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INVESTIGATION REPORT

ACCIDENT INFORMATION

Date of accident:	September 24 2020	NTSB file number:	CEN20LA417
Location of accident:	Killeen Texas	FAA Inspector:	Thomas Ballard
Location of Investigation:	Owners Hanger, Skylark Field Airport Killeen Texas	Law Enforcement:	Unknown
Investigator In charge:	John Brannen	Coroner/Medical Examiner	Unknown

AIRCRAFT INFORMATION

Aircraft Make:	Quick Silver	Aircraft registration:	N9045Z
Aircraft Model:	MX 2 Sprint	Aircraft S/N	0558
Propeller make, model & S/N	Warp Drive 3 Blade Ground Adjustable S/N - UK		

ENGINE INFORMATION

Engine Type:	Rotax 582 Mod 90	Engine TTSN	Unknown
Engine Serial Number:	4105077	Engine TTSOH	Unknown
Engine Manufacture date:	September 18 1992	Engine position:	Pusher

ADDITIONAL INFORMATION

Persons in attendance:	
	Jordan Paskevich – Rotech Flight Safety – Rotax Aircraft Engines
	Thomas Ballard – Aviation Safety Inspector - FAA
Date of Report:	October 28, 2020
RFS File number:	2020-057

DATE	ENGINE MODEL	ENGINE SERIAL NO	REGISTRATION	File number
Oct / 28 / 2020	Rotax 582 Mod 90	4105077	N9045Z	2020-057

NTSB Preliminary

On September 24, 2020, about 1105 central daylight time, an amateur-built Quicksilver MX II airplane, N9045Z, was substantially damaged when it was involved in an accident near Killeen, Texas.

The pilot and the pilot-rated passenger were fatally injured. The airplane was operated as a Title 14 Code of Federal Regulations (CFR) Part 91 personal flight. The airplane reportedly departed from the Skylark Field Airport (ILE), when shortly after takeoff the airplane's engine stopped producing power. Witnesses reported seeing the airplane maneuvering and descending without engine power. The airplane impacted the median of a divided highway and then struck a guard rail.



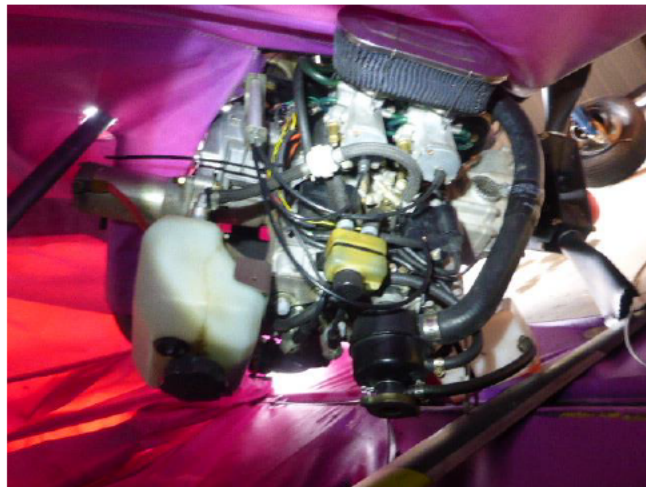
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Initial Inspection

On October 28th, 2020, the engine examination took place in the accident pilots hanger at the Skylark Field Airport in Killeen, Texas. FAA Air Safety Inspector Thomas Bullard provided oversight during the engine examination.



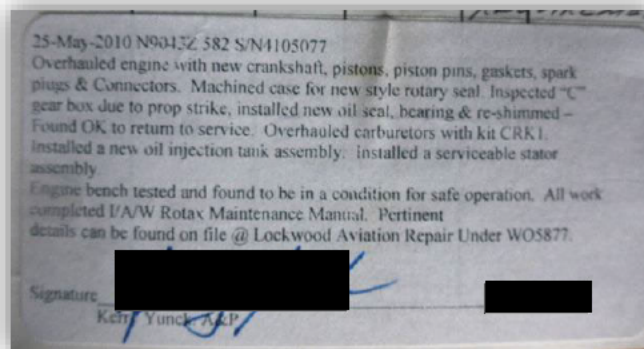
Due to the relocation and storage position of the accident aircraft, the Rotax 582 Mod 90 engine was found inverted (cylinder head and spark plugs facing down). The normal position of the engine in this type of aircraft is with the cylinder head and spark plugs facing upward. The engine and its components appeared to be undamaged and in good physical condition.



