I'm tired of Drip, Drip, Drip!
Catching 914 Oil Drips after Long Term Storage Final

By
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I'm sick of that steady drip, drip, drip. I'm to blame that I don't fly 12AY as much as I should. Since I had an overspeed and I noticed the compression falling off on one cylinder, I decided to do a 500-hour top overhaul and gearbox servicing. I asked Kerry Yunk at Lockwood to do my gearbox and pull the cylinders and take a look, dress the valves and fix and repair as necessary. I knew my valves touched the pistons in the overspeed and Kerry changed all 4 intake valves and lapped all the seats. Everything in the engine was like new. However, since the valve and cylinder cleanup there is a serious difference in compression while turning it over to burp it. It is like a 912S now. My compression checks are 79+/80. Problem is I have an oil leak somewhere up around the gearbox and below the turbo. I expected that after maintenance. The gearbox leak aside, I am writing this because over the many years I've had this engine, it has always had a small puddle of oil on the hangar floor from three or four sources.
These sources are common drips on a properly functioning 914. The oil tank vent, the turbo inlet through the filter, and the intake plenum and hoses. Each contribute to an oily nose pant and floor.

Nothing good happens when an engine sets unused. When the engine sets for a while, there are static and dynamic leaks. (See my latest Rotax troubleshooting guide also.)

Static Leaks:

1. Under the turbo is the turbo oil sump. That has an O ring on the tank but the screws that hold it to the turbo can loosen. The oil supply line to the turbo has a ball check valve to prevent overfilling of the tank. Properly functioning, the oil check valve prevents oil from draining through the turbo bearing when shut down. This ball check valve should be cleaned when oil leakage around the can is noticed. The oil reservoir has an O ring between the hot turbo and the can. This normally is good for about 5 years. Some oil draining from the oil pump can flow past the ball check as well as from the oil suction return line from the oil pump. Oil pumps internally allow oil to flow past the trochoid pump internals, but it is not bad. In the Europa XS, a drip or two of oil from under the turbo makes a mess of the top of the metal duct. Just above the turbo is the inlet line and ball check and the split in the turbo case and connection to the muffler. These can leak allowing oil to puddle on the top of the cooling duct also. See the Rotax Heavy Maintenance Manual for servicing the ball check valve.
2. After every flight the oil tank vent line will drip as tank oil vapor condenses and winds its way down the vent hose and over time it leaves a puddle which is understandable.
3. Anytime the 914 sits a month, the oil that leaks through the turbo ceramic seal flows into the turbo inlet and exhaust side. Any oil that was in the turbo cold side (area around the intake turbine) gets blown into the intake plenum. It collects in the plenum and works its way down to the two drains in the bottom of the plenum where the two drains are. This oil is a bit frothy from being whipped up by the turbine and it takes a while to work its way down to the drains, then down to the vent. The rest goes down the carb throat and into the cylinders. After shut down from a brief engine run, the oil drains down the charge hose from the turbo to the plenum and saturates the 2 inch hose. Eventually the hose will soften, and oil will drip from the charge hose area, down the turbo and drip off the exterior bottom of the turbo. This is another mess on the inlet metal duct. If you note the manifold pressure comes up slowly, check your rubber hoses between the turbo, the charge pipe, and the plenum to the carbs. You may have an oily leak and perhaps a loss of manifold pressure.

4. Since the turbo inlet fills with oil, over time, once the turbo turbine inlet side is full, it flows into the air filter. The air filter gets soaked with oil, the rubber neck of the air filter gets saturated, and the filter will begin to leak out the filter element and around the rubber neck. This oil collects on the bottom of the cowl. Then it collects on the rubber duct seal and eventually out the bottom of the cowl and drips from the cowl exit. It is not bad, but it is annoying. If the engine has sat for some time, I use a syringe with a very small plastic hose to draw the excess oil out of the turbo.

5. The hot side of the turbo will also fill with oil. Normally this is tight but the area where the turbo bolts to the muffler will get a film of oil and sometimes drip down on the tray. On engine start the oil that accumulates in the muffler rockets out of the muffler on start and coats the port side belly, wing, gear leg, the ground, etc. It will make a light blue smoke for the first few minutes, while it is spraying oil. After a full power run it is clean. Normally I don't see drips from the exhaust pipe after a flight ever. If the engine is making gobs of blue smoke, the turbo oil seal is gone. That is expensive. Get it fixed.

