

VTT Turbo Basics: The 600 whp N54 -what you gotta do to get there

C.J.Popovich 3/05/2017

So, you want 600 whp... We think every N54 powered vehicle should have 600 whp. Why not? 600 at the wheels is a good number; not so high that reliability and drivability become an issue, not so low that you're uncomfortably close to maxed stock turbo performance. There are always a variety of ways to achieve your goals, but we put together a quick list of things that will *definitely* get you to 600 whp and beyond. Each of the sections below has a few suggestions for products that we have direct and positive experience with. This doesn't mean other parts or brands won't work; it just means we *know* these parts *will* work. We'll break this article up into 5 sections; Engine Externals, Fueling, Turbos, Tune, and "Other Stuff".

Engine Externals: A great place to start in your quest for 600 whp is FBO or Full Bolt-On. This acronym can mean different things on different platforms but here we mean engine externals. We mean air filters, turbo inlets, turbos, (hot side) charge pipe, intercooler, (cold side) charge pipe, upgraded diverter or blow off valves, and a high flow turbo-back exhaust. There are many great options out there -but here is what we recommend:

Engine Externals:		
Air Filter	Dual Cone Filters	Tried, True, and inexpensive
Turbo Inlets	VTT Silicone Inlets	Huge airflow and durability
(hot side) Charge Pipe	VTT Silicone Charge Pipe	Not necessary for 600 whp but mandatory for GC family
FMIC	AD-e	We have had excellent results with the AD-e intercoolers
(cold side) Charge Pipe	Phoenix Racing	Inexpensive and functions well
BOV	RacePort, Tial, or Turbosmart BOV	All function well.
Downpipes	N54Tuning	Inexpensive and functions well
Exhaust	HKS/Corsa	Not needed for 600 whp on a 335i but sound is part of the experience. Tony loves his HKS, I love my Corsa.



VTT silicone inlets; high flow, high durability

Fueling: On the low-pressure side of things, you'll need at least a standard Stage 2 type low pressure fuel pump. We recommend Stage 3 (dual Walbro 450's) but especially on ethanol blends like E50, you could get by with a single Walbro 450 powered fuel pump. Once out of the fuel tank you have some choices. If you want to stick with Direct Injection for the benefits in efficiency and safety with OEM ECU control, you can run our Single Barrel Shotgun system, which is good for about 550 whp on 100% E85 and will do over 600 whp on ethanol blends (E60 or less). If you need more capacity our Double Barrel Shotgun is good for 750+ whp, but is overkill if you're looking for "just" 600 whp. Stepping away from Direct Injection, your other option is to go Port Injection, which is typically some sort of spacer placed between the intake manifold and the head, with provisions for 6 injectors (or one of many available intake manifolds with built-in port injection):

Fueling:		
DI Only: Ethanol Mixes		
LPFP	Single Walbro 450 based	Will support ≤ 600 whp on E60 or less
Supplemental HPFP	VTT Single Barrel Shotgun	Sufficient on ~E60 blends or less
DI Only: 100% E85		
LPFP	Double Walbro 450 based	Will support >600 whp on E85
Supplemental HPFP	VTT Double Barrel Shotgun	Capable of 800 whp on E85



VTT Shotgun kit main pieces

Fueling (cont'd):		
Port Injection: Ethanol Mixes		
LPFP	Single Walbro 450 based	Will support ≤ 600 whp on E60 or less
Port Injection	Fuel-it! /AD-e/VTT	Similarly priced and functional solutions
Port Injection: 100% E85		
LPFP	Double Walbro 450 based	Will support >600 whp on E85
Port Injection Plate	Fuel-it! /AD-e/VTT	Similarly priced and functional solutions
Pump Gas with Methanol Injection		
LPFP	Single Walbro 450 based	Will max out stock HPFP on pump gas
Methanol Injection Kit	Aquamist HFS-4	High end methanol injection system with many safety features



Prototype VTT Fueling Plate

Turbos: Now our favorite part; turbos. We'll present two choices from the VTT lab that will get you to 600 whp (and beyond). Let's start with the least expensive; our **Stage 2+** offering that we're bringing back Q2 2017. This utilizes our very own custom compressor and is VTT's highest output stock frame offering. Our other option for those seeking 600 whp is the **GC_{lites}**. These are the baby brothers to the GC's (which we recently hit 847 whp with!*). Nothing currently on the market will spool as well as the GC_{lites}, the lag is vanishingly low, and with the high flowing fully cast manifolds, back pressure is going to be reduced significantly over a stock frame design. The 2+'s get it done on a budget with a proven durable design capable of making a lot of power; the GC_{lites} are ridiculously responsive turbos that take drivability to a new level. Maximum airflow capability on the two turbos are similar but due to the high flow manifold, the GC_{lites} will flow the same power at a couple of pounds less boost (remember... boost is a measure of restriction!):

Turbos:		
Stage 2+	Custom VTT Compressor 9 Blade Turbine Stock Frame ~660 whp max	<i>Recommended Boost Pressure at 6500 RPM*</i> 16 psi 20 psi 24 psi 28 psi Overspeed 
GC_{lite}	TD04L-16T units 9 Blade Turbine Fully Cast Manifold ~660 whp max	<i>Recommended Boost Pressure at 6500 RPM*</i> 14 psi 18 psi 22 psi 26 psi Overspeed 



GC_{lite} turbos offer unmatched response... and are pretty

*assumes stock motor, FBO w/inlets, outlets, recommended FMIC, high flow exhaust, and no boost leaks

Tune: There are a variety of ways to tune a turbo vehicle, but we can give you some ballpark starting points for what it's going to take to crack 600 whp. Approximately 25-26 psi as read by MHD, targeting 10-12° of timing advance when at wide open throttle will get you there assuming all else is proper and your engine is healthy.

