

AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

| | | | | | | | |
|--|------------------|---|---------------------------|--------------------------------|---------|--------------------------|---------|
| | | | | Reference: | | CA18/2/3/10221 | |
| Aircraft Registration | ZU-DYV | Date of Accident | | 30 November 2022 | | Time of Accident | 0800Z |
| Type of Aircraft | Ela 08 Gyroplane | | | Type of Operation | | Training (Part 141) | |
| Pilot-in-command Licence Type | | National Pilot Licence (NPL) | | Age | 40 | Licence Valid | Yes |
| Pilot-in-command Flying Experience | | | Total Flying Hours | | 7 054.5 | Hours on Type | 1 606.3 |
| Last Point of Departure | | Springs Aerodrome (FASI), Gauteng province | | | | | |
| Next Point of Intended Landing | | Springs Aerodrome (FASI), Gauteng province | | | | | |
| Damage to Aircraft | | Substantial | | | | | |
| Location of the accident site with reference to easily defined geographical points (GPS readings if possible) | | | | | | | |
| Near the quarry in Brakpan at Global Positioning System (GPS) co-ordinates determined to be 26°13'03.8" South and 28°23'11.5" East, at an elevation of 5 268 feet (ft) | | | | | | | |
| Meteorological Information | | Wind direction: 290 at 5 knots (kt); Temperature: 23; Dew point: 13; Visibility 9999m; QNH 1026 hPa | | | | | |
| Number of People On-board | 1+1 | Number of People Injured | 2 | Number of People Killed | 0 | Other (On Ground) | 0 |
| Synopsis | | | | | | | |
| <p>On Wednesday morning, 30 November 2022, an instructor pilot and a student pilot on-board a Gyroplane ELA 08 with registration ZU-DYV took off from Runway (RWY) 03 at Springs Aerodrome (FASI) in Gauteng province with the intention to conduct circuit exercises. The training flight was conducted under visual meteorological conditions (VMC) by day and under the provisions of Part 141 of the Civil Aviation Regulations (CAR) 2011 as amended.</p> <p>The instructor pilot stated that the gyroplane was airborne for approximately 45 minutes on what was the last circuit for the day. During a late right base for RWY 03, the engine stopped without warning. At this time, the gyroplane was flying overhead the quarry in Brakpan area. The instructor pilot identified a road adjacent to the quarry on which to perform a forced landing. During the landing roll, the main rotor blades struck the trees on the left side of the road whilst the gyroplane was a few metres above ground and one of the blades separated from the hub. The gyroplane rolled to the left along its lateral axis twice before it came to rest on its left side. Eyewitnesses who were near the quarry witnessed the gyroplane when it was flying above them and when the engine stopped. They stated that the gyroplane flew towards their position and, whilst landing on the road, it impacted the tress and rolled on its side.</p> <p>Both occupants were injured during the accident sequence; the student pilot was airlifted to the hospital whilst the instructor pilot was transported by ambulance to the nearby Far East Rand Hospital. The gyroplane was substantially damaged.</p> | | | | | | | |
| Probable Cause | | | | | | | |
| Unsuccessful forced landing following an in-flight engine stoppage due to fuel starvation; this was likely due to the fuel pumps being inadvertently switched off. | | | | | | | |
| SRP Date | | 12 December 2023 | | Publication Date | | 21 December 2023 | |

Occurrence Details

Reference Number : CA18/2/3/10221
Occurrence Category : Category 1
Type of Operation : Private (Part 141)
Name of Operator : Gregory Lightfoot
Aircraft Registration : ZU-DYV
Aircraft Make and Model : ELA 08
Nationality : South African
Place : Open field in Brakpan
Date and Time : 30 November 2022 at 0800Z
Injuries : One serious, and one minor
Damage : Substantial

Purpose of the Investigation

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (CAR) 2011, this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and not to apportion blame or liability.

All times given in this report are Co-ordinated Universal Time (UTC) and will be denoted by (Z). South African Standard Time is UTC plus 2 hours.

Investigation Process

The Accident and Incident Investigations Division (AIID) of the South African Civil Aviation Authority (SACAA) was notified of the accident which occurred on 30 November 2022 at 0800Z. The occurrence was classified as an accident according to the CAR 2011 Part 12 and the international Civil Aviation Authority (ICAO) Standards (STD) Annex 13 definitions. Notification sent to the State of Registry and Operator in accordance with the CAR 2011 Part 12 and ICAO Annex 13 Chapter 4. The investigator was dispatched to the accident site for this occurrence.