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Initial Inspection

The engine installed in the accident aircraft was a Rotax 582 Mod 90 65 hp, 2-cylinder, 2-stroke liquid-cooled engine. The Rotax 582 is a 48 kW (65 hp) two-stroke, two-cylinder, rotary intake valve, oil injected, liquid-cooled, gear reduction-drive aircraft engine manufactured by BRP-Rotax GmbH & Co. KG. It is for use in non-certified aircraft operating in day visual flight rules. Based on the engine Serial number (4105077), this Rotax 582 Mod 90 engine was manufactured on September 18th, 1992. This would make the engine just over 28 years old from the date of manufacture. During the examination of the engine's maintenance records, it was noted that the engine was overhauled on May 25th, 2010, by a designated Rotax overhaul facility.



In the Rotax 582 Maintenance manual section 10.2) Maintenance schedule page 10-2, it states a general overhaul of the engine is to be carried out every 5 years or every 300 hours whichever comes first. According to the Rotax 582 Maintenance manual, the engine should have received an additional 3 overhauls due to calendar time (every 5 years). No other records of an overhaul were found before or after this May 25th, 2010 log book entry date. The total engine hours since last overhaul (TTSOH) are unknown.

ROTAX
AIRCRAFT ENGINES
MAINTENANCE MANUAL

10.2) Maintenance Schedule
The following maintenance is planned and necessary for ROTAX 447 UL DCDI, 503 UL DCDI, 582 UL DCDI and 582 UL DCDI mod. 99:

Checks and work	2 h	10 h	100 h	125 h	250 h	500 h	750 h	1000 h	1250 h	1500 h	1750 h	2000 h	2250 h	2500 h	2750 h	3000 h	chapter	signature
1) General run																	11.1	
2) Level check of liquids	X																11.2	
3) Recharge cylinder head valve (1)	X																11.3	

Checks and work	2 h	10 h	100 h	125 h	250 h	500 h	750 h	1000 h	1250 h	1500 h	1750 h	2000 h	2250 h	2500 h	2750 h	3000 h	chapter	signature
30) General overhaul of engine (9)																	11.30	

- 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

- 9) 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 DCDI, 503 UL DCDI, 582 UL DCDI / mod. 99

page 10 - 2
Initial issue, May 01/99

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Detailed Inspection

Carburetors: Both the MAG and PTO carburetor float bowls were removed and internally examined for condition, contamination or any other anomalies. Due to the engine sitting inverted, no fuel was found in either the MAG or PTO float bowls. No contamination or anomalies were observed.

PTO Carburetor



MAG Carburetor



The main jets of both the MAG and PTO carburetors were inspected for the correct sizing and blockage. No anomalies or obstructions were found with either of the MAG or PTO main jets and they were to proper size.

PTO Carburetor



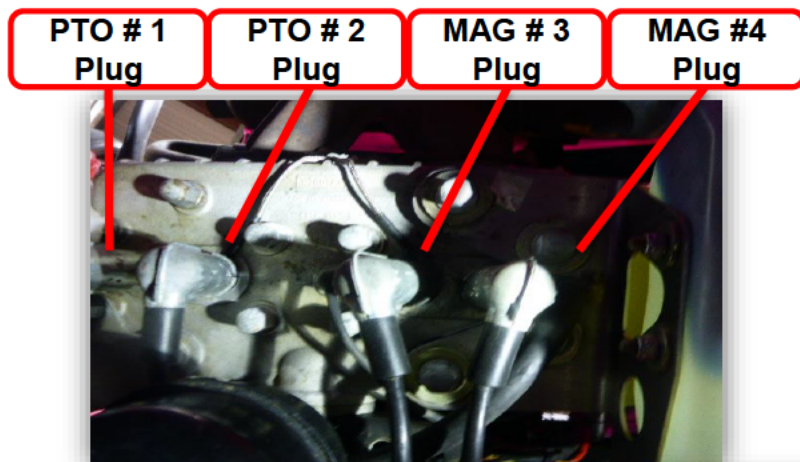
MAG Carburetor



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Detailed Inspection

Spark Plugs: The spark plugs were removed from the engine and examined for condition and proper type.



