GM High-Tech PERFORMANCE
ELECTRONICALLY REPRINTED FROM MARCH 1, 2008

NITROUS
PRESSURE GAMES

TESTING NITROGEN ASSISTED NITROUS OXIDE'S KIT

BY **RANDALL D. ALLEN** // PHOTOGRAPHY BY THE AUTHOR

Nitrous oxide, commonly referred to by its chemical composition, N_2O, is made up of two parts nitrogen and one part oxygen. When used in automotive applications, introducing the substance into the internal-combustion engine allows greater cylinder fill, and with it the potential for tremendous power gains, assuming that proper fuel delivery is maintained over the rpm range in which the nitrous oxide system is employed. For all the tremendous power benefits of nitrous, it would be fair to say that nitrous use, especially under higher-output systems, comes with the risks and common problems encountered by a majority of enthusiasts. Right at the top of the list is inconsistent performance caused by the basics of the nitrous system itself.

In order to operate at peak efficiency, a nitrous system is calibrated for a specific bottle pressure. According to Tom Darnell Jr., company co-owner of Nitrogen Assisted Nitrous Systems (NANO), nitrous manufacturers typically target bottle pressures of between 950–1,050 pounds of pressure in kits. Above the calibrated pressures, more nitrous is introduced into the engine due to higher pressures, resulting in the air/fuel ratio leaning out. Conversely, at pressures under the target, less nitrous is introduced, resulting in rich conditions. As the level of nitrous in the bottle(s) change, so too will the resulting bottle pressure. As both the amount of liquid and the bottle pressure vary with use and atmospheric conditions, variables are introduced that lead to inconsistent performance, sometimes with disastrous results.

In order to combat the variables that have plagued nitrous users for decades, NANO developed a bolt-on nitrous regulation system (patent pending) that controls both the nitrous oxide density and bottle pressure. Tom Darnell relates, "By piggybacking a cylinder filled with either high-pressure air or high-pressure nitrogen onto ei-

ther a standard 10- or 15-pound nitrous bottle inline with the nitrous, the high-pressure gas ensures that the bottle pressure remains constant. In addition to consistent bottle pressures, the high pressure (air or nitrogen) forces all the contents of the nitrous bottle out, allowing the user to make additional runs, as every drop of nitrous will be expended. For years the only real management of bottle pressure has been the use of a bottle heater, and to a lesser degree, a bottle cooler."

Strap yourselves in as we roll on over to Real Performance Motorsports (RPM) in Lewisville, Texas, and dyno-test a '02 Formula owned by Larry Morris of Denton, Texas, on RPM's DynoJet 248 chassis dyno. In addition to hitting this 6.0-liter nitrous-huffing mill with a 175-dry shot, we go for broke and fog it to the tune of a 300-horse shot. In addition to dyno testing, it's off to Texas Raceway in Kennedale, Texas, to test the effectiveness of the NANO system on a single shot. Will the NANO system perform as advertised? And if so, could we unload a bottle heater, propane torch, and a slew of accessories to return our investment?

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The Nitrogen Assisted Nitrous Oxide (NANO) Universal Add-On Kit (PN NANO01, $569) is available from NANO direct or through a select set of distributors. The kit contains a DOT-certified high-pressure bottle, a Mass-Flow regulator system, and an anti-reversion check valve. A 12-inch braided supply line, mounting brackets, and detailed installation instructions round out the kit.

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The NANO kit fits any approved 10-pound nitrous bottle, and for an additional $35 you can upgrade to a kit designed for 15-pound bottles. Installing the kit begins by removing the siphon tube from the nitrous bottle. After ensuring the contents of the nitrous bottle are empty, remove the old siphon tube with an adjustable wrench and secure the NANO tube to the nitrous bottle.

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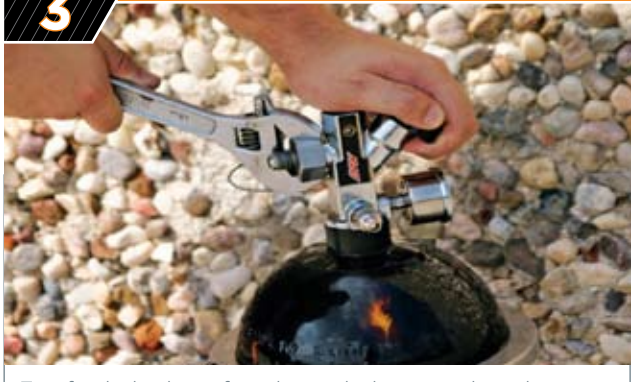

Transfer the bottle nut from the standard nitrous siphon tube over to the NANO system.

