INSIDE: SCOOT! HOLIDAY GIFT GUIDE

www.scootmagazine.com • Scoot! Issue 48

Scoot! Magazine

In This Issue:

SCOOT 911!

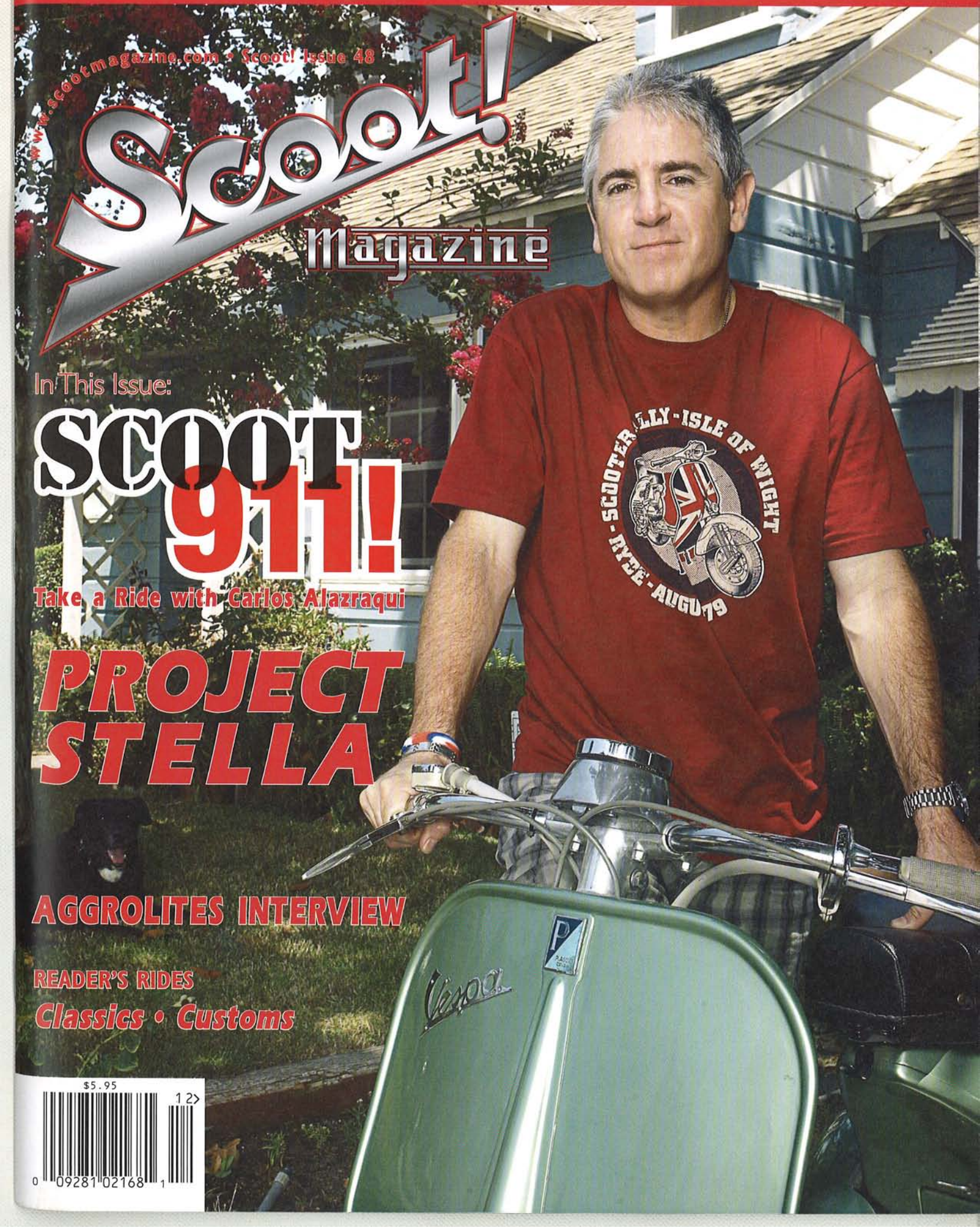
Take a Ride with Carlos Alazraqui

PROJECT STELLA

AGGROLITES INTERVIEW

READER'S RIDES

Classics • Customs



$5.95
12
0 09281 02168 1

Project Stella

Project Stella was initiated by Bald John of GGR Scooters in Tucson, AZ. Bald John approached Paolo Cividino and Tony Simoni in early 2008. The goal was to evaluate a number of performance tests for Genuine Scooter Company's Stella scooter.

