



Rotech Flight Safety Ltd. 6235 Okanagan Landing Road

Vernon, BC V1H 1M5 Canada

Phone: 250-260-6299 Fax: 250-260-6269

Website: www.rotechflightsafety.ca

INVESTIGATION REPORT

ACCIDENT INFORMATION

Date of accident:	March 16 2013	NTSB file number:	ERA13LA171
Location of accident:	Immokalee FL	FAA Inspector:	Gonzalo DelValle
Location of Investigation:	Immokalee FL	Law Enforcement:	CPL. Lussier R
Investigator In charge:	Eric Alleyne	Corner / Medical Examiner	Unknown

AIRCRAFT INFORMATION

Aircraft Make:	Aerolite	Aircraft registration:	N2549W
Aircraft Model:	103	Aircraft S/N	411
Propeller make, model & S/N	Unknown		

ENGINE INFORMATION

Engine Type:	Rotax 503 SCDI	Engine TTSN	Approx 28 hrs
Engine Serial Number:	M565960	Engine TTSOH	N/A
Engine Manufacture date:	2004	Engine position:	Pusher

ADDITIONAL INFORMATION

Persons in attendance:	Thomas Kuhns - Aviation Safety Inspector – FAA		
	Joe Rivera - Principal Maintenance Inspector - FAA		
	Marcia McNulty - Owners / Accident pilots wife		
	Jordan Paskevich - Accident Investigator - Rotech Flight Safety - Rotax		
Date of Report:	April 2013		
RFS File number:	2013-010		

DATE	ENGINE MODEL	ENGINE SERIAL NO	REGISTRATION	File number
March 16 2013	Rotax 503 SIDI	M 565960	N2549W	2013-010

NTSB PRELIMINARY

On March 16, 2013, about 1000 eastern daylight time, an experimental, amateur built, Aerolite 103, N2549W, was substantially damaged when it collided with terrain near Immokalee, Florida. The private pilot sustained serious injuries.

The airplane was registered to and operated by the private pilot under the provisions of Title 14 Code of Federal Regulations Part 91. Visual

meteorological conditions prevailed and no flight plan was filed for the personal flight. The flight departed from Immokalee Regional Airport (IMM), Immokalee, Florida at 0900.

According to the pilot's spouse, he was returning from a local flight. She spoke to him prior to his departure and he stated that everything was "fine" with the airplane. This was the last time she spoke to the pilot. At approximately 1045, the pilot called 911 to advise them that he had crashed his airplane and needed assistance. First responders located the pilot, and he was transported to a local hospital.

Examination of the airplane by the local authorities revealed that it came to rest in a heavily wooded area, and exhibited substantial damage. The airplane will be recovered for further examination at a later date.



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Initial Inspection

The on-site investigation took place on April 11 2013 at the Immokalee Regional Airport, in the owners/ pilots hanger.

FAA Aviation Safety Inspector Thomas Kuhns , FAA Principal Maintenance Inspector Joe Rivera and Owner/ pilots wife Marcia McNulty were present during the engine examination.

The engine was found sitting on the hanger floor and attached to partial remains of the aircraft and engine mount.

The carburetor was displaced from the engine due to impact. The oil injection tank was placed into a container to prevent injection oil from spilling on the ground.

Two of the three propeller blades were present but sustained sever impact damage. Signs of rotation was seen on the remaining blades. One of the propeller blades was broken off at the route and was not available for inspection.



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Initial Inspection

The Rotax engine is a 503 Single Carburetor, dual ignition, fan cooled with electric start and oil injection. It is a twin cylinder 2 stroke engine with a tuned exhaust and a reduction drive gearbox.

The fuel system was equipped with a primer bulb and a primer plunger. The fuel system was found breached between the primer bulb and fuel tank. A liquid that was constant with fuel was found contained within the fuel lines.

The fuel filter had been previously removed by FAA inspectors and recovered for further examination. The fuel filter was not available for inspection during the time of the engine examination.

Intake side of engine



Oil Injection pump



Primer Bulb



Primer Plunger



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Initial Inspection

Based on the engine serial number and a sales invoice that was recovered at the time of the engine examination, the engine was sold in November 18 2004 to Mr. John McNulty.

This would make this Rotax 503 engine over 5 years old. In the Rotax maintenance manual section **10.2) Maintenance schedule** it states that general overhaul of engine to be carried out every five years or every 300 hours whichever comes first.

No records showed that this engine ever received an overhaul.



MAINTENANCE MANUAL

10.2) Maintenance Schedule

The following maintenance is planned and necessary for ROTAX 447 UL SCDI, 503 UL DCDI, 582 UL DCDI and 582 UL DCDI mod. 99:

38	General overhaul of engine 9)																	X	11.33	
	Checks and work	2 h	10 h	12,5 h	25 h	50 h	75 h	100 h	125 h	150 h	175 h	200 h	225 h	250 h	275 h	300 h				

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- | | |
|--|---|
| <p>1) and after every replacement of gasket(s)</p> <p>2) also after any damage</p> <p>3) according to instructions of manufacturer</p> <p>4) if carbon layer is more than 0,5 mm thick, decarbonize</p> <p>5) if piston ring sticks clean and replace if necessary</p> <p>6) if used in very dusty atmosphere</p> <p>7) wear limit see Service Information 5 UL 91</p> | <p>8) If cylinder has been dismantled</p> <p>9) To be carried out every five years or every 300 hours whichever comes first. contact authorized distributor or service center.</p> <p>10) To be examined after every 12,5 hours of operation.</p> <p>11) Necessary only if piston rings are not freely moving</p> |
|--|---|

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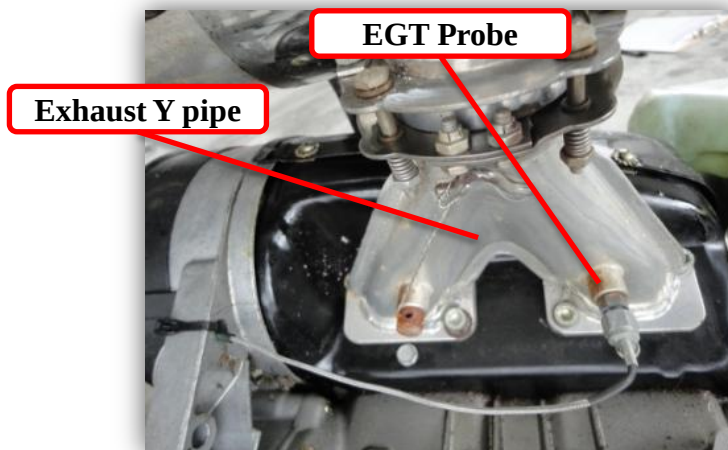
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Initial Inspection

Examination into the engine exhaust gas monitoring system revealed that the engine was only equipped with one EGT probe on the PTO (power take off) cylinder.



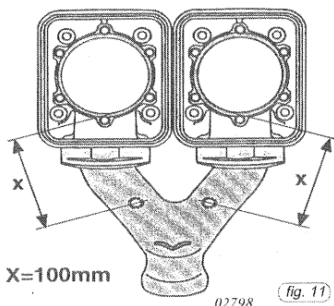
Having only one EGT probe monitoring one cylinder exhaust gases would only provide limited information on the running condition of the engine.

In the Rotax installation manual section **10) Exhaust system**, subsection **10.3) Exhaust gas temperature (EGT)** page 10-2, it states "Exhaust gas temperature will give the most rapid response in the event of improper mixture, pre-ignition or detonation. Ideally the exhaust temperature should be measured about 100mm (4 in) from the piston, with separate sensors for each cylinder."

10.3) Exhaust gas temperature (EGT):

Exhaust gas temperature will give the most rapid response in the event of improper mixture, pre-ignition or detonation. Ideally the exhaust temperature should be measured about 100 mm (4 in.) from the piston, with separate sensors for each cylinder.

EGT (max.) = 650 ° (1200 °F)



■ **ATTENTION:** The exhaust manifold is provided with tapped holes. If the EGT is not measured the holes must be closed with screws which must be safety-wired.