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Once complete, get out the NANO cylinder, which is equipped with a Nitrous Pressure Compensator that features an On/Off knob and a 6,000-psi pressure gauge. Direct from NANO, the cylinder was full of high-pressure air (HPA) and was set to 4,500 psi. Although high-pressure nitrogen (HPN) may be used, NANO recommends HPA, as it is readily available and typically $3-$5 at most paintball and scuba shops. In addition, if you are pals with any firefighters, inquire about the SCBA re-fillers common at almost any fire station across the country.

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Connect the included 12-inch HPA supply line and attach it to the NANO cylinder with a 7/16-inch wrench.

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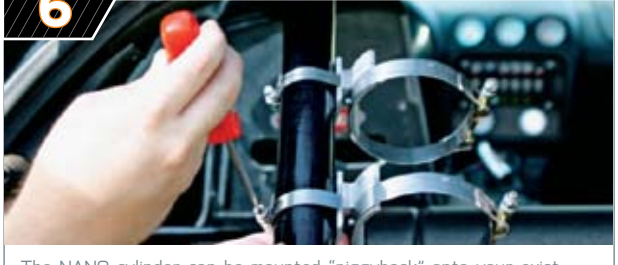

The NANO cylinder can be mounted "piggyback" onto your existing nitrous bottle or anywhere within the range of the 12-inch hose. Since the '02 TA's nitrous bottle was equipped with a Wolfe Racecraft 10-point rollcage, the driver-side tube proved to be the perfect place to mount the two supplied brackets.

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After verifying the 12-inch supply line would reach the nitrous bottle, the NANO bottle is centered in the mounting brackets.

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A 1/2-inch socket secures the bottle.

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Equipped with an Aerospace Components billet nitrous bottle bracket, the owner slips the bottle into the bracket and inserts the mounting pins.

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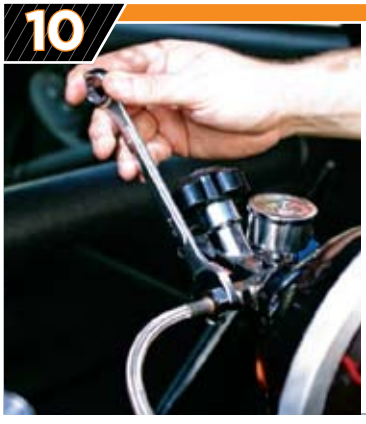

While the NANO regulator is turned off, the 12-inch supply line is fitted to the nitrous bottle with an 11/16-inch wrench. In addition to pressurizing the system once the valve is opened, it should be noted that the NANO system contains an anti-reversion valve at this connection. In layman's terms, you won't lose precious nitrous or HPA when disconnecting the nitrous bottle in order to refill it.

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The nitrous line that feeds the engine is then screwed onto the bottle nipple and tightened. The universal kit utilizes a modified NOS SuperHiFlo valve that will sustain a flow rate of 0.45 pounds of nitrous oxide per second. According to Darnell, "This typically takes care of up to 550 hp (a 550 shot), and for even greater nitrous flow, our Evil-Twin kit will flow .70 pounds per second, good for roughly 850 hp."

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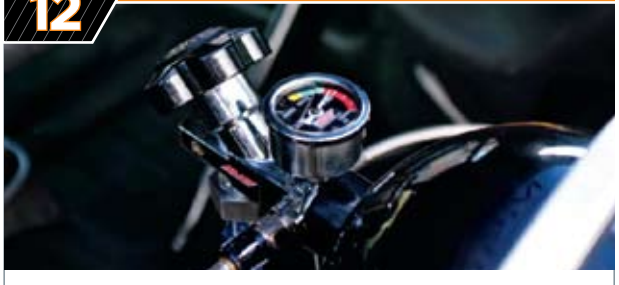

Once the system was hooked up and all the fittings were double-checked to be tight, the NANO bottle and the nitrous bottle valves were opened. After verifying that no leaks existed, the NANO-supplied liquid-filled bottle pressure gauge showed 1,150 psi.