The driving force behind this project is Paolo Cividino. Paolo is a metal fabricator by trade and it is very apparent if you have seen any of his in his show winning scooters. Perhaps you've seen his green smallframe vespa featured in the Dec. 2007 issue of *Scoot! Magazine*. Paolo began mixing his fabricating skills with his passion for scooters in 1990. And then there is Tony Simoni. This project could not have gone anywhere without this guy. Tony's experience with two-stroke racing engines dates back to 1985 and he started working with scooter racing engines in 1992. Tony is a mechanical engineer by trade and his biggest passion is 2-stroke exhausts. Tony's reputation among the scooter and performance community was priceless.

The Stella Project couldn't have been pulled off without the faith and contributions of the people and companies who donated many of the parts being tested. Bald John of GGR & Motorsport Scooters provided much of the products tested. Everyone has heard of Hot Rod Al Harpham, his reputation speaks for itself. As far as we know, Hot Rod Al is the first real tuner and builder to recognize the potential of the Stella scooter and the demand for performance Stella parts. Keep in mind Hot Rod Scooters is in California, where Stellas aren't even sold! Props from the entire Stella community go out to Hot Rod Al for leading the way and offering his experience during this project. Stellas are very similar to the P-series Vespa, but there are differences. Let's test 'em! In addition to the major sponsor Motorsport Scooters and GGR Scooters, a huge thank-you goes to SIP, PM Tuning, and Chicago Scooter Works for sending us all the pipes we were sent to test.

Stellas are sold in 49 US states (sorry Cali) by Genuine Scooter Company (sister company to Scooterworks) since 2002. The 2008 Stella boasts a few improvements. This include a halogen headlamp, better paint with new colors, Gabriel shocks front and rear for a softer ride, Continental Zippy 1 tires, and much better handlebar grips. The Stella scooter is only known as the 'Stella' in the USA. Everywhere else the Stella is known as the 'LML Star'. LML stopped producing scooters in late 2005, but kick started production in late 2007 and are still producing them today.

Here are some basic Stella Specifications:

Engine	Single cylinder, two-stroke, forced air cooled with rotary distribution, 5 transfer ports, and reed valve induction with catalytic converter.
Displacement	149.56 cc
Bore / Stroke	57.8 mm / 57.0 mm
Compression ratio	9.0 +/- 0.5 : 1
Maximum output/Power	10 +/- 0.3 bhp @ 5500 +/- 200 RPM
Ignition	Electronic, Capacitor Discharge
Ignition timing	20 +/- 2 before TDC
Vehicle Speed	60+ mph in 4th gear

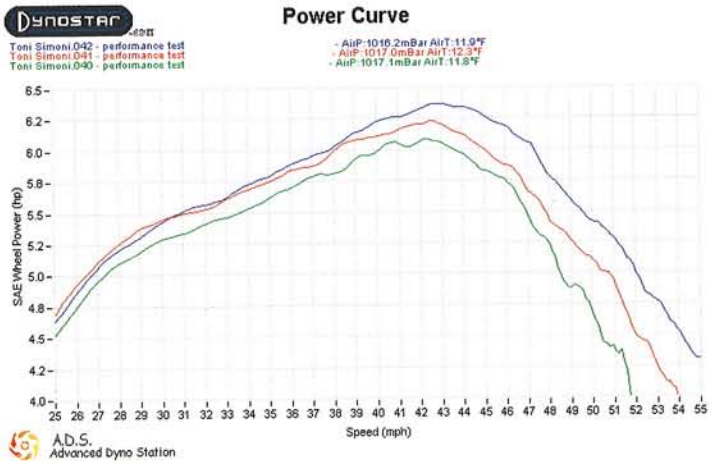
Project Goals: Compare stock performance with popular bolt-on performance options. 1- Carburetor jetting and air filters for a stock Stella. 2- Exhaust Pipes. 3- Cylinder Kits. 4- 20, 24, and 26 mm Carburetors. The goal is to provide sound performance recommendations to Stella owners and scooter shops to help them in determining what is best for a Stella scooter.

