

The Proper Care and Feeding of the Rotax Motor – Part 3

Understanding the Electrical System

by Mike Stratman

Let's face it, airplane engines are a lot like lovers. If you can't trust them they are hard to enjoy! Real high quality flying fun requires a highly reliable engine. Understanding your Rotax motor will go a long way in allowing you to enjoy your flying. The electrical system of the Rotax motor is generally misunderstood, yet can be your most versatile source for power output. Breaking down and examining each circuit in the engine can help you diagnose a problem as well as make the fullest use of the system.

The entire electrical system is located inside the rotating flywheel assembly. [see Part 2 in Figure 1.] The flywheel contains four magnets that rotate around three separate coils mounted to a stator plate assembly. [see Part 1 in Figure 1.] On the Rotax 277 and 532 engines only, the cam used to open the points is part of this flywheel. On Rotax 377, 447 and 503 engines this cam is part of the crankshaft.

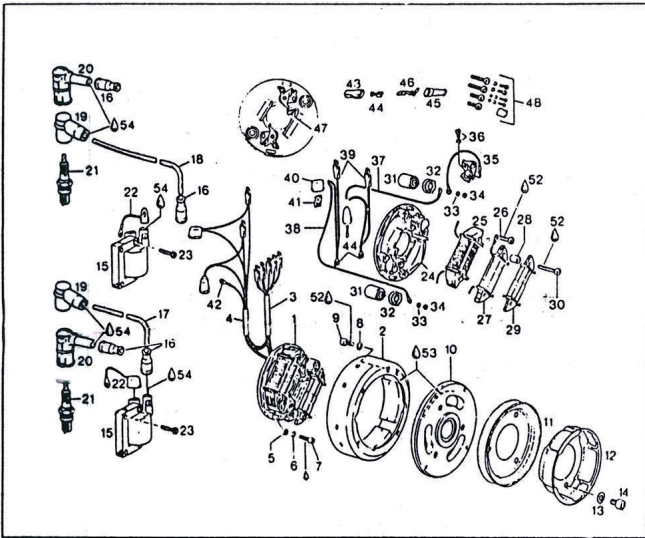


Figure 1: The Rotax Twin Parts Illustration.

The Charging Coil: The charging circuit built into every Rotax engine is designed to charge a battery system. The charging coil system is connected to the green and green-with-black-stripe output wires. Because this output is alternating current (A/C), there is no polarity, just like there is no polarity in an ordinary A/C 110-volt house current. This coil output is rated 18 to 50 volts (varying with rpm) at 30 watts max. This circuit (2 green wires) also has a pulse that increases in rate with the rpm. This allows a capacitor discharge ignition (CDI) tachometer to be used. A lighting coil or CDI tach are the same thing. They work off this, increasing with rpm pulse. After the use of a regulator/rectifier this output can be used to charge an 18- to 20-amp 12-volt motorcycle type battery. CB radios, marker lights D/C and electric starters are some of the devices that can then be run off this battery reservoir. Of course the battery output is 12 volts direct current (D/C). The charging coil is Part 29 in Figure 1. This coil is the smallest on the stator plate assembly. Again look for the green wire output.

The Lighting Coil: The lighting circuit is designed as a high wattage output to power variable voltage A/C lighting or similar load accessories. This circuit is connected to the yellow and yellow-with-black-stripe output wires. Again, because the output is A/C there is no polarity. The rated output of this circuit is 18 to 50 volts (depending on rpm) at 110 watts max. This circuit generates an increase with rpm pulse, which equals the pulse of the green or charging coil output. This allows a CDI or lighting coil tachometer to be attached to the two yellow wires (or the two green wires). Again, no polarity. The high output of this circuit is ideal for A/C-powered strobe lights as well as other A/C-powered accessories. This lighting coil is Part 25 in Figure 1. It is mounted by itself on the intake side of the stator plate assembly opposite the piggy-back mounted charging and generator coils. This is the largest (thickest) of the three coils and is easily identified by the yellow leads. On most Rotax engines these green and yellow leads are connected together at the end of the wiring harness and can easily be separated and used independently without danger.

