



ROTAX OWNER ASSISTANCE NETWORK

Information Education Support

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Oil change for the Rotax 912, 912S and 914 series aircraft engines.

Much concern and many questions have arisen from the oil purging service bulletin (SB-912-036/SB-914-022) and the subsequent Airworthiness directives: Austrian AD-113 and FAA AD-2005-01-14. The mistakes made by a few well intending, but untrained, maintenance persons have led to this barrage of confusing paperwork!

The most common question after reviewing the documents is “Do I have to re-purge my oil system after every oil change?” the answer is based on your own actions. You must understand the oil system and the intent of the maintenance manual before proceeding.

First some history:

The desirable qualities of any aircraft engine are: light weight, powerful, low frontal area and simplicity. The ROTAX 912/914 was designed with these ideals in mind. The light weight comes from keeping the engine as compact as possible and eliminating mechanical devices by taking advantage of inherent forces such as “piston blow-by pressure”. The low frontal area is enhanced by having a remote oil tank, thereby eliminating the need for an oil pan under the engine. The “piston blow-by pressure” eliminates the need for a separate scavenge pump in the crankcase, thus keeping the engine simple and further reducing weight. The high power output comes from tight tolerances and high piston speeds.



How the Oil System works: (see related diagram)

The ROTAX 912/914 is equipped with a dry sump forced flow lubrication system. The oil flow starts at the bottom of the pick-up tube in the oil tank ❶ and is sucked through the oil cooler ❷ via oil lines to the suction side of a trochoid type pump. This completes the suction side of the oil system.

The pressure side of the oil system starts next: The oil pressure from 1.5 to 5 bar (22 to 72 p.s.i.) is controlled by the pressure relief valve ❸. The surplus oil from the pressure relief valve returns back to the pump rotor via a bypass duct. The pump forces oil through a filter cartridge ❹ the oil passes through the matting to the inside of the filter. If the filter cartridge is completely clogged up, the pressure relief valve opens and oil will flow unfiltered into the engine. Prevent this situation by all means, using oil and filter as specified and punctual change of oil filter.

From the oil pump the oil pressure is fed through the oil galleries of the engine. The oil pressure sensor is located at the tail end of the system. (If you have pressure at the sender you have pressure throughout the engine)

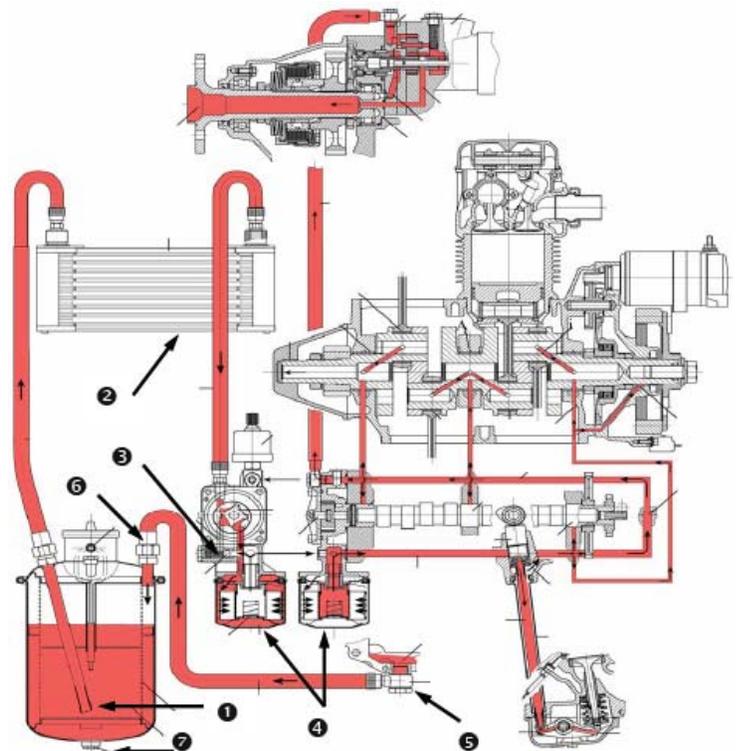
For engines equipped with a hydraulic governor (Version -3), the hydraulic governor is supplied with oil via an external oil line. From the governor flange, oil flows to the pump in the governor, which raises the pressure to approximately 23 bar (333 psi). As the pilot changes the lever position of the governor, more or less oil passes through an oil inlet flange and hollow propeller shaft to the variable pitch propeller, thus changing pitch accordingly.

