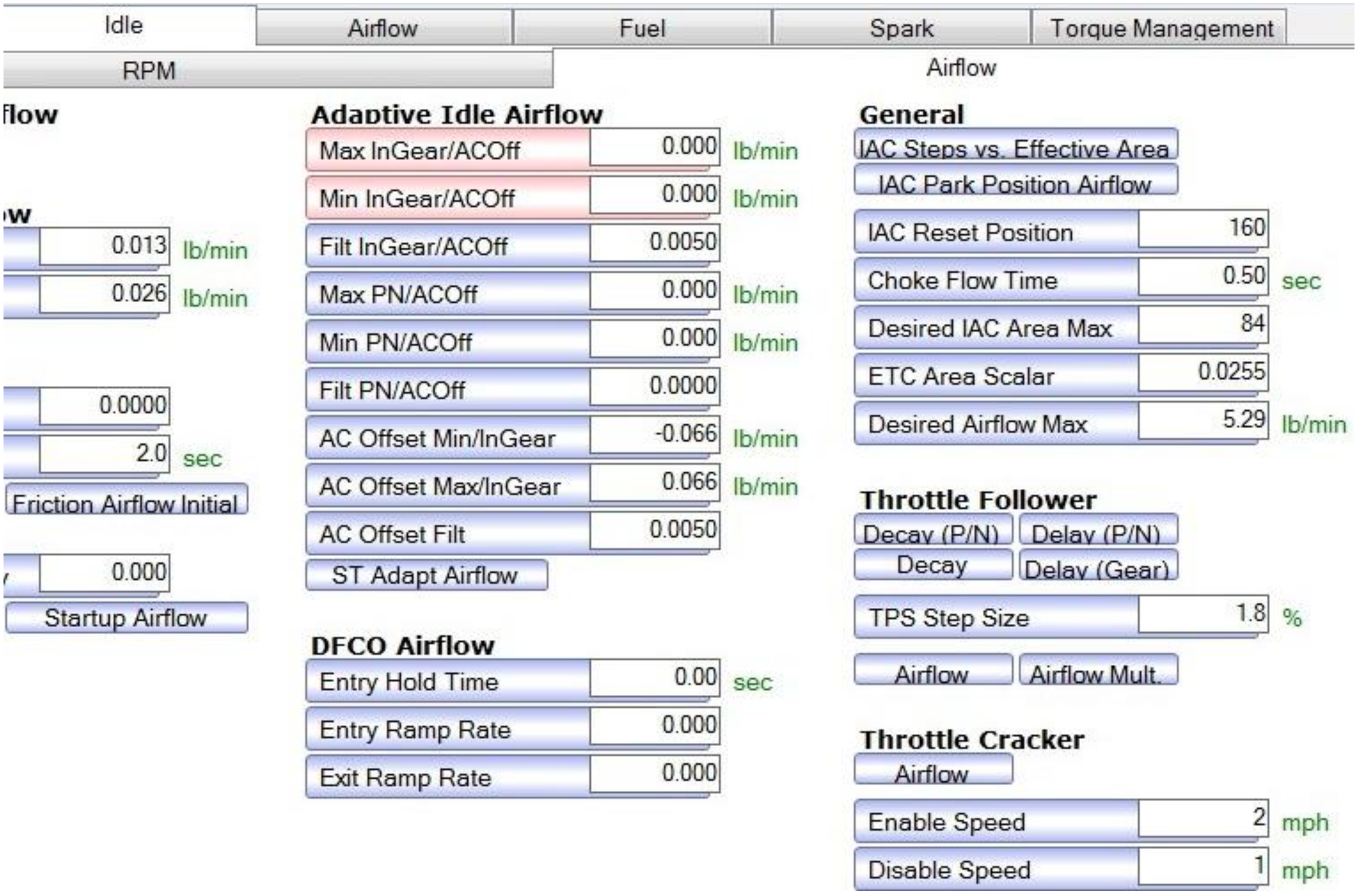
I'll also add that I believe most of us can benefit from commanding stoich after the engine comes up in temperature and continues to reach operating temp. To do this during the idle tuning process, go to **Engine > Fuel Control > OL&CL >Open Loop EQ Ratio** and set columns 140-230°F to = 1 which will command the PCM to set fueling to ~14.7. Smooth the transitions by selecting the neighboring columns if you wish. You'll have to force the PCM to stay in open loop as well, which means setting the Closed Loop Enable ECT vs IAT table to Max value (284°F)



	-40	-22	-4	14	32	50	68	86	104	122	140	158	176	194	212	230	248	266	284
20	1.670	1.483	1.329	1.270	1.214	1.138	1.060	1.043	1.060	1.013	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
25	1.623	1.483	1.329	1.270	1.214	1.145	1.065	1.047	1.068	1.013	1.000	1.000	1.000	1.000	1.000	1.000	1.002	1.010	1.012
30	1.623	1.499	1.334	1.270	1.214	1.145	1.073	1.055	1.087	1.021	1.000	1.000	1.000	1.000	1.000	1.000	1.003	1.016	1.019
35	1.623	1.517	1.339	1.270	1.214	1.146	1.076	1.070	1.102	1.023	1.000	1.000	1.000	1.000	1.000	1.000	1.003	1.018	1.021
40	1.646	1.536	1.354	1.276	1.218	1.157	1.097	1.087	1.108	1.023	1.000	1.000	1.000	1.000	1.000	1.000	1.004	1.024	1.028
45	1.670	1.558	1.371	1.290	1.229	1.170	1.115	1.101	1.110	1.023	1.000	1.000	1.000	1.000	1.000	1.000	1.007	1.034	1.041
50	1.670	1.558	1.394	1.317	1.259	1.202	1.125	1.120	1.114	1.023	1.000	1.000	1.000	1.000	1.000	1.000	1.010	1.046	1.056
55	1.670	1.575	1.411	1.332	1.271	1.214	1.136	1.133	1.115	1.023	1.000	1.000	1.000	1.000	1.000	1.000	1.011	1.055	1.066
60	1.694	1.579	1.423	1.339	1.280	1.238	1.155	1.152	1.120	1.023	1.000	1.000	1.000	1.000	1.000	1.000	1.013	1.065	1.079
65	1.694	1.597	1.440	1.354	1.294	1.252	1.200	1.178	1.132	1.025	1.000	1.000	1.000	1.000	1.000	1.000	1.015	1.076	1.091
70	1.719	1.619	1.458	1.376	1.320	1.278	1.227	1.207	1.148	1.029	1.000	1.000	1.000	1.000	1.000	1.000	1.019	1.091	1.110
75	1.719	1.619	1.458	1.384	1.334	1.296	1.262	1.236	1.158	1.030	1.000	1.000	1.000	1.000	1.000	1.000	1.020	1.101	1.121
80	1.745	1.623	1.471	1.399	1.344	1.303	1.267	1.246	1.160	1.030	1.000	1.000	1.000	1.000	1.000	1.000	1.022	1.107	1.128
85	1.745	1.623	1.471	1.399	1.344	1.303	1.268	1.247	1.160	1.030	1.000	1.000	1.000	1.000	1.000	1.000	1.022	1.108	1.130
90	1.745	1.623	1.471	1.399	1.344	1.303	1.268	1.247	1.160	1.030	1.000	1.000	1.000	1.000	1.000	1.000	1.022	1.108	1.130
95	1.745	1.623	1.471	1.399	1.344	1.303	1.268	1.247	1.160	1.030	1.000	1.000	1.000	1.000	1.000	1.000	1.022	1.108	1.130
100	1.745	1.623	1.471	1.399	1.344	1.303	1.268	1.247	1.160	1.030	1.000	1.000	1.000	1.000	1.000	1.000	1.022	1.108	1.130

With all of the changes done above, the truck should fire and hold idle. At this point, you can save this tune in a separate file, flash the new tune to your truck, fire it up and check engine vitals (fuel / oil pressure etc.) and get a heat cycle into your new valve springs (assuming you swapped them) OR you can dive strait into logging for the Desired Base Running Airflow numbers based on your specific cam and engine set-up.

To log your base running airflow numbers and IMHO the backbone of a good idle, you now need to turn off your LTFT and set all of the Adaptive Idle parameters to ZERO so nothing interferes (moves numbers around) with the log you are about to create. To do this go to **HPT > Engine > Fuel Control > OL&CL > Long Term Fuel Trim Enable**, and make both the Min. and Max. ECT settings equal to 284°F <<or on some vehicles just use the drop down menu to disable. Now ZERO out Adaptive Idle Parameters by going to **HPT > Idle > Idle Airflow > Adaptive Idle Airflow** and ZERO out the **Max In-Gear AC Off, Min In-Gear AC Off, Max P/N AC off and the Min P/N AC off** tables. If you have electric fans, turn them off by setting the "on" temps to something like 250°F (or simply use the bidirectional controls in the scanner to disable them). Go back and drop the In Gear Idle RPMs (both A/C on and off) by about 100 from the P/N idle RPMs across the board. Save this tune file with a file name you can remember (i.e. Idle Airflow Tuning) and flash the PCM with these new changes.