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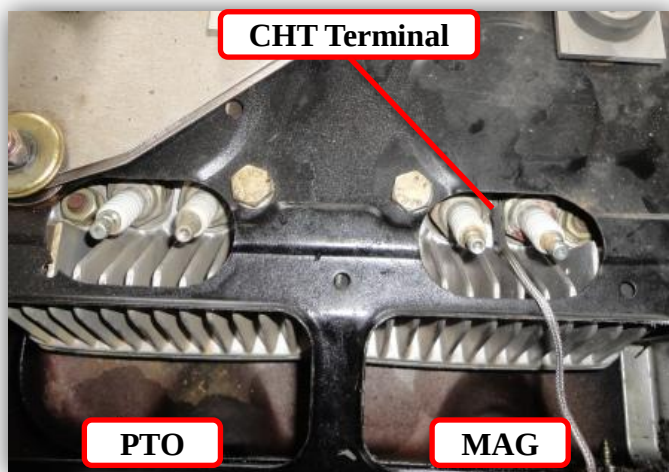
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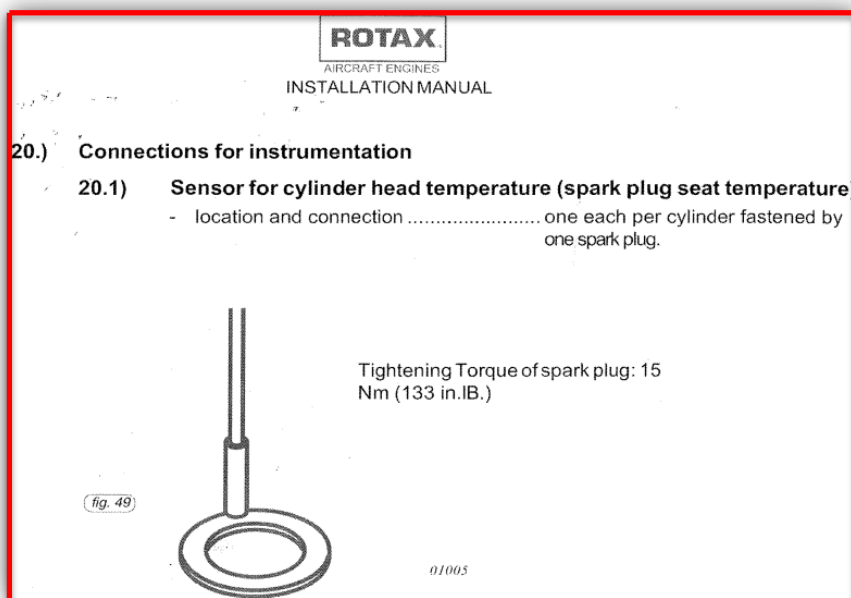
Initial Inspection

Examination into the engine cylinder head temperature monitoring system revealed that the engine was only equipped with one CHT terminal on the MAG (Magnet) cylinder.

Having only one CHT terminal monitoring one cylinder head temperature would only provide limited information on the running condition of the engine.



In the Rotax installation manual section **20) Connections for Instruments, page 20-1** It states the location and connection for the CHT sensor terminal and states one each per cylinder fastened by one spark plug.



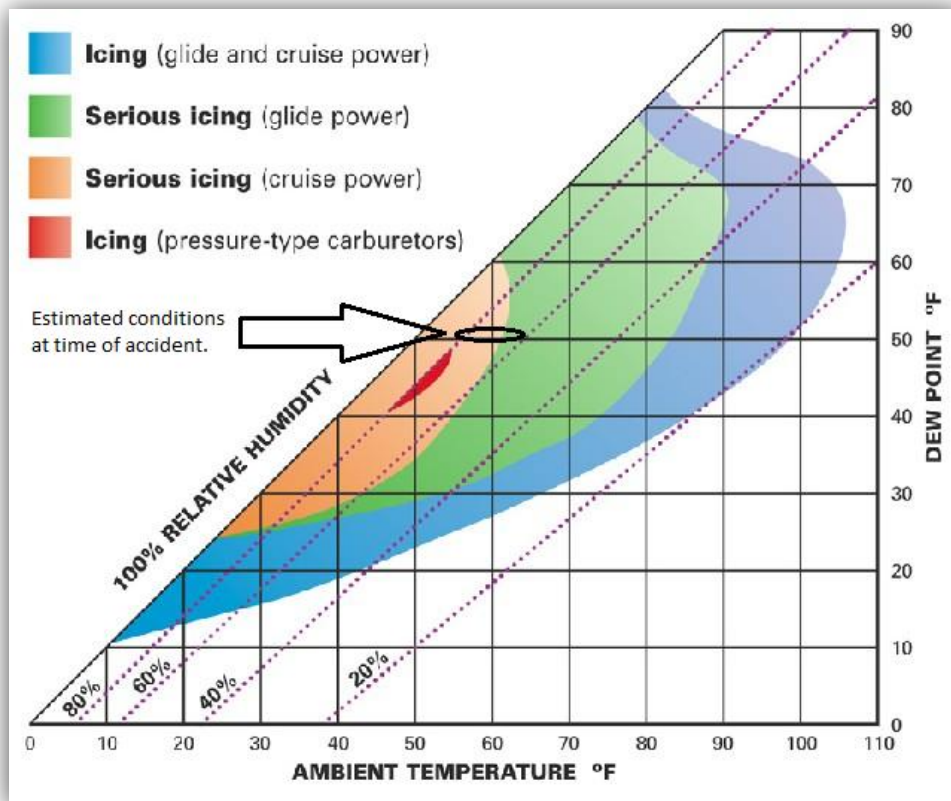
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Initial Inspection

Inspection into the carburetor and intake system revealed that this Rotax engine was not equipped with a carburetor heat system.



According to the ice conditions and carburetor ice chart provided by FAA Aviation Safety Inspector Thomas Kuhns, the pilot was flying in serious icing conditions.



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Initial Inspection

Weather Conditions at time of accident

Hourly Observations

Time (EDT)	Temp.	Dew Point	Humidity	Pressure	Visibility	Wind Dir	Wind Speed	Gust Speed	Precip	Events	Conditions
12:53 AM	54.0 °F	43.0 °F	66%	30.20 in	10.0 mi	NNE	3.5 mph	-	N/A		Clear
1:53 AM	52.0 °F	43.0 °F	71%	30.19 in	10.0 mi	NNE	3.5 mph	-	N/A		Clear
2:53 AM	50.0 °F	43.0 °F	77%	30.18 in	10.0 mi	ENE	3.5 mph	-	N/A		Clear
3:53 AM	50.0 °F	43.0 °F	77%	30.17 in	10.0 mi	Calm	Calm	-	N/A		Clear
4:53 AM	48.9 °F	42.1 °F	77%	30.16 in	10.0 mi	Calm	Calm	-	N/A		Clear
5:53 AM	48.0 °F	43.0 °F	83%	30.16 in	10.0 mi	Calm	Calm	-	N/A		Clear
6:53 AM	50.0 °F	46.0 °F	86%	30.17 in	9.0 mi	Calm	Calm	-	N/A		Clear
7:53 AM	51.1 °F	46.9 °F	86%	30.19 in	7.0 mi	Calm	Calm	-	N/A		Clear
8:53 AM	54.0 °F	50.0 °F	86%	30.19 in	9.0 mi	Calm	Calm	-	N/A		Clear
9:53 AM	64.0 °F	51.1 °F	63%	30.20 in	10.0 mi	South	6.9 mph	-	N/A		Clear
10:53 AM	69.1 °F	48.0 °F	47%	30.19 in	10.0 mi	SSE	9.2 mph	-	N/A		Clear

In the Rotax installation manual section **16) Carburetor** subsection **16.1) Carburetor air intake**, it states that “If the aircraft is to be operated in climatic conditions where carburetor icing is likely to occur, a heating system must be fitted.”

