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Board-Blessed Boost

TURBONETICS SCORES ONE FOR '05-'09 MUSTANGS IN SMOG-STRINGENT STATES

By KJ Jones

Photos by KJ Jones and courtesy of GTR High Performance

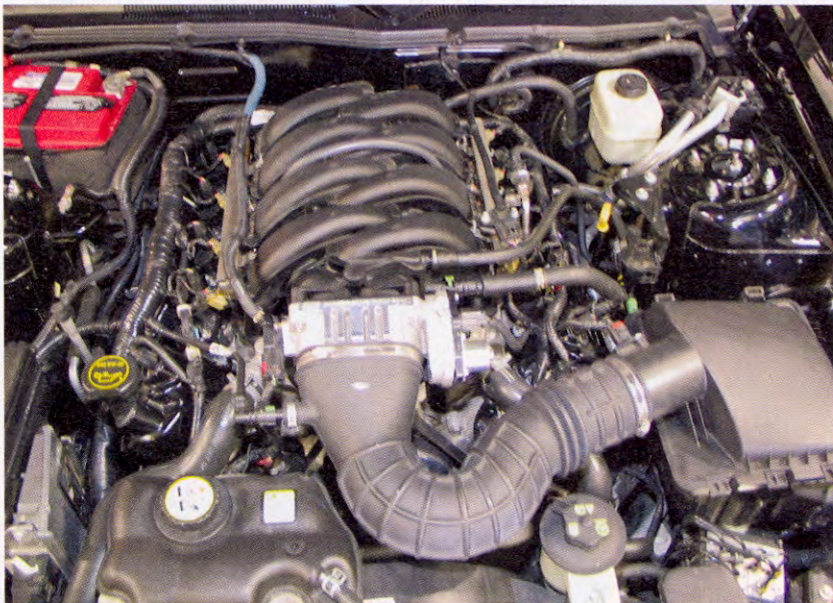
We've extolled the virtues and pitfalls of adding power adders to '79-'10 Mustangs for what honestly seems like an infinite number of times. Our work with nitrous, blowers, and turbo systems always includes giving you specifics on the amount of rear-wheel horsepower and torque they help generate. However, anti-pollution standards established by the California Air Resources Board put Cali enthusiasts in a tough spot, as installing one of the

Big Three power adders could put them at odds with the authorities. Officially, CARB's "smog laws," as the regulations are known throughout the world of high performance, are "designed to protect the environment and public health, and provide safe, clean air to all Californians by reducing emissions of air contaminants through the fair, consistent, and comprehensive enforcement of air pollution laws, and by providing training and compliance assistance," according to the organization's website (www.arb.ca.gov).

Most products designed to enhance an engine's performance require significant changes in fuel volume and timing advance that could cause engines to produce and emit carbon-dioxide levels greater than the CARB's accepted maximums for cars or trucks, based on their engine size. These limits create a catch-22 for enthusiasts craving performance, mainly because non-CARB-approved engine parts make bigger steam than smog-legal parts, and the board is extremely uptight about the amount of CO₂ vehicles emit (during an emissions

▲ While this 60mm T-40655 ceramic ball-bearing turbocharger is one of the highlights in Turbonetics' new single-turbo system for '05-'09 Mustang GTs (PN 15168-1; \$7,599), the fact that this bolt-on upgrade is 100 percent legal for use in all 50 states is the much bigger deal.

Horse Sense: By definition, California Air Resources Board-exempted parts are add-on or modified parts that have undergone CARB's engineering evaluation. If the part or modification is shown to not increase vehicle emissions, it's granted an exemption to emission-control system anti-tampering laws. This exemption is called an Executive Order, or EO. An EO allows the modification to be installed on specific emission-controlled vehicles. Every executive order part or modification has an assigned number that can be verified by Smog Check stations, Bureau of Automotive Repair referee stations, or directly by CARB.



▲ Our '06 test Pony's bone-stock, 4.6-liter Three-Valve engine laid down a paltry 272.94 horses and 298.16 lb-ft of torque at the rear wheels in baseline tests. Turbonetics' 9-psi system should bring those numbers up considerably. We'll see when we get this baby on GTR High Performance's Dynojet chassis dyno.

test). CARB's tough tests focus primarily on a fuel-injected engine's "cold-start" emissions output, which usually is predicated by the engine's basic running condition and emissions control equipment, as well as the calibration in the PCM.