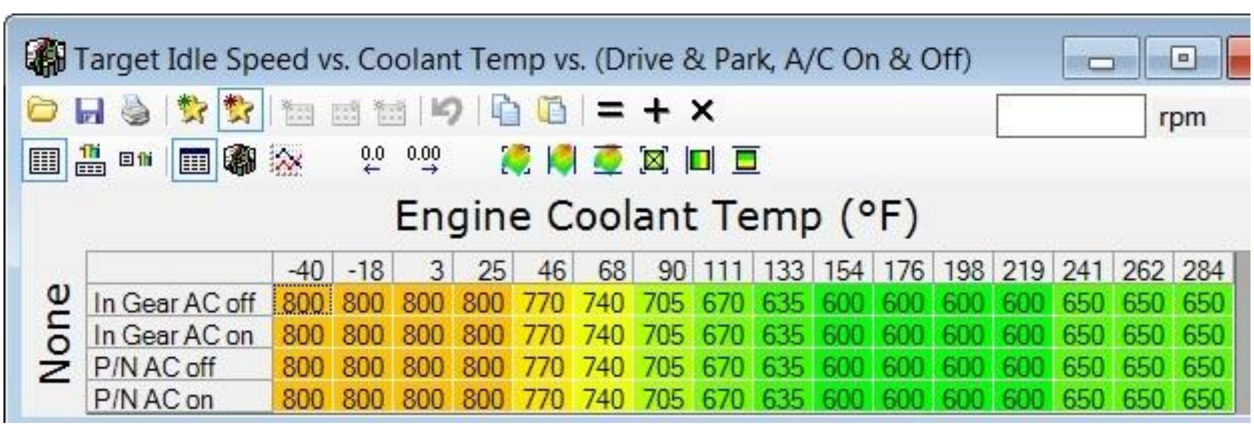


<u>Note: This procedure must be done with a COLD ENGINE and is KEY for a good idle!</u>

Download and Open the idle-airflow.cfg that is attached at the end of this post.
Use the VCM scanner to open the .cfg file.

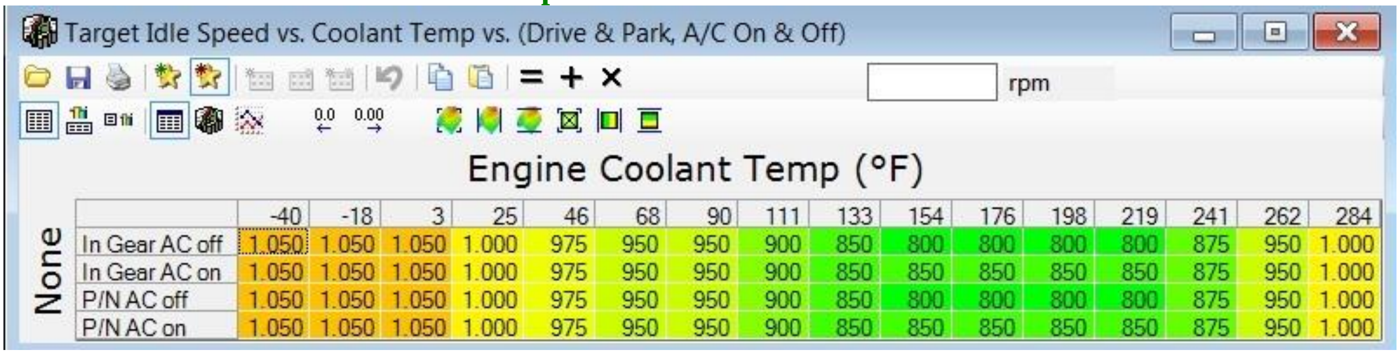
NOTE! Those who set their idle at 850-1000, don't leave it like that. The purpose of setting the idle high for your first few times starting a brand new build is to simply get it stable enough to monitor with the scanner. I do not recommend keeping it like this and I don't think Krambo is trying to say that either. You will want to adjust your target idle speed before attempting to dial in your base running airflow. Here are a few examples of three LS1's I've done recently to show some examples.

Here's the 5.7L in my Sonoma. It's a truck-oriented off road engine built into a 5.7L from a 5.3L using a 206/212 112lsa cam.



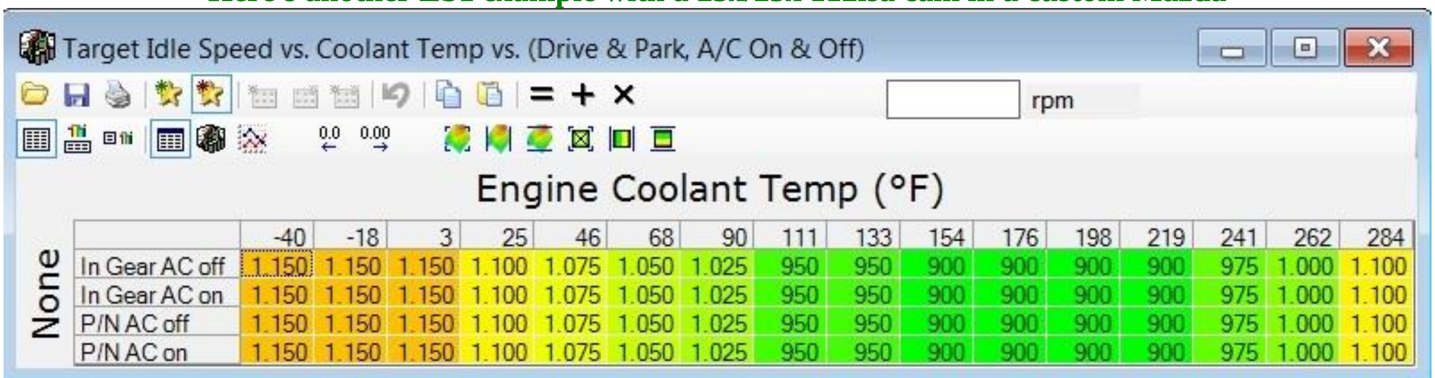
	-40	-18	3	25	46	68	90	111	133	154	176	198	219	241	262	284
In Gear AC off	800	800	800	800	770	740	705	670	635	600	600	600	600	650	650	650
In Gear AC on	800	800	800	800	770	740	705	670	635	600	600	600	600	650	650	650
P/N AC off	800	800	800	800	770	740	705	670	635	600	600	600	600	650	650	650
P/N AC on	800	800	800	800	770	740	705	670	635	600	600	600	600	650	650	650

Here's an LS1 example with a 22x/23x 115lsa cam in a C5 Vette



	-40	-18	3	25	46	68	90	111	133	154	176	198	219	241	262	284
In Gear AC off	1.050	1.050	1.050	1.000	975	950	950	900	850	800	800	800	800	875	950	1.000
In Gear AC on	1.050	1.050	1.050	1.000	975	950	950	900	850	850	850	850	850	875	950	1.000
P/N AC off	1.050	1.050	1.050	1.000	975	950	950	900	850	800	800	800	800	875	950	1.000
P/N AC on	1.050	1.050	1.050	1.000	975	950	950	900	850	850	850	850	850	875	950	1.000

Here's another LS1 example with a 23x/23x 112lsa cam in a custom Mazda

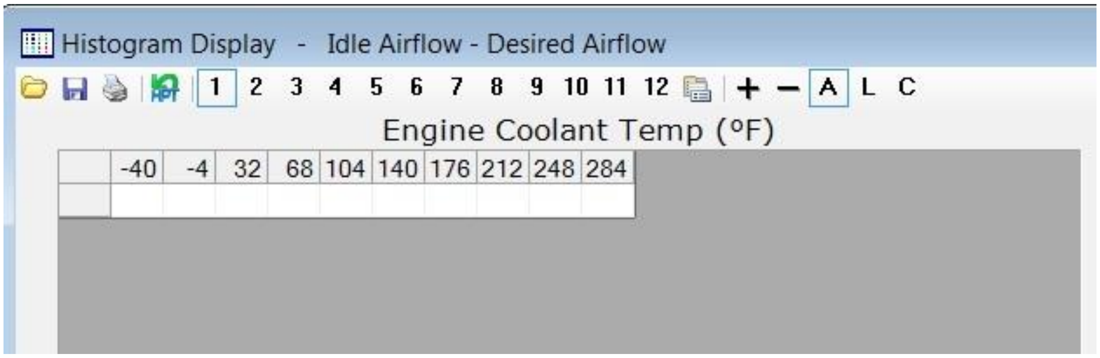


	-40	-18	3	25	46	68	90	111	133	154	176	198	219	241	262	284
In Gear AC off	1.150	1.150	1.150	1.100	1.075	1.050	1.025	950	950	900	900	900	900	975	1.000	1.100
In Gear AC on	1.150	1.150	1.150	1.100	1.075	1.050	1.025	950	950	900	900	900	900	975	1.000	1.100
P/N AC off	1.150	1.150	1.150	1.100	1.075	1.050	1.025	950	950	900	900	900	900	975	1.000	1.100
P/N AC on	1.150	1.150	1.150	1.100	1.075	1.050	1.025	950	950	900	900	900	900	975	1.000	1.100

