REPUBLIC OF SLOVENIA
MINISTRY OF INFRASTRUCTURE

AIR, MARITIME AND RAILWAY ACCIDENT AND INCIDENT

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unofficial translation

FINAL REPORT ON THE ACCIDENT INVESTIGATION

of the AQUILA AT01 motor aircraft,

reg. mark OE-CYY,

near Lesce airport (LJBL),

August 5, 2022

Republic of Slovenia

» 2022 «

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INTRODUCTION

The final Aircraft Accident Investigation Report contains the facts, analysis, causes, and safety recommendations of the Aircraft Accident Investigation Board based on the circumstances under which the accident occurred.

In accordance with point 3.1, Chapter 3, Annex 13 to the Convention on International Civil Aviation (12th edition, July 2020), Article 1 of Regulation (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation (OJ L No 295, 12 November 2010, p. 35), the fourth paragraph of Article 137 of the Aviation Act (Official Gazette of the Republic of Slovenia, No. 81/10 – official consolidated text, 46/16, 47/19 and 18/23) and Article 2 of the Regulation on the Investigation of Aviation Accidents, Serious Incidents and Incidents (Official Gazette of the Republic of Slovenia, No. 72/03, 110/05 and 53/19), **the purpose of the final report on the investigation of the aircraft accident is not to establish guilt or responsibility.**

The final investigation report must undoubtedly serve the purpose of aviation safety.

It is important that the final investigation report be used to prevent aviation accidents or incidents. Using the final aircraft accident investigation report for other purposes may lead to misinterpretation.

The composition of the commission:

1. **Toni STOJČEVSKI, - Chief Investigator,** Head of Service, Aviation Accident and Incident Investigator,
2. **Marko CVEK, Member of the Commission,** Aviation Accident and Incident Investigator

An investigator from the Austrian Investigation Authority, the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation, and Technology, the Austrian Safety Investigation Authority, and the Civil Aviation Department took part in the investigation as an accredited representative of the country of registration, the operator, and the owner of the aircraft.

SUMMARY

Date and time of accident: August 5, 2022 at 2:30 p.m. local time

Place of the accident: near Lesce airport (LJBL): N 46°19'33.18" / E 14°13'27.42"

Type of flight: Technical flight from the place of the technical inspection (LJBL) to the home airport in Graz (LOWG)

Aircraft: two-seater powered aircraft

- **Aircraft manufacturer:** Aquila Aviation international GmbH[1]
- **Manufacturer's mark:** AT01
- **Aircraft registration:** OE-CYY (in the register of the Austrian aviation authorities)
- **Aircraft serial number:** AT01-124
- **Airworthiness validity:** June 8, 2023[2]

Owner/operator: Austrian Aviation Training GmbH

User: Austrian Aviation Training GmbH

CAMO org.: MALI AIR Luftverkehr GmbH št.AT.MG.A-050

Crew and passenger information:

- **Crew:** pilot (1)
- **Number of passengers:** 1
- **Total number:** 2

Consequences:

Injuries	*Crew*	*Passengers*	*Others*
Fatal	/	/	/
Major	/	/	/
Minor/None	1	1	

Aircraft and equipment: Major structural damage to the wings, fuselage, and landing gear. The equipment was not damaged.

[1] https://aquila-aviation.de/en/home/

[2] ARC - Airworthiness Review Certificate in accordance with Annex Vb (Part – ML) https://www.easa.europa.eu/en/document-library/easy-access-rules/online-publications/easy-access-rules-continuing-airworthiness?page=12&kw=Part-ML#_Toc256000955

1 FACTS

1.1 Flight information

On August 5, 2022, the pilot took over the aircraft at Lesce Airport (LJBL) from the aircraft maintenance organisation for the purpose of a technical flight (ferry flight) to the home base at the airport in Graz, Austria. A "Certificate of Release[3]" was issued by the maintenance organisation. After the pre-flight inspection, the pilot took off with the passenger at 14:20 local time. After take-off, he performed a school circuit and a touch-and-go landing to check the operation of the engine and then continued the flight according to the flight plan he had previously submitted to the Slovenia control. During the climb, a sudden engine failure occurred at an altitude of 3,200 feet. The pilot steered the aircraft back towards the airport of departure and informed the air traffic controller that they would have to return to LJBL due to an engine problem. Shortly afterwards, the pilot announced that he would make an emergency landing on the part of the Gorenje highway towards the vehicles. During the landing on the far right edge of the lane, the aircraft skidded with its right wing about 40 m along the embankment until it came to a standstill. The nose leg of the landing gear was damaged, the right wing was damaged, and the structure of the rear part of the fuselage was torn. The pilot and the passenger left the aircraft unharmed.

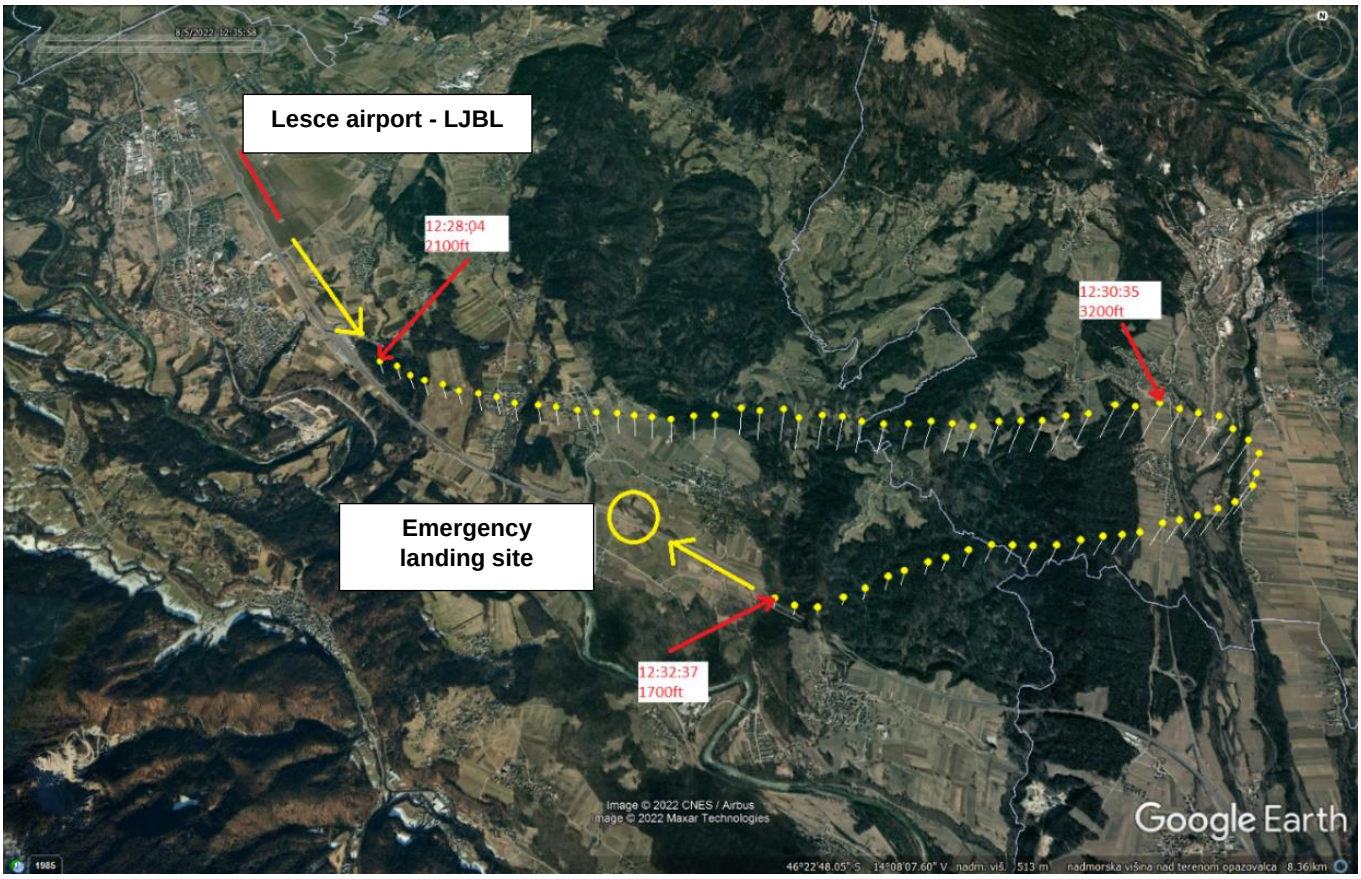


Figure 1: Flight line (OE-CYY) and place of emergency landing

[3] A Certificate of Release to Service (CRS) is a statement from an authorised organisation issued by duly authorised personnel after verifying that the task for which it is signed has been properly performed.

1.2 Aircraft damage information

The aircraft landed on the Gorenjska highway in the direction of Jesenice. During the landing on the highway, the aircraft was not damaged until the moment when the pilot steered the aircraft to the far right of the runway to avoid a collision with vehicles, causing the right wing of the aircraft to slide along the embankment at the edge of the highway. During heavy braking and sliding of the right wing against the terrain, the nose leg of the landing gear was damaged (aerodynamic covers of the landing gear wheels, tyres), part of the right wing, right flap, and aileron of the aircraft were broken off and fell off, and the tail of the aircraft was damaged (broken off). Surface cracks were visible on part of the left wing. The propeller also showed surface damage. A small amount of fuel leaked from the fuel drain valve, which was pushed by the edge of the cracked abutment onto the concrete curb next to the damaged nose leg.