Earning a coveted EO authorization number is a long and expensive process that most aftermarket companies don't pursue. From a dollars-and-cents perspective, the returns from sold products just don't justify the overall investment for making parts to meet the board's restrictive standards and still perform in the same manner as non-compliant hardware.

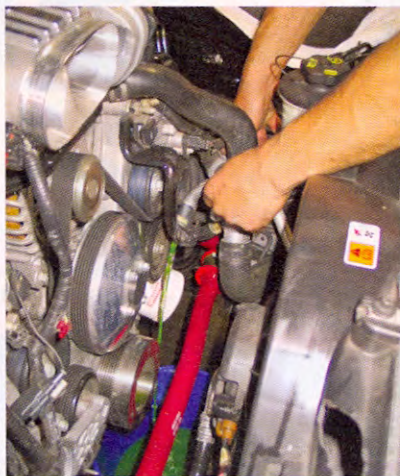
The hard reality is in order to be profitable, aftermarket performance-parts manufacturers must build for the masses in the entire U.S. and beyond, not exclusively for Mustang fans in the Golden State. And at the end of the day, improving a Pony's performance is what we're all about, and it's one of the main reasons why non-CARB-legal products are predominately featured in our tech reports.

As you know, making big steam usually is our primary goal during these types of exercises. Honestly, CARB's clean-burn attitude is the least of our concern. However, this doesn't mean we have absolutely no compassion for 'Stangbangers in California or any other state with tough smog laws. However, we're interested in working with new, cool CARB-approved hardware for late-model Mustangs. Faithful readers on the West Coast know such opportunities have been few and far between for many years. So when we received word that a turbocharged setup for late-model 'Stangs had received CARB's blessing, we knew right away that installing one and giving you

Continued on page 60



▲ Ricardo Topete of GTR High Performance in Rancho Cucamonga, California, performed the installation for us, which starts with securing the Mustang on a twin-post hoist, removing the battery completely, and then taking off the Pony's front bumper cover.



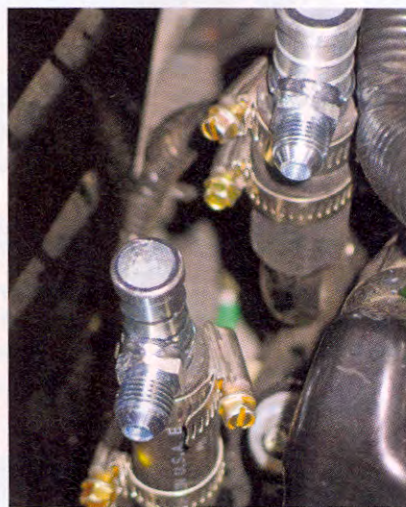
▲ Removing the coolant reservoir also is required. Ricardo uses a clean five-gallon pail to recover the antifreeze, as it will be reused once the turbo system is completely installed. The radiator brackets also are redrilled to relocate the radiator 3/4 inch forward for additional clearance.



▲ The PCM is briefly removed to facilitate tucking the main engine harness into a pocket of space along the inside of the passenger-side fender. Having the wires out of the way eases positioning the turbo kit's 3-inch downpipe a bit. An air-conditioning line also is bent below the radiator at this time, for sufficient up-pipe clearance.



▲ We mentioned fuel volume being an integral part of performance/engine upgrades for late-model, EFI Mustangs. Turbonetics provides new 39-lb/hr fuel injectors with each kit, a set of eight Autolite HT0 (colder heat-range) spark plugs, and the all-important PCM calibration (uploaded via a DiabloSport Predator handheld flash tuner prior to hitting the dyno) that keeps combustion and evaporative emissions within CARB's accepted parameters, despite higher fuel flow.



▲ Turbochargers included in most Mustang systems are both lubricated and cooled only by engine oil. Turbonetics takes one step further and adds additional water cooling for its S197 system. Hoses (CARB requires replacement hoses to have SAE J30R9 "zero permeability" rating) and these two AN -6 T adapters are incorporated into the factory heater plumbing to transfer coolant into and out of the turbo housing.