PTO #1 Spark Plug

- NGK BR8ES
- Good physical condition
- Electrode gap of 0.020
- Non-removable resistor cap
- No anomalies seen



PTO #2 Spark Plug

- NGK BR8ES
- Good physical condition
- Electrode gap of 0.020
- Non-removable resistor cap
- No anomalies seen



MAG #3 Spark Plug

- NGK BR8ES
- Good physical condition
- Electrode gap of 0.020
- Non-removable resistor cap
- No anomalies seen



MAG #4 Spark Plug

- NGK BR8ES
- Good physical condition
- Electrode gap of 0.020
- Non-removable resistor cap
- No anomalies seen



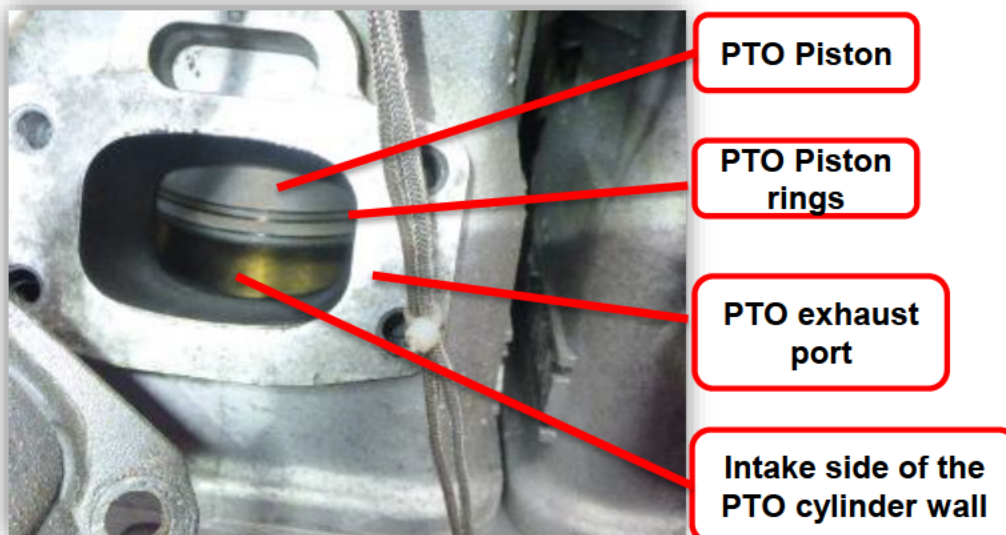
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Detailed Inspection

Exhaust system: The exhaust system was inspected for condition, modification and defects. No anomalies were seen with the exhaust system. The exhaust system was removed from the engine to inspect the combustion chamber of the MAG and PTO cylinders.



PTO Piston and Cylinder: With the exhaust cylinder ports opened, the exhaust side of the PTO piston and intake side of the cylinder could be examined for any anomalies. No vertical scoring or transfer of metal was seen with the PTO piston or the PTO cylinder walls. Both piston rings were free within the respective land grooves of the piston. The crankshaft was rotated to expose the intake side of the cylinder walls. No anomalies were seen with the PTO piston or cylinder.



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Oct / 28 / 2020	Rotax 582 Mod 90	4105077	N9045Z	2020-057

Detailed Inspection

MAG Piston and Cylinder: With the exhaust cylinder ports opened, the exhaust side of the MAG piston and intake side of the cylinder could be examined for any anomalies.

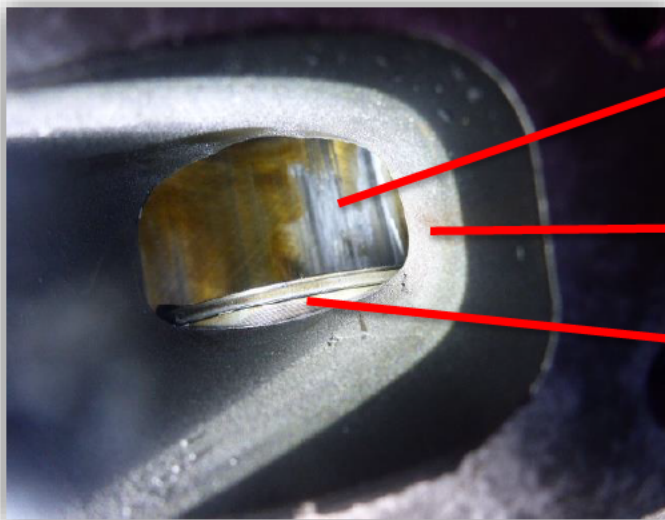


**MAG
Piston**

**Scoring and metal
transfer seen on corner
of the piston**

**MAG Exhaust
port**

Vertical Scoring and metal transfer was seen on the side of the MAG piston. The crankshaft was rotated and scoring and metal transfer was also found on the intake side of the MAG cylinder wall.