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16.1) Carburetor air intake

If the aircraft is to be operated in climatic conditions where carburetor icing is likely to occur, a heating system must be fitted.

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Detailed Inspection

Spark Plugs & Caps

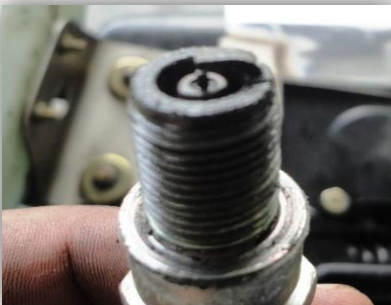
PTO (power take off) # 1 Spark Plug & Cap

- LB05EZ Spark plug cap with resistor in good physical condition
- NGK B8ES Spark plug without resistor
- Black electrode with heavy oil deposits on the electrodes and insulator. In the Rotax maintenance manual section **11) Maintenance of the various systems**, subsection **11.7) Inspection of spark plugs** it states " On engines with single carburetor, one sooty spark plug usually indicates a bad plug or faulty ignition system. If both plugs are sooty with oil deposits, carburetion and air system should be checked.
- The electrode gap was .021 (Not within specs) (.016 - .018 electrode gap limitation)



PTO (power take off) # 2 Spark Plug & Cap

- LB05EZ Spark plug cap with resistor in good physical condition
- NGK BR8EV fine electrode spark plug with resistor and removable threaded cap (**Non conforming spark plug**)
- Black electrode with heavy oil deposits on the electrodes and insulator. In the Rotax maintenance manual section **11) Maintenance of the various systems**, subsection **11.7) Inspection of spark plugs** it states " On engines with single carburetor, one sooty spark plug usually indicates a bad plug or faulty ignition system. If both plugs are sooty with oil deposits, carburetion and air system should be checked.
- The electrode gap was .019 (Not within specs) (.016 - .018 electrode gap limitation)



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Detailed Inspection

Spark Plugs & Caps (Continued)

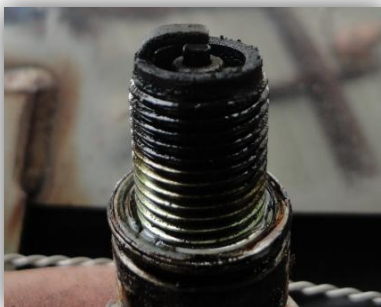
MAG (Magneto) # 3 Spark Plug & Cap

- LB05EZ Spark plug cap with resistor in good physical condition
- NGK BR8EV fine electrode spark plug with resistor and removable threaded cap (**Non conforming spark plug**)
- Black electrode with heavy oil deposits on the electrodes and insulator. In the Rotax maintenance manual section **11) Maintenance of the various systems**, subsection **11.7) Inspection of spark plugs** it states “ On engines with single carburetor, one sooty spark plug usually indicates a bad plug or faulty ignition system. If both plugs are sooty with oil deposits, carburetion and air system should be checked.
- The electrode gap was .020 (Not within specs) (.016 - .018 electrode gap limitation)



MAG (Magneto) # 4 Spark Plug & Cap

- LB05EZ Spark plug cap with resistor in good physical condition
- NGK B8ES Spark plug without resistor
- Black electrode with heavy oil deposits on the electrodes and insulator. In the Rotax maintenance manual section **11) Maintenance of the various systems**, subsection **11.7) Inspection of spark plugs** it states “ On engines with single carburetor, one sooty spark plug usually indicates a bad plug or faulty ignition system. If both plugs are sooty with oil deposits, carburetion and air system should be checked.
- The electrode gap was .018 (within specs) (.016 - .018 electrode gap limitation)



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Detailed Inspection

Spark Plugs & Caps (Continued)

Rotax maintenance manual section **10.2) Maintenance schedule** it states that inspection of the spark plugs should be carried out every 12.5 hours of operations and replaced every 25 hours. (See Appendix A for the Rotax Maintenance schedule)

Ignition Modules & Ignition wires

The ignition models and ignition wires were examined for condition and conformity. The ignition modules were the proper type and in good physical condition



A cracked boot was found on the # 4 MAG spark plug ignition wire. This boot is to protect the contacts from the elements. Rotax maintenance manual section **10.2) Maintenance schedule** it states that checking of the ignition system is to be done every 25 hours. (See Appendix A for the Rotax Maintenance schedule)

Rotax maintenance manual section **11.9) Check of the ignition system** states to “ Verify all electrical connections for good contact and ensure there are free of corrosion. Inspect the wiring for wear, damage and corrosion.

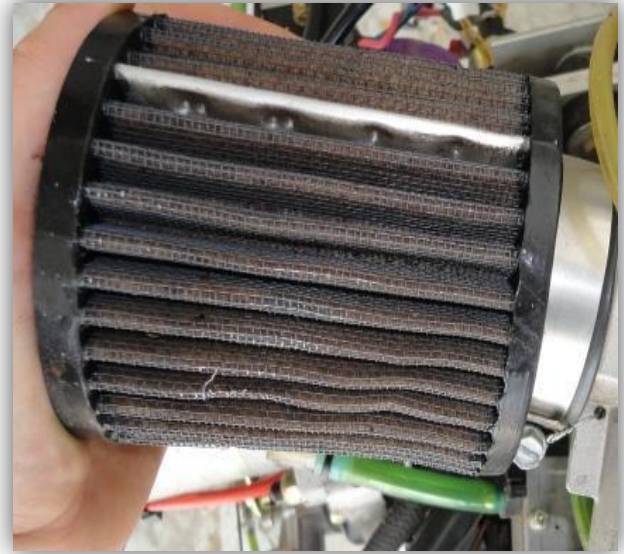


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Detailed Inspection

Air filter

The air filter was examined for condition and conformity. The air filter was found to be dirty which would affect the overall performance of the engine.



In the Rotax operators manual section **10.3.2) Daily checks**, it states **WARNING:** Repair as necessary all discrepancies and shortcoming before flight. It also states to Verify security and condition of intake silencer and air filter.

10.3.2) Daily checks

▲ **WARNING:** Repair as necessary all discrepancies and shortcoming before flight.

- Verify security and condition of intake silencer and air filter.

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582 DCDI
OM Edition 2 / Rev. 0

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In the Rotax installation manual section **10.2) Maintenance Schedule**, it states to clean and oil air filter every 25, 50, 75, 100, 125, 150, 175, 200, 225, 250, 275 hours. (**See Appendix A for the Rotax Maintenance schedule**)

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Detailed Inspection

Air filter (Continued)

The air filter was found to be a non conforming air filter with no lock wire fixation tabs. In the Rotax installation manual section **17.2) Air filter** it states that only air filters approved by Rotax are permitted for use. The air filters specified by Rotax are special K&N air filters.

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17.2) Air filter

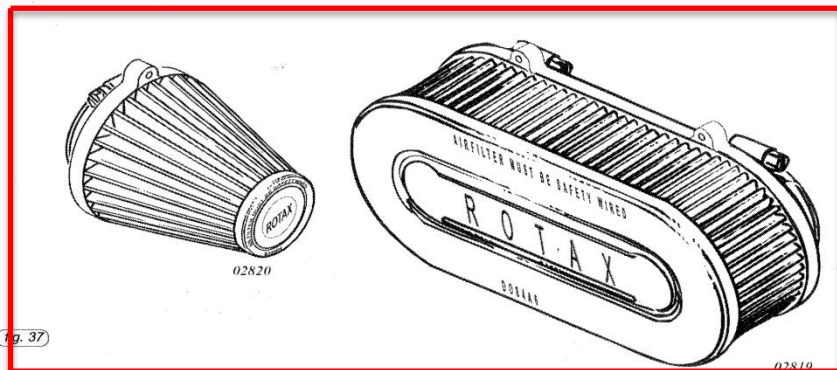
Only air filters approved by ROTAX are permitted for use. The air filters specified by ROTAX are special K & N air filters. Dry filter elements of paper are not allowed for humid operating conditions, as they absorb water, thus reducing the air intake leading to enrichment of the fuel/air mixture.