▲ On the oil side, yes, punching a hole in the pan (for a drainback line) is required. A punch and 3/8-inch NPT tapping tool are included. Note the use of thick grease on the tap, which helps keep metal shavings out of the oil pan when threads are being cut.



▲ Since the downpipe (the turbo's main hot-side tube) runs next to and below the passenger side of the engine, all wiring in those areas (starter, crank sensor, and so on) must be relocated or protected with tubing wrap. Wrapping wires and tubes is a tedious process, but it prevents damage to wiring due to extreme heat from the exhaust.



▲ These are our project 'Stang's OEM catalytic converters, which remain intact and unmodified with this CARB-legal turbo system. Despite the performance gains that come with removing these pieces and replacing them with H- or X-shaped crossover tubing, tampering with or removing cats is a huge no-no in any state. Without the converters, the Turbonetics Mustang system wouldn't stand a chance at being validated by CARB.



▲ The only cutting is done on the 'Stang's factory H-pipe tubing 2 1/2 inches back from the welds on each cat. With the exhaust section removed, Ricardo installs the turbo system's Y-pipe, which routes exhaust gas to the up-pipe and into the compressor housing on the turbocharger.



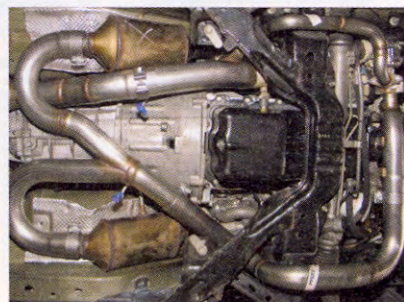
▲ Positioning the downpipe is a trial-and-error affair, as the 3-inch tube must be wrangled spot-on through a tight passageway between the engine and chassis. Notice the lip incorporated in the end of the pipe. Turbonetics includes a V-band clamp with the kit, which is used to secure the tube to the turbo's exhaust housing.



▲ This wastegate tubing tucks closely below the passenger-side A-arm and into the turbo system's exhaust tube. All of the stainless-steel/hot-side and aluminum/cold-side plumbing in Turbonetic's system is fully TIG welded. The system is designed with completely slip-fit pipes that are secured with 2.5-inch band clamps.



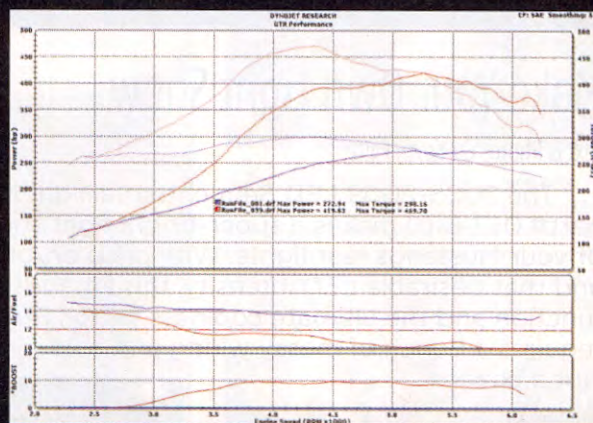
▲ Two brackets are affixed to the transmission and clamped on each side of the Y-pipe tubing, and help keep the tubing structure rigid and free of vibration against the Mustang's chassis.



▲ This is the under-car view of the completed myriad of the turbo kit's hot and cold tubing. A single Y-style tube channels exhaust from the downpipe and out to the tailpipes and mufflers. While fitment is good, the plumbing does require some finessing to install. It is strongly advised that you keep the clamps loose until all clearances and the final fitment are confirmed when installing this system.

After installing Turbonetics' CARB-legal, S197 turbocharger system on an '06 Mustang GT (stock engine, five-speed transmission), we definitely were anxious to see exactly what type of "clean" rear-wheel power and torque the huffer makes. For smog purposes and to provide general safety margins against detonation when California's 91-octane fuel (minimum octane permitted for the turbo system) is used, the company's tuning is a lot more conservative than non-smog-legal and custom calibrations we've worked with for power adders. However, although custom dyno tunes tend to be slightly leaner on the fuel side and have more timing advance, the plug-and-play PCM change that Turbonetics created is on the money overall, as both horsepower and especially torque levels show more-than-considerable gains with the bolt-on system.