**Vertical scoring and
metal transfer seen on
the intake side of the
MAG cylinder wall**

MAG exhaust port

**MAG
Piston**

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Detailed Inspection

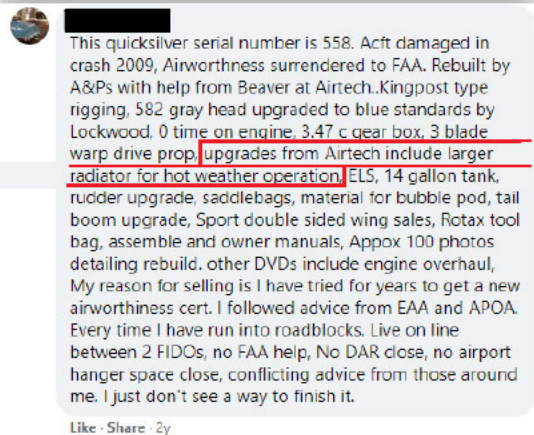
There are many different types of piston / cylinder wall damage and reasons for them to occur. Below are a few examples of the types of damaged and potential causes.

Description	Example	
Poor fuel-oil ratio: insufficient quantity of oil cause deep scores on the piston and cylinder wall. The piston and cylinder wall will also be dry, dull in colour and absent of an oil film.		
Incorrect Oil: Poor oil quality or incorrect oil type does not properly lubricate and causes excessive carbon deposit build up. The piston rings can stick because of oil carbon, allowing gasses to pass the piston and cause exhaust side seizures. The carbon deposit damages the surfaces, reducing proper lubrication.		
Heat Seizure: Incorrect air/fuel ratio can cause insufficient lubrication normally associated with overheating. This can be caused by either lean jetting, incorrect propeller loading, intake or main seal leak. Major piston damage and metal transfer will be observed.		
Cold Seizure: Thermo-imbalance of pistons and cylinder due to improper warm-up of engine and excessive temperature differences of the intake and exhaust of engine. The result is the piston expands faster than the cylinder wall. This type of damaged can be identified by the scoring and metal transfer on the corners of the piston and intake side of the cylinder wall.		

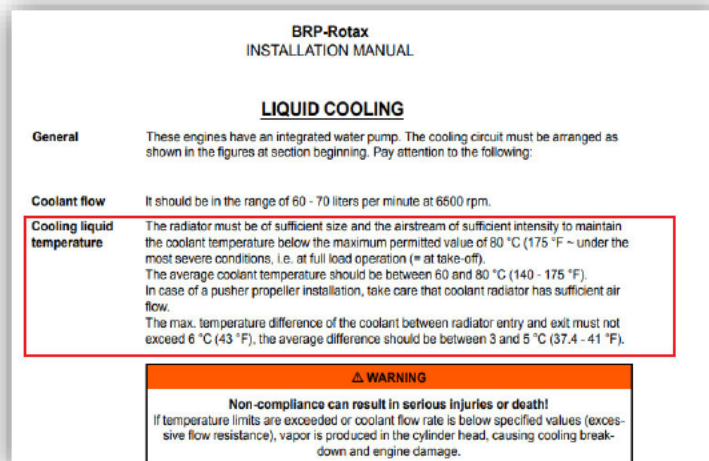
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Detailed Inspection

Coolant System: The Rotax 582 Mod 90 features liquid cooled cylinder heads, cylinders, water pump and an externally mounted coolant radiator. The coolant radiator was inspected and found to be approximately 1.5 times larger than the Rotax coolant radiator. This larger radiator would have required a longer warm up period in cooler climates. The owner stated that the larger radiator was for hot weather operation.



In the Rotax 582 installation manual it states: The radiator must be of sufficient size and the airstream of sufficient intensity to maintain the coolant temperature below the maximum permitted value of 80 °C (175 °F ~ under the most severe conditions, i.e. at full load operation (= at take-off). The average coolant temperature should be between 60 and 80 °C (140 - 175 °F). The max. temperature difference of the coolant between radiator entry and exit must not exceed 6 °C (43 °F), the average difference should be between 3 and 5 °C (37.4 - 41 °F).