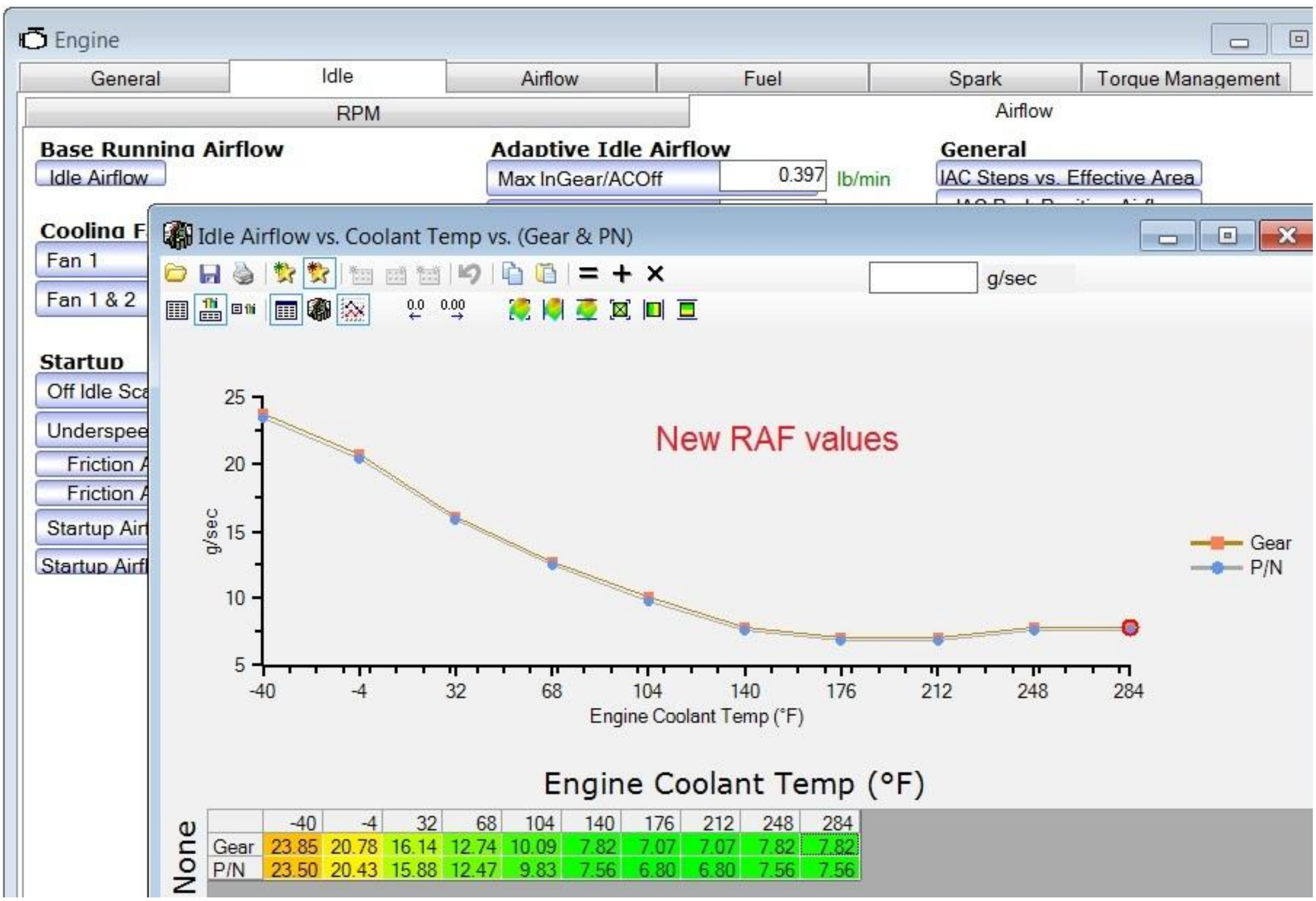
Connect to the truck and begin scanning before you start the truck (obviously you need the key in the "on" position). Reset the LTFT using the VCM **Controls (VCM Scanner > VCM Controls > Fuel & Spark > Reset Fuel Trims)**. Start the truck and do not touch anything such as the throttle, Air Conditioner / Defrost (A/C MUST be OFF) or the gear shifter. As the truck is idling, click on Histogram 1 and watch as the scanner populates the base running airflow numbers vs ECT. Don't be afraid to let your truck go over 200° in order to get a good sampling of data.
I try to do this on a cold morning and I use the VCM scanner controls to disable the fan(s) until I think the engine is warm enough (usually 235°F I call it quits if the vehicle even can get this hot with the fans off).

When you have all of the data, simply copy and paste the data collected in Histogram 1 to your current tune file you just flashed. The data will be pasted into the Base Running Airflow table **(HPT > Engine > Idle > Idle Airflow > Base Running Airflow)** for both P/N and In-Gear. BE SURE TO PASTE THE NUMBERS IN THE CORRECT CORESPONDING CELLS! Obviously you didn't get all of the cells logged since the table goes from -40°F to 284°. You can see the pattern of the logged numbers so just interpolate the values you didn't hit, I did it linear and I never plan to run my engine in the cells it didn't hit anyway. Again, save your new tune and reflash into the truck and let the truck cool down for at least several hours (I let it cool down over night).

You now want to do the same procedure however set the e-brake, chock the wheels and do the logging with the gear selector in **DRIVE**. Be safe here and stay in the driver's seat during the entire procedure. Just as before, do not touch the throttle, change gears or run the A/C or Defrost. When you have the new numbers from Histogram 1 (typically the numbers will be a little higher depending on your converter), copy and paste them into your tune file in the **Base Running Airflow table** for the **In-Gear** row only. Again as mentioned before, be sure to copy and paste in the correct cells. Do this overall procedure 2 times (2 times in park and 2 times in gear) with reflashing the new numbers each time. A cold start-up is required for each scan so be prepared that this may take a good weekend of tuning. This procedure will get you real close to dialing in your Base Running Airflow table and you should notice a significant improvement on idle quality especially transitioning from Park to Drive after each set of new numbers entered into your tune.



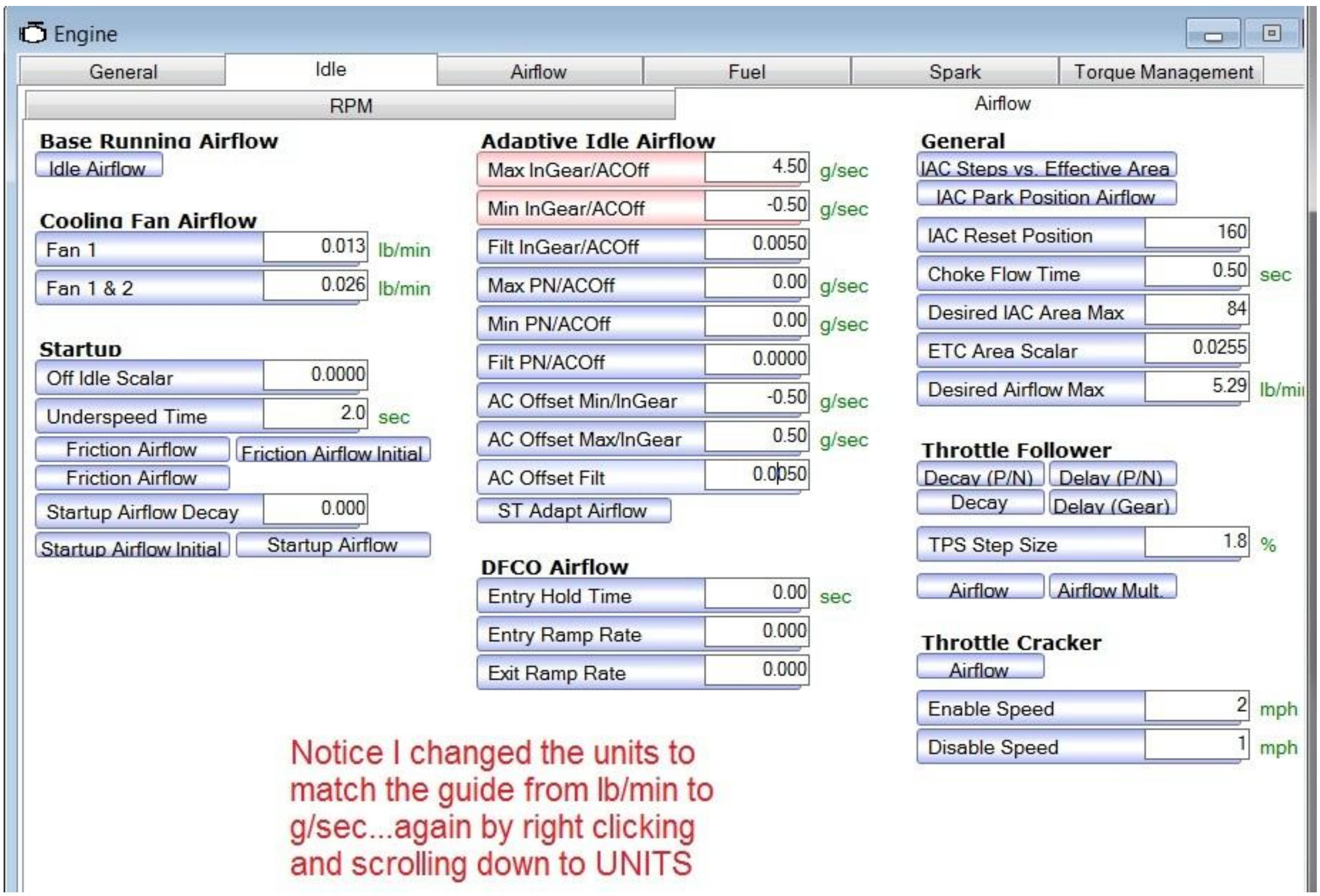
NOTE: If for some reason the units in the config don't look right where you're pasting the new data into the tune, check the units!



