

# The Proper Care And Feeding of the Rotax Motor

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REPRINTED FROM ULTRALIGHT FLYING!  
JANUARY 1987 ISSUE

It is entirely possible that a lot of people who put their faith in the Rotax motor actually know very little about what makes it tick. It is vitally important that the owner of a 2-cycle motor knows something about what he needs to do to keep it running. An informed operator maintenance program is not only wise, it's an absolute necessity.

The following is compiled from the Rotax operator's manual and the collective experience of both the Rotax factory representatives and the CPS engine shop personnel. First I'll explain what you need to do to keep your Rotax healthy, then what to do first in the event of an engine failure.

Preventative maintenance starts with the new engine break-in program outlined in the Rotax operator's manual included with every engine. Follow this program to the letter. Don't try to "baby" your motor by deviating from the chart shown in Figure 1. Be prepared for a full 60 minutes of operation. This means no dogs, kids, or sleeping neighbors in the area to distract you or complain about the noise or dust storm you create.

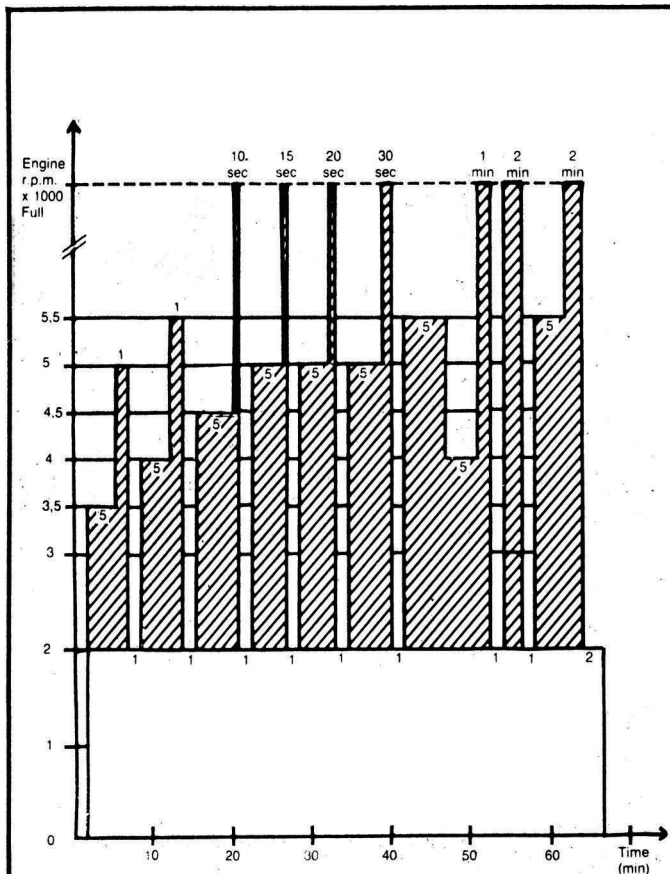
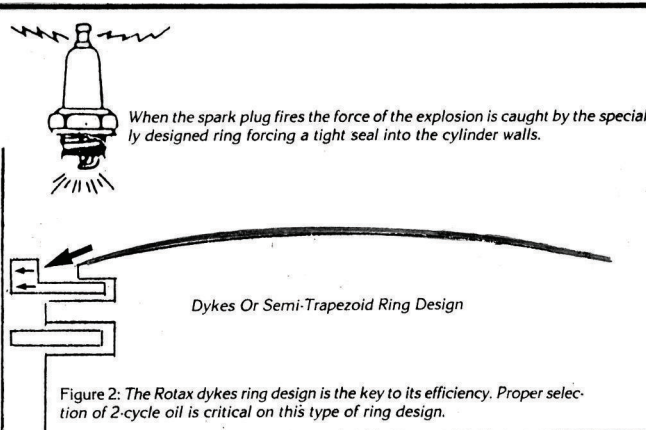
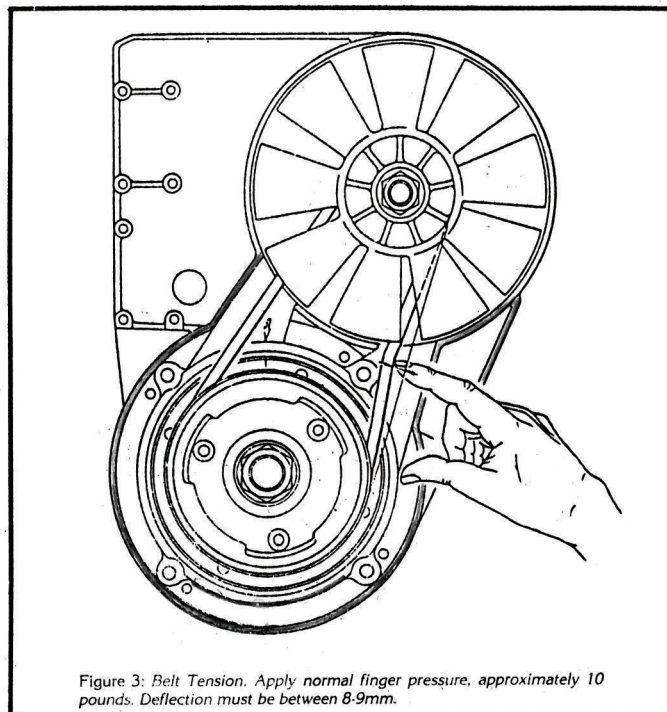