Dynamic Leaks:

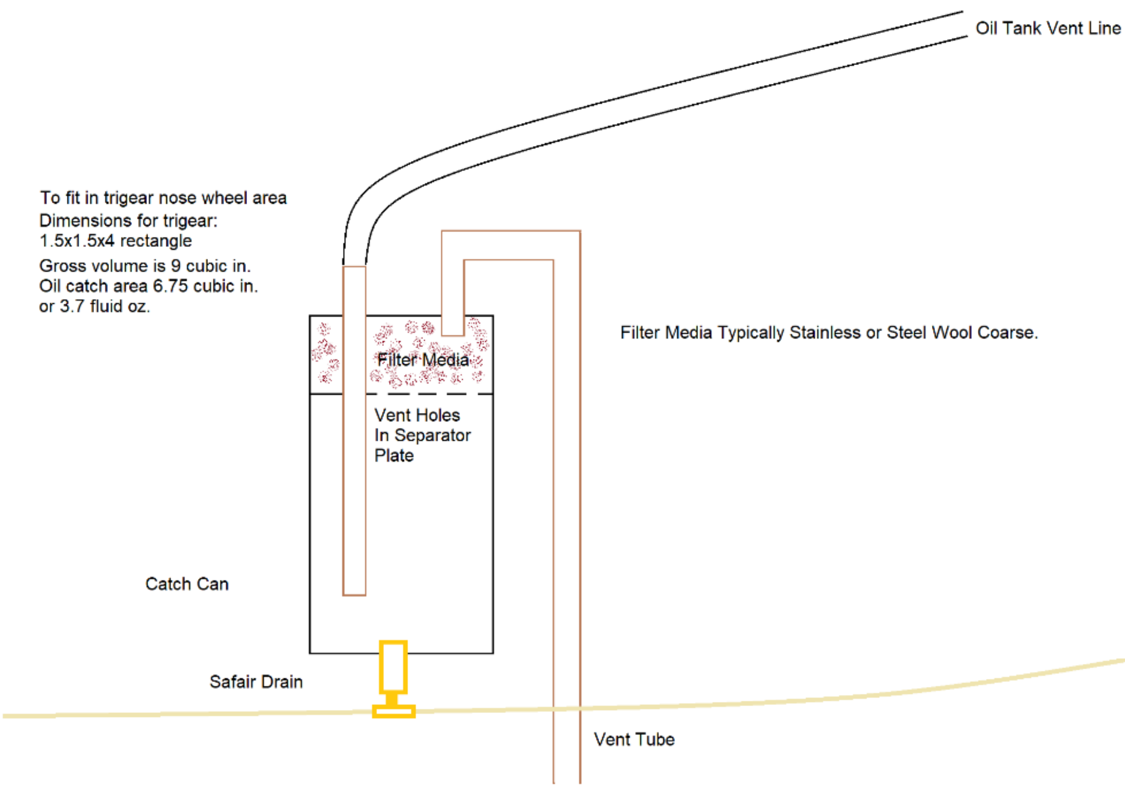
1. After engine start and until the engine is warmed up, oil flows through and unfortunately around the oil seal of the turbo until that seal/bearing heats up. All that oil goes into the muffler and intake plenum, carbs and manifold. Normally there is little to no blue smoke, but one should watch. The plenum is always pressurized by the turbo and as a result oil from the turbo will be forced under pressure out the drain vents under the plenum. This messes up the belly.
2. Once the exhaust system is hot, oil normally does not spit out of the exhaust pipe. However, after every flight and the engine cools, oil collects so some oil loss is expected but it is normally not noticeable.
3. The oil tank when hot is pressurized slightly. The blowby gasses of the crank case blow the oil from the bottom engine banjo fitting, up the hose and into the top of the tank. That pressurized blow by of hydrocarbons, water vapor, NOx, and hot oil vapor has to go somewhere. It is normally vented out of the tank and then out to the free air stream. The vapor travels down a long hose and will cool and an oil film will flow out of the tank vent on to the belly. (On air cooled engines I run an aluminum pipe on to the exhaust pipe and have the heat of the exhaust burn off the vapor.) Unfortunately, the Rotax engines do not have a convenient exhaust pipe out of the belly except on the old 912 equipped Classic engine firewall forward's muffler.
4. One other source of yucky belly filth is the vapor or overflow out of the glycol expansion tank. If the engine begins to reach the glycol vapor or boiling point, pressure builds and this vapor pressure is vented from the cap to the expansion tank and then overboard.

