

Boosting your Bike's Ignition System

Hotter Spark for Breaker Point Systems

In a world full of major technical advances, it is surprising that the ignition system on most contemporary street bikes differ little from that on Grandpa's pre-war Ford.

In extreme cases (no names here), the ignitions on some new bikes are barely adequate for normal operating conditions. Push a few variables the wrong way – higher than normal altitude, poor quality gas, constant low-speed running – and you have a motorcycle that refuses to motor.

Upgrading a bike's ignition system is one way to eliminate some misfiring problems and will increase reliability while decreasing frequency of necessary maintenance.

If your bike is a two-stroke, you probably have first-hand experience with plug-fouling problems, and the need for frequent service.

If you indulge in any form of motoring where the engine is under load for extended periods, or racing, an ignition breakdown is not unusual. A fresh set of plugs will usually get the engine running straight for a while, but is often a treatment of symptoms, and not a cure.

An ignition conversion – we will describe several different methods here – is a cure for more than symptoms.

THE PROBLEM

Under ideal conditions, even a weak spark at the plug is sufficient for ignition and combustion to occur. Ideal conditions are new spark plug (properly gapped), correct air/fuel, ratio, proper engine compression and temperature, and spot-on timing. Ideal conditions can't last very long. As conditions deteriorate, a poor spark will produce less than adequate combustion, promoting accumulation of deposits. As these deposits build up, especially on the spark plug itself, initiation of the combustion process becomes increasingly difficult. When the spark can no longer fire in the face of adversity, the engine ceases to operate.

THE SOLUTION

If the engine is put into a reasonably good state of tune, providing an extremely *hot* spark will most likely keep it that way.

Deposits won't form as easily, the engine will run better and cleaner, and will require less maintenance.

Spark intensity can be increased in several ways. As a rule, automotive engines have more cylinders and higher demands on their ignitions, so car coils are more powerful and are frequently used to upgrade motorcycle ignitions. A strong second choice is an aftermarket system, which will produce a stronger spark and is usu-ally easier to install. A new idea is an ignition electronic amplifier for use with stock or modified systems. (It doesn't actually amplify, but we'll explain that shortly.)

Note: The following modifications should be applied only to motorcycles which use a battery to supply power to the ignition. Some bikes, such as Honda XLs, have a magneto ignition, and a battery for the lighting system.

Additionally, some bikes, including most Fours, use dual-output ignition coils. For these applications, the Electronic Ignition Amplifier can be installed in the same manner as for conventional coils. A coil swap, however, could be best accomplished using a high output dual-tower coil. At this time, several manufacturers related that such a coil was almost ready for release, and should be available shortly.

BASIC IGNITION THEORY

The conventional ignition system is basically simple. When the breaker points, or contacts, are closed, current flows through one side of the ignition coil, building up a magnetic field. When the points open, the current stops, and the magnetic field suddenly collapses. The nature of the coil (actually a step-up transformer)

is such that an extremely high voltage is produced. This voltage, when applied to the spark plug, causes a miniature bolt of lightning, igniting the fuel/air mixture in the cylinder.

BOOSTING SPARK OUTPUT

If one increases the voltage available to the ignition system, a hotter spark will be produced. But since we're normally restricted to the 6- and 12-volt standard, that method isn't possible. Keeping the contact points closed longer will allow a stronger magnetic field to build up in the coil, which will produce a greater output. But there is a limit, called saturation. The saturation point is when the magnetic field is at its maximum for the available system voltage. Keeping the contacts closed longer will not increase the magnetic field or spark output. In fact, coil efficiency and output are greatest prior to the saturation point.

One would think the output of the stock oil/points system is limited, and indeed it is. But by implementing the system with modern electronic circuitry, spark output can be increased substantially.

Mentioned briefly, installing hotter coils will intensify the spark. This coil conversion is analogous to boring out an engine. The basic operation is unchanged, there's just more of what you previously had.

Combining high-output coils with ignition amplifiers will produce an unbelievably strong spark.

PREPARATION

Since the stock contact breaker assembly will be retained, it should be serviced. Maximum benefit from any modification can be derived only if the total system is operating properly.

First, contact points must be in proper condition. Point surfaces should be smooth and clean. A file and/or 400 abrasive paper should be used to dress the contacts. Severely pitted contact points should be replaced. Clean the points – new ones, too – with non-residual solvent or contact cleaner. A white business card can be used to remove remaining debris by drawing it between the closed contacts.

The condenser (capacitor) should be replaced periodically to prevent possible spark breakdown. While the condenser should last virtually indefinitely, there are instances when failure occurs. Additionally, paper-type condensers should be replaced by more dependable mylar versions.

The actual project pictured and described here began with fitting a Yamaha RD350 with a tune-up kit (price \$13.65) from Accel. The firm has earned a good reputation in the automotive field and has recently introduced a line of ignition components for motorcycles.