Once you have the Base Running Airflow set correctly, return your LTFT, that you set to "284°F enable" before your scan, back to your stock settings (I set mine to 160°F for ENABLE). While you have your file open, set your Min temp for adaptive idle to an appropriate temperature **(HPT > Engine > Idle > Idle RPM > Adaptive Idle RPM Min ECT)**. As a guideline, it should be "about" 30 degrees cooler than your engine normally runs. If it runs at 180 when warm then 150 is your target (this is typical for a 160° thermostat). Max temp -- leave it alone, I run mine at 220°.

As a guideline, your STIT & LTIT should be within +/- 0.75 to 1.0 g/sec after this tuning procedure. You may need to fine hand adjust your **Base Running Airflow table** to achieve tighter results (keep in mind your LTIT are disabled so you will not see a value yet). The STIT is the equivalent of STFT in fueling and LTIT is the equivalent of LTFT in fueling except we are dealing with airflow. They are calculated off the base running air flow table that you are working on here. It is an adjustment (+/-) to that base airflow table. The STIT & LTIT add together to offset the base running airflow to keep the engine idling properly. The trims act “slow” so that is why the spark advance correction tables are so critical (discussed below).

Put the MAX **Adaptive Idle Airflow** values you zero’d out previously back to stock (4.50g/sec) and put the Min values to -0.5 g/sec or less. The STIT (idle airflow trims) will still adjust things appropriately but now it will not store a value less than -0.5 g/sec. Setting the Min Values to -0.5g/sec is very beneficial for big cams as on a hot restart more airflow is necessary. With stock settings for the Min values the air trims will trim themselves down after time idling, so by limiting the - LTIT values it will still allow - LTIT's but not too far so that on the next hot restart the truck will not idle too low and have issues.



SAVE ALL OF THIS GOODNESS YOU HAVE BEEN WORKING ON!

I save it to a different file called “Working Tune” personally. Flash this new tune with all of the updates into your truck. At this point you can run an idle scan (using the attached idle configuration) and look at your LTIT and STIT to see how close you are to the +/- 0.75 to 1.0 g/sec. Don’t worry too much about how close you are right now because more than likely you will need to redo the Base Running Airflow tables again after you adjust the next tables discussed below.

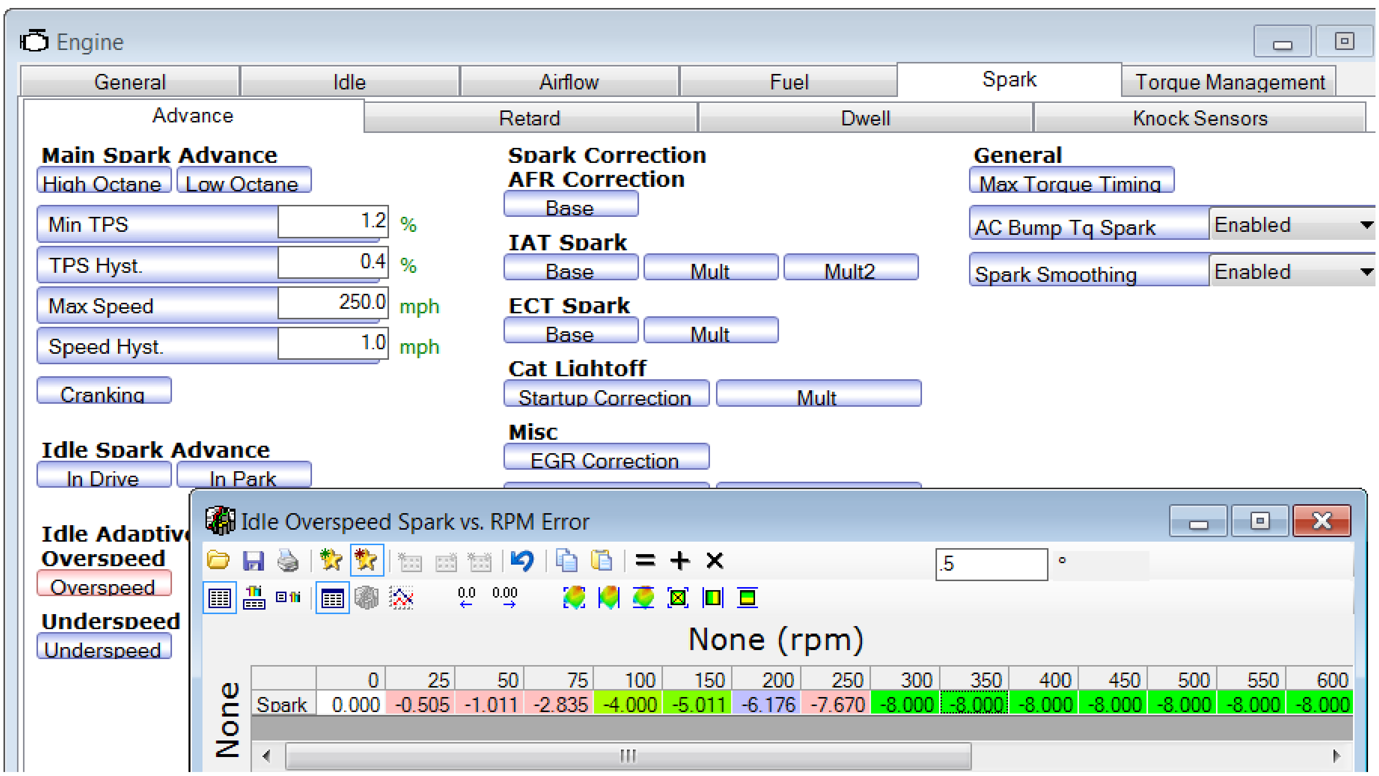
Attached Files

Idle-Airflow.cfg (2.6 KB, 110 views)

By now, your new cammed truck should be idling pretty well (unless you have a cam like mine) so you can go into some of the finer points, one being the **Idle Overspeed** and **Underspeed** tables **(HPT > Engine > Spark Control > Idle Adaptive Spark Control, Overspeed and Underspeed).** (Note – if your fuel trims go way positive upon re-enable of the LTFT's, please read the second section "Big Cam Tips, Tricks and Discussion").

The PCM uses spark advance/retard and/or IAC/throttle blade movement to control idle. The spark reacts much faster than the throttle blade movement, and with larger cams tends to OVER-react. This tends to cause the idle to drop too low, or jump too high, which then causes the PCM to try to correct it back the other direction again using the Idle Overspeed and Underspeed spark correction tables. In your scan, look at the timing line in the chart view…
does it bounce high and low or does it remain relatively stable (+/- 2°)?

If it bounces around quite a bit, it may be a good idea to adjust these tables. **Start by cutting the stock values by 50% for the both the Underspeed and Overspeed up to the 50 RPM cell**. Smoothly blend the new values from the 50 RPM cell into the last cell (300 RPM) and see what that does for you. It really helped my saw-toothed timing line and smoothed the roughness quite a bit, the stock tables are aggressive.