Two kinds of filter design are applied on these engines:

- Single air filter
- Double air filter

With 2 carburetors on engine, either 2 single air filters or 1 double air filter may be fitted.

■ **WARNING:** Always secure air filters against loss.



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Detailed Inspection

Carburetor

The carburetor was inspected for condition, conformity and proper components.

Since the carburetor was found displaced from the engine due to impact, the carburetor position angle relative to the crankshaft could not be determined.

This carburetor relative angle is important to ensure an equal mixture distribution to both cylinders on a single carbureted engine.

The carburetor float bowl was removed and examined for contamination and proper components. The float bowl had no fuel contained inside but evidence of fuel contamination could be seen through the float bowl. The float bowl gave off an odor of old stale fuel.



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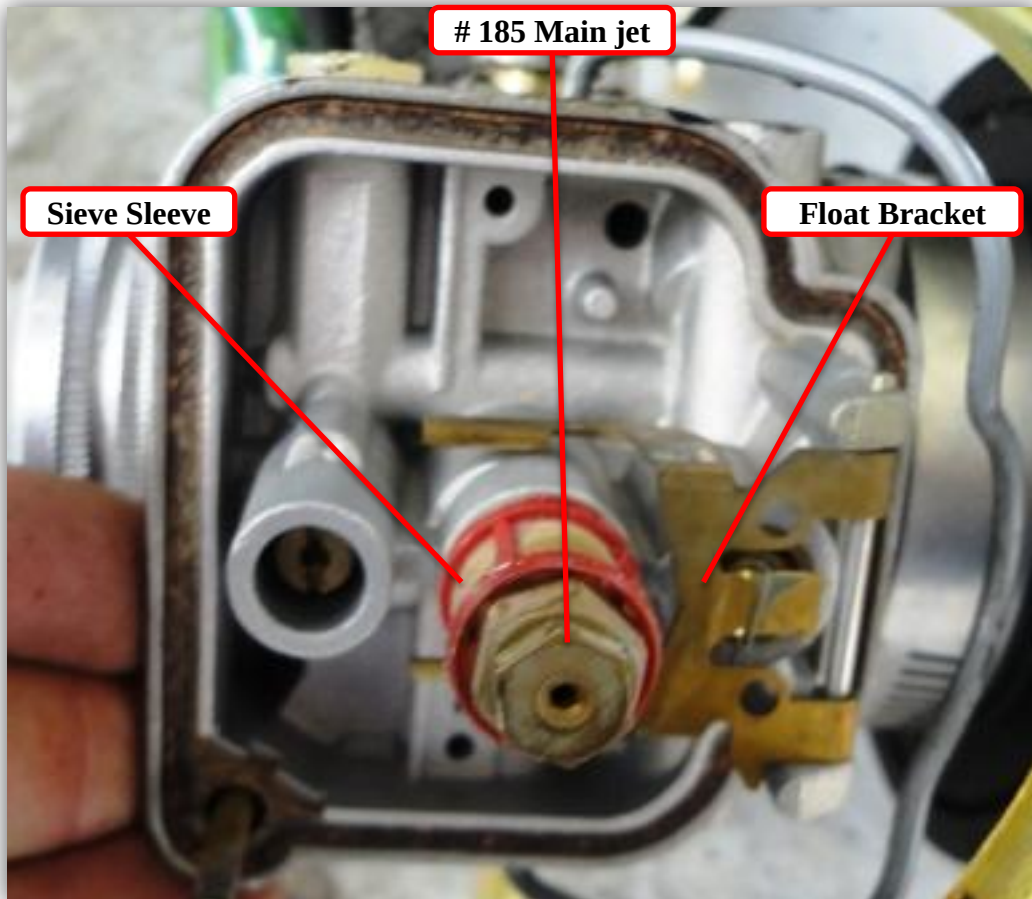
Detailed Inspection

Carburetor (Continued)

With the float bowl removed the bottom of the carburetor could be examined for condition and proper components.

The main jet was examined for proper size and any obstructions and blockages. The carburetor main jet was a number 185 (stock size) and was free of any obstructions and blockages.

The sieve sleeve was examined for condition proper installation. No anomalies were seen with the sieve sleeve. The float bracket was examined and found to be in good overall condition.



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Detailed Inspection

Carburetor (Continued)

The intake of the carburetor was examined for condition and contamination. Yellow staining and a build up of material was found in the intake of the carburetor. This is signs of poor fuel quality and improper of air filtration.

Yellow staining and buildup of material



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Carburetor (Continued)

The top of the carburetor was removed to examine the jet needle for condition, proper installation and proper components.

The jet needle was the stock number 15K2 with the needle clip in the stock number 3 position. It was found installed correctly and in good overall condition.

No anomalies were found with the jet needle.



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Detailed Inspection

Fuel Pump

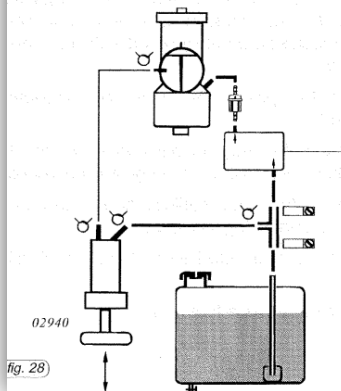
The fuel pump was examined for condition, proper type and mounting position.

The fuel pump was the proper type sold by Rotax and in good overall condition. It was mounted with the weep drain hole towards the bottom of the fuel pump as recommended in the Rotax installation manual.

The Fuel pump was improperly mounted using tie wraps and fixated to the engine. In the Rotax installation manual section **15) Fuel system page 15-1** It states "The fuel pump should be installed in a cool place (not on the engine itself). With the small drain hole near the impulse connection towards the bottom". No other anomalies were found with the fuel pump.

15) Fuel System

Schematic arrangement, 1 carburetor version



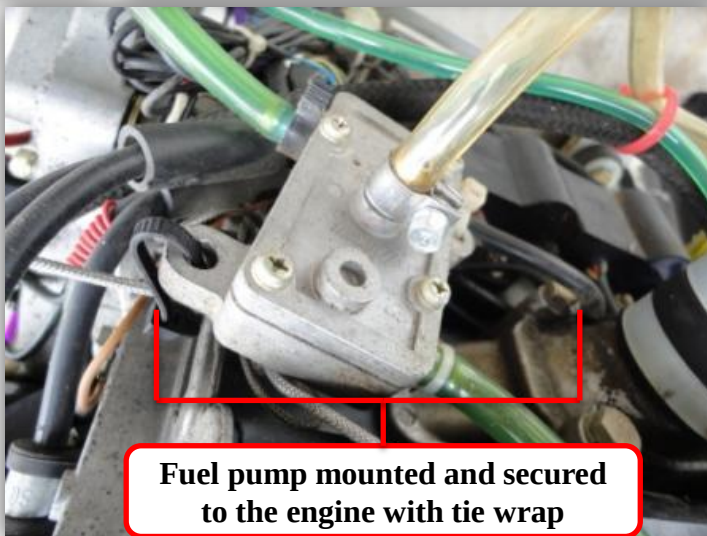
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The fuel pump should be installed in a cool place (not on the engine itself), with the small drain hole near the impulse connection towards the bottom. This hole drains oil condensate from the pump diaphragm chamber.

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Detailed Inspection

Fuel lines

The fuel lines were examined for condition, security and proper routing. The fuel line from the fuel pump to the carburetor was secured with tie wraps. In the Rotax repair manual section **10.2.5) Elimination of air leaks in the fuel line:** It states that "Some commercial clips are often not very satisfactory on small pipes, as they tend to tighten up oval, creating a possible leak. "Crimp on" clips can be unsatisfactory if incorrectly applied, and are difficult to remove for servicing. Replace all doubtful fuel line clamps with good quality approved ones." Rotax recommended clips are P/N 938 195 which are a spring type clamp.