The '05-'09 S197s, many of which are which are now beyond their warranty periods, have become attractive candidates for modification. Moreover, California performance enthusiasts have shied away from adding turbo systems on their Ponies for fear of incurring the wrath of



CARB. Turbonetics has put an end to the apprehension, as this turbo system gives stock 'Stangs the ability to run with the big dogs and pass state emissions inspections with flying colors.

RPM	BASELINE				TURBO					DIFFERENCE			
	HP	TQ	A/F	SPARK	HP	TQ	A/F	PSI	SPARK	HP	TQ	A/F	SPARK
2,600	129.58	261.75	14.62	23.05	132.44	267.52	13.77	0.00	17.04	2.86	5.77	-0.85	-6.01
2,800	142.28	266.87	14.48	24.74	152.85	286.67	13.48	0.51	16.55	10.57	19.80	-1.00	-8.19
3,000	152.23	266.51	14.27	26.27	174.20	304.95	12.92	2.13	16.77	21.97	38.44	-1.35	-9.50
3,200	162.51	266.73	14.13	27.76	199.94	328.10	12.20	4.54	17.64	37.43	61.37	-1.93	-10.12
3,400	177.26	273.82	14.14	27.74	230.36	355.81	11.53	6.25	17.69	53.10	81.99	-2.61	-10.05
3,600	195.47	285.17	14.11	27.50	268.29	391.33	11.40	7.75	16.98	72.82	106.16	-2.71	-10.52
3,800	207.35	286.58	13.93	27.50	312.88	432.40	11.57	9.45	15.18	105.53	145.82	-2.36	-12.32
4,000	223.33	293.24	13.67	27.25	347.41	456.16	11.49	9.44	14.12	124.08	162.92	-2.18	-13.13
4,200	237.67	297.21	13.58	27.24	373.09	466.55	11.42	8.99	13.65	135.42	169.34	-2.16	-13.59
4,400	249.19	297.46	13.40	26.42	391.52	467.37	11.12	9.25	12.98	142.33	169.91	-2.28	-13.44
4,600	256.65	293.04	13.25	25.05	391.37	446.88	10.63	9.44	12.23	134.72	153.84	-2.62	-12.82
4,800	263.69	288.54	13.24	25.43	396.52	433.88	10.44	9.25	12.00	132.83	145.34	-2.80	-13.43
5,000	269.49	283.08	13.20	26.59	404.93	425.33	10.15	9.48	12.00	135.44	142.25	-3.05	-14.59
5,200	272.54	275.28	13.27	26.07	416.98	421.15	10.13	8.52	12.00	144.44	145.87	-3.14	-14.07
5,400	267.22	259.91	13.36	23.71	411.86	400.60	10.50	8.54	12.26	144.64	140.69	-2.86	-11.45
5,600	271.85	254.96	13.43	22.73	404.08	378.98	10.57	7.72	12.93	132.23	124.02	-2.86	-9.80
5,800	271.11	245.50	13.34	19.97	391.82	354.81	10.00	7.77	13.91	120.71	109.31	-3.34	-6.06
6,000	269.52	235.93	13.22	20.20	365.65	320.09	10.00	7.50	14.26	96.13	84.16	-3.22	-5.94
6,200	268.26	227.25	13.23	20.25	362.94	307.47	0.00	0.00	14.75	94.68	80.22	-13.23	-5.50



▲ Before dyno testing, Turbonetics' "smog-legal" calibration is loaded into the 'Stang's PCM via a DiabloSport Predator handheld flash tuner, which is included with each kit. The plug-and-play tune is the result of more than a year of development by engineers at Turbonetics. They were challenged with improving power and torque on an '05-'09 Mustang GT's stock pump-gas (91-octane), Three-Valve, 4.6-liter engine without increasing combustion or evaporative emissions; more than 150 different parameters had to be adjusted to make the system operate properly.



▲ Upon completion of the installation, this is the decal that is affixed to an S197's radiator cover, letting state smog inspectors and all others know that your Mustang's boost is backed by the board. Turbonetics' V-6 Mustang turbo system (PN 15184) also has been given CARB's approval, and feeds six-popper Ponies enough oats to make rear-wheel steam that rivals their V-8 brothers power, in bone-stock trim.

all the intelligence was mandatory!