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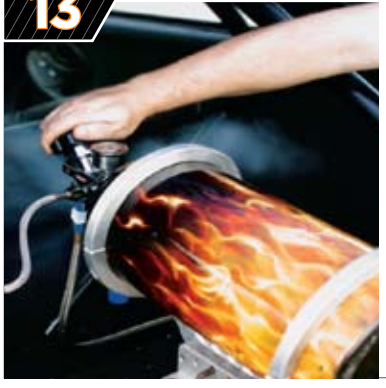

Since the NANO bottle itself was pre-set to 1,050 psi, the direct and indirect heat that had accumulated in the nitrous bottle had raised the pressure. In order to reduce the pressure to the manufacturer's recommendation of 1,050 psi, the NANO bottle valve was closed and the nitrous supply line was loosened until enough nitrous was purged to achieve the target.

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In addition to verifying that 1,050 psi registered at the nitrous bottle with the NANO turned on, an Auto Meter Phantom nitrous pressure gauge mounted in the 'Bird's A/C vent was read to verify that both gauges showed equivalent pressure.

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Upon installation completion, the NANO system is quite unobtrusive, and a single bottle will typically support nitrous usage for up to 15 pounds. In addition to being pre-set at 1,050 psi, the regulator on the NANO cylinder is adjustable plus or minus 200 psi in 50-psi increments, allowing even further refinement. According to Darnell, "We tell customers that if they want to maintain their current level of performance, they should pill down their nitrous jets by about 20 percent." Although a new nitrous tune isn't mandatory, it's highly recommended if you choose to utilize the same jetting.

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The subject test car is owned by Larry Morris, a business development manager. Purchased new and now wearing a scant 40,000 miles, the '02 Formula utilizes a 6.0L iron-block motor with Lunati Pro-Mod rods and custom Diamond pistons. LPE prepared the heads and flowed them to Stage II specs. Real Performance Motorsports installed a custom dry two-stage nitrous system that incorporates NX Ice Man Pro solenoids.

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Each nitrous solenoid is plumbed into a distribution block, where custom steel lines and a proprietary nozzle distribution system spray nitrous into a "Fast Toys Ram Air Box" that gets gulped up and into the induction system. Other than a Walbro 255-lph in-tank pump and a supplementary Walbro booster pump, custom tuning by RPM and 60-pound MSD injectors easily handle up to a 300-shot.

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Equipped with a TH400 transmission and Precision Industries 3,400-stall torque converter, the Formula launches off the transbrake and will lift the wheels without any effort. As an aside, numerous track sessions were needed to dial in the suspension package to allow repeatability in testing. Testing netted the Formula a respectable .06-second eighth-mile average improvement, but more importantly, over 2 mph!

DRAG RESULTS

Tests were at Texas Raceway in Kennedale, Texas, which features a well-prepared eighth-mile track. In order to ensure consistency in testing, two full 10-pound nitrous bottles were brought to the test site. Both bottles were manufactured by Nitrous Express; the only difference was that one bottle was set up with NANO-supplied hardware. For the initial set of tests, the bottle without NANO was tested. Prior to staging, a bottle heater was employed to raise the nitrous pressure to 1,200 psi, and upon purging the bottle pressure dropped to the manufacturer's recommendation of 1,050 psi. At the completion of each run the bottle heater was turned back on and the process was repeated for the three recorded runs. In all runs the bottle pressure was 1,050 psi upon launch, and it fell to 850 psi at the end of the track.

For the NANO tests, no bottle heater was used. Upon opening the NANO and setting the pressure to 1,050 psi, the bottle maintained that pressure after purging. A total of three runs were recorded with the NANO and the bottle pressure remained at 1,050 from the beginning to the end of the run.

INFO	BASELINE	NANO	
Temperature (F)	82.9	81.0	
Barometric Pressure	29.74	29.75	
	BASELINE	**NANO**	**GAIN**
60-foot Time Best	1.35	1.32	.03
60-foot Time Avg.	1.36	1.33	.03
1/8th-Mile mph Best	111.05	112.83	1.78
1/8th-Mile mph Avg.	110.63	112.73	2.10
1/8th-mile Time Best	6.15	6.08	.07
1/8th-mile Time Avg.	6.16	6.10	.06

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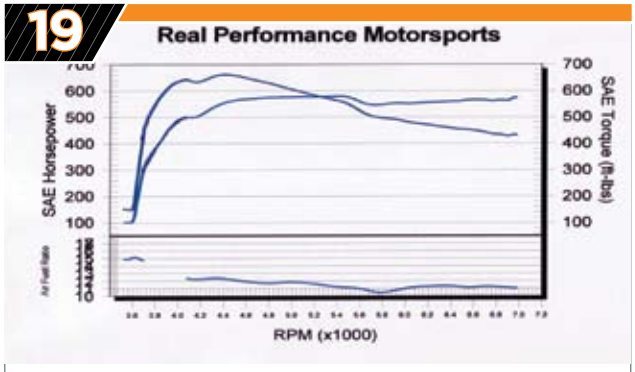

On the dyno without the use of NANO, the Formula pulled down a respectable 579.2hp peak at 5,400 rpm with 661.4 lb-ft of torque at 4,400 with a 175-shot. The variability in horsepower above 5,400 and the fluctuations in air/fuel ratio are typical of nitrous cars.