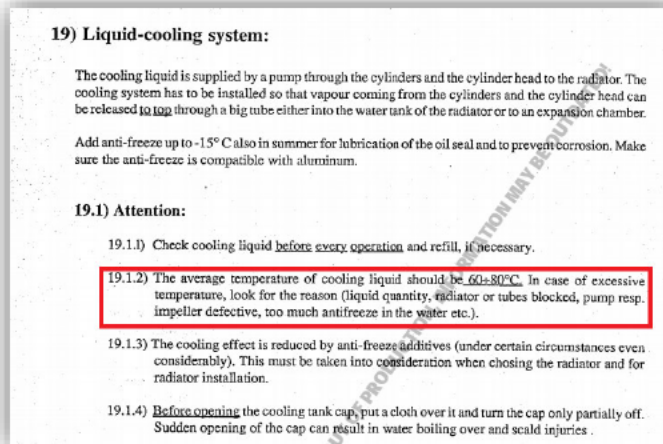


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Detailed Inspection

Coolant System continued:

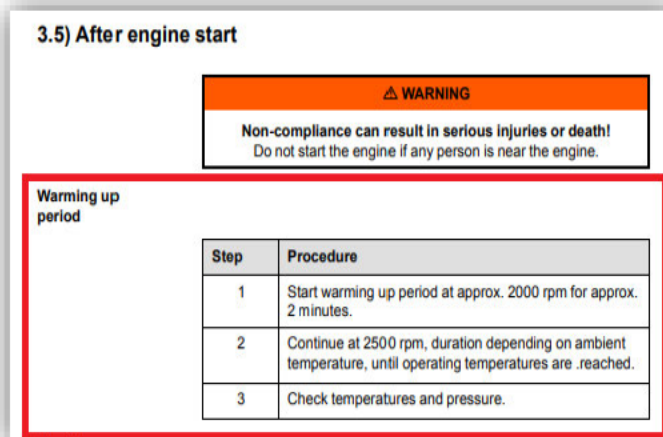
In the Rotax 582 operators manual it states that the average of cooling liquid should be 60C – 80C.



In the Rotax 582 operators manual it states in section **3.5) After engine start**

Warming up period:

- 1 Start warming up period at approx. 2000 rpm for approx. 2 minutes.
- 2 Continue at 2500 rpm, duration depending on ambient temperature, until operating temperatures are reached.
- 3 Check temperatures and pressure.



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Summary

The Rotax 582 engine that was installed into the accident aircraft appeared to have suffered a MAG piston “cold seizure” that may have resulted in a complete or partial loss of engine power.

A cold piston seizure is defined as: Thermo-imbalance of pistons and cylinder due to improper warm-up of engine and excessive temperature differences of the intake and exhaust of engine. The result is the piston expands faster than the cylinder wall. This type of damaged can be identified by the scoring and metal transfer on the corners of the piston and intake side of the cylinder wall.

The engine coolant system radiator was approximately 1.5 times the size (larger) than the Rotax coolant radiator and would have resulted in a longer warm up period in a colder climate.

According to the Rotax 582 Maintenance manual, the engine should have received a minimum of 3 overhauls since its last overhaul that was done on May 25th 2010 due to calendar time (engine overhaul required every 5 years or 300 hours). The total engine hours since overhaul (TTSOH) are unknown.

Rotax states in the operators manual the following in **section 1.4) Safety Information, General Safety Instructions page 1-7: Warning:** This engine, by its design, is subject to sudden stoppage. Engine stoppage can result in crash landings, forced landings or no power landings. Such crash landings can lead to serious bodily injury or death.

Warning: Non-compliance can result in serious injuries or death! This is not a certificated aircraft engine. It has not received any safety or durability testing, and conforms to no aircraft standards. It is for use in experimental, uncertificated aircraft and vehicles only in which an engine failure will not compromise safety. User assumes all risk of use, and acknowledges by his use that he knows this engine is subject to sudden stoppage.

Use for intended purpose: You should be aware that any engine may seize or stall at any time. This could lead to a crash landing and possible severe injury or death. For this reason, we recommend strict compliance with the maintenance and operation and any additional information which may be given to you by your dealer.