



CHAPTER 5

“It’s all right if your automobile goes wrong while you are driving it. You can get out in the road and tinker with it. But if your airplane breaks down, you can’t sit on a convenient cloud and tinker with that!”

- Katherine Stinson, American Magazine, 1917

5. Maintenance

Maintenance. The term is synonymous with safety, reliability, and efficiency. Its importance can hardly be overstated. Unfortunately, this is one area that can be a significant problem for the new ultralight operator. Acting as his own mechanic, he can, unknowingly, create more problems than he can solve. The temptation to tinker is great, especially for mechanical types. We routinely get ultralights that are brought in to our shop for maintenance that are so amiss that the layman is virtually rendered incapable of ever getting the engine back into proper operating condition.

One of our most recent experiences with this type of thing

was with a newly purchased Hurricane. The aircraft was delivered, in generally good flying condition, to the new owner, Bill Massey, at our airport in Corning the previous month.



As a newcomer to ultralight ownership, Bill had many questions and concerns. He didn't know if the engine sounded right. It was a little hard starting. Fuel was leaking out of the carburetors. While Bill is a private pilot and quite mechanical, he didn't have any experience with the Rotax 503 engine. He and his partner had been flying the ultralight, but they were also spending a great deal of time working on the engine. Finally, frustrated, they broke down and brought it in.

The items on the discrepancy list confirmed a familiar scenario. Bill and his partner had put a great deal of time into trying to solve the individual problems that they had identified. However, they didn't possess the background knowledge of the operation and maintenance of the Rotax 503.

This list of individual problems is a classic example of how the unfamiliar mechanic can not only spin his wheels but can create more problems than he will solve. There are two concepts that are paramount when working on Rotax engines: first, the systems all interact together. And second, the work has already been done for you.

As Brian explained to Bill, the operation of the aircraft, the engine, the ignition system, the carburetion, the exhaust system, the gearbox, the propeller, and the airframe all interact with each

other. Each component, each system of the aircraft is dependent on all of the other systems. Therefore, if you change the carburetor the effects will show up in more than just one area. As we said, the Rotax 503 is designed to operate under very specific conditions.

Fortunately, the Rotax factory has done a lot of testing and Rotax engines have been in service for a very long time. As a result the precise conditions under which Rotax engines operate have been determined. This information is all documented and available to the general public. We know, for example, the precise carburetor settings for a specific aircraft, the exact gearbox, the exact propeller, the exact exhaust system, the precise fuel/oil mixture, and the exact components to be used in order to operate successfully, safely, and reliably.

Rotax Engines w/o Intake Silencer

Engine Type	Main Jet	Idler Jet	Needle Jet	Needle	Clip from top	Airscrew
Rotax 277	148	45	2.72	8L2	2	1.0
Rotax 377	165	45	2.70	8O2	2	0.5
Rotax 447	165	45	2.70	15K2	2	0.5
Rotax 447 DC	135	50	2.70	6G1	3	1.0
Rotax 503 SC Up to Serial #3785371	180	45	2.74	8G2	3	0.5
Rotax 503 SC After Serial #3785372	185	45	2.72	15K2	3	0.5
Rotax 503 DC	158	45	2.70	11K2	2	0.5
Rotax 532 SC	195	55	2.74	15K2	3	1.0
Rotax 532/582 DC	165	55	2.72	11G2	3	1.0
Rotax 618 DC MAG*	170	50	2.68	9M10J	2	1.0
Rotax 618 DC PTO*	160	50	2.68	9M10J	2	1.0

* 618 MAG & PTO Carb require different jetting per 19 UL97-DE

Compliments of CPS

The chart above is an example of some of the work that has been done for you. This and similar charts can be found in the

California Power Systems' Parts Catalog, a must for any ultralight pilot. Mike Stratman, president of CPS, has done an outstanding job of compiling all the necessary information for the operation of the Rotax engine. Empowered with the knowledge of how to set up a Rotax 503, there is no excuse for having engine problems.

The Rotax engines' success was not made possible by four leaf clovers or rabbits' feet. Their success was made of knowledge, testing, and experience by engineers who offer you a treasure of information and experience; you need to keep this in mind. Once you start making changes, you are competing with a distinguished group who are operating at a level that the average ultralight pilot will most likely never reach.

The first step in trouble shooting any Rotax engine problem is quite simple: *Check to see that the engine is, in fact, set up just like it is suppose to be.* In the example of the Hurricane, Bill and his partner were able to identify several things that were not stock, such as the fact that the main jet was six sizes too lean. They said this was because it was running too rich with the stock jets in it.

Now let's think about that – there are literally thousands of Rotax 503s operating successfully with stock jets in them. All of these engines are built to the exact same specifications. While it may not initially appear so, when you change your stock engine you are saying, "My engine is different than all of the thousands of other Rotax engines operating correctly."

As your understanding of Rotax engines deepens, you will realize that something else is wrong. As in the case of the Hurricane, there was some other factor that was causing the engine to run rich.

Rather than tackling one problem at a time, the first step in getting the engine operating correctly again is to get it back to the stock configuration. Anything on the engine: propeller, exhaust, gearbox, or any component that is not set up in the stock configuration should be corrected.

The engine is designed to operate at a very specific rpm. The load that is imposed on the engine dramatically affects how it operates. Loading the engine too much or too little will result in the engine not producing adequate power and will cause the engine to

run too lean or too rich. The exhaust system is tuned to operate using this specific rpm. The pressure wave created by the exhaust itself to scavenge exhaust gases and draw more air into the engine is referred to as a “tuned exhaust.”

If you modify the exhaust system you completely change the characteristics of that pressure wave and the engine’s ability to scavenge the exhaust gases and as a result the engine may run worse or in some cases may produce more power with modified exhaust systems. This is the big sales hype behind these special tuned exhaust systems sold after market.

“*Because it’s there*” may be a perfectly good reason to climb the highest mountain in the world, but it doesn’t really justify spending hundreds of dollars on an after market exhaust system. Especially when you consider the fact that if a different type exhaust system would be better for the engine, Rotax would have incorporated it into their design. Human nature being what it is, many believe these after market, super-tuned exhaust systems are “better.” On the contrary, the sole guaranteed result will be more money and effort invested. The likely result: frustration and a burned up engine.

There is no doubt that the exhaust systems sold after market are capable of producing more power. The problem lies in the fact that it does produce more power at one specific rpm, full throttle operation; this also happens to be the rpm at which the engine is operated the least.

The trade off for this additional power is that the pressure wave used to create it at full throttle makes the engine extremely susceptible to inadequate operation and it becomes sensitive to altitude and climate changes at the lower power settings. The tuned exhaust system built by Rotax sacrifices maximum power in order to achieve a stable mid range mixture and power setting.

Now, we can not go into all of the technicalities related to changing the exhaust system, suffice to say that once you step into this area you take over the role of engineer. You will no longer be able to rely on any of the existing data to set up the engine. Individuals who modify the stock Rotax exhaust system improperly suffer many of the same dilemmas and can spend hundreds of