Figure 2: Position and damage of the OE-CYY at the stop point

Figure 3: Landing direction and position of OE-CYY after landing on the highway section

1.3 Crew information

1.3.1 Pilot

The pilot, 40 years old and an Iranian citizen, is the holder of::

- Sport Pilot Licence PPL(A) with the date of issue 13 April 2022,
- valid ratings and authorizations: IR SEP(land) – valid until May 31, 2023; IR MEP(land) – valid until April 30, 2023,
- Medical certificate for aviation personnel, category 1/2 LAPL (medical certificate class 1/2), valid until May 18, 2023 (category 1) and August 8, 2024 (category 2), issued by an authorised organisation (AT. BETWEEN 106981).

The pilot's total flight time up to the date of the aircraft crash was 4432 hours and 56 minutes.

1.3.2 Pilot's flight licence information (licence transcript)

AVIATION LICENCE TYPE:	PILOT - PPL(A) - LICENCE
Licencing country:	Austria
Licencing office:	Austrocontol
Special authorizations (information from the license):	SEP(land) …….. validity 31/05/2024 MEP(land)…….....validity 30/04/2023
Date of issue of the permit:	13/04/2022
Notes (information from the license):	/

1.3.3 Data on the pilot's medical certificate (transcript from the medical certificate)

Type of medical certificate: ---------- (Validity):	1 / 2 /LAPL 18/05/2023/ 08/08/2024
Issuing country: Authorised medical practitioner number:	AUSTRIA AT.AME.0057
Check date	18/05/2022
Restrictions (information from the license)	/

1.3.4 Experience and Flight Time of the Pilot

A review of the pilot's flight records (pilot log) shows that the pilot is experienced, as his total flight time up to the date of the accident is 4432 hours and 56 minutes. The pilot's information shows that he had flown for 5 hours and 20 minutes in the last year up to the date of the accident and had flown for 40 minutes in the 24 hours prior to the accident.

1.4 Aircraft information

- Type of aircraft: Aquila AT01 - single-engine, two-seater, low-wing, composite construction, fixed tricycle landing gear. Produced by AQUILA Aviation International GmbH[4], Fermany.
- Serial number: AT01-124
- Year of manufacture: 2004
- Registration number: OE-CYY (in the register of the Austrian aviation authorities)
- Total number of hours: 4978:25 hours
- Total number of landings: 9657

1.4.1 Engine data

- Engine: ROTAX 912 S3, 4-stroke air-and water-cooled engine.
- Engine serial number: 4.924.500
- Engine power: 69 kW

1.4.2 Propeller information

AQUILA AT01 has a two-blade hydraulically controlled constant-speed propeller. The propeller blades consist of a wooden core covered with composite.

- Propeller: MTV-21-A
- Propeller serial number: 080726
- Diameter: 170 cm

[4] https://aquila-aviation.de/en/company/fields-of-work-certificates/ -

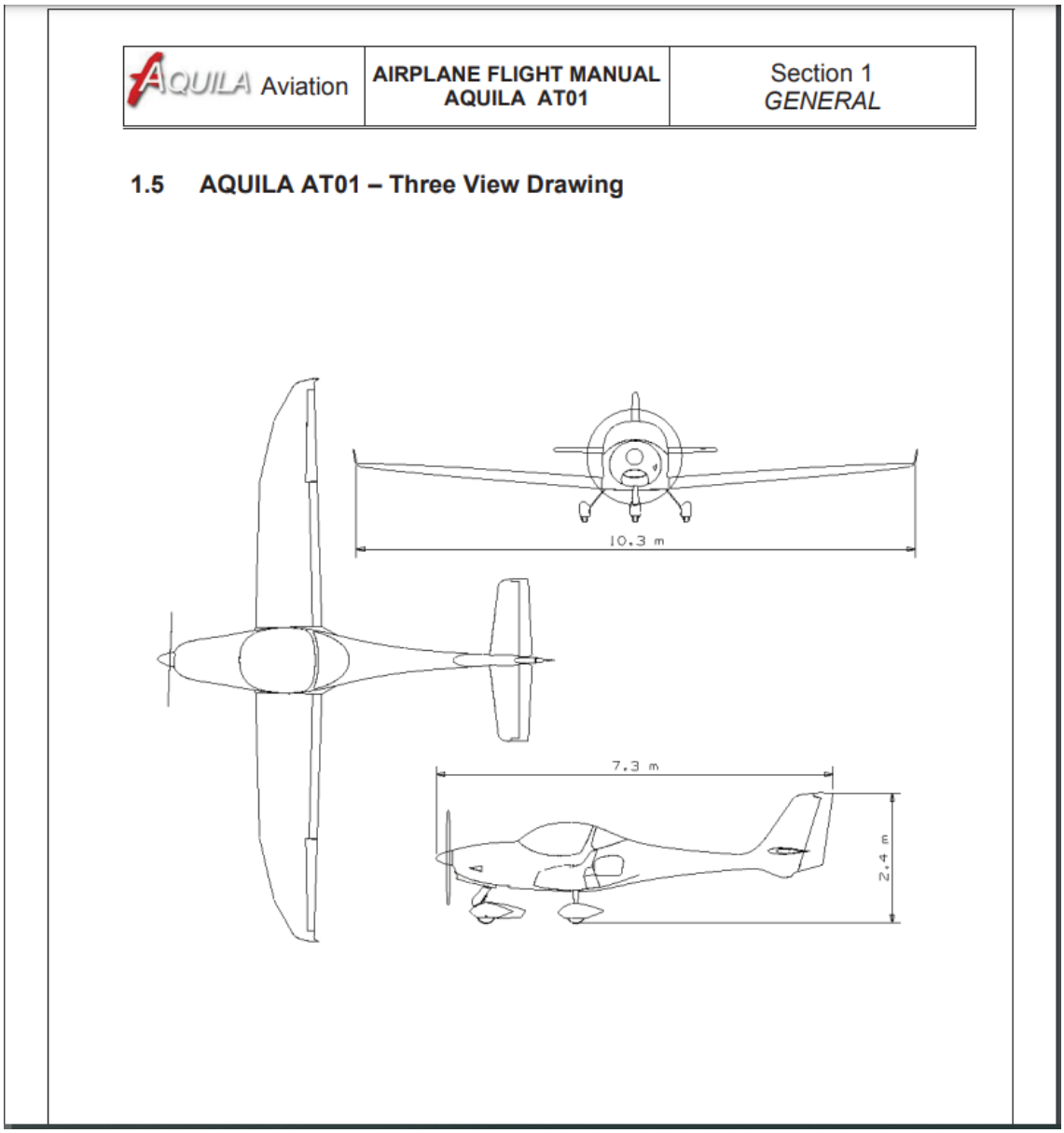
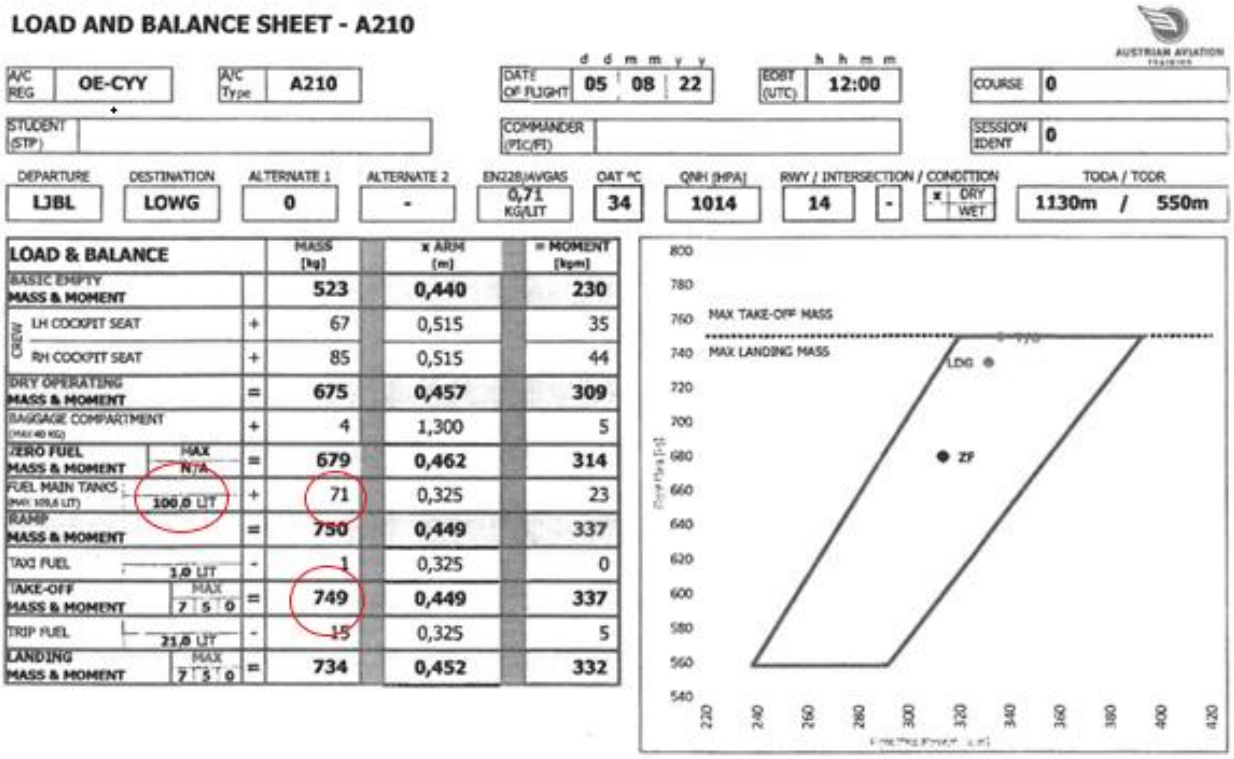