EVALUATION CRITERIA

This was an ignition experiment and evaluation, so the goals and circumstances limited actual tests to ignition only. We weren't able to run the project bike at the drag strip, for instance, nor could we test for miles per gallon. What we measured were spark intensity and load felt by the bike's electrical system.

BASELINE MEASUREMENTS

Contact points were gapped at .014-in., which is approximately 90 degrees of dwell on the RD350. This setting was maintained throughout the procedures, as any change in point dwell would be reflected in power consumption.

A meter was hooked into the primary ignition circuit so current draw of the components, could be measured.

With the engine stopped and ignition on, a stock coil drew 2.5 amperes of current. At idle, average current flow was 1.4 amps, and at 4500 rpm, flow was 1.2 amps. Raising the engine higher reduced current flow only slightly more, hence 4500 was used as the upper rpm limit.

Next we needed some measure of coil output, the real issue at hand.

The Yamaha factory manual relates a method used to test coil output under operating conditions. Using a testing device, the output of a jump a gap before reaching the spark plug. If the spark jumps at least 7 mm (about 1/4 in.), output is deemed sufficient.

Thinking this method would be valid in comparing different systems, a similar device was fabricated from some odds 'n ends laying around the shop. The device was fastened directly to the top of the spark plug. The

output of the coil is conducted through a spring to a movable electrode. Using a piece of nylon tubing as an insulator (cowards, we!) the threaded electrode could be screwed in or out, varying this external spark gap.

Test procedure was simple. With the gap closed completely, the engine was started, and brought to operating temperature. Bringing the speed up to 4500 rpm, the gap was slowly widened. Just at the point of misfire, the engine was shut down. Vernier calipers were then used to measure the length of the external spark gap. The stock Yamaha components met factory requirements with little extra: 7.5mm. Baseline established, the Yamaha ignition system underwent the various modifications.

IGNITION AMPLIFIER

First installed was the Accel ignition amplifier. As mentioned, the name is a bit misleading. The amplifier goes between the points and the coil, or in this case, each amplifier goes between each set of points and the coil. Even under ideal conditions the points aren't really a good electrical switch. The amplifier is. When the points open, the break in current tells the amplifier and the amplifier triggers the release of spark from the coil, with increased efficiency and a more intense spark.

INSTALLATION

Wiring the ignition amplifiers is simple. A problem does arise, however, when one attempts to mount the two modules on the bike. Measuring 5-1/2 x 3 x 1-1/2 inches each, the boxes must be shoe-horned into position wherever there is room.

On the RD350, one was mounted beneath the right side-cover. Holes were carefully drilled through the airbox and rectifier bracket, and machine screws and nuts used to fasten the module.

The other module can be placed in the cavity originally occupied by the toolkit. under the rear of the gas tank. Use some foam rubber to keep the module from rattling around.

Once the modules are in position, they are wired into the ignition system. Although some crimp-on connectors are provided, they are the eyelet type, and are more suitable to automotive applications. It's much easier to solder the wires into place, using an iron and resin-core solder.

In general, wiring the unit proceeds as follows:

There are four wires leading from the amplifier: red, green, white, and black. The red wire supplies power to the unit, and it is connected to the hot side of your bikers ignition coil. The other lead on the ignition coil goes to the breaker points, and coil, and the white amplifier wire connected to the loose coil wire. Here are the specifics on wiring the Yamaha RD350:

Remove the gas tank, and locate the coil for the left cylinder. A brown and an orange wire are fastened to the coil. Remove 1/2 in. of insulation from the brown wire, and solder the red amplifier wire to it. Wrap the connection securely with electrician's tape.

Cut the orange wire midway between the coil and its connector. Solder the green amplifier wire to the stub of orange wire still connected to the coil.

The short piece of orange wire with the connector attached should then be soldered to the white amplifier wire. Wrap the connections with electrician's tape.

There is a large crimp-on connector provided in the kit. Fasten it to the black amplifier wire, which is a ground connection. We mounted it on the bike beneath one of the nuts securing a stock spark plug coil to its bracket. Scrape the paint off around the mounting bracket hole to ensure a good electrical connection. The other amplifier is wired to the right coil in exactly the same way as the left.

RESULTS

Current flow through the coil was measured at 2.4 amps static, a shade less than stock. At idle, current was 1.4 amps, and at 4500 rpm, 1.2 amps, same as stock.

Current flow through the contact points, however, was dramatically reduced. Instead of carrying 2.5 amps static, 1.4 amps idling, and 1.2 amps at 4500 rpm, current flow was a mere 0.09 amps, 0.06 amps, and 0.06 amps respectively. In more simple terms, current through the points under normal operating conditions was

reduced to less than 1/20th of the original load. With this system, burned and pitted points are history. Maintenance is reduced to periodical cleaning, and an occasional inspection for proper dwell time. Spark intensity was also improved. The blue arc cleared 7.5 mm with ease, and didn't falter until the 11.0-mm mark was reached! Although we possessed no equipment capable of measuring actual spark energy, this longer spark appeared and sounded much stronger than stock.