Update RPM error time (**HPT > Engine > Idle > Idle RPM > Adaptive Idle RPM > Update RPM Err Time)** can be set to ~0.4 so the STIT reacts a bit faster on mildly cammed trucks. "Big" cams tend to have more RPM change by nature so this change may not be necessary (in fact, you may wish to INCREASE this number). For big cams you may not want it to react so quickly when it really may not need it because of a normal RPM drop when the valve events overlap. You will need to experiment here as each application is different. I use 0.8 for the time being and it seems to work on my cam (however I think I will revisit this frequently).

Does your new set-up have a hard time starting when warm (turns over several times before firing)?
You can add another 0.5-1.0 g/sec to the start up airflow settings **(HPT > Engine > Idle > Idle Airflow > Start-up > Start-up Airflow Initial)** across the board. Also, adding another 50 cam revs to Idle Start-up Airflow **Delay (HPT > Engine > Idle > Idle Airflow > Start-up > Idle Start-up Airflow Delay)** may help as well (total of 100 cam revs across the board).

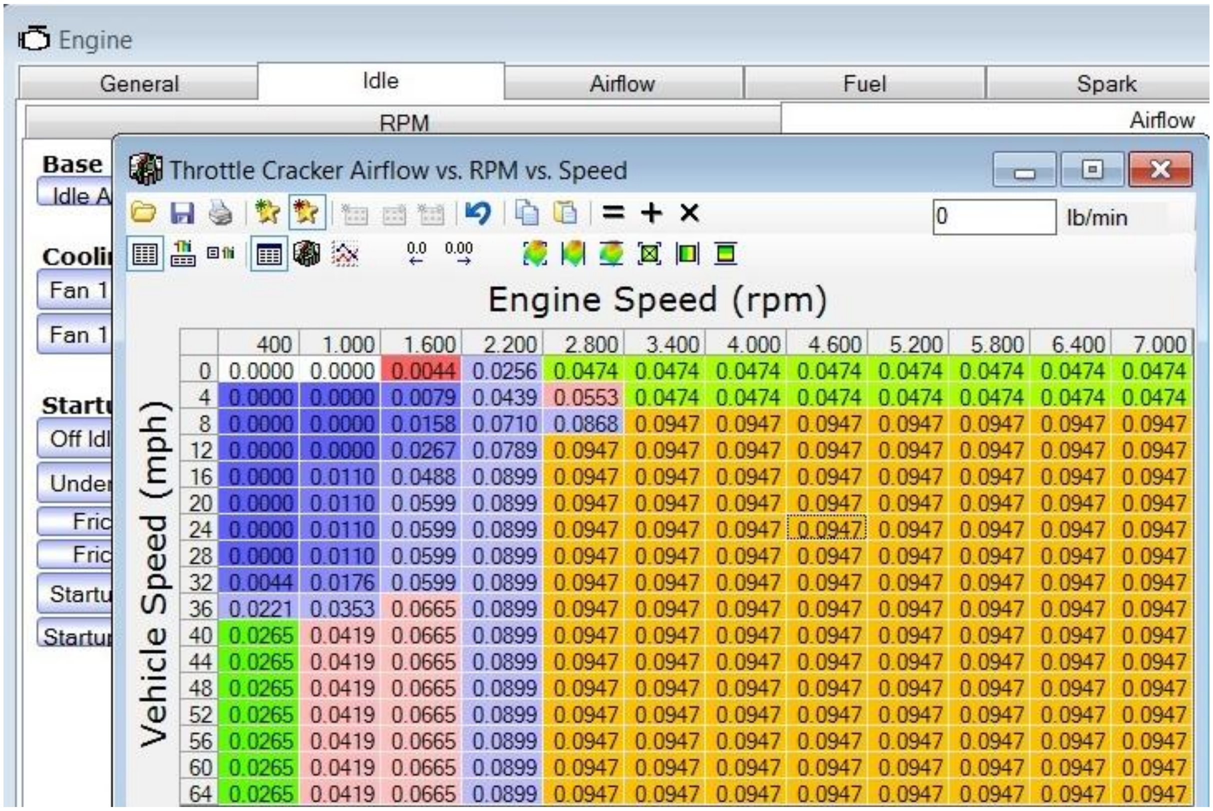
By and large you do not need to adjust the IAC steps VS effective area **(HPT > Engine > Idle > Idle Airflow > General > IAC steps VS effective area)** ***unless*** you have a larger than stock throttle body. Also the ETC Area Scalar **(HPT > Engine > Idle > Idle Airflow > General > ETC Area Scalar)** falls into the same category.
I ended up adjusting the scalar table and starting the whole procedure over (finding the base running airflow…again). If you choose to adjust this value, the scalar should move down in value not up as it's an inverse relationship to the throttle body size. For a 90MM LS2 TB, use 0.0190. Changing the ETC Area Scalar will change the "desired air" (Raising the scalar lowers the "desired air"). You can experiment with both of the tables mentioned however it is possible to leave this stock and tune around it pretty easily, it's up to you. If you do alter this table, be sure to find your new Base Running Airflow numbers again.

Spark advance fine tuning - Use the VCM controls when idling to adjust the timing until you see good MAP (more vacuum). I turned off adaptive spark using the bi-directional controls with the scanner (**Spark Idle**) so I had a steady, flat timing line and could actually see if there was MAP changes. Do this by going to the VCM bi-directional controls and disable the Adaptive Spark Control (called "Spark Idle" under the fuel and spark tab) by actually clicking the "ON" button. Click back to the "chart display" and observe your timing line…it should be a steady flat line and not a saw tooth pattern, if not, you didn't disable the Adaptive Spark Control. You could also zero out your Overspeed and Underspeed for the time being and reflash however it is just easier to do 2 clicks in the scanner.

O.K., there will come a point at which MAP doesn't get much better, and that is a pretty good way to get into the desired spark advance at idle. Listen to your engine for idle quality as well. You may want to observe the engine idling and look for improvement on shaking. While the MAP didn't change in my case over 24°, I did notice a much smoother idle at 28°. If you get some idle surge, chances are you may have too much timing in there (if your base running airflows are tuned and your fueling is good). Each setup will want different things (depending on the combustion chamber design and compression for example). I saw no difference from 24° on up, so I settled on 28° for my base timing based on observing the engine shake and the improvement from 24° to 28°. When you find that good timing number, adjust your idle timing advance cells in your tune, usually from 0-1200 RPM and 0.08 – 0.28 g/cyl (remember…do all the timing tables: Idles and Mains!), save and reflash the new changes to the PCM.

Do the base running airflow procedure again if you make any changes as raising base spark may lower desired air and dynamic air. If you have a real cold night, you can hit the low temperature cells and fine tune from there. If you do this procedure in the summer, expect to do it again when it gets cold so you can hit those colder cells. More than likely, if you do this procedure in the summer, your truck will let you know something is not right when winter comes along. Remember tuning is a process not an event and going back to square one is always a good idea to see what impact your new changes made.

Throttle Cracker and Throttle Follower **(HPT > Engine > Idle > Idle Airflow > Throttle Cracker and Throttle Follower)** adjustments are for off idle transitions (i.e. coming to a stop). As a guideline (since your standing idle is now fairly dialed in), zero out your cracker table from columns 400-1000 RPM and through rows 0-32 MPH. Set the 1600 RPM column from 0-12 MPH to zero as well. Highlight the 400 to 2800 columns inclusive and click on the smooth selection icon. Again, smoothing is a good idea for proper transitions. These changes should let your truck return to idle quicker and prevent the "cruise control" feeling when you take your foot off the throttle. Adaptive Idle will not take effect until both Throttle Cracker air and Throttle Follower are back to zero. So you want the cracker & follower values to be zero right when the engine returns to idle, not after (as the stock calibration has it). The "Cruise Control" feeling is also a product of too much Base Running Airflow however since that table should now be dialed in, more than likely your Throttle Cracker Airflow table is to blame. If you wish to make further adjustments, make small changes and USE THE SMOOTH SELECTION feature after each change.



	400	1.000	1.600	2.200	2.800	3.400	4.000	4.600	5.200	5.800	6.400	7.000
0	0.0000	0.0000	0.0044	0.0256	0.0474	0.0474	0.0474	0.0474	0.0474	0.0474	0.0474	0.0474
4	0.0000	0.0000	0.0079	0.0439	0.0553	0.0474	0.0474	0.0474	0.0474	0.0474	0.0474	0.0474
8	0.0000	0.0000	0.0158	0.0710	0.0868	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947
12	0.0000	0.0000	0.0267	0.0789	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947
16	0.0000	0.0110	0.0488	0.0899	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947
20	0.0000	0.0110	0.0599	0.0899	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947
24	0.0000	0.0110	0.0599	0.0899	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947
28	0.0000	0.0110	0.0599	0.0899	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947
32	0.0044	0.0176	0.0599	0.0899	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947
36	0.0221	0.0353	0.0665	0.0899	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947
40	0.0265	0.0419	0.0665	0.0899	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947
44	0.0265	0.0419	0.0665	0.0899	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947
48	0.0265	0.0419	0.0665	0.0899	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947
52	0.0265	0.0419	0.0665	0.0899	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947
56	0.0265	0.0419	0.0665	0.0899	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947
60	0.0265	0.0419	0.0665	0.0899	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947
64	0.0265	0.0419	0.0665	0.0899	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947	0.0947

Throttle Follower parameters do not need too much adjustment IMHO. I kept them stock (from a 03 SS file) however did bump up the decay values (doubled) in the 0-4 MPH cells in all gears so that my idle would come to rest a little quicker with less fluctuation.