10.2.5) Elimination of air leaks in the fuel line:

If air leaks are indicated, seek to eliminate them. The arrows on the diagram show possible air leakage points. Some commercial clips are often not very satisfactory on small pipes, as they tend to tighten up oval, creating a possible leak. "Crimp on" clips can be unsatisfactory if incorrectly applied, and are difficult to remove for servicing.

Replace all doubtful fuel line clips with good quality approved ones. Quick release type connectors can cause air leaks, and also produce flow restrictions and possible blockage sites - likewise fuel tap connections and glands. If the fuel tank is below the engine, it is best to leave the fuel tap turned on all the time - use it only in an emergency.



**Tie Wraps used to secure fuel line
between fuel pump and carburetor**

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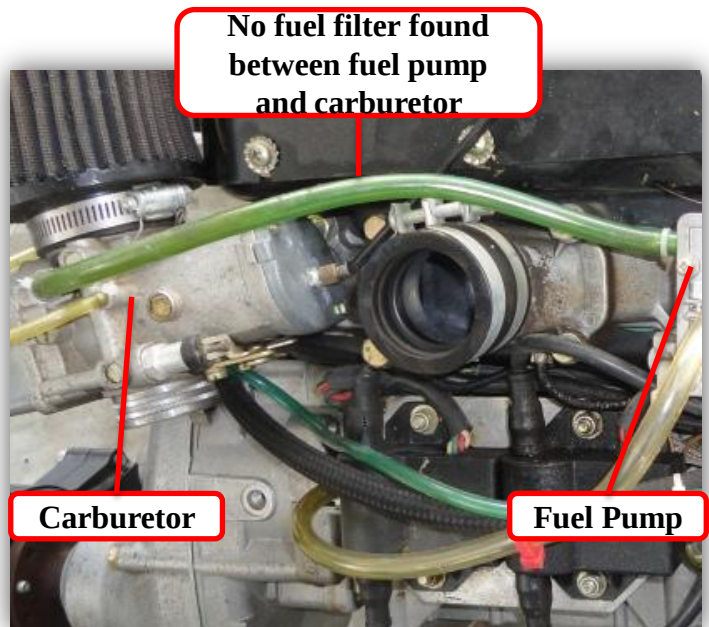
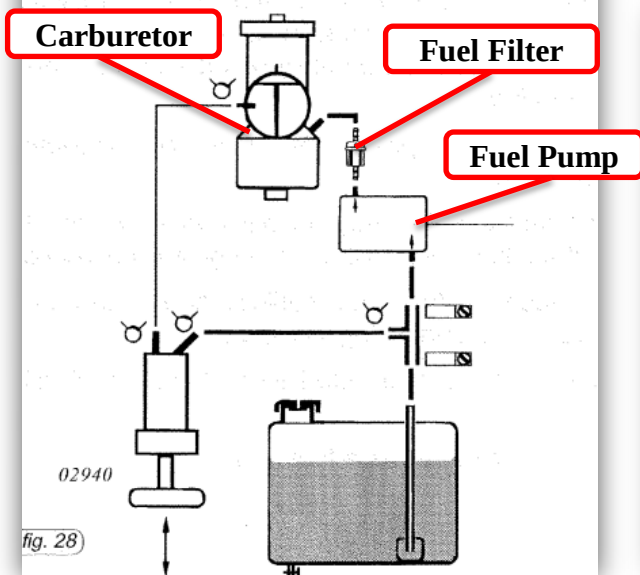
Fuel lines (Continued)

In the Rotax installation manual section **15) Fuel System**, page 15-2, it states that “A suitable fuel filter of 0.15mm mesh size must be fitted between fuel pump and the carburetor. No fuel filter was found installed between the fuel pump and Carburetor.

A suitable fuel filter of 0,15 mm mesh size must be fitted between pump and carburetor. Do not use paper filters. The fuel tank must have a drain cock for

15) Fuel System

Schematic arrangement, 1 carburetor version



In the Rotax repair manual section **10.2.4) Examination of fuel line between tank and fuel pump**: it states “ This section of pipe is under considerable negative pressure when the engine is running hard, and the tiniest flaw in any joint will cause air to be sucked into the system, considerably reducing the capacity of the fuel pump. Air leaks are much more dangerous when the fuel tank is mounted below the fuel pump and carburetor.

10.2.4) Examination of fuel line between tank and fuel pump:

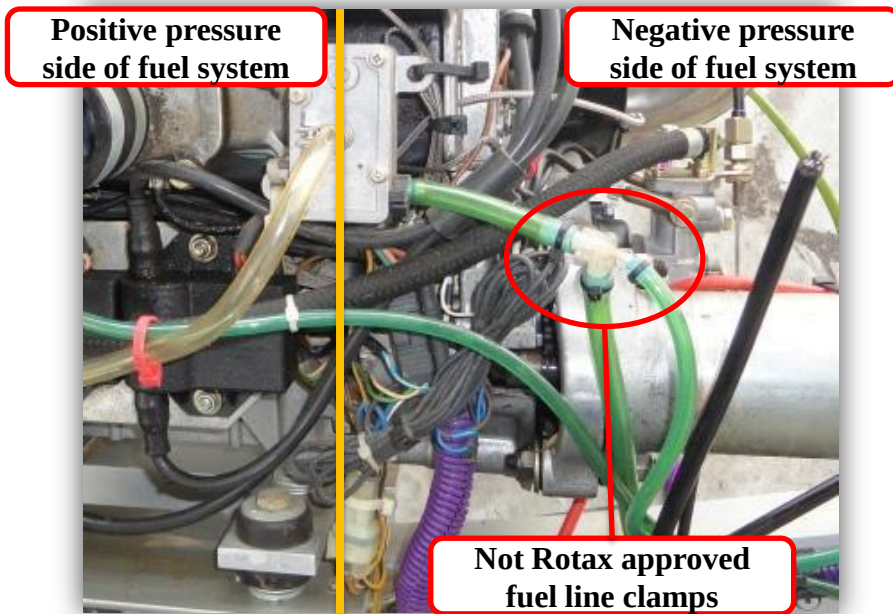
This section of pipe is under considerable negative pressure when the engine is running hard, and the tiniest flaw in any joint will cause air to be sucked into the system, considerably reducing the capacity of the fuel pump. Air leaks are much more dangerous when the fuel tank is mounted below the fuel pump and carburetor.

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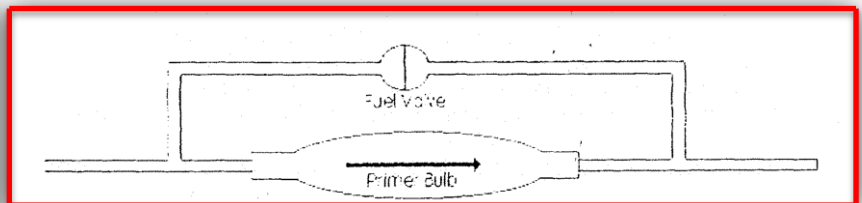
Detailed Inspection

Fuel lines (Continued)

The fuel lines between the fuel tank and fuel pump (negative pressure side) were secured with non Rotax approved tie wraps. These tie wraps do not tighten uniformly and could cause air to leak into the fuel system especially if there are multiple connecting joints.



Rotax does not state the use of a primer bulb in the Rotax installation manual. Primer bulbs can fail and causing a fuel starvation. It is standard practice and recommended that a by pass system be installed around the primer bulb with the use of a fuel valve as seen in the diagram below.