Figure 1: Rotax 60-minute break-in chart.

Do this only with a properly loaded engine, installed on an aircraft, and secure for full power run-up. During this break-in program rings are "seating" or wearing a tight seal into the surrounding cylinder walls. The important word here is wear. This is a carefully controlled necessary process directed by the 60-minute break-in chart. After



the break-in always warm up a cold engine gradually. If you remember nothing else from this article, never gun or race a cold engine. The pistons are made of aluminum. The cylinder walls are made of steel. Aluminum and steel have extremely different rates of expansion when subjected to radical changes in operating temperatures. The clearances between these parts are exacting and must not be violated by an impatient pilot. Following the 60-minute break-in chart carefully, at least a 1 to 2-minute idle speed warm-up on every cold start should save the operator untold amounts of grief.



The proper 2-cycle oil is also important to assure good piston wear. While the choice of oil is a separate subject in itself, it is critical to the dykes, or semi-trapezoid rings used in Rotax engines. [See "Understanding 2-Cycle Lubricants," March 1986.] When the spark plug fires, the force of the explosion is "caught" by the specially designed top ring. See Figure 2.



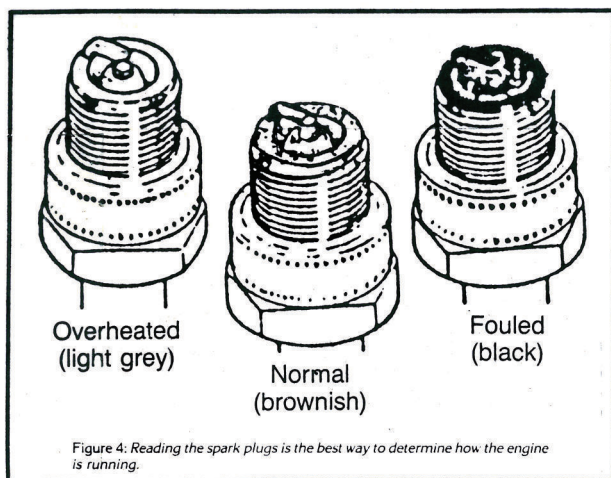


Figure 4: Reading the spark plugs is the best way to determine how the engine is running.

### Scheduled Maintenance

There is a list of scheduled maintenance items that must be checked after break-in. Check the operator's manual for a complete list of checks. Here are a few of the more important items that must be checked:

☐ **Cylinder Head Nuts:** Cylinder head nuts must be retorqued to 160-210 inch/pounds no later than 2 hours engine time after break-in. This usually requires removal of the upper cooling cowl.