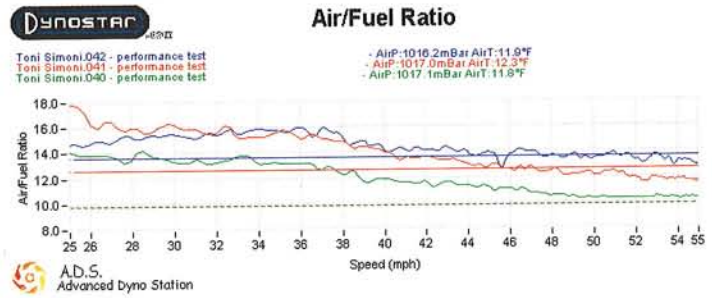
The following tests were done on 4 separate days. More than 150 dyno runs were made and many were repeated to ensure the accuracy of the results. Each run was made in 4th gear with wide open throttle. An air fuel (A/F) sensor was used to ensure accurate jetting throughout the tests. Horsepower (HP) is calculated from torque values and for this article we will show HP and not torque. MPH will also be used instead of RPM. It was determined speed is easier for most to relate to. The tests were performed in the preferred sequence of upgrades. Preferred sequence refers to an order of upgrades complimenting performance increase. The Dyno Star brand dynometer used for the Stella Project is owned by Karl Engellenner of Motorcycle Machinist Specialties in Sacramento, CA.

After each dyno session a road test was performed to examine tangible performance gains using a Digatron model "54K Max" data acquisition device. The Digatron can record many vehicle statistics. Road speed (MPH), head temperature (CHT), and RPM are the focus of Project Stella. Road Speed is important because a dyno graph will yield a power curve that goes well beyond a scooter's 'road condition' capabilities. The road tests were performed with a 230lb rider sitting upright, wide open throttle, on a flat road. Our test Stella speedometer read 5 MPH faster at a true 50 MPH (about 5700 RPM). The Digatron speedometer was calibrated with the dynometer. Cylinder head temperature was monitored to ensure temperatures stayed below 350°F to prevent an engine seizure.

Below is an example of a Digatron output graph for a stock Stella with PM Tuning exhaust pipe. The spikes in RPM (purple) are from gear shifts. Top MPH (grey) can be extracted at the point where a flat line occurs. Cylinder head temperature CHT (green) tends to increase when speed is at its maximum and eventually settles into a max plateau of 310°F with this set up.

Test 1: Stock Stella with air filter & jetting changes



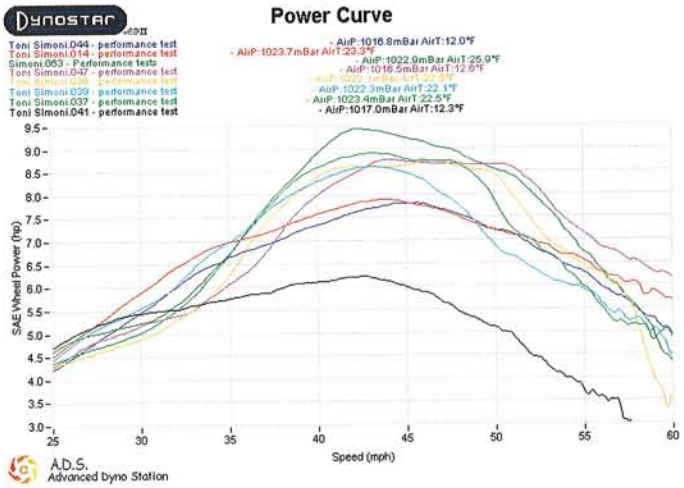


Green: Factory supplied blue air filter with factory jetting. (40/130 slow running jet, E3 mixer tube, 120 air corrector jet, and 94 main jet)
Red: P200 air filter with Bald John's Jetting as published on the StellaSpeed.com forum (55/160 slow running jet, 160 air corrector jet, BE3 mixer tube, and 100 main jet).
Blue: T-5 air filter with the 55/160 slow running jet, 160 air corrector jet, BE3 mixer tube, and 100 main jet.