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Detailed Inspection

Oil injection system

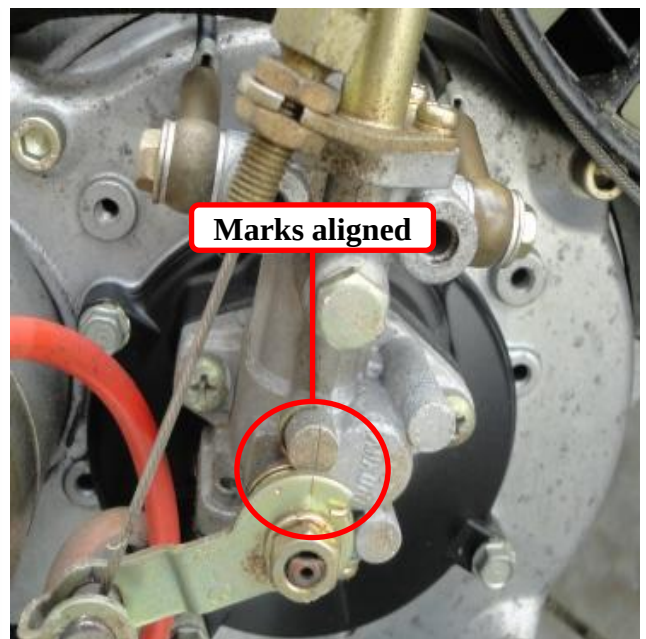
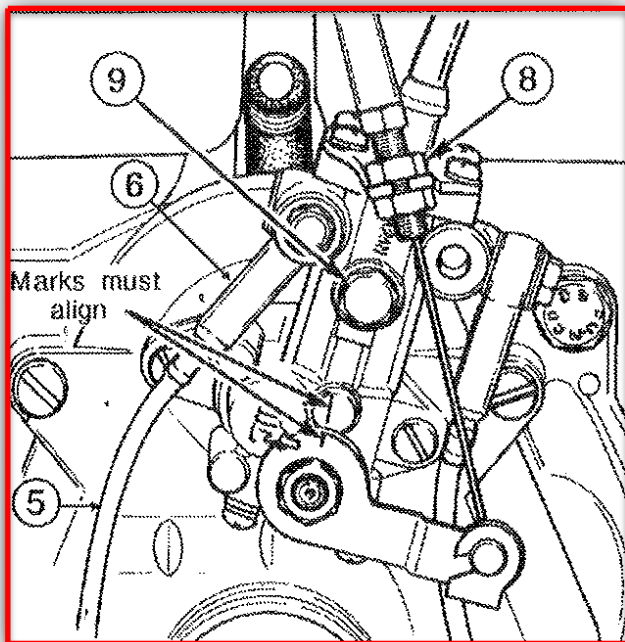
The oil injection system was examined for condition and proper set up. The oil injection pump is driven by the crankshaft via the pump gear and feeds the engine with fresh oil.

The oil pump is a piston type pump with a metering system and diffuser jets that are installed in the intake socket of each cylinder.

This oil injection pump supplies the exact proportioned quantity of Super two stroke oil to the fuel mixture defined by the engine RPM and the oil pump lever position. The oil comes to the pump from an oil tank by gravity.

It is important to set up the oil injection system properly in order for the engine to receive proper lubrication.

Inspection into the set up of this engines oil injection system appeared to be correct as the alignment marks on the injection pump and lever lined up with the throttle positioned at idle.



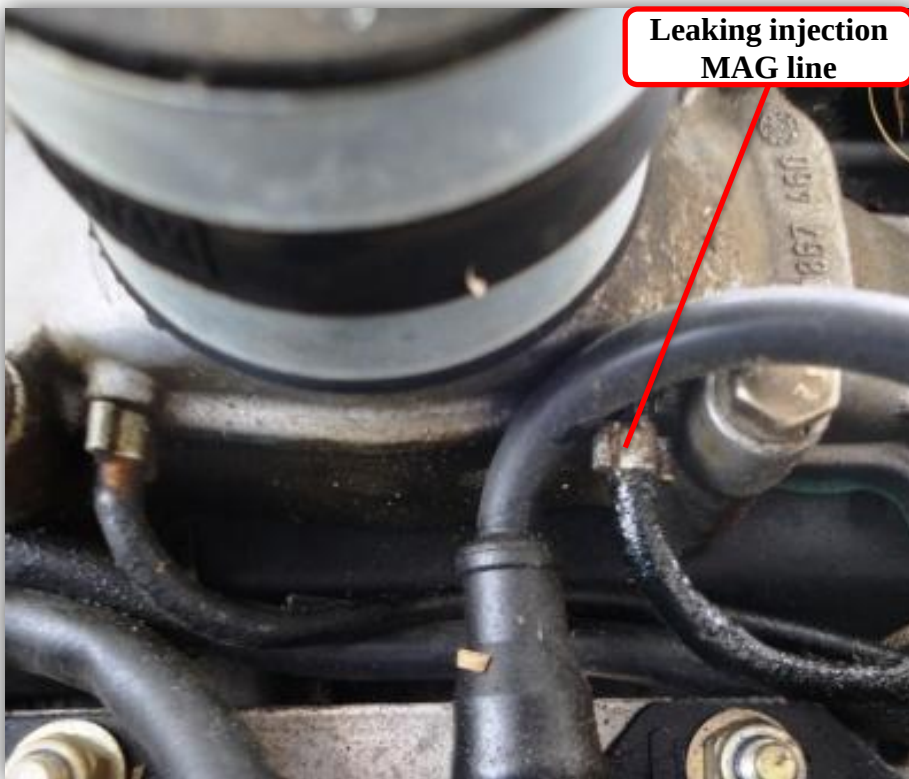
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Detailed Inspection

Oil injection system (Continued)

The oil injection lines from the injection pump to the intake manifold were examined for condition.

The MAG injection line appeared to be wet and seeping injection oil. A leaking injection line would affect the overall performance of the lubricating system which could lead to engine damage and a possible piston seizure.



In the Rotax operating manual in section **10.3.2) Daily Checks** it state “ Verify oil hoses for security, inspect for leaks and chafing (rotary valve gear lubrication system and oil injection system)”.

10.3.2) Daily checks

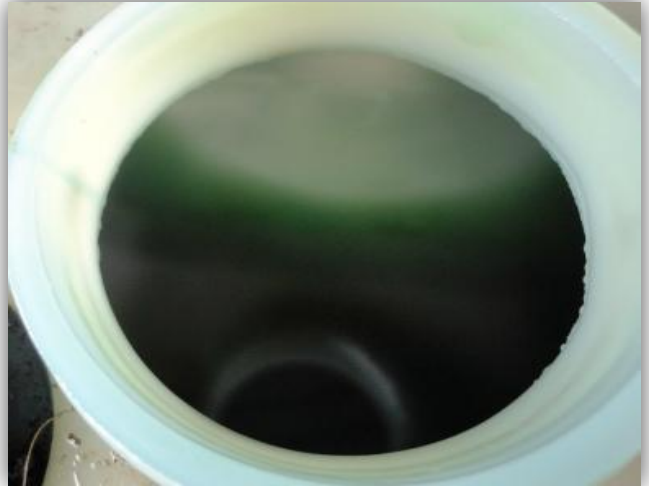
- Verify oil hoses for security, inspect for leaks and chafing (rotary valve gear lubrication system and oil injection system).

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Detailed Inspection

Oil injection system (Continued)

The oil injection tank was examined for contents and condition. The injection tank appeared be in good overall condition and half full of oil. It is undetermined the type of oil that was used in the injection tank.



The injection feed line from oil tank to injection pump was examined for condition. The injection feed line appeared to be in good overall condition with no leaks. The oil filter was examined for blockage. No blockage could be seen in the oil filter.



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Detailed Inspection

Exhaust System

The exhaust system was examined for condition , modifications and the proper approved type. The exhaust appeared to be in good overall condition and of the proper type with no modifications found. No anomalies found with the exhaust system.



Piston Examination

The exhaust Y pipe was removed to expose the exhaust side of the piston's for seizure and metal transfer marks.



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Detailed Inspection

PTO Piston Examination

With the exhaust ports exposed the exhaust side of the Power take-off piston could be examined. No metal transfer, vertical scoring or seizure marks were seen on the exhaust side of the Power take-off piston.

The Power take-off piston rings were free in there respective ring land grooves and were in good overall condition. No anomalies were found on the exhaust side of the PTO piston.



The intake manifold was removed to expose the intake side of the PTO piston. No metal transfer, vertical scoring or seizure marks were seen on the intake side of the Power take-off piston. No anomalies were found on the intake side of the PTO piston.