In talking with Ron Paragoris, he was thinking about installing an oil catch can on his Rotax. I looked at the commercial auto units and the cost varied quite a bit. Even the generic ones were $50 without a drain and weighed a couple pounds. They were also fairly large, however the small ones are only 3-4 inches in diameter and 4-6 inches tall. Fitting a can that large into the mono is a trick. The air inlet area under the oil tank is one area to consider. I thought about making a smaller version as on the Jabiru unit. Jabiru made their tank out of fiberglass with one inlet and one outlet. There is no drain but recently they have installed a panel in the glass to view the oil level. I wanted a drain as taking apart an oily catch system is not high on my fun list. Also, I was concerned some synthetic oils may soften fiberglass.

In automotive designs the EPA regulations regulates the emission of the oil vapors and many of these catch tanks work with the PVC valve and vent the vapor back to the engine intake manifold to be re-burnt which makes the oil catch can a closed system. Marine units tend to vent the cooled oil vapor back to the intake manifold also. However, the oil collects in the can and must be periodically dumped. Aircraft units are similar but cost 5 times more. Aircraft type air/oil separators are lighter on the average. Aircraft units vary according to the FAA certification time frame. Most are aircraft specific. The homebuilder unit has a 5/8-inch inlet/outlet and a drain back to the Lycoming or Continental crankcase. These aviation units don't have the options I need for a Rotax, and they are larger than I like, and are more than I want to pay.

The can above is typical of the inexpensive and small sized cans available on Amazon or similar. The lower part of the can simply unscrews to empty. But I'm lazy. The wall thickness is thick enough to tap an 1/8 NPT fitting for a Saf-Air or similar drain.

Basic Rotax Oil Vent Catch Can

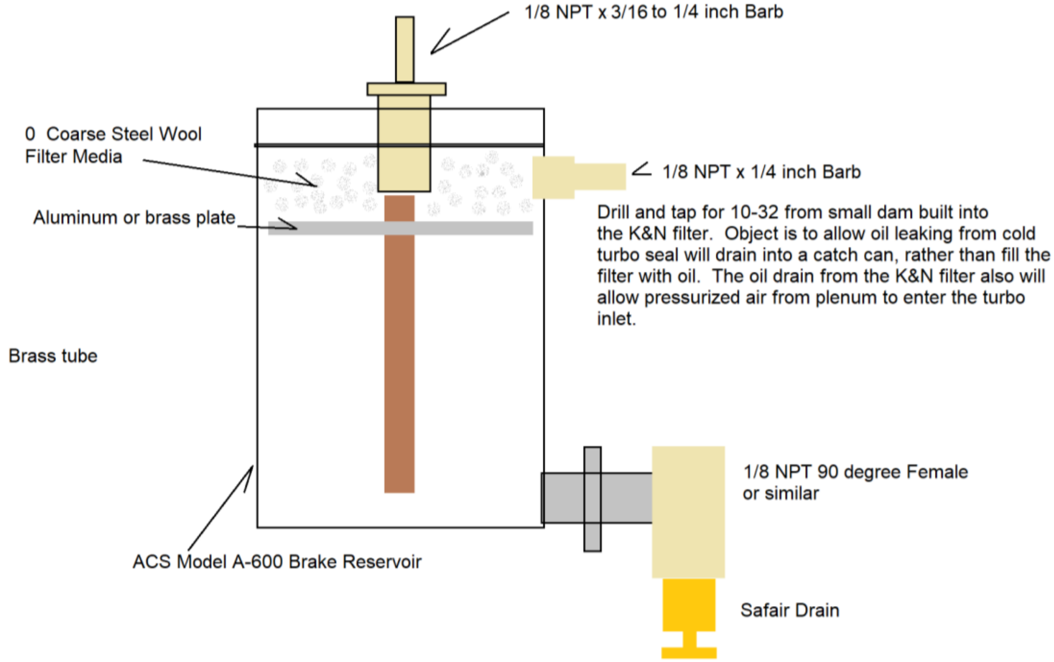


I have a trigear so, I have an area just behind the normal metal firewall area where I create an area for the nose gear trunnion. However, I was very neat, and the hole is rather tight and an automotive type unit won't fit in this area without much extracurricular activity. The area under the oil tank in the turbo inlet would have to have a hole drilled to allow me to drain the oil. I wanted a smaller catch can as the oil amount is small and since I service the aircraft every 25 hours, why not just add a Saf-Air push to drain valve.