Comments: Prior to modifying the stock configuration, the Stella was placed on the dyno and many carburetors adjustments were done. Using an air A/F exhaust sensor, carburetor jetting was easy to monitor. A flat A/F curve between 12.5 and 13.5 is typically the goal, but a flat curve was not possible no matter what jet changes were made to any of these changes. After 20+ dyno runs the best A/F curve was determined as making the best power and was used as a guide on all subsequent tests. The stock supplied 20/20 Spaco carb comes with an odd "E3" atomizer jet and restrictive blue screened air filter. It was not possible to adjust the jetting to yield a more power with the E3 mixer and blue air filter. Switching to the P200 air filter and different jets yielded a leaner (higher A/F) curve with a little power gain. The P200 air filter is less restrictive because of its course mesh. Top road speed increased from 51 to 52 MPH. Switching to the T-5 air filter improved both the A/F and power curves. The T-5 filter fit nicely onto the 20/20 carb because the inlet of the carb is 24mm (the throat of the carburetor is 20mm), however the carb box lib will not fit because the T-5 filter is 10mm taller. The T-5 air filter has a smooth rounded ledge around the air inlet to the carburetor and gave an even flatter Air Fuel curve. This test was done out of curiosity and should be noted that the carb box lid will not fit with the T-5 air filter. All subsequent tests performed were made with P200 filter and carb box lid attached. 53 MPH was achieved by switching to the T-5 air filter.

Test 2: Exhaust pipes

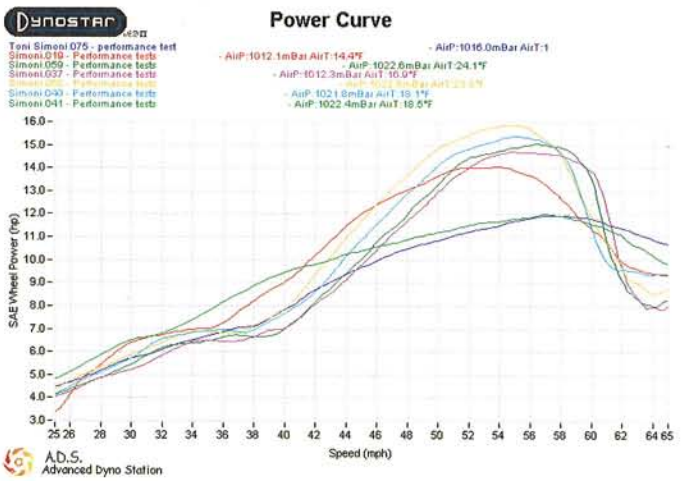
Exhaust tests using the stock Stella cylinder:



Black: Stock
Dark Blue: Polini
Red: Sito Plus
Light Blue: Simonini
Yellow: Prima
Magenta: PM Tuning
Light Green: JL
Dark Green: 226

Comments: The stock exhaust was used as the baseline. Only carburetor jet changes were done to obtain best power for each pipe for each of the pipe tests. The stock Stella exhaust is quiet and has a very restrictive built-in catalytic converter in the header. The Sito Plus was considerably louder with a 'stock-type' heavy duty construction similar to the stock exhaust. The Sito Plus increases the power output nicely, and delivers a 54 MPH top speed. The Simonini pipe starts to unleash the power of the Stella. It is a lighter construction pipe, and mounts on the right side. The Polini pipe has the same construction as the Simonini and has slightly less in power over the Sito Plus. The top finishers are definitely the JL, the Prima, the 226, and the PM Tuning exhaust. All are very nice performance exhausts and all yielded approximately 57 MPH on our tests. SIP's JL exhaust and the 226 exhaust tested proved to have the best acceleration due to their steep initial power curve, which is very enjoyable to ride. PM Tuning's exhaust provided slightly higher top speed of 58MPH because of greater power output over 50 mph.