Figure 4: Dimensions of the Aquila AT01 aircraft: information from the manufacturer's manual

1.4.3 Mass and center of mass

Analysis of the data obtained (data from the aircraft manufacturer and data from the operational manual) shows that the maximum take-off weight (MTOW) of the aircraft is 750 kg, while the weight of the empty aircraft is 523 kg. The sum of the values for the fuel quantity, the mass of the crew, and the mass of the empty aircraft should not exceed the value of the MTOW - 750 kg. The Commission notes that the maximum permissible take-off weight of the aircraft was not exceeded at the time of the occurrence, as evidenced by the report on the latest measurements. The calculation of the permissible weight and the position of the aircraft's centre of gravity (Load & Balance Sheet form), which the pilot submitted as proof of flight preparation, shows that with a fuel mass of 71 kg (100 litres), it would not exceed the MTOW - 750 kg. The actual amount of fuel before take-off was less than the value given by the pilot when calculating the permissible weight and determining the position of the centre of gravity during flight preparation. The analysis of the fuel quantity shows that the take-off weight of the aircraft at take-off was 699 kg. The pilot's pre-

flight calculation is 749 kg, taking into account the amount of fuel in the tanks of 100 litres (71 kg), which differs by 50 litres from the actual amount of fuel found during the investigation of the accident.



LOAD AND BALANCE SHEET - A210

A/C REG	A/C Type	DATE OF FLIGHT	EOBT (UTC)	COURSE
OE-CYY	A210	05 08 22	12:00	0

STUDENT (STP)	COMMANDER (PIC/FI)	SESSION IDENT
		0

DEPARTURE	DESTINATION	ALTERNATE 1	ALTERNATE 2	EN228/AVGAS	OAT °C	QNH [HPA]	RWY / INTERSECTION / CONDITION	TODA / TODR
LJBL	LOWG	0	-	0,71 KG/LIT	34	1014	14 - x DRY WET	1130m / 550m

LOAD & BALANCE		MASS [kg]	x ARM [m]	= MOMENT [kgm]
BASIC EMPTY MASS & MOMENT		523	0,440	230
CREW LH COCKPIT SEAT	+	67	0,515	35
CREW RH COCKPIT SEAT	+	85	0,515	44
DRY OPERATING MASS & MOMENT	=	675	0,457	309
BAGGAGE COMPARTMENT	+	4	1,300	5
ZERO FUEL MASS & MOMENT (MAX N/A)	=	679	0,462	314
FUEL MAIN TANKS 100,0 LIT	+	71	0,325	23
RAMP MASS & MOMENT	=	750	0,449	337
TAXI FUEL 1,0 LIT	-	1	0,325	0
TAKE-OFF MASS & MOMENT (MAX 750)	=	749	0,449	337
TRIP FUEL 21,0 LIT	-	15	0,325	5
LANDING MASS & MOMENT (MAX 750)	=	734	0,452	332

Figure 5: Calculation of the weight of the aircraft in preparation for the flight on August 5, 2022: "Load and Balance" form

1.4.4 Data on fuel consumption

The aircraft's fuel system consists of two fuel tanks, one in each wing. The capacity of each tank is 60 litres, and the unused part of the fuel in the system is 5.2 litres. The tanks are limited at the top and bottom by the wing fairing, which is specially reinforced at these points. The supply of fuel from the tanks to the carburettors is made possible by a motorised fuel pump. In addition to the engine fuel pump, an electric fuel pump is also connected to the system, which serves as a reserve pump in the event of an engine pump failure or if the fuel pressure is too low. Low fuel pressure in the fuel supply lines in the carburettor is detected by low fuel pressure sensors and indicated by a red warning light on the instrument panel in the aircraft cabin. The electric fuel pump must be switched on when a “low fuel pressure" warning is displayed. As part of the fuel system, a fuel selector switch with 3 positions is installed to select the tank in use and to cut off the fuel supply. It is located on the central part — the pedestal between the seats in the cockpit - Figure no. 6. During the investigation at the scene, the fuel selector switch was in the OFF position - the fuel supply was switched off.

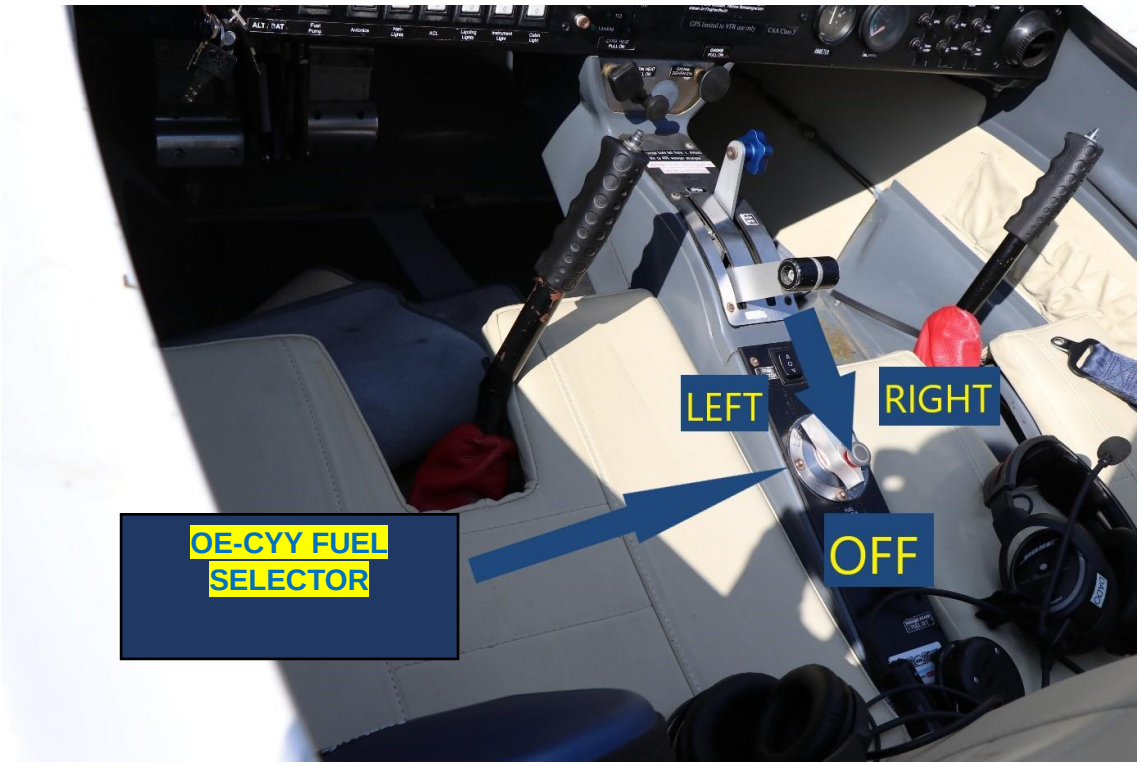


Figure 6: The position of the fuel selector OE-CYY at the scene immediately after the accident

1.4.5 Fuel quantity display

A fuel sensor is installed in each tank, which generates an electrical signal depending on the amount of fuel in the tanks and sends it to the fuel quantity displays on the instrument panel in the cockpit. The fuel quantity display shows the following values: FULL, 3/4, 1/2, 1/4, and EMPTY.

Figure 7: OE-CYY fuel gauge on the instrument panel in the aircraft cabin

In addition to the above-mentioned method of measuring the amount of fuel in the tanks, there is also an additional, manual measurement method, which is a mandatory accessory on aircraft in this category and represents a priority control of the correct operation of the fuel quantity indicators. The procedure for checking the amount of fuel in preparation for flight is described in Chapter 4 (Normal Procedures) of the aircraft manual, AFM (point 4.4.2: Check before each flight, Figure no. 8). It is carried out with the help of a stick, which is dipped into the fuel tank through the opening of the fuel tank. After pulling the dipstick out of the fuel, check the position of the "wet" area on the dipstick according to the markings on the dipstick: 1/4, ½, and 3/4.

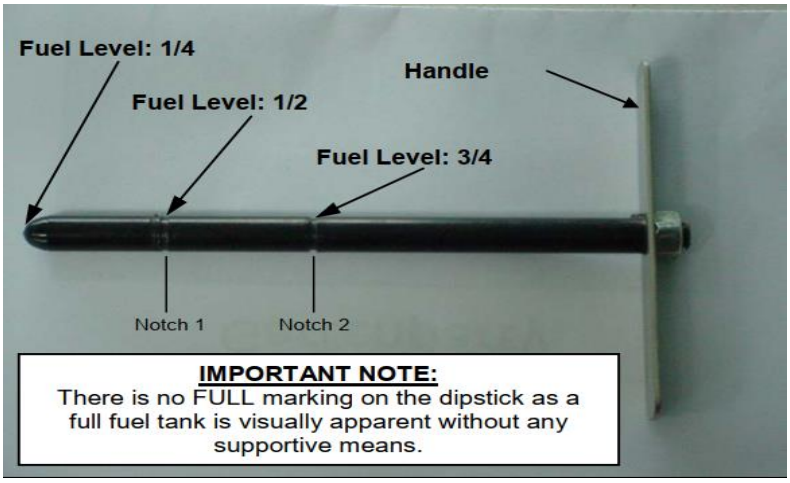


Figure 8: "Deep-Stic": a stick for manually measuring the amount of fuel in the tanks

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4.4.2 Check Before Every Flight

NOTE

The fuel level dipstick for checking the fuel tank level is stored on the inner side of the baggage compartment door.