I chose to experiment using an ACS brake reservoir. It has an NPT threaded hole in the top and one out the bottom. So, I have an inlet and drain. I just need to drill and tap for a vent out. But nothing is simple.

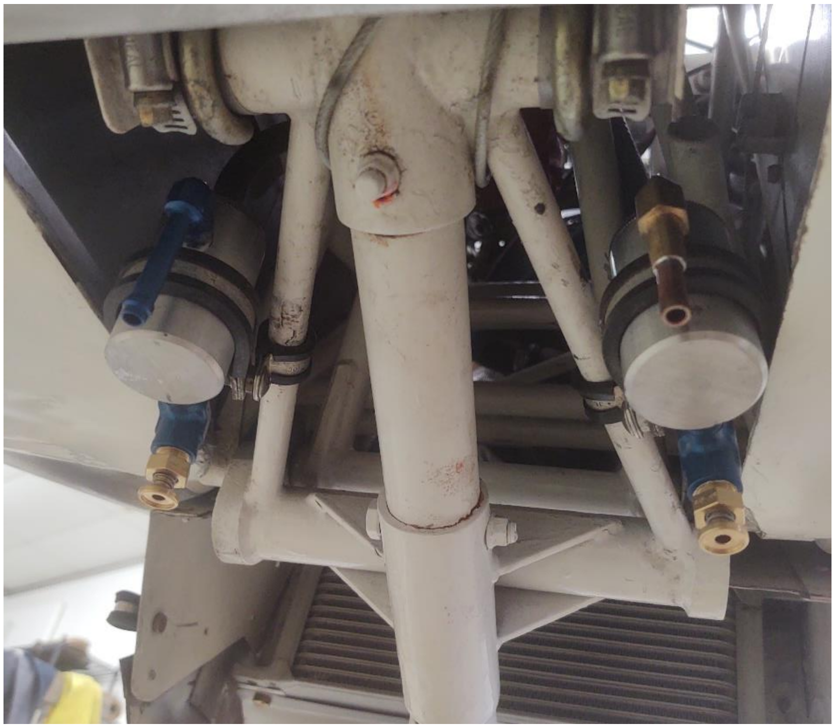
The ACS planned oil catch can is shown below. It is simply an inlet which flows the oil along a tube or side of the tank into a reservoir. Near the top of the can is a separator to prevent spraying oil from flowing out the vent. Many use a filter medium (basically coarse stainless-steel wool) to catch any droplets from flowing out the vent line. After all, we have a catch can to prevent the vented air/oil from bypassing the trap and flowing out on to the bottom of the aircraft.

Oil Catch 914 Plenum and Oil Filter Drain



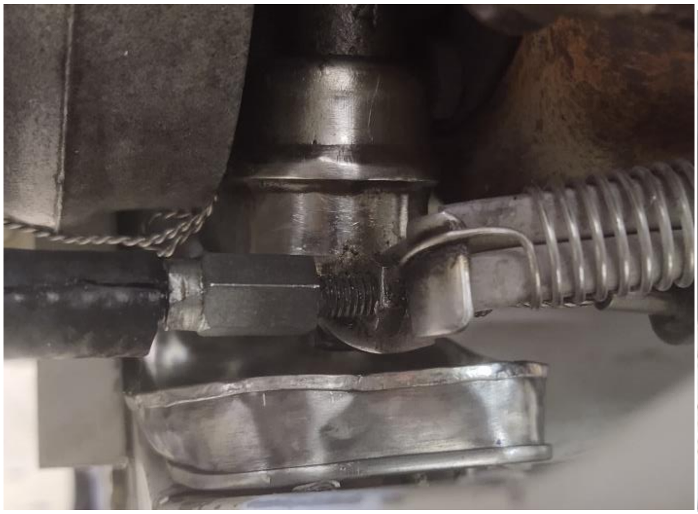
The can is small, and I used OO steel wool above the washer to filter out the oil spray.

Placement of the two ACS drip cans for experimental purposes was to attach the oil tank drain (right side) and the plenum catch can (on the left).

