

# A Slippery Subject

## Choosing the Best Oil for Your Rotax 912, 912S, or 914 Engine

Four-stroke engine oil questions have topped the list of technical inquiries at Lockwood Aviation Repair during the past few months, so this month I will attempt to shed a little light on this slippery subject.

The first 912 engines came on the market in the United States in 1989, and through about 1994 the main thing you needed to know about choosing an oil for your Rotax 912 engine was that you should use an automotive oil, avoid aviation oils, and oil additives. Rotax did much of its initial testing of the 912 engines with unleaded gas and Mobil 1 automotive oil, and that oil performed well in those tests, and it still does when used with unleaded gasoline.

Over time our knowledge of oil requirements for the 9-series engine grew, especially with respect to avgas use. (The 9-series engines include the Rotax 912, 912UL, 912S, 912ULS, 914, and 914UL engine types.) We learned that operators using avgas most of the time should avoid the full synthetic oils because those oils would not suspend the lead particles in 100LL throughout the 100-hour oil change intervals. Conversely, operators who burned autogas could use the full synthetic oils and take advantage of the 100-hour oil change intervals. Now, changes in oil formulations are having a more significant influence on oil recommendations.

Some of the more recent modifications oil manufacturers have made to their motor oil have been driven

by the Environmental Protection Agency's requirement for automobiles to meet tougher emission standards (and for automotive manufacturers to warranty that cars will meet those standards for a longer period). Consequently, some of the oils that once worked well in the 912 engine have been reformulated, and they are now prone to foaming in our engine application, especially at altitudes above 10,000 feet. These oils must be avoided in the 9-series engines.

When oil foams in the 912 engine and gearbox, it turns into a mousse—like whipped cream. This becomes a problem, because the oil must remain in a liquid state so that it will drain

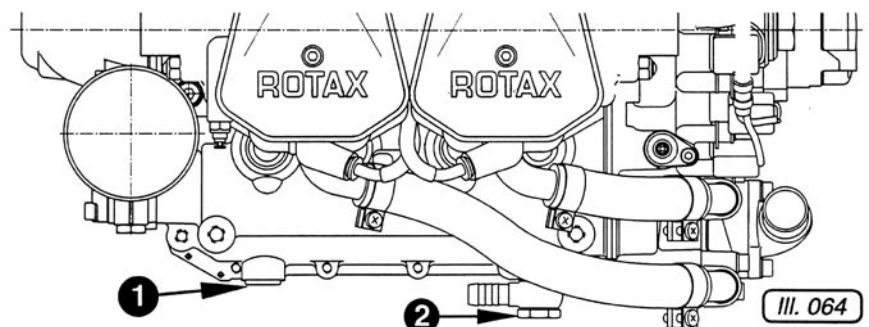
the bottom of the crankcase where it is pushed back to the oil tank via the combination oil return and crankcase vent line. If too much oil remains in the engine, the oil level in the oil tank can run dangerously low, risking serious engine damage.

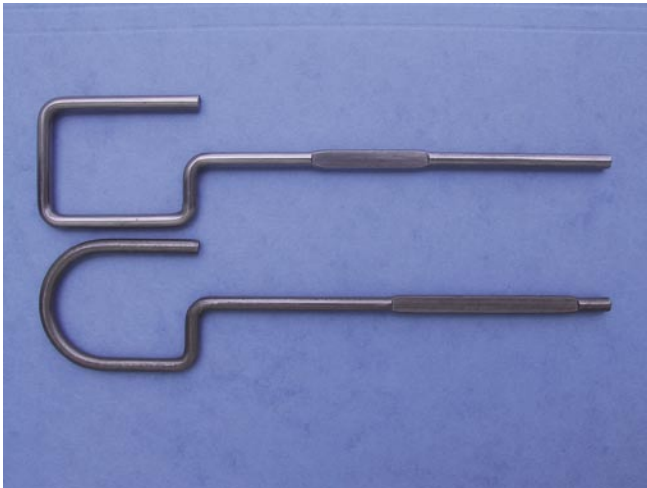
### Testing in Process

Rotax has tested a number of oils to solve this problem, but it cannot test all oils and/or retest them every time the oil manufacturer changes the blend. In fact, Rotax doesn't necessarily know when an oil manufacturer changes its blend.

Most of the oils listed in the recently updated Rotax Service Instruction SI-18-1997 R5, Selection of Motor Oils

**The 912 series engines are shipped from the factory with the oil return line banjo fitting in position 2, which is suitable for tractor installations. Pusher installations should move the banjo fitting to position 1. This will prevent excessive amounts of oil from pooling in the block during climb.**





All oil tanks on 912, 912S and 914 engines should be equipped with the new dipstick (top) allowing for a higher oil level in the tank. The new and old style dipsticks are pictured here side by side for your reference. See Rotax service bulletins SB 912-040 UL and SB 914-026 UL for more information.



Currently, these three oils are approved for use in Rotax 9-series engines and are available in the United States .

and General Operating Tips for Rotax Engines Type 912 and 914 Series, are European oils that differ from the oils sold under the same name in North America. (See [www.rotax-owner.com](http://www.rotax-owner.com)

website for this Service Instruction.) This includes Valvoline DuraBlend, which has been reformulated in the United States and has not been tested by Rotax. This is a different oil than the Valvoline listed as approved in the Rotax Service Instruction.

To help solve this problem Rotax has been testing Pennzoil motorcycle oil, which is available in the United States (but not in Europe). This oil has tested well with unleaded auto fuel and is now included in the table of Motor Oils Recommended for Use With Unleaded Fuel or Mogas on page 3 of SI-18-1997 R5. Testing of this oil with avgas is not yet complete, so although I am optimistic it will test well with 100LL, we will have to wait for Rotax's final word.