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Detailed Inspection

MAG Piston Examination

With the exhaust ports exposed the exhaust side of the Magneto piston could be examined. Metal transfer and seizure marks were seen on the exhaust side of the Magneto Piston.



The intake manifold was removed to expose the intake side of the MAG piston. Metal transfer and seizure marks were seen on the intake side of t

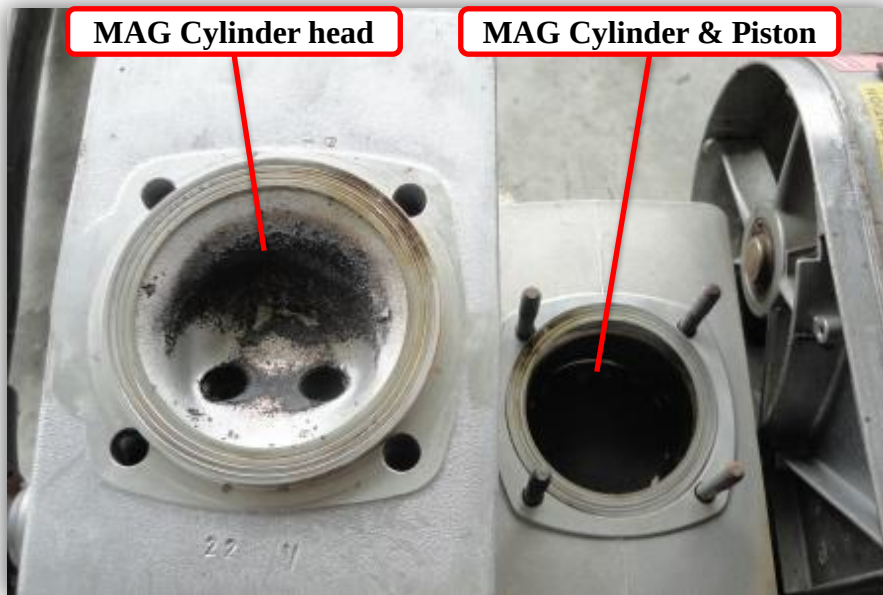


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Detailed Inspection

MAG Cylinder Head

The Magneto cylinder head was removed for examination and to access the cylinder and piston.



The cylinder head was examined for damage and excessive build up of carbon. No anomalies were seen with the magneto cylinder head.

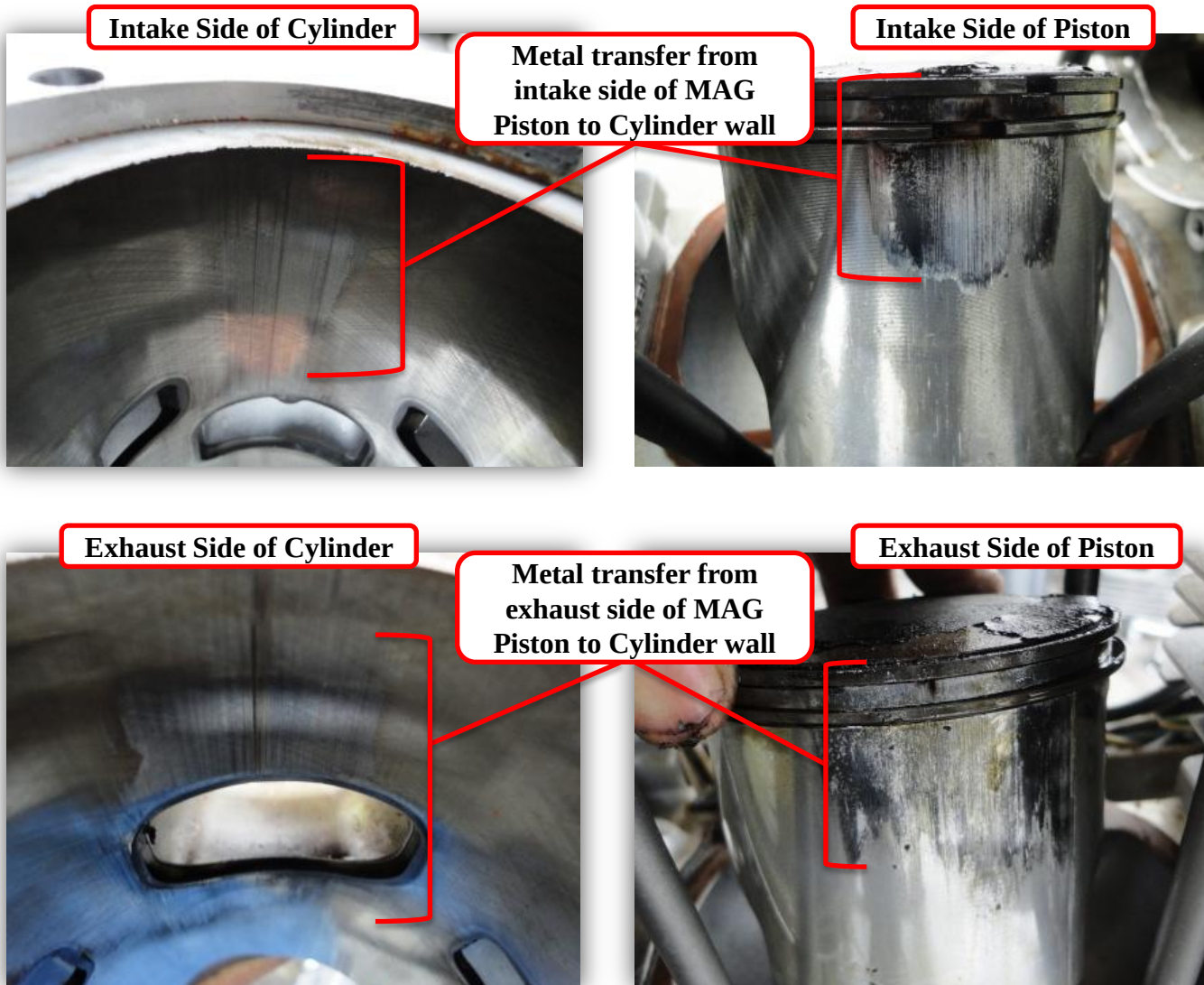


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Detailed Inspection

MAG Piston & Cylinder

The magneto cylinder was removed for closer examination and to expose the piston.



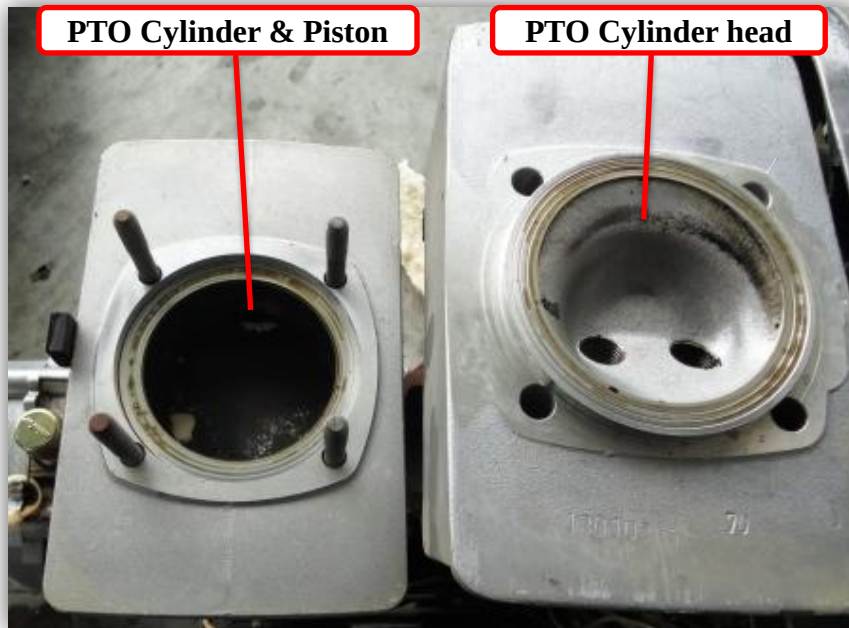
Metal transfer was seen on both the intake side and the exhaust side of the magneto piston and cylinder. The seizure marks on the magneto piston extended from the top of the piston, though the piston rings reaching approximately half way down the side of the piston.