1.	Daily pre-flight inspection	Completed
2.	Tow bar	CHECK if removed.
3.	Fuel quantity	CHECK with fuel level dipstick and verify with indicated fuel level in the cockpit.

Figure 9: Aircraft manufacturer's instructions on checking the amount of fuel before each flight

1.5 Meteorological data

Weather data on August 5, 2022, at 2:30 p.m. at the location of Brezje in the Gorenje Mountains.

1.5.1 Measurements and observations

At the closest location to Brezje na Gorenjska (lat: N 46°19'33.18", lon: E 14°13'27.42"), the meteorological measurements of the ARSO national network of meteorological stations are carried out at the Lesce station. The table below shows the weather data measured at the Lesce automatic weather station at 14:30.

DATUM	ČAS	T na 2m [°C]	HITROST VETRA [m/s]	SMER VETRA	SUNKI VETRA [m/s]
05.08.2022	14:30	33,8	2,3	SE	5,1

The radar image shows the precipitation in the area of Slovenia at the time of the accident (12:30 UTC). We can see that isolated showers were forming in Austria, but there were no showers or thunderstorms in the area of the accident at that time.

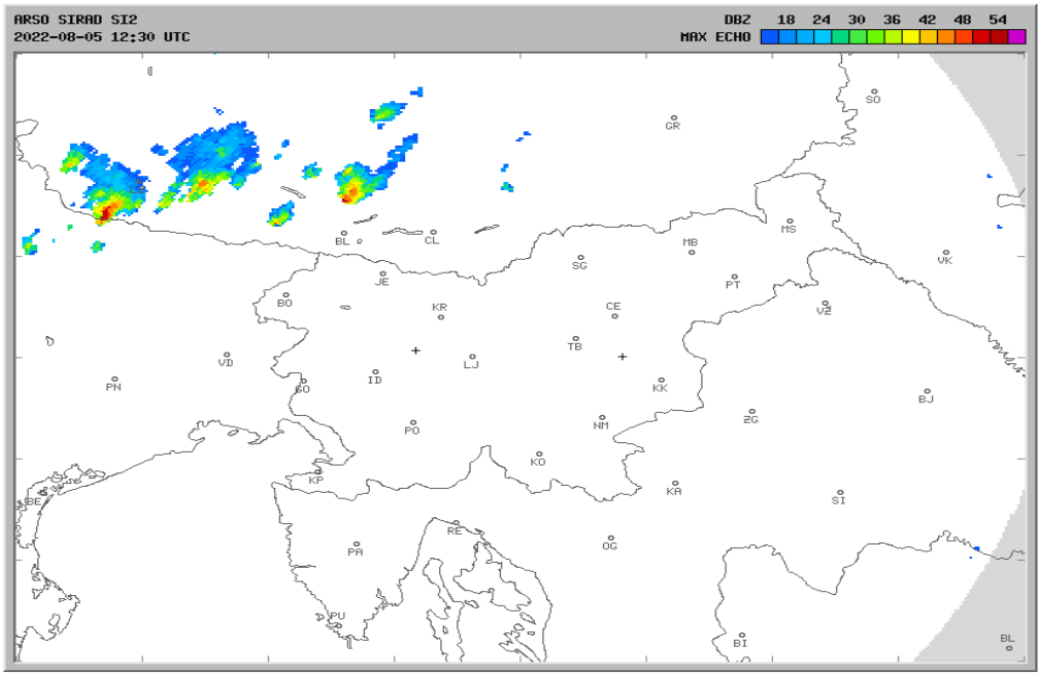


Figure 10: Precipitation radar image for May 8, 2022, at 12:30 UTC (14:30 local time)

1.5.2 Summary of weather conditions

Based on measurements and observations, we estimate that on August 5, 2022, at 14:30, there were some cumulus clouds, weak winds, thunderstorms, and no showers near the Brezje location in Gorenjska. No dangerous weather conditions were detected that could affect the performance of the flight.

1.6 The course of the investigation

Immediately after the accident, the investigating authority was informed by ReCO and OKC Kranj. The scene of the accident was secured by the police until the arrival of the chief investigator. The pilot of the aircraft, a passenger, representatives of the police, fire brigade, and DARS were present at the scene of the accident to ensure the safety of traffic on the AC. The on-site investigation included a visual inspection of the amount of fuel in the wing tanks. It was found that the left wing tank was empty, while the right wing tank still contained about 1/2 fuel. The fuel quantity indicator in the aircraft cabin showed the maximum deviation of both indicators in the full position (Figure no. 11 (FULL).

Figure 11: Position of fuel instrument indicators at the scene

There was a fuel stain about 20 cm in diameter at the edge of the highway lane. According to the statements and documents obtained by the first responders at the scene of the accident, the fuel dripped for several minutes from the drain valve, which was pushed through the torn-off panelling of the lower part of the nose of the aircraft. The approximate amount of fuel that leaked from the depressed drain valve is between 2 and 3 litres (the leaked fuel was absorbed by the firefighters, Figure 12).

After documenting the data from the scene, the aircraft was sealed and taken to the hangar of the Aeroservice Maintenance Organisation at LJBL Airport in the late evening, accompanied by the police. The investigation continued in parallel with the police investigation in the hangar and on the premises of Aeroservice, where an analysis of the functioning of the fuel system was carried out. In the preliminary part of the investigation, the amount of fuel in the tanks was measured, and

an analysis of the operation of the system for controlling and measuring the amount of fuel was carried out. An inspection of the fuel system and an analysis of the tank documentation were carried out. Aeroservice and the operator received documents on the work carried out on the aircraft, including the pilot's documentation, the aircraft user's documentation, and the aircraft manufacturer's documents. A representative of the Austrian Aviation Investigation Authority, acting as an accredited representative, interviewed the pilot involved in the accident to support the investigation.

Figure 12: A small amount of fuel leaked from a fuel drain valve at the scene

2 ANALYSIS

2.1 Analysis of the amount of fuel in the aircraft before the flight

On the day of the accident, the pilot intended to take over the aircraft, which had been in the maintenance organisation of Lesce Airport for a long time, and fly it back to the home airport of Graz in Austria (LOWG). The aircraft was handed over to the maintenance organisation Aeroservice d. o. o. almost a year before the accident, namely on August 25, 2021, with the aim of a general overhaul of the ROTAX engine and regular maintenance.

The available documentation for the aircraft shows that:

- On August 25, 2021, the aircraft arrived at LJBL; flight time: 45 minutes;
- On September 14, 2021, short flight: flight time: 10 minutes (engine operation time on the ground: 20 minutes)—30 minutes total;
- On August 4, 2022, completed the test flight: flight time 20 minutes (engine operating time on the ground 15 minutes)–35 minutes in total;
- On August 5, 2022, departure from LJBL: flight time until engine stops in the air: 10 min.

The amount of fuel in the tanks was not recorded when the aircraft arrived, but the records show that 30 litres of fuel were added to the tanks on August 24, 2021, and 20 litres of fuel on the day the aircraft arrived at LJBL on August 25, 2021. No fuel was added to the aircraft during its presence at Lesce Airport.

The personnel of the maintenance organisation that serviced the aircraft carried out an engine performance test on the ground and in the air the day before the aircraft was handed over. According to the pilot who conducted the test flight, approximately 1/3 of the fuel tank (approximately 18 litres) was in the left tank and 1/2 of the fuel tank (approximately 28 litres) was in the right tank when preparing for the flight. Both tanks were measured by the test pilot using a dipstick before the flight and compared with the display of the instrument in the cabin of the aircraft, which showed the same value. This was followed by a test of the engine on the ground and a test of the aircraft controls in the air. The ground test, during which the aircraft travelled to the runway, lasted 15 minutes.

The test pilot stated that during take-off and landing, the fuel selector was in the position for the right (fuller) tank, but during the flight itself, he used both tanks for testing. Based on the testimony of the test pilot and the calculation of the fuel consumption (according to the methodology and data of the AFM), the Commission estimates that there were about 9 litres of fuel left in the left tank after the end of the aircraft's tests on the day before the event.

2.2 Analysis of the preparation and implementation of the flight

Before taking over the aircraft, the pilot carried out navigational and meteorological preparations and checked that the take-off weight of the aircraft and the position of the centre of gravity were within the permissible limits. He also carried out a pre-flight inspection of the aircraft in accordance with the checklist. While checking the amount of fuel in the tanks, he checked the fuel quantity display on the cockpit instrument. According to the statement, he did not perform the deep-stick inspection that was in the aircraft to actually check the amount of fuel in the tanks because he believed the instrument that indicated that both tanks were full. The pilot stated:

> *"I did a partial external check after the POH, I checked the fuel level in both tanks using the cockpit fuel gauge (on the instrument). Both tanks appeared to be full. I relied on this information because the aircraft had been in maintenance for a long time, and the maintenance organisation should carry out the process of long-term storage, which means full fuel tanks to prevent corrosion and water in the fuel tanks."*

After completing the pre-flight inspection, the pilot set the fuel selector switch to the "LEFT" position and assumed that there were 50 litres of fuel in each of the two tanks, i.e., a total of 100 litres.