Exhaust tests using a standard 166cc Malossi cylinder:

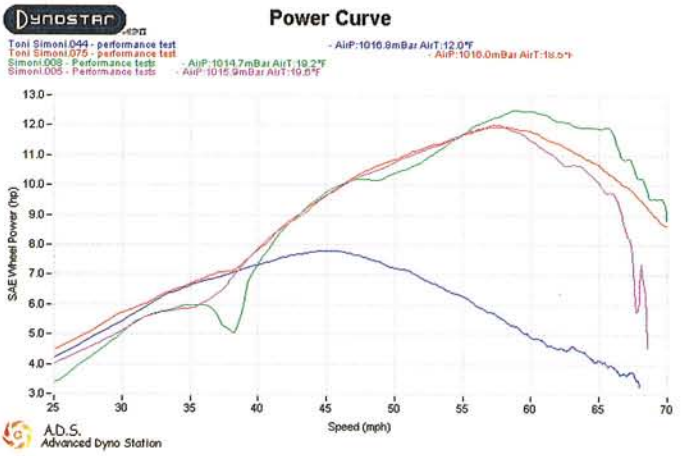


Dark Blue: Polini
Red: Simonini
Baby Blue: JL (SIP)
Yellow: 226
Magenta: Prima – (by Genuine)
Light Green: Sito Plus
Dark Green: PM Tuning

Comments: The stock exhaust was not used in this test because it is typically replaced when an aftermarket cylinder purchased. The Sito Plus out performs all pipes in low end power which is great for hills and riding two-up. The Polini pipe again fell short and the Simonini pipe gives a nice low end power and a decent peak power compared to the other pipes tested. The same top 4 finishers; PM Tuning, JL (SIP), Pima (Genuine), and 226 take the cake with only slight differences in power between them.

Test 3: Cylinder Kit Testing

4 cylinder kits using Polini Exhaust:



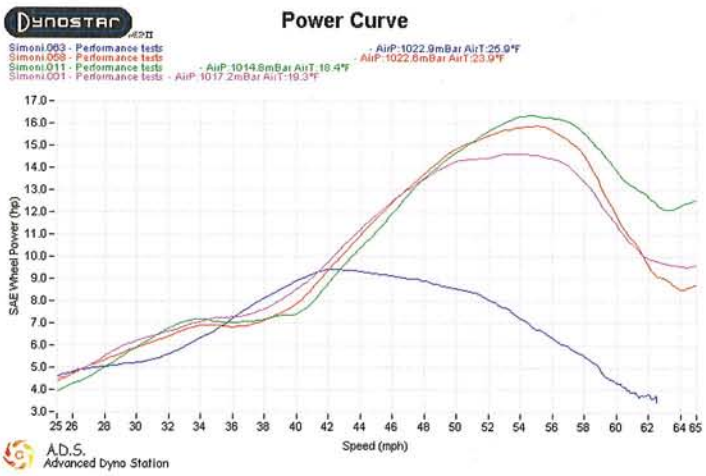
Blue: Stock cylinder.
Green: Polini 177cc Kit.
Red: Malossi 166cc Kit.
Yellow: Malossi 166cc kit (Ported).

Comments: When a performance cylinder kit is purchased an exhaust is usually purchased as well. The kit is typically bolted on without matching the case to the cylinder. Chamfering of the cylinder ports is highly recommended to ensure long ring life. Matching the cases, however it is not mandatory and will not disturb engine reliability. Therefore each kit was merely bolted on with no case matching. The Malossi kit base gasket surface matched the stock Stella cases close, but still has about10% mismatch. The Polini kit, on the other hand had about 30% mismatch and could be a reason why it did not out perform the Malossi kit. The transfer ports in the Polini kit are larger and have more potential than that of the Malossi kit.