Air conditioning fluctuations. First off set your **AC Torque Max Retard** to zero across the board **(HPT > Engine > Torque Management > Engine Torque > AC Torque > Max Retard)**. If you have issues with a bad stutter when the AC engages, up your **"Idle RPMs with the A/C on" (both in gear and in P/N)** only by 50 RPMs across the board. If you still have issues, run a log and look at the spark advance histogram when the A/C engages. Find what g/cyl is referenced at that moment and increase your spark tables in that area to improve stall resistance / stumble (don't go crazy with the timing though a few degrees may be all that is needed). Another suggestion is to lower the A/C Torque TPS Max. **(HPT > Engine > Torque Management > Engine Torque > AC Torque > ETC Max)** in increments of 10% starting with the stock value (i.e. if stock setting is 10, go to 9 and try it, and so on) but do not go lower than 2.5%. I personally did not mess with this setting as I had no reason to. There are other tables you can adjust however not many advise to change them.

Misfires. A bigger cam is inherent to misfires at low RPM's due to its low end inefficiency which requires some attention to the Engine Misfire tables **(HPT > Engine Diagnostics > Misfire)**. I do not have a general guideline here other than increase all tables. The max value you can enter is **32767** so I would suggest starting with 20% of that number and increase as you trip a DTC for the **P0300** (Random Cylinder Misfire code). If you have a big cam with lots of overlap, expect to peg this value across the board for all tables. If fact, I ended up deleting the **P0300** code as it was a nuisance. Misfires will prevent the Torque converter from locking when commanded among other things. Deleting this code prevents this in my case.

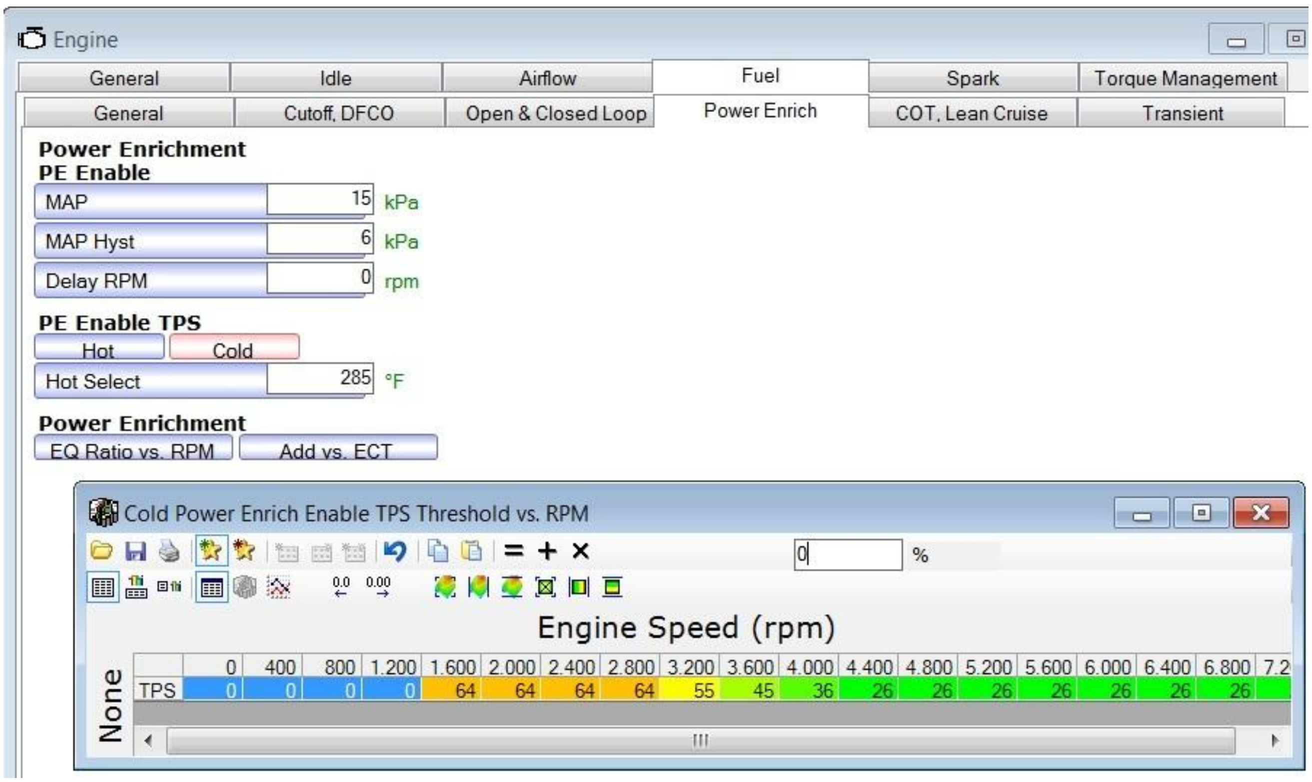
There are a lot of tables not covered here that impact idle quality so keep in mind there is more than just what was discussed in this write-up for a good idle. I would say, that using this procedure, 99% of you will be in good shape. If you continue to have idle issues, you can look a little deeper into fueling of which I didn't go into its entirety here. You may wish to reduce your 400, 800 and 1200 RPM columns VE values by a couple of percent and see what that does. Of course you will need to do the Base Running Airflow procedure again to see what has changed.

Big Cam (lots of overlap) tips, tricks and discussion:

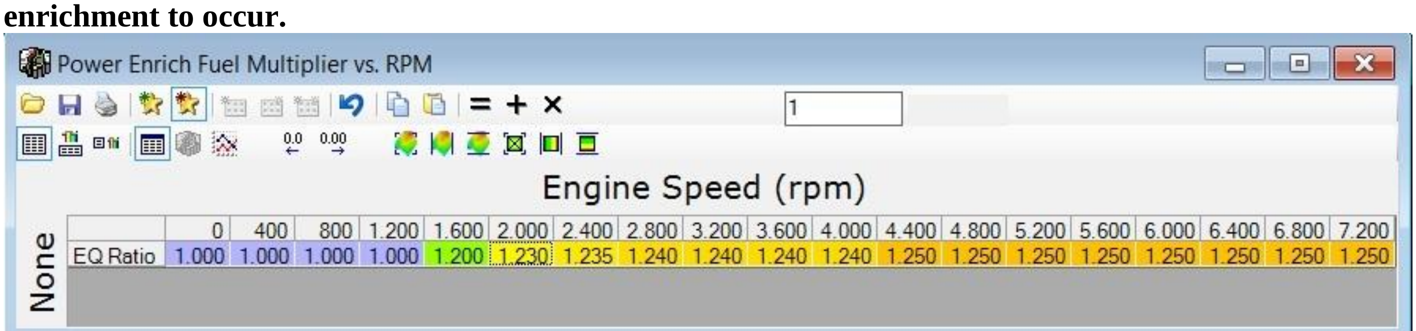
After I had my base airflow pretty well dialed in, fueling appropriate and timing where it should be and re-enabled my **LTFT's**… it all went to hell. My fuel trims would just dump the max amount of fuel (+25); the motor would shudder, misfire and smell very rich with heavy soot on the exhaust openings. Keep in mind that positive fuel trims are dumped on top of your Power Enrichment at WOT as well and I certainly didn't want all that extra fuel at WOT. I should have figured this however I didn't realize it would be this bad. After refusing to believe just the overlap and the headers would cause this bad of a false lean condition (and subsequent maxed + fuel trims), I confirmed I had no air/exhaust leaks. Now I needed to find a way to keep my fueling stable during idle. I figured I had the choice of going full on **Speed Density** or do a **Hybrid Open Loop** approach. Here is what I did, as I chose the "**Hybrid Open Loop/Closed Loop"** approach:

With a big cam (lots of overlap) and long tube headers, O2 sensors (including widebands) are worthless at idle. I had two approaches that I tried. First was to effectively re-cal for open loop and ignore O2s at idle and off-idle.