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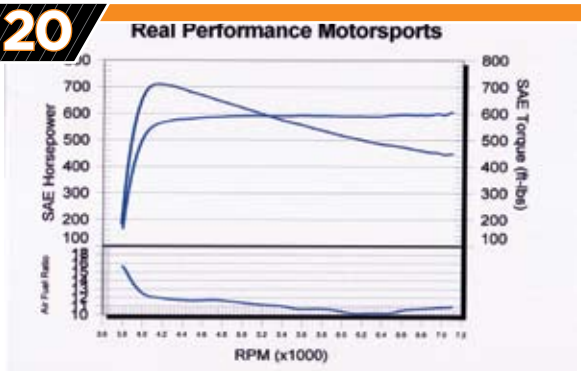

After turning on the NANO and purging the system to 1,050 psi, the rowdy 244/248 RPM VI camshaft used every bit of its .612/.615 lift and blistered out 604.5 hp and 708.7 lb-ft of torque, netting gains attributable to the NANO system at 25.3 and 47.3 respectively.

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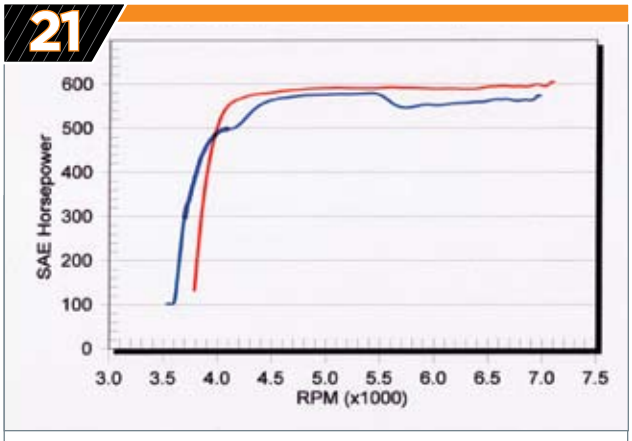

A comparison of the baseline run and the NANO-enabled run for horsepower clearly shows the peak and average gains attributable to the system. Although we expected the NANO system would improve top end horsepower, the assist that the NANO system gave should not be discounted when the 6.0L motor was fully loaded at the beginning of the pull. Although it's clear that the baseline run's converter flash occurred earlier in the pull, the absence of a "temporary" dip in power coming out of the converter flash on the NANO pull keeps the air/fuel ratio in the safe zone.

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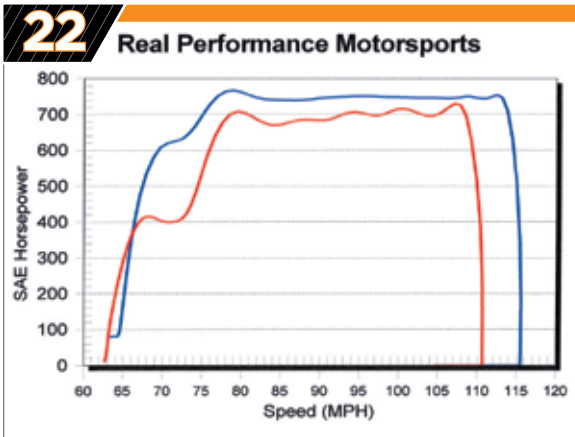

A final pull was made to test the NANO on the dyno, this time with a 300-shot. Although torque didn't register properly, a gain of 47.5 hp was attributable to the NANO over a non-NANO pull. Even on a 300-shot, the horsepower curve is almost dead flat as opposed to the drunk-man's S-graph as depicted without the NANO. Although it is tempting to "pill" your car up, think twice without NANO, as the cylinder pressures and pounding your rods are taking as they cycle through this type of abuse are portents of a wicked storm a brewin'!

CONCLUSION

After getting out the components of the NANO kit, it was apparent that installation was going to be a snap. Any enthusiast who owns an adjustable wrench and a few hand tools can easily install the system in 15 minutes or less. The biggest decision to make when installing the system is whether to piggyback the NANO high-pressure air/high-pressure nitrogen cylinder onto your existing nitrous bottle or mount it in an adjacent area such as a rollbar.