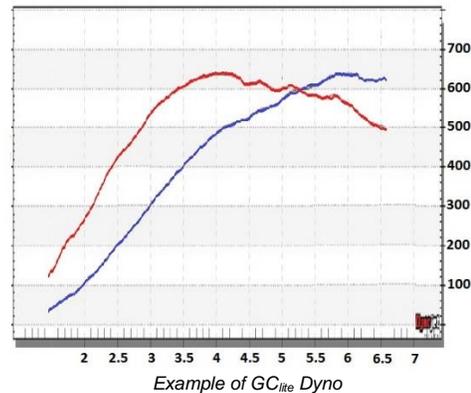
Air Fuel ratios will be about 11.9 or so on ethanol or ethanol blends, and if you're using race gas drop that a little to about the 11.5 range. Again, these are the sorts of things that tuners fight over; some guys like more fuel, more boost and less timing, others go the other way -our advice? Don't get caught up in the details, let the tuners do the tuning just make sure your car does what you want it to do and logs stay clean -especially on multiple passes. Our only comment with respect to tuning is that we at VTT have made nearly 800 whp on a stock motor without touching the knock tables, and we've blown up engines making much less power than that when we *did* touch those knock tables. Bottom line is that we don't recommend desensitizing knock sensors.

Other Stuff: If you have a manual transmission, you're going to want to switch over to a single mass flywheel and upgrade your clutch; we've used Spec Stage 3+, and Spec Twin Disk with no issues. The MFactory offering looks good but we haven't run one yet. If you are on a tight budget the 335is/550i clutch will hold 600 whp for a little while, but don't expect it to like launches or last long at all. If you're an auto, you'll at least want the Alpina flash, if not one of the forthcoming auto transmission solutions such as the soon-to-be-released Nizpro offering. Never a bad idea to get some fresh transmission fluid in there regardless of transmission type.

We are big fans of the tried and true NGK 5992, which has been replaced by NGK 95770. On the shop car, we use 0.018" gap, but for ~600 whp 0.022" should be ok. Take your time gapping them! As far as MAP sensors, we prefer to use the N20 engine 3.5 bar sensor. You'll need an adapter to splice it into the factory wiring, and BMS has this for a reasonable price. Regarding engine oil; increased power means increased heat, so we consider it very important not only to use a quality oil to start with, but also to change it often. We like Amsoil and Motul, and we change the oil every 3-4k. The PCV system on these cars can start to get tricky as power levels double the stock design, but for 600 whp a simple PCV valve upgrade and a catch-can are sufficient for most people to stay out of trouble. We have you covered for the PCV valve and once more we turn you to BMS for a reasonably priced and proven product with their catch can.

Final Thoughts: We hope you all have enjoyed this quick primer on how to get 600 whp out of your N54 powered vehicle. Feel like you're in over your head? Let us do the work for you at our shop in Hayward, CA. We're putting together VTT power packages where we provide everything you need to go from stock to 600 or even 700 whp -and don't worry, anything on the packages can be tweaked to your liking or even taken off the list if you already have some hardware you like. Check out our VTT600 package below. Remember, the turbos and components should always be matched to the power, reliability, and response goals of the customer. From mild to wild, let us know how we can help you sort out a package that will deliver what you're looking for. Thanks for reading!

VTT600 Package:			
Turbos	GC _{ite} or Stage 2+	LPFP	VTT Single Shot
Air Filter	VTT DCI	Additional Fueling	VTT PI or Shotgun HPFP
Turbo Inlets	VTT Silicone Inlets	Coils	Dephi
(hot side) Charge Pipe	VTT Silicone Charge Pipe	Spark Plugs	NGK 95770
FMIC	AD-e 650WHP	Tuner	MHD Android Device
(cold side) Charge Pipe	Phoenix Racing	Cable	DCAN and OTG
BOV	RacePort BOV	Map Sensor	N20 (plus harness)
Downpipes	N54Tuning	PCV Valve	VTT PCV



**Remain calm. We did everything we could to get 847 whp out of them; every single mod known and several unknown, including welding a v-band to the throttle body to eliminate any chance of boost leaks, prototype velocity stacks, a proprietary crankcase ventilation system (reduce crankcase pressure and you free up a small amount of horsepower) and some magic tricks we aren't going to write about in this article... if you want to do what we did, email us and we'll share.*