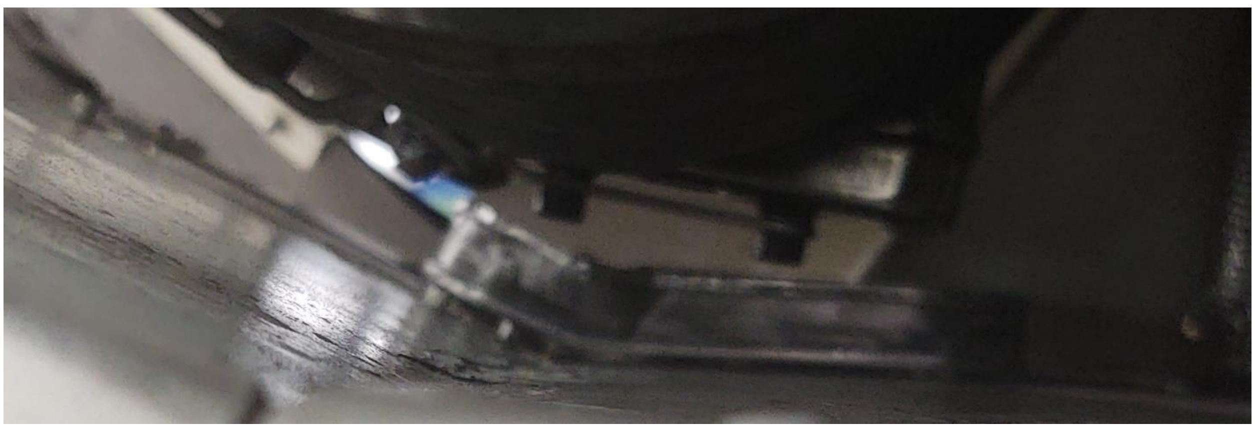


The next issue was the oil that drips from the bottom of the oil reservoir can under the turbo.
I fabricated a can from the bottom of a metal quart can from the shop. I cut it down, rolled the edges and inserted a small 5/32 OD brass tube as a drain. Of course, nothing is easy. The area I wanted to place the can was curved, the drain needed to be installed in the can to drain easily. I used my flaring tool to flare the brass tube end, dimpled the bottom of my catch can, then used a #8 brass washer and dimpled that to form a flush fitting drain. To seal the drain, I soldered the brass to the steel can and used the brass washer as a simple soldered in flange to permanently hold the brass tube firmly in place.

It is not pretty but it is an experiment only.




The drain is out of a drilled hole then will tuck under the rubber seal and exit the rear without any catch.



The drip tray under the turbo covers the area under the reservoir from front to back. Looking from the port side under the muffler the angled drip can sets right under the reservoir.

The three separate catch cans/drip tray should work. But as in any experiment, it will require tweaking.

So far, my ground test results are mixed. The under turbo catch can has been a waste of time but we will see after a 25 flight hours. Of course, my air charge 2 inch tube from my turbo outlet to the plenum was a greasy mess and required tightening of the clamp. Looks like a change of the rubber hose will be in the cards soon.

The tank vent seems to work fine, but time will tell. It has only a couple drops of oil and water from vapor oil so far in the tank from the ground runs.

The plenum catch can has been a big help. This can did catch all the plenum oil from my initial ground runs. I find I can simply tilt my reservoir can and drain every bit of the oil using the Saf-Air drain.
I have not considered a catch can for the glycol. Since my engine has just had maintenance, I noticed my cylinder temps with the cowl on at full power are climbing much more rapidly. I'm getting a small amount of boiling in my glycol and the reservoir tank fills nearly full. This is common after maintenance as the slightest pressure leak causes elevated glycol temps and when the cylinder temps hit about 250F

and a shutdown is made shortly thereafter, some steam will escape. Boil over in my aircraft is normally due to a small pressure leak raising the boiling point of the 50/50 mix glycol.
I have always said a Rotax should not leak oil or glycol. However, after any maintenance of the oil or coolant lines one must do an extensive leak check. My high CHT issue on runs was most likely the slight pressure leak in my cooling system, and a clamp was tightened, and more extensive checks will be made.

Always do a leak check after maintenance of the engine after major maintenance. Even a simple oil change requires more than just a quick check at idle then cowl up and go fly. I prefer to run up and do a full power check on the ground.

Here are some maintenance related issues I've seen over the last 20 years to double check prior to an engine run after maintenance chores.