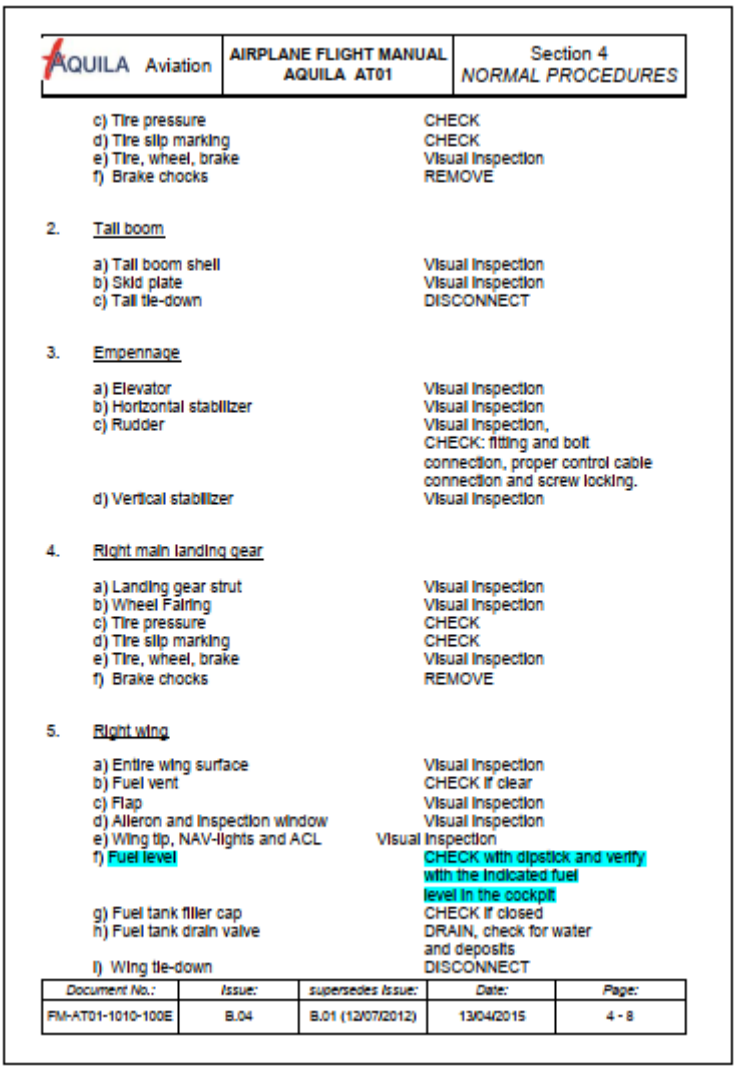
Figure 13: The position of the fuel selector at the time of the event

The engine start, engine test, check of the aircraft configuration before take-off, and take-off itself were uneventful. After take-off, the pilot decided to do a school round at LJBL with landing and extension (touch and go). The flight was then continued towards VFR point W3, where a sudden engine failure occurred. The pilot immediately steered the aircraft back to Lesce Airport and acted in accordance with the aircraft manufacturer's checklist in the event of engine failure.

In the event of an exceptional occurrence, such as a failure or interruption of engine operation during flight, the manufacturer has specified in the Flight Manual that in this case the fuel selector switch should be moved to another position, "SWITCH to fullest tank" (Appendix No. 3). Had the pilot followed this procedure, he would most likely have been able to successfully start the aircraft's engine by moving the fuel selector switch to the correct position; however, "FULL" was displayed in the aircraft cabin for both fuel tanks. The requirement to change the fuel selector switch in the event of an in-flight engine failure would make sense if the manufacturer's checklist required a change of position to a different fuel tank in the event of an in-flight engine failure, regardless of which fuel tank was full.

Given the aircraft's current altitude and distance from the airport, the pilot estimated that the return would not guarantee a safe landing at LJBL, so he informed the air traffic controller of the decision to make an emergency landing. Given the unfamiliarity of the terrain and the presence of obstacles (power lines) near a potentially suitable area for an off-airport landing, the pilot opted to land on the highway, which at the time of the decision was near and to the left of the aircraft's flight line, with the engine inoperative.

The aircraft landed on the highway lane in the direction of traffic. Traffic on the highway was heavy at the time, but the pilot managed to land in a clear section between two lines of cars. After touching the road, the pilot realised that if he continued to land in the direction of the traffic flow, he would not be able to avoid a collision with the vehicle in front of him that he was heading towards. So he turned far to the right at the edge of the road and then slid about 50 metres sideways down the embankment, where he came to a stop in a position 90 degrees to the right in relation to the direction of landing..



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c) Tire pressure	CHECK
d) Tire slip marking	CHECK
e) Tire, wheel, brake	Visual inspection
f) Brake chocks	REMOVE

2. Tail boom

a) Tail boom shell	Visual inspection
b) Skid plate	Visual inspection
c) Tail tie-down	DISCONNECT

3. Empennage

a) Elevator	Visual inspection
b) Horizontal stabilizer	Visual inspection
c) Rudder	Visual inspection, CHECK: fitting and bolt connection, proper control cable connection and screw locking.
d) Vertical stabilizer	Visual inspection

4. Right main landing gear

a) Landing gear strut	Visual inspection
b) Wheel Fairing	Visual inspection
c) Tire pressure	CHECK
d) Tire slip marking	CHECK
e) Tire, wheel, brake	Visual inspection
f) Brake chocks	REMOVE

5. Right wing

a) Entire wing surface	Visual inspection
b) Fuel vent	CHECK if clear
c) Flap	Visual inspection
d) Aileron and inspection window	Visual inspection
e) Wing tip, NAV-lights and ACL	Visual inspection
f) Fuel level	CHECK with dipstick and verify with the indicated fuel level in the cockpit
g) Fuel tank filler cap	CHECK if closed
h) Fuel tank drain valve	DRAIN, check for water and deposits
i) Wing tie-down	DISCONNECT

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Figure 14: Checklist in AFM: fuel control for left and right wings is the same

2.3 Analysis of fuel quantity indication

The amount of fuel in the tank is measured using a fuel probe that works on the principle of measuring the capacitance between the electrodes, which changes when the amount of fuel in the tank changes. The electrical voltage in the circuit changes and generates an electrical signal that is transmitted to the fuel gauge in the cockpit. As part of the investigation, a more detailed analysis of the fuel quantity displays in the aircraft cabin was carried out.

2.3.1 Amount of fuel in the tanks at the accident site

During the inspection of the aircraft at the scene of the accident, the amount of fuel was determined to be:

- FUEL SELECTION POSITION: left tank
- MAIN POWER SWITCH: ON

RESERVOIR	Physical inspection	Indicator in the cabin: on the instrument
RIGHT	1/2	Full (indicator position as in figure no. 11)

LEFT	Empty	Full (indicator position as in figure no. 11)

2.3.2 *Analysis of the amount of fuel when the fuel instrument on the instrument panel is operating*

When draining the fuel from both tanks, the amount of fuel in the left tank was measured at 0.16 litres. The amount of fuel measured in the right tank was 31 litres. No water was found in the fuel. The water drainage system and the entire fuel installation system were checked to detect possible leaks. When checking the function of the fuel gauge on the cockpit instrument panel, it was found that one of the connection contacts on the back of the instrument was loose. The female part of the contact was approximately 2/3 outside the length of the male contact and in the non-contact position.