☐ **Fan Belt Tension:** Fan belt tension must be checked between 15 and 20 hours of operation. The tension is controlled by shims installed or removed on the cooling fan support shaft. A loose fan belt can easily overheat an engine. A too-tight fan belt will wear quickly and rob a tremendous amount of power. See Figure 3 for proper adjustments.

☐ **Spark Plugs:** Spark plugs need to be checked on a regular basis or at least every 10 hours of operation. Check the gap (.015 inch) and/or replace when needed. Always replace both at the same time. If both plugs have "white" electrodes with "melt" droplets, first suspect a lean mixture. If calibration is correct and there is no evidence of manifold leaks or lack of fuel, change the plugs to a colder range. Heavy oil deposits on the electrodes and insulators cause engine troubles and have to be replaced every 10 hours. See Figure 4 for examples.

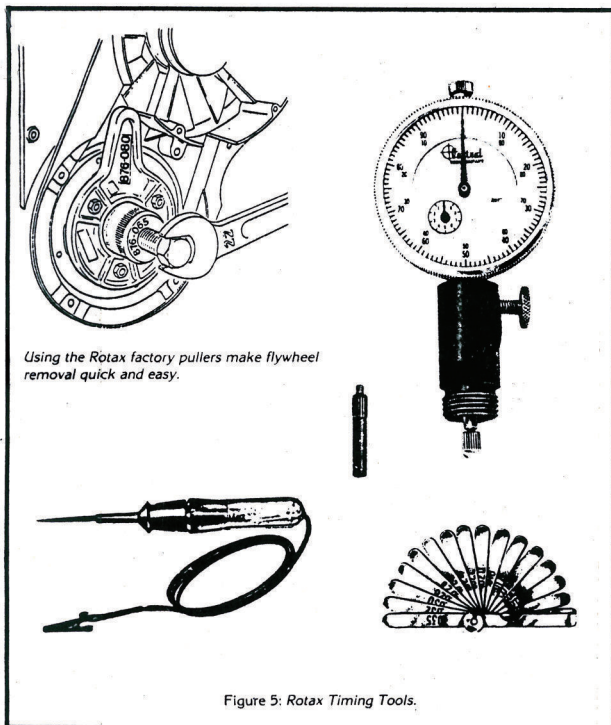


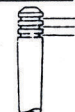
Figure 5: Rotax Timing Tools.

☐ **Ignition Timing:** Ignition timing must be set after the first 20 hours. This is not a request. The rubbing block that rides on the cam will wear in during this period. Correct timing is absolutely critical to continued engine survival. It is amazing how few pilots know how to set, or know how exacting the ignition timing is. If you like a reliable motor and plan on staying in the air a lot, the proper tools and knowledge to set and check your own timing can be your best insurance. Our engine shop has seen countless motors with burnt and bored pistons all directly traced to incorrect timing, some with as little as a .010-inch difference in timing between cylinders. If you replace points, resetting the timing is a must at 20 hours. [See "Timing The Rotax Motor," September 1986.] See Figure 5 for the tools needed to check and set the timing in Rotax motors.

	277(A)	277(B)	377(A)	377(B)	447(A)	447(B)	503(A)
Main Jet	148	140	165	155	165	155	180
Idle Jet	45	45	45	45	45	45	45
Needle Jet	2.72	2.72	2.70	2.70	2.70	2.70	2.74
Jet Needle	8L2	8L2	802	802	15K2	15K2	8G2
Position	2	2	2	2	2	2	3
Idle Screw (turns out)	1	1	.5	.5	.5	.5	.5

	(A)	(B)	(A)	(B)	(A)
	503(B)	503DC	503DC	532DC	532SC
Main Jet	158	158	148	165	155
Idle Jet	45	45	45	55	55
Needle Jet	2.74	2.74	2.74	2.72	2.72
Jet Needle	6H2	8L2	8L2	11G2	11G2
Position	3	1	1	3	3
Idle Screw (turns out)	.5	.5	.5	1	1



All above with window in bottom of piston 2303B engine side, (4.4 mm wide x 3.8 mm high)

(A) With K&N air cleaner (RC1200/sp2100), without Rotax air intake silencer, with or without Rotax after muffler kit.