The Generator Coil: This medium-size coil is mounted below the smaller charging coil on the exhaust side of the stator plate assembly. This coil produces the output that powers the ignition. The voltage produced by this coil is transferred at the precise moment to the external coils (Part 15) by each of two sets of points. These in turn produce 20,000 volts, firing the spark plugs. The key to the whole thing here is "at the precise moment." Each plug must fire when the piston is .086 before top dead center (BTDC) plus/minus .003 inch.

A Rotax twin uses two separate points to handle each cylinder. Each set of points has to control each cylinder. In a Chevy V-8, one set of points plus a rotor and an adjustable 8-point distributor and cap fires the plugs. Good ignition timing is important in a Chevy. In a Rotax it is absolutely critical. Precise engine timing is every bit as important to engine reliability as oil in the gas. I will repeat this again only because it bears repeating. Flying a 2-stroke without checking and setting your own timing is simply courting disaster. [see "Timing the Rotax Engine," September 1986.]

The blue and blue-with-red-stripe wires are each of the leads coming from each of the sets of points. These blue leads exit the stator assembly and go to each of the external coils. The two black wires are simply a continuation of these leads. Shorting these two black wires together will kill the engine. Connecting either to ground will kill one set of points or one cylinder only. A "breaker point" tachometer is connected to the black wires. A malfunction of a tach connected to these leads can cause an engine failure. This is extremely rare because the short would have to provide continuity to kill the motor. Nevertheless, Rotax does not want a breaker point tach "to leave the ground." Use a CDI or lighting coil type tachometer.

Here is a brief summary of the color code of the leads:

Yellow—Solid	Lighting Coil (no polarity)
Yellow—w/black stripe	18 to 50 volts 110 watts
Green—solid	Charging coil (no polarity)
Green—w/black stripe	A/C 18 to 50 volts 30 watts
Blue—Solid	Generator coil
Blue—w/red stripe	Carries pulse/volts to fire plugs
Black—points MAG	Connect to kill ignition
Black—points PTO	

The Dampening Box #866-572: This box has a very important function. It is simply a resistor and a diode in series connected to an engine ground. If a fouled plug or similar malfunction occurs, the 20,000 volts produced by the coils to fire the plugs has to go somewhere. This dampening box takes this voltage and transfers it harmlessly to ground.

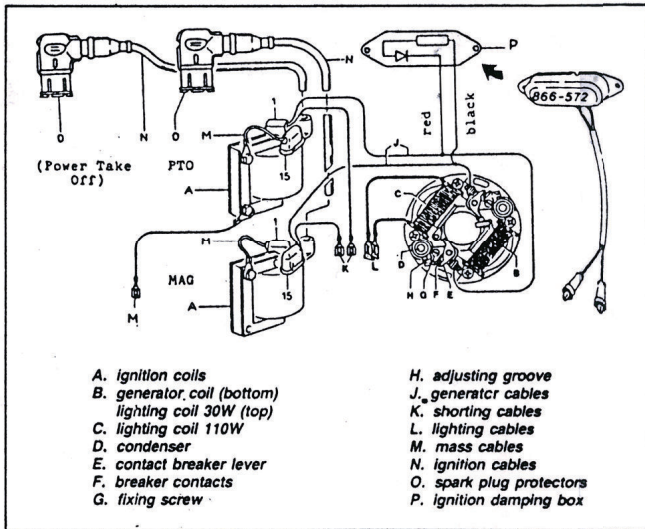


Figure 2: The schematic wiring of a Rotax twin cylinder engine with dampening box.

Without this function the voltage can either transfer to the secondary coils or the plug will fire at the wrong time. At this point detonation, backfiring, and general destruction of expensive engine parts can occur. If you disconnect the dampening box and the miss is eliminated, this means the spark finds it easier to pass the resistance of the dampening box rather than to fire the plugs at the exact moment needed. This box is not to be removed for obvious reasons. Fouled plugs, incorrectly gapped plugs, broken or bad plug wires, or more commonly, excessive use of "radio noise suppression parts" are the cause of the miss. See Figure 2 for the wiring diagram of the Rotax engine illustrating the dampening box and its function in the circuit.

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