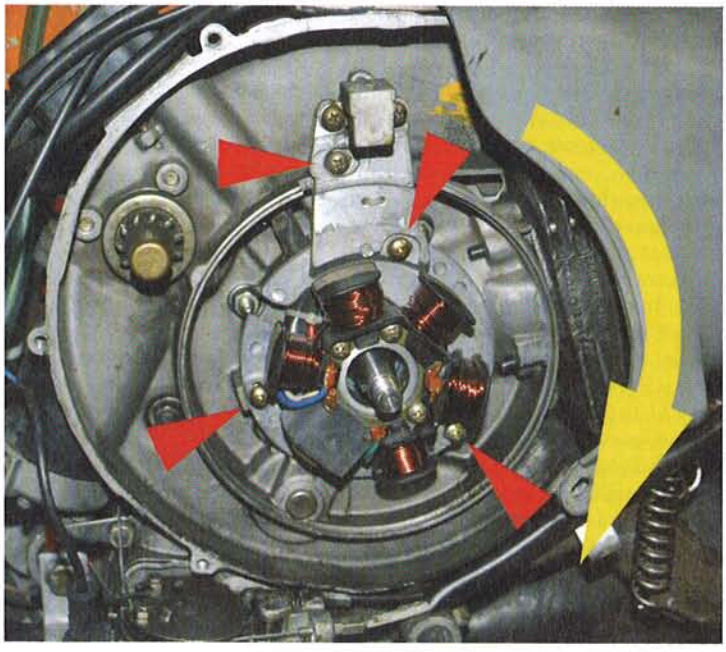
The Polini exhaust was selected for this test because it is an inexpensive performance exhaust that is readily available and there was curiosity about how it would perform with the Polini kit. The Polini pipe and Polini 177cc kit together make a great combination of power. Wow! The Malossi kit is a close 2nd when looking at the power output, but both kits hold a maximum speed of 60 MPH. Even though the ported cylinder dips in power at 38 MPH it is able to reach modest 62 MPH. For the ported Malossi kit the Gordon Blair Two-stroke engine design programs by SAE (Society of Automotive Engineers) was used to produce revised port widths and heights to achieve a theoretical 2 HP gain. The exhaust was widened a total of 4mm, each main transfer port widen 2mm toward the exhaust port, secondary transfer ports and rear boost ports raised 2mm to match main transfer port height.

The Made in the USA "226" pipe was selected.

4 cylinder kits using 226 Exhaust:



Comments: There is more heat generated from higher running compression provided by the performance exhaust which sends sonic return waves pressurizing the unburnt air/fuel mixture through the exhaust port just before it closes. Also, there is more heat generated in the cylinder due to the increased horsepower. Power is heat. With the addition of a cylinder kit and a performance exhaust, the power output almost doubles. It is advised to retard the Stella timing (rotate the stator clockwise see photo) which will yield about 18° before top dead center.
Stella's have a 2° auto-retard ignition. At 4500 RPM the timing will retard from 18° to 16°. This helps prevent detonation, commonly compared to the sound of ball bearings rattling around in a tin can or pennies on your floorboard. Detonation is the pre-ignition (or self-ignition) of the air/fuel



mixture before the spark plug fires. Detonation often causes extra heat in the cylinder and can lead to a seizure or an eroded piston.

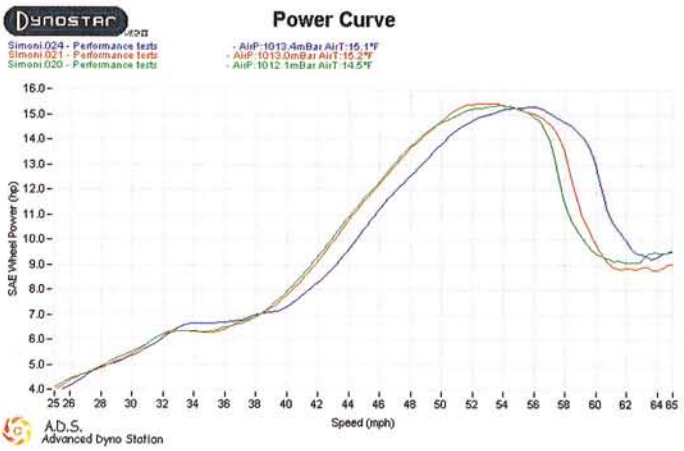
For this test the made in USA "226" pipe was selected. The "226" prototype is a reconfigured "chicken-wing." The "chicken-wing" is a scooter racing exhaust pipe that Tony Simoni fabricated and sold in the early and mid-1990's. The original pipe design routed up and over the battery and has been reconfigured to exit on the right side of the engine and looked a bit like a chicken wing when removed.

The Polini has the best low end power most likely due to the larger piston and lower port timings. The Malossi kit powers past the Polini by over 1 HP yet still travels at the same max speed of 62 MPH. The ported Malossi Kit boosts the power and delivers 65 MPH. *Caution: Altering cylinder ports can reduce piston ring life, reduce reliability, and should be performed by someone skilled and knowledgeable.*

Test 4: Carburetor and reed valve testing.