After oil is forced through the engine oil galleries the surplus oil returns back to the crankcase via ducts and by escaping from every point of lubrication. The oil accumulates on the bottom of the crankcase and is forced back to the oil tank by the piston blow-by gases via hose fitting ❺ and oil return hose (blue).

The oil return fitting ❺ on the tank is angled to cause a swirling action that, in combination with the baffle and screen, separate air from the oil. Thus establishing an oil supply nearly free of air in the suction line.

The oil tank breather ❷ connection is located on the neck of the tank and is routed to a suitable container or into the atmosphere (green).

For oil change, the oil is drained at drain screw ❸ on the bottom of the oil tank.



Review:

Now we know how the system works lets divide and conquer: There are three stages to the system:

1. A suction stage to the pump (the oil is sucked from the oil tank, through the cooler to the pump)
2. A pressure stage through the engine (the pump forces oil through the oil galleries)
3. A return stage to the tank (oil drains to the bottom of the engine and is forced back to the tank by the piston blow-by gases)

Now that we understand the oil system we can consider some practical scenarios:

1. If we had worked on the suction stage, such as removing and replacing the oil cooler, what must be done? Answer: We would need to purge the air from the oil system. See SI-912-018
2. When the oil level is checked it sometimes is lower than expected. Why? Answer: If we want to check the oil level we must return any residual oil in the crankcase back to the tank. This is done by removing the filler cap from the oil tank and then "hand turning" the prop in the correct direction of rotation until a gurgle sound is heard coming from the tank. This sound indicates that air, not oil, is now being forced out of the crankcase and the bulk of the oil is in the tank.
3. Finally, the big question: We want to perform a simple oil change without undue labor and down time costs. Answer: No problem. The current Line Maintenance Manual (remember, it is the owners responsibility to ensure the most current publications are being used) spells out a simple oil change in section 5.2. But, the challenge is to read the manual as it is intended. As a result, SI-912-010 has been issued to clarify and expand on the oil change procedure but it also can be difficult to read.

Lets follow the intent of the manual in plain English to see how simple the oil change really is:

Step one: warm up the engine

Step two: return the residual oil to the tank as in item #2 above. Check the level and record level on your inspection sheet. (For oil consumption trend monitoring.)

Step three: Remove plug from tank and drain oil. Reinstall and safety-wire the drain plug.

Step four: refill tank

Step five: remove and replace oil filter.

STOP:

Although it is easy to read into the manual that you should carry on into the next section in the manual (5.2.1-Oil tank cleaning) that step is separate and optional in the case of heavy contamination. If you do clean the tank you will have to purge the oil system (SI-912-018) Why you ask? Because technically you are then opening and draining the suction stage of the oil system. (It would be simple to plug the pick up tube **1** when removing the tank lid to avoid opening and draining the oil system. This is a consideration that has potential but has the serious drawback of forgetting to remove the plug from the pick-up tube)

Lets carry on:

SI-912-010 expands on the procedure with several important warnings and cautions. This SI should be reviewed clearly understood before starting the oil change procedure. The only additional steps added by SI-912-010 are:

Step six: Turn the engine by hand about 20 times after finishing step five, and

Step seven: Run the engine and check for leaks. (You do that anyways, right?)

You're done!

Conclusion:

Do you need to purge the oil system after a simple oil change? Answer: No, not if stick to the procedure above and you do not open and drain the oil system.

Tips and hints:

*Only use the genuine Rotax oil filter! (More on the technical reasons for this in a future article)

*Half fill the new oil filter with fresh oil before installing it. This helps avoid air in the oil system.

*See SI-912-016 for oil selection and more useful operational tips and hints. Required reading!

*Install a new gasket on the oil tank plug every oil change. This is a crush gasket and it should only be crushed once!

*Install gasket with parting line towards the plug head.

We hope this has helped you to understand the oil system. By understanding the technical aspects of any engine you can avoid the mistakes made by others that come from good intentions based on poor knowledge. So, before you consider blowing out the oil cooler and oil lines with shop air at the oil change, or any other actions, read the maintenance manual and related publications and remember that the oil system has a suction stage that must be maintained free of air.