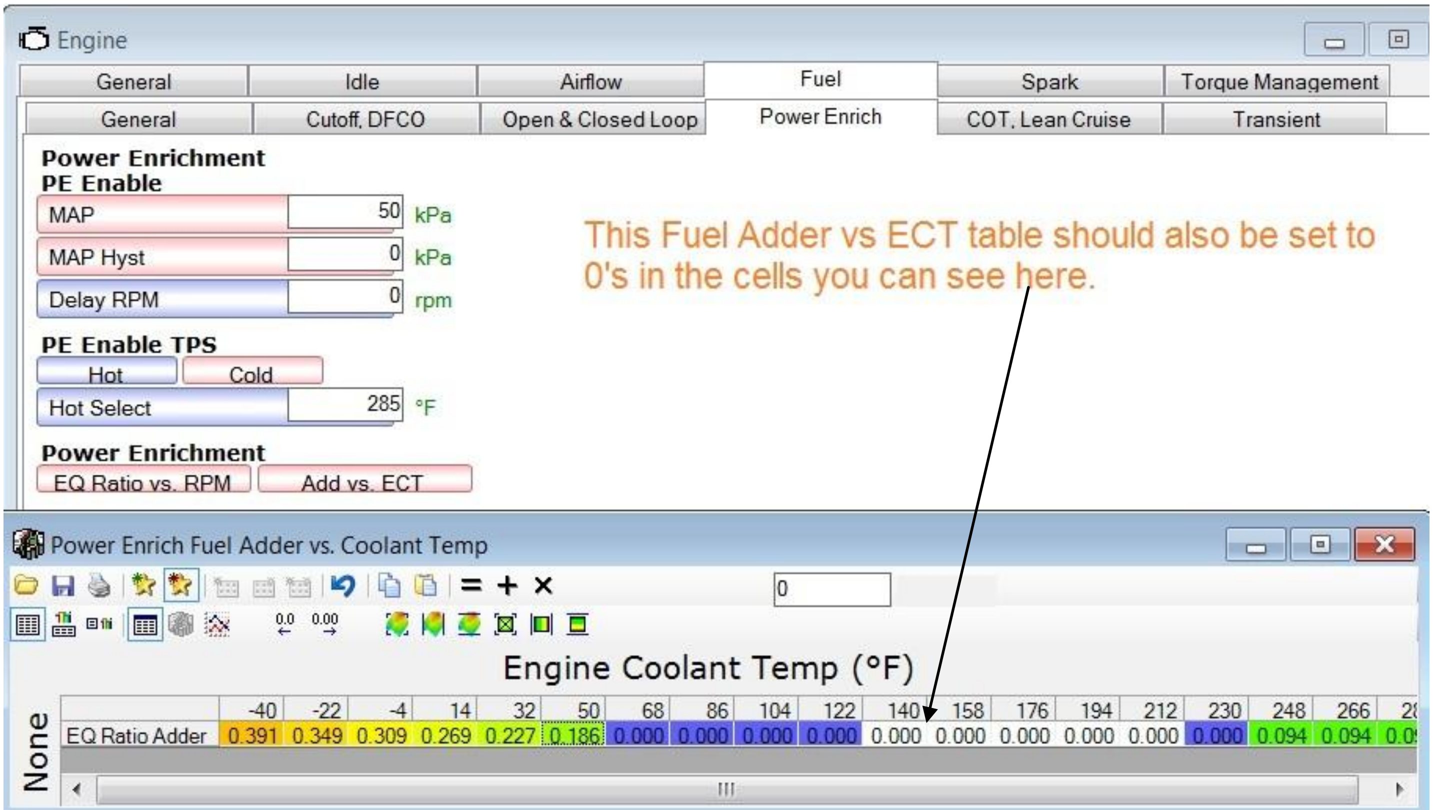
Disable closed loop at idle and part throttle by setting **PE TPS vs. RPM to 0** from 0 RPM to 1200 RPM inclusive. This forces **PE** mode at idle (and subsequently **Open Loop**) and ignores the O2's



Set PE enrichment to 1.0 from 0 RPM to 1200 RPM inclusive. This "prevents" any PE mode fuel enrichment to occur.

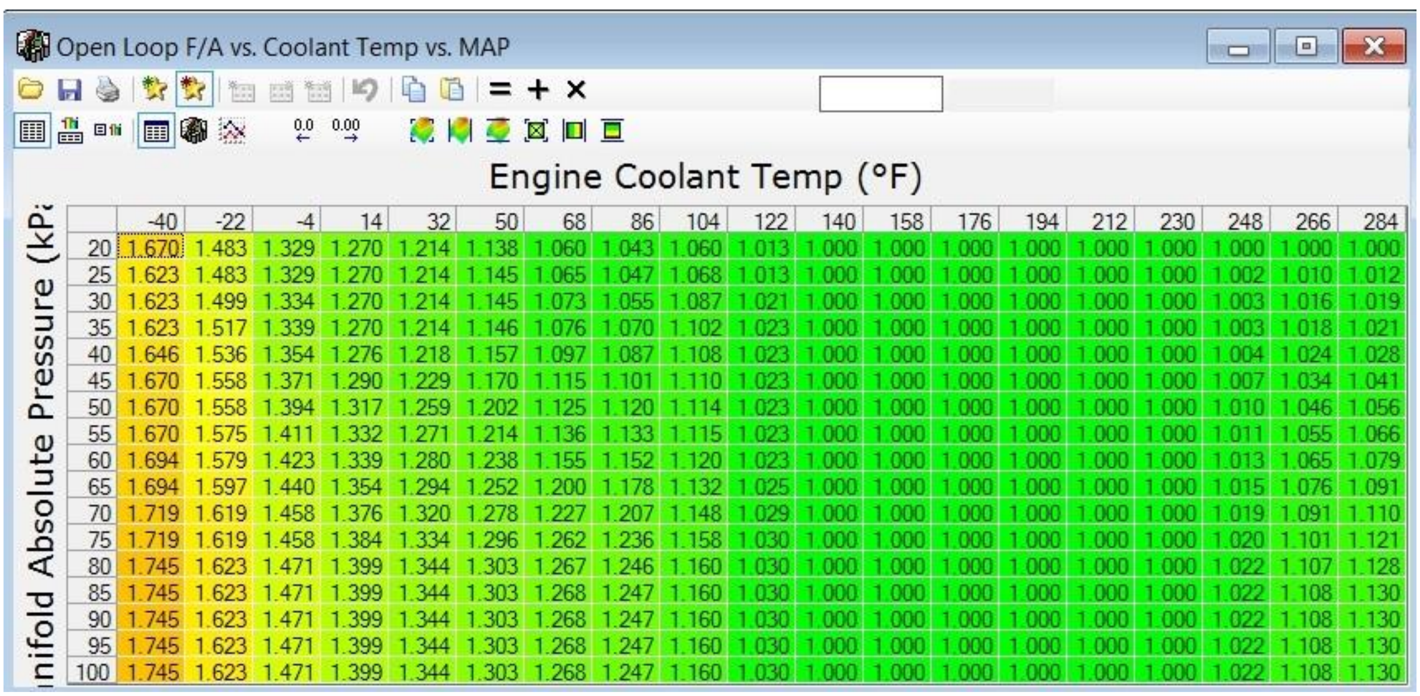


Also...



	-40	-22	-4	14	32	50	68	86	104	122	140	158	176	194	212	230	248	266	28
EQ Ratio Adder	0.391	0.349	0.309	0.269	0.227	0.186	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.094	0.094	0.0

Set columns 68°F through 230°F in your **OL F/A vs. Coolant Temp vs. Map** to 1.00 (one) up to the Map value you saw during your idle scans. For me I have a 1.00 in all cells from column 68°F – 230°F and 20-80 KPa inclusive. **(HPT > Engine > Fuel Control > OL/CL > Open Loop > Eq Ratio)**. This is the open loop fuel adder table I showed you before by forcing ~14.7 from 140 degrees to hot idle...over-rule my suggestions and follow the next few steps Krambo has here if you are experiencing the big cam issues described in this particular section.