The actual hardware in Turbonetics' '05-'09 Mustang GT turbo system (PN 15168-1; \$7,599) really isn't "new," per se. The fact that this bolt-on boost kit is the first of its kind to be approved by CARB makes it worth covering.

We found a perfect candidate for testing in a stock, five-speed, '06 Mustang GT

that GTR High Performance regularly services. Installing the turbo system is quite involved (the kit's detailed manual is nearly 100 pages long); it isn't a recommended DIY install unless you have a twin-post hoist and complete shop facilities at home. GTR co-owner Ricardo Topete handled the wrenchwork and dyno testing for us.

While we can't show every step of the bolt-on process, these photos and cap-

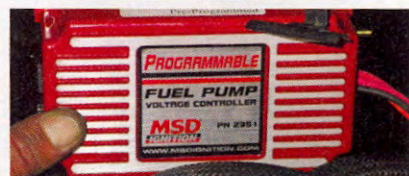
tions depict some of the CARB-legal turbo system's key features, important facets of its installation, and our dyno results. One thing we really like about this kit is that all of its brackets attach to existing factory positions (holes, studs, and so on), so there's no drilling or elaborate fabricating required, and all of an S197's original accessory equipment, including air conditioning, is unfazed by the turbo system. **5.0**



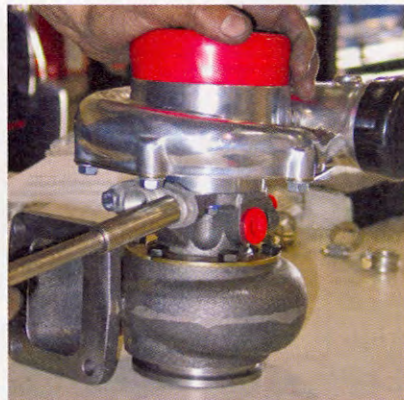
▲ Turbonetics' external Evolution wastegate is outfitted with a spring that regulates boost at a maximum 9 psi. In the event boost falls a bit shy of the number upon initial startup and testing, the 'gate can be adjusted by loosening the jam nut and turning the Allen screw clockwise in small increments to raise boost pressure.



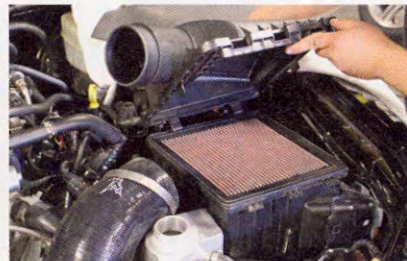
▲ Turbocharged air is cooled with a four-core, front-mount, air-to-air intercooler. The Sparco unit is huge (measuring 3 1/2 x 12 inches), but it bolts in cleanly behind the front bumper support using brackets that are included with the turbo system.



▲ In addition to the bigger fuel injectors, an MSD fuel-pump controller is provided to ensure air/fuel remains on the rich side when boost climbs. The controller is pre-programmed by Turbonetics, so installation is as simple as mounting, wiring, and providing a boost signal for it to function.



▲ A small amount of bench assembly is required before mounting the turbocharger. Ricardo adds the included fittings for oil and coolant lines, and then places the turbocharger on a stainless-steel gasket that sits on its mounting plate. Mock fitting the turbo is mandatory, as the compressor housing must be clocked for proper discharge-to-intercooler tubing alignment.



▲ CARB mandates using the factory's airbox for the turbocharger system, for the hydrocarbon absorption mat below its lid. However, the stock paper air-filter element is replaced with this drop-in, high-flow piece. A clean, leak-free airbox-to-turbocharger connection is made with a silicon coupling hose that also comes with the kit.



▲ Tubing and such make for a crowded area at the front of the engine bay, and thus requires relocating an S197's coolant reservoir. A clean aluminum replacement canister comes with the Turbonetics package. The reservoir gets its footing from bands that secure the power-steering-fluid container on the driver side of the engine compartment.



▲ Once the turbo is final-mounted and all of the tubing and clamps are confirmed secure and tight, this is how an S197's engine bay looks with Turbonetics' CARB-legal turbo system installed. This 60mm system can be upgraded to 78mm and support more than 700 rear-wheel horses. But, of course, a stout engine with forged internals is required, and that upgrade technically is *not* approved by the board.

SOURCES 5.0

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