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Detailed Inspection

PTO Cylinder Head

The Power take-off cylinder head was removed for examination and to access the cylinder and piston.



The cylinder head was examined for damage and excessive build up of carbon. No anomalies were seen with the magneto cylinder head.



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Detailed Inspection

PTO Piston & Cylinder

The Power Take-off cylinder was removed for closer examination and to expose the piston.



The PTO piston and cylinder appeared to be in good overall condition with no signs of seizure or metal transfer. No anomalies found with the PTO piston and cylinder

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Detailed Inspection

Intake Manifold & Carburetor Socket

The intake manifold and Carburetor socket was examined for condition and conformity.



The carburetor socket was examined for cracking and deterioration. No cracking or deterioration was seen on the carburetor socket. The intake manifold was examined for condition. The oil injection lines connecting to the intake manifold appeared to be leaking. No other anomalies were found with the intake manifold.

Cooling Fan & Belt

The cooling fan and belt were examined for condition. The cooling fan appeared to be in good overall condition and the Belt was tight with no evidence of fraying. No anomalies were found with the cooling fan & belt.



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Appendix A



MAINTENANCE MANUAL

10.2) Maintenance Schedule

The following maintenance is planned and necessary for ROTAX 447 UL SCDI, 503 UL DCDI, 582 UL DCDI and 582 UL DCDI mod. 99:

Checks and work	2 h	10 h	12.5 h	25 h	50 h	75 h	100 h	125 h	150 h	175 h	200 h	225 h	250 h	275 h	300 h	chapter	signature
1 Ground run				X												11.1	
2 Level check of liquids	X															11.2	
3 Retorque cylinder head nuts 1)		X														11.3	
4 Retorque exhaust manifold screws 1)	X	X														11.4	
5 Check rewind starter rope 10)			X													11.5	
6 Check electric starter gear					X		X		X		X		X			11.6	
7 Inspect spark plugs 10)			X													11.7	
8 Replace spark plugs				X	X	X	X	X	X	X	X	X	X	X		11.8	
9 Check ignition system				X												11.9	
10 Check and clean inside spark plug caps 10)			X													11.10	
11 Checking of V- belt tension		X		X	X	X	X	X	X	X	X	X	X	X		11.11	
12 Lubricate ball joints				X	X	X	X	X	X	X	X	X	X	X		11.12	
13 Replace exhaust muffler springs						X			X			X				11.13	
14 Lubricate control cables 3)				X	X	X	X	X	X	X	X	X	X	X		11.14	
15 Check propeller balance and tracking 2,3)				X	X	X	X	X	X	X	X	X	X	X		11.15	
16 Inspect propeller mounting bolts 3)																11.16	
17 Clean and oil air filter				X	X	X	X	X	X	X	X	X	X	X		11.17	
18 Check fuel filter				X	X	X		X	X	X		X	X	X		11.18	
19 Replace fuel filter							X									11.18	
20 Check carburetor(s) and re-adjust (idle speed, cable tension, ...)	X			X		X		X		X		X		X		11.19	
21 Clean carburetor(s) and check for wear					X		X		X		X		X			11.19	
22 Replace jet needle and needle jet									X							11.20	
23 Check fuel pump (measure fuel pressure)						X			X			X				11.21	
24 Check gearbox oil level				X	X	X		X	X	X		X	X	X		11.22	
25 Replace gearbox oil		X					X				X					11.22	
26 Check and adjust gearbox, preload of springs (type B gearbox)							X				X					11.23	
27 Replace rotary valve lubrication oil							X									11.24	
28 Inspect cylinder head and piston crown 4)					X		X		X		X		X			11.25	
29 Inspect piston rings for free movement 5)					X		X		X		X		X			11.26	
30 Check piston diameter 7)					X (6)		X (6)		X (6)		X (6)		X			11.27	
31 Piston ring: check gap 7,11)					X (6)		X (6)		X		X (6)		X			11.28	
32 Piston ring: check axial clearance (rectang. Ring) 8,12)					X (6)		X (6)		X		X (6)		X			11.28	
33 Check cylinder diameter 7,11)					X (6)		X (6)		X		X (6)		X			11.29	
34 Cylinder: check for roundness 7,11)					X (6)		X (6)		X		X (6)		X			11.29	
35 Replace cylinder head-, cylinder base- and exhaust-gasket 8)					X (6)		X (6)		X		X (6)		X			11.30	
36 Inspect piston pin and bearing									X							11.31	
37 Inspect crankshaft and replace outer seals if necessary									X							11.32	
38 General overhaul of engine 9)															X	11.33	
Checks and work	2 h	10 h	12.5 h	25 h	50 h	75 h	100 h	125 h	150 h	175 h	200 h	225 h	250 h	275 h	300 h		

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- 1) and after every replacement of gasket(s)
- 2) also after any damage
- 3) according to instructions of manufacturer
- 4) if carbon layer is more than 0,5 mm thick, decarbonize
- 5) if piston ring sticks clean and replace if necessary
- 6) if used in very dusty atmosphere
- 7) wear limit see Service Information 5 UL 91
- 8) If cylinder has been dismantled
- 9) To be carried out every five years or every 300 hours whichever comes first. contact authorized distributor or service center.
- 10) To be examined after every 12,5 hours of operation.
- 11) Necessary only if piston rings are not freely moving

Effectivity: 447 UL SCDI, 503 UL DCDI, 582 UL DCDI /mod. 99

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•Summary

- This Rotax 503 engine is past the 5 year overhaul schedule that is set out in the Rotax maintenance manual. There were no records or evidence supporting that this engine ever received an overhaul.
- Several non conforming components were found installed on the engine that could effect the overall performance and reliability of the engine.
- Insufficient cylinder head and exhaust gas temperature monitoring was found on this engine. This would make it difficult for the pilot/operator to know if the engine was running too cool or hot, lean or rich.
- Incorrect fuel line connection clamps (Tie Wraps) were found installed on the fuel system that could allow air to be introduced into the fuel system.
- No fuel line by pass was found around the primer bulb. If the primer bulb check valve ever became dislodged it could block fuel flow.
- No fuel filter was found installed between the fuel pump and carburetor as stated in the Rotax Installation manual.
- Leaking oil injection lines were found at the intake manifold connection. This would effect the overall effectiveness of the lubrication system.
- Dirty air cleaner was found installed on the engine that could effect the overall performance of the engine.
- Pilot/operator was flying in known icing conditions. No carburetor heat was installed on this engine contrary to the Rotax installation manual instructions.
- MAG piston seizure was seen on the intake and exhaust side of the piston. This would result in a reduction in engine power and causing the engine to quit running.

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Conclusion

It is determined that the cause of engine power loss was due to a magneto piston heat seizure on the exhaust side of the piston. The magneto piston also established a sympathetic seizure on the intake side of the piston.

A sympathetic seizure occurs due to the floating nature of the piston within the cylinder. The initial piston seizure occurred on the exhaust side of the engine then transferred over to the intake side.

Factors that can cause a piston heat seizure are the following:

-Excessive heat, over 1200F/650C EGT: Without proper EGT indication the pilot/operator would not know if the engine was exceeding the maximum exhaust gas temperatures.

-Lean fuel to air mixture, improper jetting or adjustments on carburetor: Ice build up on the carburetor diffuser could affect the mixture setting resulting in a lean fuel to air ratio. It is known that the pilot/operator was flying in known icing conditions with no carburetor heat installed on the aircraft.

-Incorrect loading on propeller allowing excessive RPM: This could not be determined because the engine was displaced from the aircraft and the engine and propeller were not in operational condition.

Report Completed by: Jordan Paskevich – Rotech Flight Safety