After witnessing the first pull on the dyno, where the fluctuations in the horsepower and torque curves as the rpm was elevated and the bottle pressure started dropping without the NANO system enabled, it worried me that the air/fuel ratio was on a march upward once the engine crested 6,000 rpm. Bottle pressure had dipped on a full bottle from a pre-dyno pull psi of 1,050 all the way down to 850. Clearly, to get the bottle back up to 1,050, a bottle-heater or track-side "propane torch" would have been necessary, but as the contents of the bottle declined, the air/fuel ratio would have steadily increased. In contrast, when the NANO system's valve was opened and the on-board regulator was set to 1,050, the engine maintained that nitrous pressure for the duration of the dyno run. **Simply maintaining a constant pressure over the duration of the dyno run resulted in outstanding gains of 25.3 horsepower and 47.3 lb-ft of torque. Subsequent pulls on the dyno as the contents of the bottle decreased showed no changes in torque or horsepower output. Simply put, the NANO system worked.** As the size of the nitrous shot increases, so too does the variability in output due to the amount of nitrous being flowed to the engine. Although no tuning was completed for this article, one look at the horsepower chart

for the 300-shot shows none of the wild variability in power production sans the NANO. A gain of 47.5 hp on the 300-shot was impressive. Track testing was conducted only on a 175-shot, mainly because it was first necessary to be able to pull consistent 60-foot and eighth-mile times without the NANO before testing could begin. Although eighth-mile times averaged just under a tenth better, the real potential of the system can be seen in mph and mph average with and without NANO. **Running close to 2 mph faster in the eighth-mile shows that the horsepower and torque gains shown on the dyno were pretty much on the money. Had time permitted, it's entirely possible the car could have picked up 1.5 to 2 tenths running the 1,320.**

If you are a dyed-in-the-wool nitrous junkie who either occasionally squeezes your car on a Saturday-night cruise or heads out to the track to run as hard as possible, strongly consider the NANO system. HPA is readily available for a minimal cost at any paintball or scuba shop, and the benefits of making reliable, repeatable power far outweigh the cost of the system. According to Darnell, "Our customers rave about the consistency they achieve with the system. No longer does a racer or enthusiast have to fight inconsistent air/fuel ratios at the top of the track with potentially catastrophic consequences." Even if you were racing in Antarctica, a bottle heater wouldn't be necessary, as the high-pressure air will put your nitrous pressure at whatever you set it at. In addition to consistent track passes, every drop of nitrous is utilized. For those of you hesitant to run nitrous on your LS-series mill, think again, as the days of running inconsistent times at the track or leaning out your motor after you miscount the number of times you juiced up your ride are distant memories.

DYNO RESULTS

Tests were conducted on a Dynojet 248 chassis dynamometer equipped with a wide-band O_2 sensor. All horsepower and torque readings were converted back to SAE. Average horsepower and torque were taken from 4,100–6,900 rpm. Since the TA was equipped with a Turbo 400 automatic transmission and a 3,400-stall Vigilante torque converter, the car was pulled in Third gear. Rather than simply romping on it, which caused the car to downshift into Second (and invalidate the dyno pull), the throttle was eased down until just over 3,400 rpm and then mashed to the gunwales.

CONFIGURATION–175 SHOT

INFO	BASELINE	NANO	
Intake Air Temp Deg	100.2	98.7	
Vapor Pressure (In. Hg)	.46	.47	
Barometric Pressure	29.37	29.34	
Correction Factor (SAE)	1.04	1.04	
Air/Fuel ratio Avg.	11.6	11.3	
	BASELINE	NANO	GAIN
Horsepower	579.2	604.5	25.3
Average Horsepower	559.3	587.5	28.2
Torque	661.4	708.7	47.3
Average Torque	546.0	573.5	27.4

CONFIGURATION–300 SHOT

Info	BASELINE	NANO	
Intake Air Temp Deg	111.2	100.3	
Vapor Pressure (In.Hg)	.32	.29	
Barometric Pressure	30.19	29.52	
Correction Factor (SAE)	1.01	1.03	
Air/Fuel ratio Avg.	11.4	11.3	
	BASELINE	NANO	GAIN
Horsepower	714.3	761.8	47.5

NITROGEN ASSISTED NITROUS OXIDE

NANO Nitrous LLC 785-331-2390
www.nanonitrous.com sales@nanonitrous.com