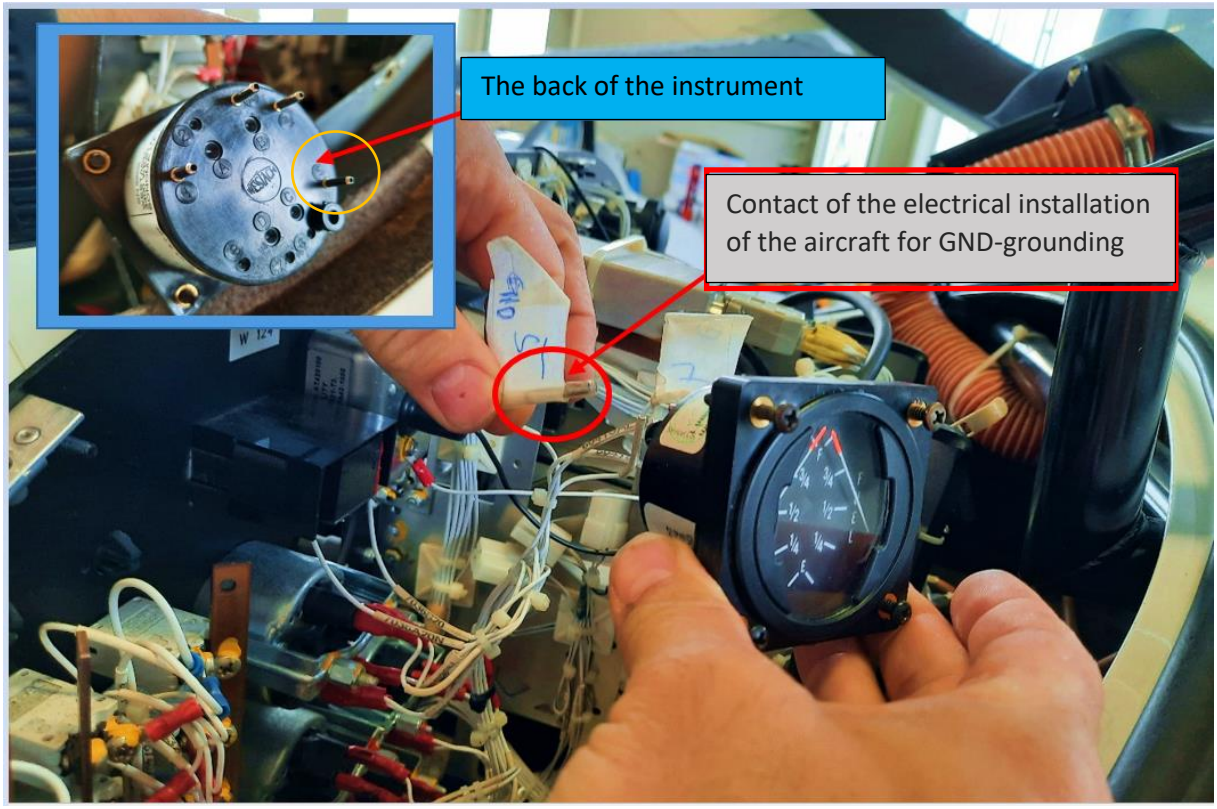


Figure 15: Display of a separate grounding contact: the instrument pointers indicate a position above the FULL (F) mark

The display of the manufacturer's device [5]was compared with the position of the GND wire (GND is the abbreviation for "ground"). It turned out that the fuel quantity display is correct if the contact of the ground wire is correctly fitted (Figure 14). If the ground wire contact is loose or protruding (Figure 15), both fuel quantity instrument displays are completely off in the top position. **Such an instrument display can be identified as full of fuel.**

[5] https://www.westach.com/fuel-level-gauges - Fuel gauge manufacturer link https://www.westach.com/product-page/mis-matched-connectors

Figure 16: Indicators of the instrument when the GND contact is connected

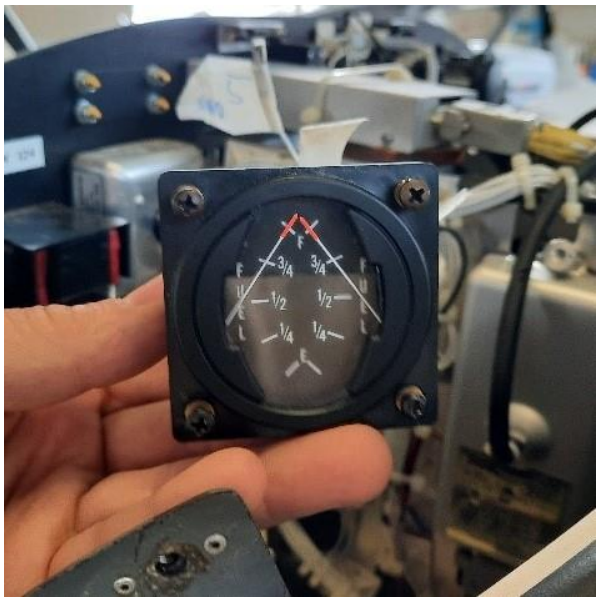


Figure 17: Indicators of the instrument when the GND contact is not connected

Figure 18: Male and female connectors

The manufacturer of the device has indicated on its website how the non-matching contacts of the device are to be connected to the electrical installation.

Figure 19: Westach Fuel Gauge, P/N: 2840-122

2.3.3 Analysis of comparable fuel quantity display instruments

As part of the investigation, an analysis was carried out on another Cessna 206 GA aircraft equipped with an identical instrument from the same manufacturer, Westach, as the instrument in the aircraft involved in the accident. It was found that the pointers of the fuel instrument of another aircraft indicate the maximum deviation "full" in the event of an interruption of the GND contact, which is identical to the case of an interruption of the GND contact of the OE-CYY aircraft (Figure No. 15).

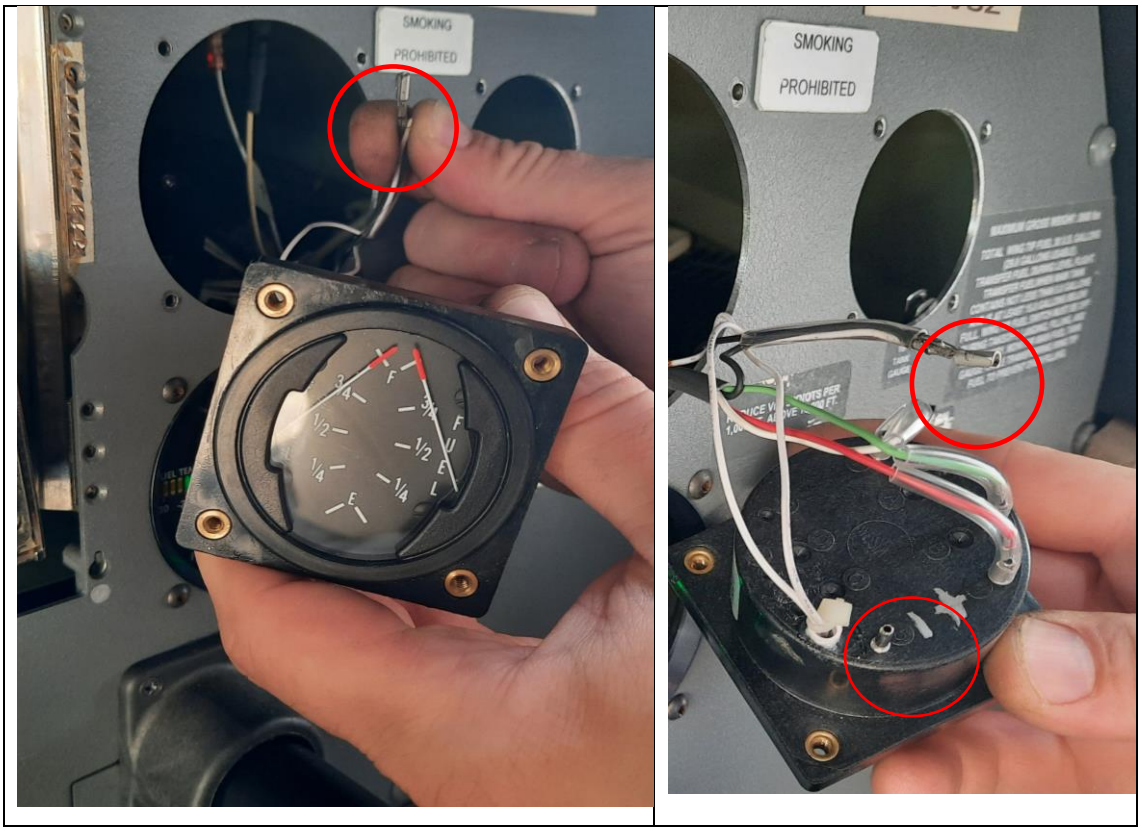


Figure 20: Performance check of the Westach fuel instrument on another GA category aircraft

It was found that the pointers of the fuelling instrument of the same manufacturer in another aircraft[6] have an identical position when the GND contact is disconnected, namely that both pointers are in the outermost upper position (Fig. No. 17).

3 CONCLUSIONS

In accordance with the objectives of the investigation with respect to civil aviation safety and the prevention of recurrence of such accidents and incidents in the future, the findings presented in this report do not constitute a determination of guilt or responsibility. The use of this report for purposes other than improving aviation safety may lead to misinterpretation.

3.1 Findings

3.1.1 Crew

- The pilot holds a PPL(A) class SEP(land) licence valid until May 31, 2024. The pilot's overall flying experience indicates a high level of flying experience. In the last year up to the day of the accident, he had flown for 5 hours and 20 minutes, in the last 30 days before the accident, he had flown for 0 hours and 40 minutes, which indicates that he did not regularly maintain a flight qualification in the category of the aircraft involved in the accident.
- The pilot has a valid medical certificate for the I. and II. Class and LAPL (Medical Certificate Class II), valid until May 18, 2023. The pilot was in good health at the time of the accident. The pilot's medical condition had no influence on the accident.
- Before the flight, the pilot has completed the navigational and meteorological preparations in accordance with the Standard Operating Procedures (SOP).
- The pilot only partially completed the pre-flight inspection of the aircraft. He did not check the amount of fuel in the wing tanks with a dipstick as required by the manufacturer's operating manual (AFM) and the operator's checklist.
- The pilot's expectation that the maintenance organisation must supply the aircraft with fuel as part of regular and specific maintenance work has no legal or operational basis.
- During the flight, the pilot acted correctly and in accordance with the prescribed emergency procedures from the aircraft manufacturer's and operator's checklist.
- The pilot's assessment and decision to make an emergency landing on the highway were correct in view of the circumstances at the time of the engine failure, the available flight altitude, and the particularities of the terrain.
- The pilot successfully carried out the emergency landing due to engine failure in order to avoid loss of life, injury, and major damage to property.
- The pilot and the passenger were not injured during the landing and left the aircraft on their own.

[6] The check is carried out on a Cessna 206 aircraft, which has an FAA and EASA type certificate.