For proper operation, plugs should be at least one heat range colder, and preferably a racing plug. The RD's B8HS plugs should be swapped for a pair of B9HV wire-tips. Gap should be increased to .035 to .040-in. to take advantage of the increased fire-power. According to Accel, improved combustion will sometimes require needle and/or jet enrichment. The project RD350, which had previously run less than cleanly, became crisper and much cleaner.

ADDITIONAL COMMENTS

At \$24.95 each, Accel Electronic Ignition Amplifiers provide quite a zap – provided you're willing to part with the money. Remember, though, many bikes will require only one amplifier. Additionally, if you sell your bike, the unit can be installed on its successor.

ACCEL COIL CONVERSION

A second way to provide a hotter spark is to swap the stock coils for a pair of hotter automotive coils. There are many different coils available, but some are better suited than others for this conversion. The Accel Performance coils are easily adapted as they are electrically similar to the stock units.

INSTALLATION

Chrome-plated Accel coils are impressive looking. You'll notice them, also, because they're impressively large.

The intended mounting location was on the front downtubes beneath the steering head. Under full suspension compression, however, the fender would have contacted the coils.

After much deliberation, the coils were mounted to the downtubes, outboard of the exhaust outlets. They're down in the airflow, but hamper engine cooling little, if at all.

If you can find the room on your own bike, try to mount the coil(s) in or near the stock location. Make sure the coil is securely fastened, in any case. Wiring a coil is simple. There are two primary wires connected to the stock coil. One leads to the breaker points, the other to the hot side of the ignition. For negative-ground systems, the (+) coil terminal connects to the ignition hot wire, and the (-) coil terminal to the breaker points. The connections would be reversed for a positive-ground system. For the Yamaha RD350, remove the gas tank, disconnect and remove the stock coils. Run #16 or larger wire from the positive (+) terminals of each coil to the vicinity of the original coil connections. Connect the two new coil wires to the red/black ignition hot lead. The connectors may be cut off the stock coil and reused. Or, the wires can be fastened by soldering.

From the negative (-) side of each coil, run a # 16 wire to the same location. The left coil wire is connected to the orange ignition lead. The right coil wire is fastened to the gray ignition lead. Because of the increased output of these coils, high-dielectric plug wire must be used. An Accel 7-mm silicone yellow jacket wire kit was installed to complete the job.

RESULTS

Static current draw was 3.2 amps, 0.7 amp over stock. At idle, current was 1.4 amps, only 0.2 amp over stock. At 4500 rpm, current was the same as stock, 1.2 amps.

When testing for spark, the reason for using special plug wire became obvious. Spark length was double stock – 5.0mm – and very hot.

COMMENTS

The high output of these coils could require the same plug and carb changes as installation of the ignition amplifiers.

Current flow through the contact points is slightly more than stock coils at idle, but comparable to stock as

engine speed increases.

Accel Performance coils retail for \$18.95 each, and a silicone wire kit is \$5.95, for a rough total of \$44.

If you will choose between these two similarly priced Accel modifications, several factors should be considered. An amplified stock system provides a very healthy spark, and reduces maintenance to a minimum. Although more difficult to install than performance coils, the components are hidden from public view. The coil swap is easier to perform, and will deliver a hotter spark for \$6 less. Expect to service your breaker points only slightly more frequently than with a stock system, but far more often than with the amplified stock system. The exposed chrome-plated coils do not detract from the bike's styling, but add a competition flavor to its appearance.

AMPLIFIED COIL SWAP

If you're willing to spend the money, combining hot coils with ignition amplifiers is best. High output is attained with an increase in point life and reliability.

INSTALLATION

Mount each of the coils and amplifiers as described previously. Using the crimp connectors provided in the kits, connect the amplifier wires as follows. Left amplifier and coil:

Red..... coil (+) terminal and motorcycle ignition hot lead (red/brown)

Green..... coil (-) terminal

White..... motorcycle breaker points lead (orange)

Black..... chassis ground

Connect the right amplifier and coil similarly. The white amplifier wire, however, will connect to the gray breaker point lead.

RESULTS

Current draw at idle is 3.0 amps, 0.5 more than stock, and 0.2 amps less than with straight Accel coils. Idle current is 1.6 amps, and at 4500 rpm, current is 1.2 amps.

Spark output is, to say the least, healthy. Because the spark was finding several different paths to reach, the engine, an additional sheet of insulation had to be installed under the test fixture. Measured spark length was nearly 17.0 mm, and very aggressive.

COMMENTS AND SUMMARY

With nearly \$100 of high-output ignition installed, there now exists at least one Yamaha RD350 which will never experience plug fouling problems. If your bike has a tendency to consume spark plugs at an unusual rate, you might wish to consider adapting one of these detailed modifications. Installation is fairly simple, and cost could conceivably be offset by the reduced need for expensive tune ups.

If the components are not available locally, contact:

Accel Eliminator Ignition

Accessories Unlimited, Inc., distributors

754 Orange Ave.

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(203)932-2797

Think about it the next time you're on your way to the store for a six-pack of spark plugs.