1. Oil filters are messy if not properly seated. Always lube the oil seal prior to installation. I fill my oil filter prior to install, so it is necessary to use rags or paper towels to catch any spillage. Don't catch the rag/towel in the oil filter O ring or fail to follow the tightening instructions.

2. Another issue is sealing the magnetic plug. This 18 foot pound plug has a new hex head predrilled for safety wire. I like this new unit, but I find its threads are a bit loose and I use sealant on the threads like Loctite 515 or similar or it will drip.

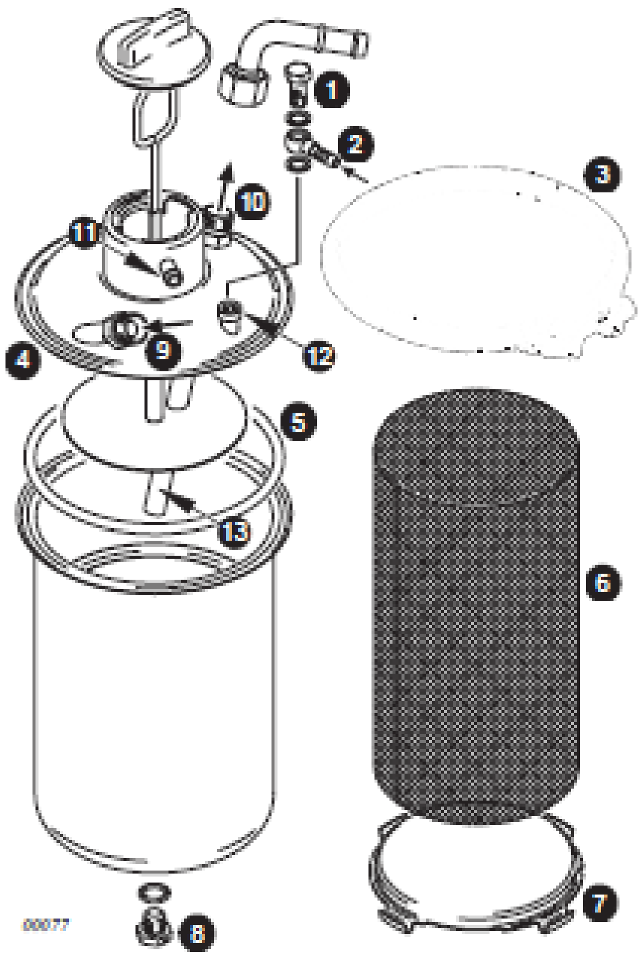
3. The oil tank vent line is a messy drip after flight. The tank should only have an inlet pressure of about 5 PSI max from the crankcase so a 5/16 sized hole to exit should not spray oily vapor. I have no idea what the pressure is from the turbo oil return. It can't be that much pressure as the line is only an ID of 3mm. The only requirement should be to have the drain hose run downhill and exit the aircraft at a zero pressure point. Be sure to not angle the vent to cause suction or pressure at the vent.

4. Double check your charging and plenum connection hoses. Simple rubber hose gets slimy and slippery and can pop off under full boost. The new Viton lined (EPA approved marine grade) hose clamps and holds better. I don't use all silicone hose unless a tough outer liner protector layer is on the silicone hose or liner as I fear the silicone will be cut/damaged from clamping.

5. One other messy drip source is the oil can. I recently had a few sprays on the cowl metal inlet duct from my oil can O ring seal. The tank top sat proud of its normal position due to the metal screen not seated fully down on the lower baffle which inhibited the can top from seating and sealing with the O ring. At full power the pressure builds in the crankcase and can and the oil will spit out of the seal and all over your engine compartment.

Note:

The oil can bottom baffle (7) fits inside the oil screen (6). It is designed to fit up against the can top (4). Oil that enters the "IN" fitting (9) flows crankcase oil and gases back to the oil tank and impacts directly on the seal area so you must have a good seal of that O ring. I do not use sealant on the oil tank.
I carefully rolled the prickly edges of the screen (6) and made sure the fit of the screen was flawless. I installed a new O ring, rotated and checked the fit, and all was fine.



I run 100LL fuel all the time and I believe after the last cleaning I was less than careful seating my oil screen. It is now a thing of beauty and fits flawlessly. Of the 4 areas of oil leaks I found the maintainer was the issue. Any drip of coolant or oil from your Rotax must be investigated. Once you investigate, it is usually something simple.

As my father always said, "Go slow and take your time. Do it right the first time."