(B) With Rotax air intake silencer, with K&N CM0300 air cleaner, with or without Rotax after muffler kit.

Figure 6: Recommended factory jetting for Bing carburetors.

☐ **Decarboning:** Decarboning engines is a practice some operators feel is necessary. There is an easy way to see if this is even needed. Periodically remove the exhaust manifold to expose the pistons as viewed through the ports. Rotate the engine until the rings are exposed in the middle of the port. Rock the prop sharply in such a manner to get the pistons to jiggle up and down. Look very closely for the movement of the rings in their grooves. If a slight movement of the rings can be seen everything is likely okay. If no movement is seen it is probable that the rings could be "stuck" in their grooves by carbon deposits. Decarboning is not just removing the heads and scraping the stuff off the pistons. This will likely just make things worse by supplying the top ring with more deposits. The cylinders need to be removed and everything cleaned carefully, making sure everything goes back only as it was—rings on the same piston and pistons on the same cylinder. Head bolts need to be retorqued after 2 hours as per new engine procedures.

Main jet correction chart for different altitudes and temperatures.

1. Air density decreases with decreasing pressure and increasing temperature. If an engine is operating at higher than sea level, the weight of the aspirated air decreases, whereas the aspirated fuel quantity remains practically the same. This results in richer fuel/air mixture than at lower sea level.
2. If the engine is operated at high altitude for a longer period, it is useful to adjust the carburetor calibration to re-establish the original composition of the fuel/air mixture. With increasing sea level (lower air pressure) the oxygen quantity sucked in by the engine decreases. The consequent loss in performance cannot be compensated by a different carburetor setting.
3. To adjust the carburetor, in general a different main jet size is sufficient. Only in very particular cases a different needle jet and/or different idle jet has to be installed.

Example:  $160 \times .89 = 142$  Main Jet

Altitude-Meters Feet	0	500	1000	1500	2000	2500	3000	3500	4000
	0	1500'	3000'	4500'	6000'	7500'	9000'	10500'	12000'
Temperature °F °C									
- 22° -30°	1.04	1.03	1.01	1.00	.98	.97	.96	.94	.93
- 4° -20°	1.03	1.02	1.00	.99	.97	.96	.95	.93	.92
14° -10°	1.02	1.01	.99	.98	.96	.95	.94	.92	.91
32° 0°	1.01	1.00	.98	.97	.95	.94	.93	.91	.90
50° 10°	1.00	.99	.97	.96	.95	.93	.92	.91	.89
59° 15°	1.00	.99	.97	.96	.94	.93	.92	.90	.89
68° 20°	1.00	.98	.97	.95	.94	.93	.91	.90	.88
86° 30°	.99	.97	.96	.94	.93	.92	.90	.89	.88
104° 40°	.98	.96	.95	.94	.92	.91	.90	.88	.87
123° 50°	.97	.96	.94	.93	.92	.90	.89	.88	.86

NOTE: Before operating the engine again at low altitude, reinstallation of the original jet is necessary. Engine damage may otherwise occur!

Figure 7: Rotax-Bing main jet correction chart.

☐ **Carburetion:** All new aircraft usually come with an engine package that has been set up and tested by highly skilled Rotax representatives. The carburetor is set with jetting to accommodate the specific engine and prop load. Generally their setup is highly accurate and should not be fooled with. The only operator related change that should be attempted is main jet correction. Operating altitudes and temperatures may vary greatly from place to place. Figure 6 is the recommended factory jetting for all Rotax engines. Figure 7 is the main jet correction chart for density altitude compensation for Bing carburetors used on Rotax engines. These two charts, when used in conjunction with each other, can take most of the guesswork out of carburetion.

Armed with the information and maintenance program listed here it is reasonably safe to say that your Rotax motor should prove extremely reliable. While this information is only part of the scheduled maintenance listed in detail in the Rotax operator's manual, it is strongly suggested that the owner read and understand this manual completely. Next time we'll get into more preventative measures like engine monitoring gauges, choice of fuel and what to do first when your motor either stops or simply acts up.