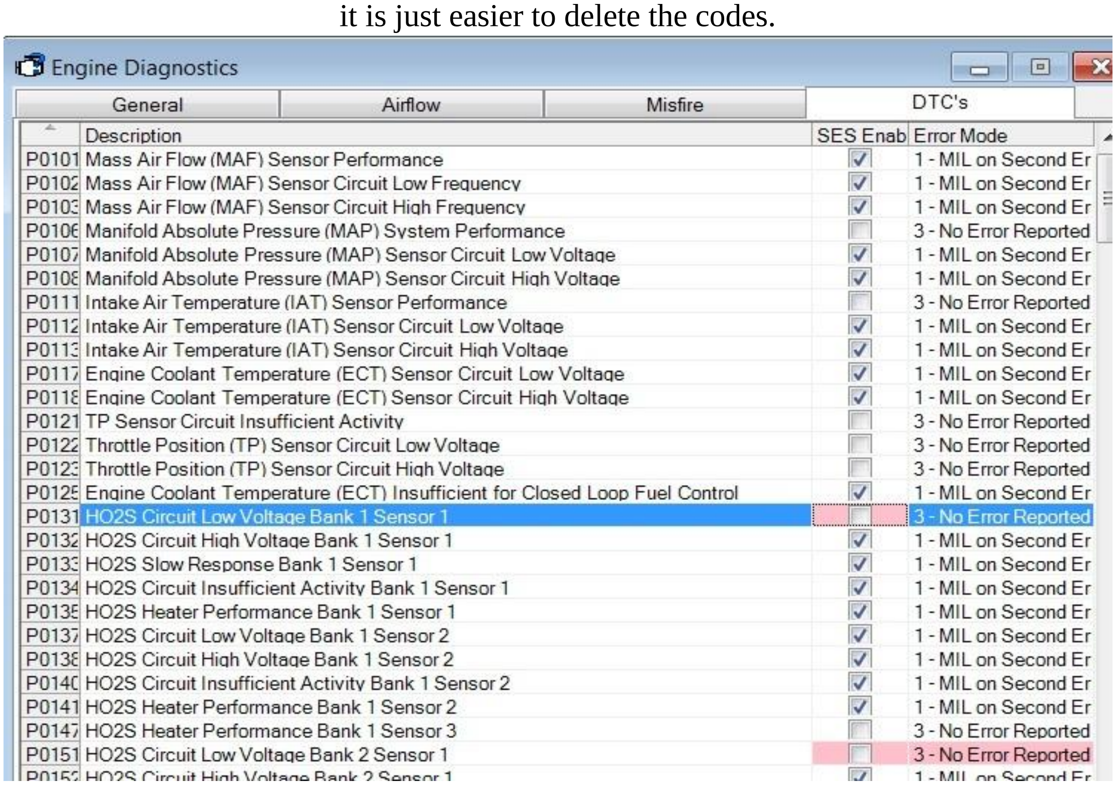
	-40	-22	-4	14	32	50	68	86	104	122	140	158	176	194	212	230	248	266	284
20	1.670	1.483	1.329	1.270	1.214	1.138	1.060	1.043	1.060	1.013	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
25	1.623	1.483	1.329	1.270	1.214	1.145	1.065	1.047	1.068	1.013	1.000	1.000	1.000	1.000	1.000	1.000	1.002	1.010	1.012
30	1.623	1.499	1.334	1.270	1.214	1.145	1.073	1.055	1.087	1.021	1.000	1.000	1.000	1.000	1.000	1.000	1.003	1.016	1.019
35	1.623	1.517	1.339	1.270	1.214	1.146	1.076	1.070	1.102	1.023	1.000	1.000	1.000	1.000	1.000	1.000	1.003	1.018	1.021
40	1.646	1.536	1.354	1.276	1.218	1.157	1.097	1.087	1.108	1.023	1.000	1.000	1.000	1.000	1.000	1.000	1.004	1.024	1.028
45	1.670	1.558	1.371	1.290	1.229	1.170	1.115	1.101	1.110	1.023	1.000	1.000	1.000	1.000	1.000	1.000	1.007	1.034	1.041
50	1.670	1.558	1.394	1.317	1.259	1.202	1.125	1.120	1.114	1.023	1.000	1.000	1.000	1.000	1.000	1.000	1.010	1.046	1.056
55	1.670	1.575	1.411	1.332	1.271	1.214	1.136	1.133	1.115	1.023	1.000	1.000	1.000	1.000	1.000	1.000	1.011	1.055	1.066
60	1.694	1.579	1.423	1.339	1.280	1.238	1.155	1.152	1.120	1.023	1.000	1.000	1.000	1.000	1.000	1.000	1.013	1.065	1.079
65	1.694	1.597	1.440	1.354	1.294	1.252	1.200	1.178	1.132	1.025	1.000	1.000	1.000	1.000	1.000	1.000	1.015	1.076	1.091
70	1.719	1.619	1.458	1.376	1.320	1.278	1.227	1.207	1.148	1.029	1.000	1.000	1.000	1.000	1.000	1.000	1.019	1.091	1.110
75	1.719	1.619	1.458	1.384	1.334	1.296	1.262	1.236	1.158	1.030	1.000	1.000	1.000	1.000	1.000	1.000	1.020	1.101	1.121
80	1.745	1.623	1.471	1.399	1.344	1.303	1.267	1.246	1.160	1.030	1.000	1.000	1.000	1.000	1.000	1.000	1.022	1.107	1.128
85	1.745	1.623	1.471	1.399	1.344	1.303	1.268	1.247	1.160	1.030	1.000	1.000	1.000	1.000	1.000	1.000	1.022	1.108	1.130
90	1.745	1.623	1.471	1.399	1.344	1.303	1.268	1.247	1.160	1.030	1.000	1.000	1.000	1.000	1.000	1.000	1.022	1.108	1.130
95	1.745	1.623	1.471	1.399	1.344	1.303	1.268	1.247	1.160	1.030	1.000	1.000	1.000	1.000	1.000	1.000	1.022	1.108	1.130
100	1.745	1.623	1.471	1.399	1.344	1.303	1.268	1.247	1.160	1.030	1.000	1.000	1.000	1.000	1.000	1.000	1.022	1.108	1.130

Set **PE enable** to a value lower than what you see at idle (look at your previous idle scans), I set mine to 50 KPa and see 75-76 KPa at idle **(HPT > Engine > Fuel Control > Power Enrichment > Power Enrichment Pe Enable tables)**. In the same group of tables, set the **Delay RPM and Enable Torque** to Zero. I also made sure there was no "adders" adding fuel such as **"Add vs. ECT"** and **"Add vs. IAT"**. Doing all of this ensures you will actually be in **PE** Mode and subsequently **OL** at idle.

Disable STFT Open Loop **(HPT > Engine > Fuel Control > OL/CL > Open Loop > STFT Open Loop).** This is optional however did help me out for off idle transitions:

Set Closed loop proportional O2 error to (left to right):

Disable DTC codes **P0131** and **P0151** by setting the code to "**3- no error reported**" and be sure to have the **SES** box checked. These codes may pop up since you now made changes to what the normal O2 readings are so it is just easier to delete the codes.



Save the changes and Flash the PCM with the new settings…

Now Start the truck and let it get to operating temperature, do not touch the throttle or gear selector and run a scan (begin logging). Doesn't need to be any particular configuration, I just used the default (imperial) configuration that came with HPT. Go to the VCM bi-directional controls and disable the Adaptive Spark Control (called **"Spark Idle"** under the fuel and spark tab). Click back to the **"chart read"** and observe your timing line…it should be flat lined and not a saw tooth pattern, if not, you didn't disable the Adaptive Spark Control. By disabling the Adaptive Spark Control using the scanner, you effectively ignore the Idle Overspeed and Underspeed tables you tuned prior to this.

Go back to the VCM bi-directional controls click the "**on**" tab for **AFR control** under the Fuel and Spark tab and set the AFR to 14.7 (should by default be that). Raise this by 0.5 AFR and listen to idle quality. Keep raising this by 0.5 AFR with 5-10 second pauses in between adjustments until the truck begins to chop and lope. This means you have reached a lean condition and should stop there. Time to back off the AFR off by lowering it 0.1 AFR at a time until you have found the sweet spot for idle quality. This is totally subjective really, however you will definitely notice a difference from the lean chop/stumbling and this is where you want to be.

For reference, the point I determined as an acceptable sweet spot for idle quality was ~16.3 from the start point of 14.7 (same as the guy that coined this method). Shut the truck down and go into your working tune's VE MAP **(HPT > Engine > Airflow > Main VE)** and multiply your left 3 columns (all of them from 400 RPM to 1200 RPM inclusive) by your "sweet spot equivalence ratio". For example, 14.7/16.3=0.9. Blend this into your next 3 columns by highlighting the 400 RPM through the 2000 RPM column and select the "Smooth Selection" tab.

Save this file and re-flash the PCM. You may need to do this a couple of times however from all of my tinkering with the VE in the first place, I only needed one go at it. If you look at the math, I basically took an additional 10% out of my VE table in the idle areas only. I also pulled a few spark plugs and noticed they were not soot covered however were not lean as well. Being that I was effectively in Open Loop with this procedure, the fuel trims would leave the fueling alone and the motor runs nicely and wouldn't grow rich as it sits idling…and I could still use the LTFT for cruising.

Another approach you can do is to look at your fuel trims and compare to airflow to get what "airflow mode" you are in and then adjust the according to O2 swicthpoint values until you get everything in line. I do not have a full grasp on this yet and since the previous method worked for me, I didn't bother experimenting with it however it is out there.