A popular Stella Speed forum upgrade is the 24G carb with T-5 filter, both standard on Vespa T-5 models. Another upgrade is to replace the Stella's stock metal reed pedals with a fiberglass Boyesen brand reeds. Three carburetors were compared along with three different reed cage arrangements. Genuine's Prima pipe was used with a 166cc Malossi kit for the following tests.

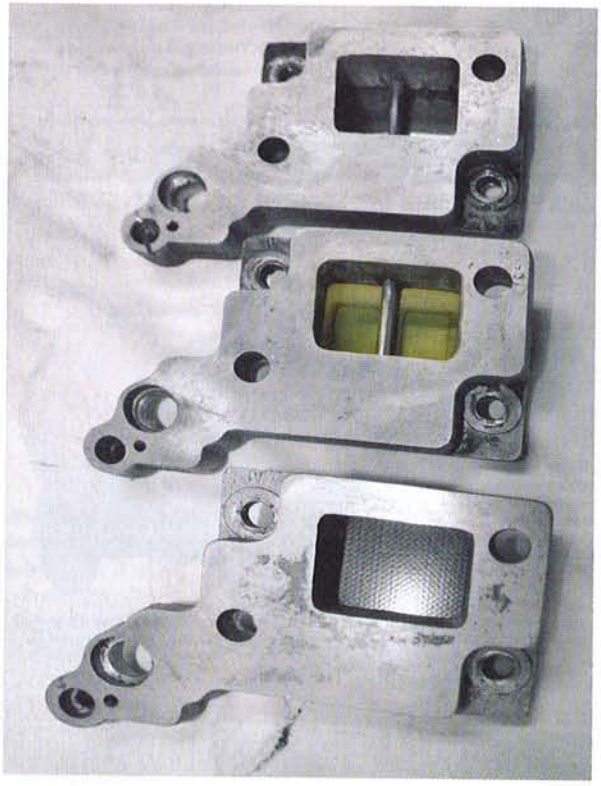
Carburetor Test:

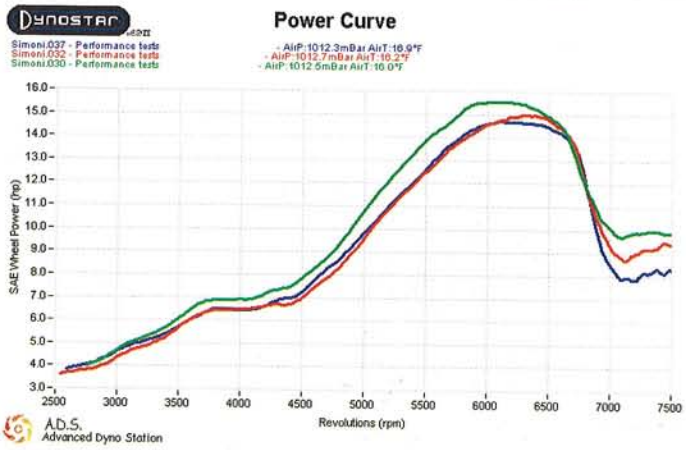


Green: Stock Spaco 20mm carb with P200 Air filter
Red: Spaco 24mm G carb with T-5 Air Filter. The T-5 air filter is standard for this carb and is about 10mm taller than the P200 and Stock Stella filter. The 24G carb is 10mm shorter and allows for the taller T-5 air filter to fit under the Stella's carb box lid. The T-5 filter will not fit under the Stella's carb box lid unless the 24G carb is used.
Blue: Spaco 26mm E carb with a P200 air filter.

Comments: There is no significant performance gain by increasing the carburetor size to 24mm. There is a slight increase in power after 57MPH, but this is top road speed with this set up and this gain would not be noticed unless riding downhill. The 26mm carb added no speed and there is a significant loss of lower speed performance. Top speed achieved with all three crabs is 62 MPH.

Reed Valve Test:





Blue: Stock reed cage.
Red: Boyesen Reed pedals.
Green: GGR Scooters carbon fiber Stella reed.