3.1.2 Aircraft

- The aircraft had been at LJBL airport for an extended period due to a general engine overhaul at the manufacturer Rotax and regular maintenance at the authorised maintenance organisation Aeroservice d. o. o. Upon completion of the maintenance, the maintenance organisation issued the pilot a "Certificate of Release" by the maintenance organisation.
- During the review of all documentation on the course of aircraft maintenance, regular, preventive, and special maintenance inspections, repairs, and modifications, no significant deviations were found that would consequently affect the accident.
- A faulty operation or deviation of the fuel gauges on the instrument in the cockpit was not noted in the logbook. A deviation of the fuel gauges from the actual value of the fuel quantity in the individual fuel tanks was not detected during the regular maintenance inspections by the maintenance organisation and the CAMO with which the aircraft was registered.
- If there is a loose contact or if the contact of the grounding wire on the back of the device is exposed, both pointers of the measuring device indicate full or are in an extreme position.
- The interruption of the GND contact in the electrical installation of the aircraft is due to the loose contact of the non-matching contacts of the instrument with the electrical installation. The interruption of contact was most likely due to the influence of high temperatures, vibrations, or changes in the structure of the material.
- There is a dipstick in the cockpit of the aircraft, which is used to measure the actual amount of fuel in the tanks, as specified by the manufacturer in the manual for the operation of the aircraft.
- The engine stopped due to a lack of fuel in the left wing tank, which caused the fuel at the position of the fuel selector switch to reach the engine to consume fuel from the left tank, for which the fuel instrument on the instrument panel in the aircraft cabin displayed the incorrect fuel quantity value.

3.1.3 Other

- At the time of the engine failure, the pilot did not declare an emergency with "may-day" or "pan-pan" in his communication with the air traffic controller. Nevertheless, he clearly communicated to the air traffic controller the circumstances of the accident and the subsequent decision to make an emergency landing[7].
- The meteorological conditions at the time of the accident were favourable and had no influence on the accident.
- At all times, the air traffic controller provided air traffic management services in accordance with regulations and established practice; accordingly, after the pilot reported the engine failure, he alerted the relevant services by proceeding to the scene of the accident.

The Commission considers that there was a lack of communication between the owner of the aircraft, the flight crew, and the representative of the maintenance organisation when the aircraft was handed over. The aircraft had been parked in the maintenance organisation's parking lot for almost a year, during a general engine overhaul and a subsequent periodic inspection. Following the short flight performed by the maintenance organisation's pilot the day before the accident, it would have been expected that the maintenance organisation's representative would have informed the crew receiving the aircraft of the details of the test flight performed, including information on the amount of fuel remaining in the tanks, when handing over the aircraft. Otherwise, aviation regulations do not require the maintenance organisation representative to inform the owner or operator of the amount of fuel remaining after the test flight. However, there should be a mutual awareness that the fuel quality may deteriorate due to the prolonged disuse of the aircraft and that the amount of fuel may not be sufficient to bring the crew safely back to the home airport in Graz from which the aircraft had recently arrived. Thus, neither the crew who took over the aircraft nor the representative of the maintenance organisation personally communicated with each other and exchanged information about the quantity and quality of the fuel in the aircraft's wing tanks.

The Commission considers that, given the circumstances of the event, the knowledge of the position of the aircraft after departure from Lesce airport, the traffic conditions on the highway section, the obstacles on the ground, and other data on the elements of the flight, the pilot successfully carried out the emergency procedures in a very short but sufficient time, which are established for such cases by the aircraft manufacturers and by the flight schools and operators in which the flight personnel work.

[7] https://skybrary.aero/articles/emergency-communications

3.2 Conclusion

3.2.1 Immediate cause

- The aircraft collided with the terrain when it tried to make an emergency landing on a busy highway.

3.2.2 Indirect cause

- Total engine failure in the air due to a only partially completed check of the available fuel in preparation for the flight.

4 SAFETY RECOMMENDATIONS

In the risk assessment, which is based on a technical and operational evaluation, the Commission has determined whether the perceived risk is acceptable or permissible. Risk is defined as the combination of the overall probability or frequency of the occurrence of an adverse effect caused by a hazard and the severity of that effect. The Commission concludes that the risk of such a failure of the GND contact of the fuel instrument and the resulting false or misleading display of the fuel quantity on the fuel instrument in the aircraft cabin, as well as the possible consequences of such a display, constitute a significant impact on safety. The common denominator of such events is the human factor and the awareness that the pilot should ensure, based on the manufacturer's and operator's instructions, that the instructions of the aircraft's pre-flight checks are followed according to the list, including checking the amount of fuel in the tanks using the prescribed dipstick. Nevertheless, the Commission concludes that the aircraft manufacturer should specify in the aircraft maintenance manual the method of connection of the contacts and the consequences of a possible interruption of the GND contact in relation to the display of indicators on the manufacturer's fuel instrument fitted to the aircraft. In order to reduce the safety risks, the investigation authority makes the following safety recommendation to the manufacturer and designer of the aircraft, AQUILA AVIATION INTERNATIONAL GMBH, after publication of the final report:

SI-SR001-2024

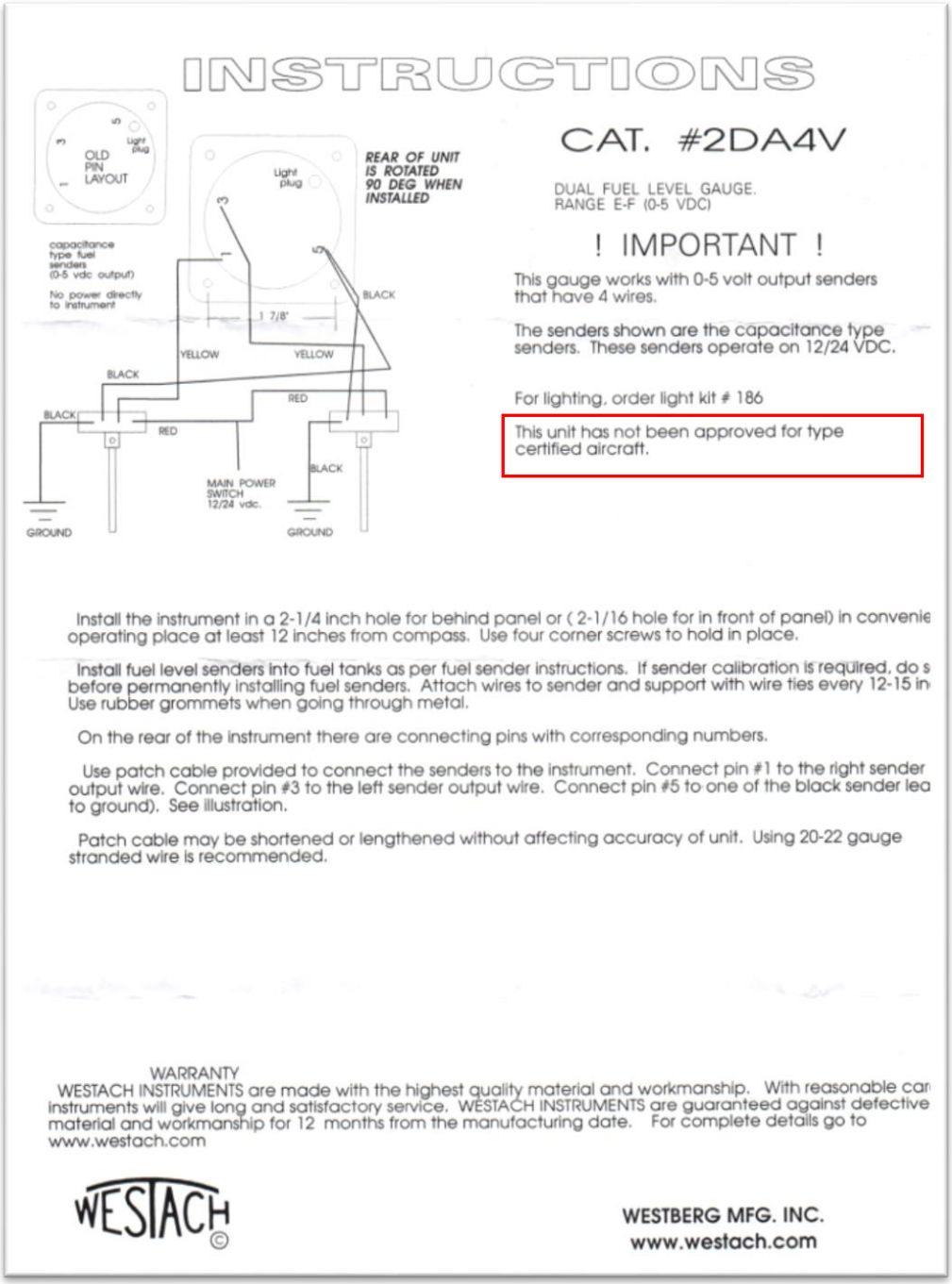
Based on the findings, the designer and manufacturer of the aircraft should, within 12 months of the publication of the final report, revise the aircraft maintenance manual in the part relating to fuel exploitation and consider the possible need to issue an additional safety bulletin on the fuel gauge on the Westach instrument.

In the period leading up to the publication of the final report, the maintenance organisation Aeroservice Lesce took safety measures on its own initiative in the form of prescribed communication procedures and checklists for the acceptance and delivery of aircraft that are or have been accepted into the maintenance organisation in order to improve traceability and communication with customers. During the investigation, safety issues were identified in relation to compliance with the instructions to check the amount of fuel in the fuel tanks before each flight. In aviation practice, these types of instructions are well known and are processed in operational

procedures established by manufacturers and also by aircraft operators, owners, and users. Therefore, the investigation authority has no safety recommendations regarding the above points but expects the operator, the owner, the CAMO organisation, and the user of the aircraft to initiate safety measures as part of their inspection in order to reduce their own safety risks.