Mobil 1 oil is also approved for use with unleaded fuel in the Rotax 912 engine, but as with most full synthetic oils it is not recommended for use with 100LL. As we said earlier, synthetic oils like Mobil 1 offer superior protection at higher oil temperatures and during extended oil change intervals of up to 100 hours, but they have difficulty suspending the lead that works its way into the oil when burning 100LL. This can result in the buildup of a lead paste in the oil passageways of the engine and oil tank. (100LL contains more than four times the tetraethyl lead

found in 80/87 avgas and roughly 18 times as much as the old pre-1970 leaded avgas. As we continue to learn more about the hazards of lead to our environment and ourselves, the day draws closer when 100LL will be replaced with an unleaded substitute.)

#### What Can You Do?

If you use some avgas in your 9-series engine but it makes up less than 30 percent of your average fuel burn, then you may choose oils approved for use with unleaded fuel. (Again, see Motor Oils Recommended for Use With Unleaded Fuel or Mogas on page 3 of SI-18-1997 R5.) In this case, keep your oil change intervals to 50 hours or less, even when using Mobil 1.

If you use 100LL avgas more than 30 percent of the time and you live in Europe, a number of Shell products listed in the Rotax Service Instruction (SI) are recommended for use with avgas.

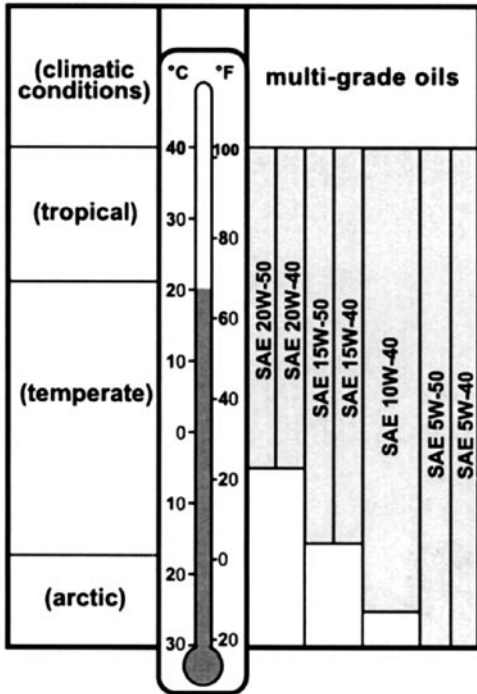
North Americans who burn 100LL more than 30 percent of the time in their 9-series engines must be a little innovative until more readily available oils appear on Rotax's approved list. No oil, synthetic or mineral based, is likely to suspend the lead that will build up over the duration of a 100-hour oil change interval.

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Use this chart to choose the best oil viscosity level for the outside air temperature at which you are operating your engine. Rotax recommends using the highest weight oil for your temperature range.

Those who must burn 100LL more than 30 percent of the time can reduce their oil change intervals to 33 hours or less, and both the Mobil 1 and Pennzoil motorcycle oil should do an adequate job of dealing with the lead. If you are towing gliders or running at high power settings, you should change oil every 25 hours.

The Pennzoil motorcycle oil seems to be working well in the 912 and 912S engines, provided your oil temperature is normal (lower than 230°F). If your oil temperature creeps higher than 230°F on climb-out, use Mobil 1. That oil is also the best bet for the

Rotax 914 engine because of the extreme temperatures generated within the turbocharger.

Why use motorcycle oil versus the less expensive automotive oils? Because four-stroke motorcycle oils, like the Pennzoil motorcycle oil and the Mobil 1 MX4T 10W40 shown here, contain special anti-wear additives for the gearbox to help extend the life of the gears and prevent the oil from foaming. Like most motorcycle engines, Rotax uses the engine oil to lubricate the gearbox.

Some callers to our shop ask about using Mobil 1 20W50 V-twin oil. No one at Mobil has been able to tell us if its V-twin oil has the gear additives, but the 10W40 MX4T does. Consequently, we recommend the 10W40 MX4T.

### The Bottom Line on Fuel

Use unleaded fuel whenever possible and encourage your local airport to sell 91 octane or higher premium fuel. The 80-hp Rotax 912 engine will run on regular 87-octane fuel, but the 912S and 914 engines must have 91 octane or higher premium autogas. (Note: All octane ratings listed in this article are United States octane ratings—RON + MON/2.)

As more information about this subject is gathered in future months, we'll publish updates in this column.

*Disclaimer: The information in this article is the opinion of this author and has not been reviewed by Rotax. EAA*

Each month in Power ON, Phillip Lockwood, president of Lockwood Aviation Repair ([lockwood@digital.net](mailto:lockwood@digital.net), [www.lockwood-aviation.com](http://www.lockwood-aviation.com)), will address common Rotax engine maintenance or operation issues. In addition, readers are invited to send their questions about various alternative engines to our panel of engine "answer men" or to [editorial@eaa.org](mailto:editorial@eaa.org), or

- For HKS engines, write Dana Persiani, [danapersiani@yahoo.com](mailto:danapersiani@yahoo.com).
- For 1/2 VW engines, write Bill Bronson, [onehalfvwguy@worldnet.att.net](mailto:onehalfvwguy@worldnet.att.net).
- For Corvair engines, write William Wynne, [WilliamTCA@aol.com](mailto:WilliamTCA@aol.com).
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- For Hirth engines, write Matt Dandar, [rpe@bpsom.com](mailto:rpe@bpsom.com).
- For (non-Rotax) two-stroke engines, write Torello Tacchi, [tacchi88@bellsouth.net](mailto:tacchi88@bellsouth.net).

We'll reprint questions and answers of interest in upcoming Power ON columns.

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