Comments: The stock reed petals are two thin stainless steel pedals. The Boyesen reed petal consists of a fiberglass, 2–staged/2-petal design with 2 thin reed petals set on top of a thicker 'base' reed. The GGR reed consists of a single petal design and is designed to be used with the Stella's center reed block divider removed from the reed cage. The GGR reed petal thickness is somewhere between the thinner and the thicker Boyesen reeds. Surprisingly, no improvement gained when switching to the Boyesen reeds, however a more sensitive throttle response (snappy) is typically felt after their installation. Wow, what a boost of power when switching to the GGR reed. The GGR reed petal design improve power is because the dividing bar is removed. The "area" allowed for air-fuel to enter the crankcase when the stock or Boyesen reed is fully open is equivalent to a 18 mm Ø hole. The equivalent area is increased to a 19mm Ø hole with the stock dividing bar. With that said, I believe the reed cage size is the limiting factor. A reed cage with a wider opening would have to be used if more air/fuel is desired to enter the motor.

Conclusion, Dyno graphs can be deceiving:

Dyno results can be hard to translate to what the rider is to expect on the road. Testing still needs to be evaluated even if high horsepower is achieved. In all of the tests performed the maximum road speed achieved was 65MPH (7100 RPM-See ported Malossi graph). The road tests performed had a 230lb rider sitting upright on a flat 1 mile long road. A 3-4 MPH gain is achieved by sitting in a tucked position with helmet just above the speedometer.

Comparing dyno graphs from different dynos is often difficult. Each Dyno has it own factors that are used to calculate rear wheel power. For instance, DynoJet brand dynos have a factor that assumes a certain horsepower loss through the transmission and adds a horsepower factor to the measurements, thus boosting horsepower outputs by as much as 3%. There are also many different way to calculate horsepower at the rear wheel. The US commonly uses SAE while Europe mostly uses DIN. DIN will also boost your power output on the screen by another 5%. There are many other ways to increase dyno printed results. With that said, when comparing performance graphs it is best that the tests be done at the same facility using the same calculations, all on the same day.

Not all the tests ran smooth: For instance, when the ported Malossi kit and performance pipe was taken off the dyno and put immediately on the road, after two minutes at 50 MPH the engine was pinging (detonation) and cylinder temperature reached in excess of 400 degrees and the engine almost soft seized. The clutch was pulled in before the engine locked up. The A/F curve showed that there was a lean spot at 50 MPH. Jetting changes were made to achieve best power. Best power often leads to a lean or near

Exhaust Pipe Tested	Top Speed with Stock Cylinder	Top Speed with 166cc Malossi Kit
Stock	51 MPH	not tested
JL-Evo 125-150cc (by S.I.P.)	57 MPH	62 MPH
Polini 80-150cc	55 MPH	60 MPH
PM Tuning PM24EV 125-180cc	58 MPH	62 MPH
Prima 150cc (by Genuine)	57 MPH	62 MPH
Sito Plus 125-150cc	55 MPH	60 MPH
Simoni 80-150cc	56 MPH	60 MPH
226 (Poalo & Tony's Prototype)	57 MPH	62 MPH

lean condition (i.e. A/F greater that 13.5) which was the most probable reason for the soft siezure. In response, the timing was changed to the fully clockwise position which is approximately 18 degrees, replaced the 87 octane fuel with 91 octane fuel, and the main jet was increase by 2 sizes. The detonation went away and cylinder head temperature dropped to a safe 350°F. A common seize point for an air cooled two-stroke is between 425°F and 450°F. For maximum power many tuners use 350°F as a reference point. For future dyno testing I would recommend "load" testing the scooter while it is on the dyno. This is typically done with and eddy-current braking system that adds resistance to the dyno drum and requires the scooter to run under an applied load, hence simulating rider/passenger weight, and wind resistance. Using this dyno tool can be very useful, but you will also notice a strain being placed on the motor and the engine will heat up so I recommend monitoring cylinder head temperature and possibly exhaust gas temperature during these tests.

- For a lower cost performance increase install a Sito Plus exhaust and a P200 air filter.
- If more power and an exciting ride is what you desire and money is not a limiting factor then obtain one of the great performance pipes listed in this test (PM Tuning, JL, Prima, or 226).
- The next performance progression is the GGR reed petal and then a Malossi cylinder kit. In general, a larger displacement cylinder kit is a great idea for riding two-up, riding faster up hills, and when top speed is a priority.

We hope you found this information useful and interesting as we did.

Top Speed with 166cc Malossi Kit	Sound Level (DbA) at 20 feet away
$69	92
$460	111
$179	108
$230	110
$299	111
$109	100
$149	107
not yet available	104