5 ATTACHMENTS

ATTACHMENT 1 Fuel gauge manufacturer's instructions – WESTACH



INSTRUCTIONS

CAT. #2DA4V

DUAL FUEL LEVEL GAUGE.
RANGE E-F (0-5 VDC)

! IMPORTANT !

This gauge works with 0-5 volt output senders that have 4 wires.

The senders shown are the capacitance type senders. These senders operate on 12/24 VDC.

For lighting, order light kit # 186

This unit has not been approved for type certified aircraft.

Install the instrument in a 2-1/4 inch hole for behind panel or (2-1/16 hole for in front of panel) in convenie operating place at least 12 inches from compass. Use four corner screws to hold in place.

Install fuel level senders into fuel tanks as per fuel sender instructions. If sender calibration is required, do s before permanently installing fuel senders. Attach wires to sender and support with wire ties every 12-15 in Use rubber grommets when going through metal.

On the rear of the instrument there are connecting pins with corresponding numbers.

Use patch cable provided to connect the senders to the instrument. Connect pin #1 to the right sender output wire. Connect pin #3 to the left sender output wire. Connect pin #5 to one of the black sender lea to ground). See illustration.

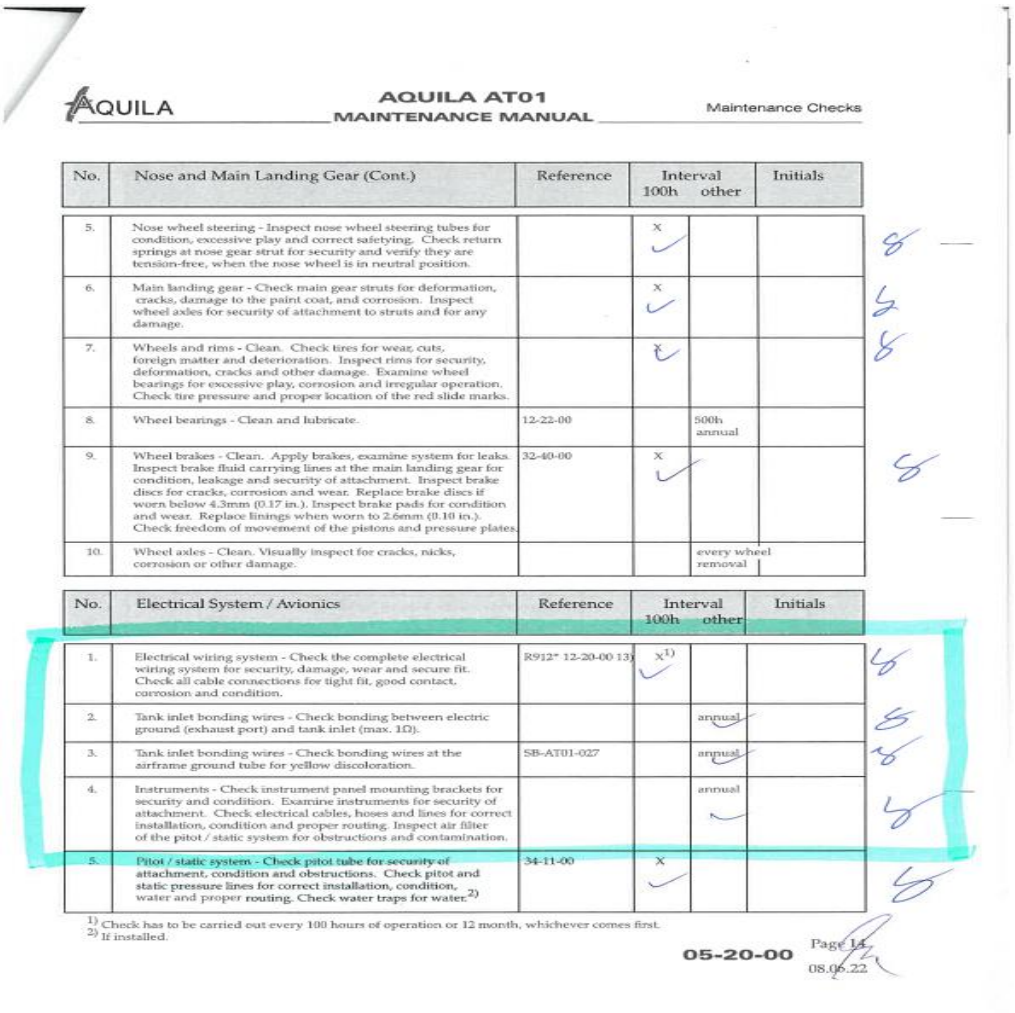
Patch cable may be shortened or lengthened without affecting accuracy of unit. Using 20-22 gauge stranded wire is recommended.

WARRANTY
WESTACH INSTRUMENTS are made with the highest quality material and workmanship. With reasonable car instruments will give long and satisfactory service. WESTACH INSTRUMENTS are guaranteed against defective material and workmanship for 12 months from the manufacturing date. For complete details go to www.westach.com

WESTACH ©

WESTBERG MFG. INC.
www.westach.com

ATTACHMENT 2 According to the inspection scheet specified by the aircraft manufacturer, an inspection was carried out on the electrical system in the maintenance organisation on August 3, 2023



AQUILA AQUILA AT01 MAINTENANCE MANUAL Maintenance Checks

No.	Nose and Main Landing Gear (Cont.)	Reference	Interval 100h	Interval other	Initials
5.	Nose wheel steering - Inspect nose wheel steering tubes for condition, excessive play and correct safetying. Check return springs at nose gear strut for security and verify they are tension-free, when the nose wheel is in neutral position.		X		
6.	Main landing gear - Check main gear struts for deformation, cracks, damage to the paint coat, and corrosion. Inspect wheel axles for security of attachment to struts and for any damage.		X		
7.	Wheels and rims - Clean. Check tires for wear, cuts, foreign matter and deterioration. Inspect rims for security, deformation, cracks and other damage. Examine wheel bearings for excessive play, corrosion and irregular operation. Check tire pressure and proper location of the red slide marks.		X		
8.	Wheel bearings - Clean and lubricate.	12-22-00		500h annual	
9.	Wheel brakes - Clean. Apply brakes, examine system for leaks. Inspect brake fluid carrying lines at the main landing gear for condition, leakage and security of attachment. Inspect brake discs for cracks, corrosion and wear. Replace brake discs if worn below 4.3mm (0.17 in.). Inspect brake pads for condition and wear. Replace linings when worn to 2.6mm (0.10 in.). Check freedom of movement of the pistons and pressure plates.	32-40-00	X		
10.	Wheel axles - Clean. Visually inspect for cracks, nicks, corrosion or other damage.			every wheel removal	

No.	Electrical System / Avionics	Reference	Interval 100h	Interval other	Initials
1.	Electrical wiring system - Check the complete electrical wiring system for security, damage, wear and secure fit. Check all cable connections for tight fit, good contact, corrosion and condition.	R912* 12-20-00 13)	X[1)]		
2.	Tank inlet bonding wires - Check bonding between electric ground (exhaust port) and tank inlet (max. 1Ω).			annual	
3.	Tank inlet bonding wires - Check bonding wires at the airframe ground tube for yellow discoloration.	SB-AT01-027		annual	
4.	Instruments - Check instrument panel mounting brackets for security and condition. Examine instruments for security of attachment. Check electrical cables, hoses and lines for correct installation, condition and proper routing. Inspect air filter of the pitot / static system for obstructions and contamination.			annual	
5.	Pitot / static system - Check pitot tube for security of attachment, condition and obstructions. Check pitot and static pressure lines for correct installation, condition, water and proper routing. Check water traps for water.[2)]	34-11-00	X		

1) Check has to be carried out every 100 hours of operation or 12 month, whichever comes first.
2) If installed.

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08.06.22

ATTACHMENT3 Flight Manual: Selecting the position of the fuel selector in the event of an emergency

AQUILA Aviation	AIRPLANE FLIGHT MANUAL AQUILA AT01	Section 3 *EMERGENCY PROCEDURES*

3.3 ENGINE FAILURES

3.3.1 Engine Failure During Take-off Run

1.	Throttle	IDLE
2.	Brakes	APPLY as required

3.3.2 Engine Failure Immediately After Take-off

A) ENGINE POWER LOSS

1.	Throttle	full OPEN
2.	Electrical fuel pump	ON
3.	Airspeed	70 KIAS
4.	Propeller control lever	HIGH-RPM position
5.	Fuel selector valve	SWITCH to fullest tank
6.	Choke	OFF
7.	Carburetor heat	ON
8.	Ignition switch	BOTH

WARNING

If engine power cannot be restored immediately, an emergency landing must be initiated under consideration of local conditions and the circumstances of the particular situation:

Before landing:

9.	Fuel selector valve	OFF
10.	Ignition switch	OFF
11.	ALT/BAT switch	OFF

WARNING

If BAT switch is in OFF position: Stall warning system is inoperative!

3.3.3 In-flight Engine Failure

A) ENGINE ROUGHNESS

1.	Carburetor heat	ON
2.	Electrical fuel pump	ON
3.	Ignition switch	SWITCH through the positions L-BOTH, then R-BOTH

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