Notes:

- Whenever the following words are mentioned in this report, they shall mean the following:
Accident — this investigated accident
Aircraft — the ELA 08 involved in this accident
Investigation — the investigation into the circumstances of this accident
Pilot — the pilot involved in this accident
Report — this accident report*
- Photos and figures used in this report were taken from different sources and may have been adjusted from the original for the sole purpose of improving clarity of the report. Modifications to images used in this report were limited to cropping, magnification, file compression; or enhancement of colour, brightness, contrast; or addition of text boxes, arrows, or lines.*

Disclaimer

This report is produced without prejudice to the rights of the SACAA, which are reserved.

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| Abbreviation | Description |
|---------------------|--|
| ° | Degrees |
| °C | Degrees Celsius |
| AIID | Accident and Incident Investigations Division |
| ATF | Authority to Fly |
| AP | Approved Person |
| CAR | Civil Aviation Regulations |
| CCM | Conventional Controlled Microlight |
| C of R | Certificate of Registration |
| CHT | Cylinder Head Temperature |
| CRS | Certificate of Release to Service |
| CVR | Cockpit Voice Recorder |
| E | East |
| EMS | Emergency Medical Service |
| FASI | Springs Aerodrome |
| FDR | Flight Data Recorder |
| ft | Feet |
| GPS | Global Positioning System |
| hPa | Hectopascal |
| KPH | Kilometre per Hour |
| kt | Knots |
| m | Metres |
| METAR | Meteorological Aerodrome Report |
| MPH | Miles per Hour |
| NM | Nautical Mile |
| NPL | National Pilot Licence |
| SACAA | South African Civil Aviation Authority |
| SACATS | South African Civil Aviation Technical Standard |
| SAPS | South African Police Service |
| SAWS | South African Weather Service |
| S | South |
| SN | Serial Number |
| SPL | Student Pilot Licence |
| TBO | Time Between Overhaul |
| POH | Pilot's Operating Handbook |
| PN | Part Number |
| RWY | Runway |
| QNH | Altitude Above Mean Sea Level |
| Z | Zulu (Term for Universal Co-ordinated Time - Zero Hours Greenwich) |

1. FACTUAL INFORMATION

1.1. History of Flight

- 1.1.1. On Wednesday morning, 30 November 2022, a flight instructor pilot and a student pilot on-board a Gyroplane ELA 08 with registration ZU-DYV were engaged in a circuit training flight on Runway (RWY) 03 at Springs Aerodrome (FASI), Gauteng province. Fine weather conditions prevailed at the time of the flight. The flight was conducted in visual meteorological conditions by day and under the provisions of Part 141 of the Civil Aviation Regulations (CAR) 2011 as amended.
- 1.1.2. According to the instructor pilot, the gyroplane was uplifted with 25 litres of unleaded fuel which brought the total fuel to 50 litres in the tank prior to the flight. The fuel was checked for water and sediments, and it was found clean. After boarding the gyroplane, the student pilot sat in the front cockpit seat as he had not flown for some time, and the instructor sat on the rear cockpit seat. The student pilot was the owner of the gyroplane; he had a Recreational Student Pilot Licence (RSPL). The student pilot started the engine, thereafter, the instructor taxied the gyroplane and, after lining up on RWY 03, they took off and climbed as expected to a height of 5900 feet (ft) above mean sea level (AMSL). The student pilot conducted two touch-and-go landings on RWY 03 which were uneventful.
- 1.1.3. During the third touch-and-go landing, another aircraft within the same airspace broadcasted wind direction on frequency 122.4-Megahertz (MHz) which prompted a runway change from RWY 03 to RWY 21. Whilst on the right downwind for RWY 21, there were three other aircraft in the circuit in front of the gyroplane. When the gyroplane turned base leg overhead the quarry in Brakpan area, the engine stopped without warning. The pilot identified a road in the vicinity on which to perform a forced landing. During approach, he leaned out to assess the road and spotted trees on the left side of the road. He steered the gyroplane to the right and side-slipped to avoid the trees on the left side. Whilst the gyroplane was a few metres above the road, the main rotor blades struck the trees and, as a result, one of the main rotor blades separated from the hub. After impact, the pilot stated that he could not free himself from the seat belt and an eyewitness assisted him out of the gyroplane and sat him under a tree. He further stated that one of the pilots who were flying the circuit on RWY 21 flew towards their last position after failing to hear the gyroplane's transmissions. He spotted the gyroplane's crash site and broadcasted for assistance via the radio.
- 1.1.4. According to the eyewitnesses who were at the quarry, they witnessed the gyroplane overhead the quarry which banked left from where they were positioned. Moments later, when the eyewitnesses were making their way to the road that was adjacent to the quarry, they noticed the same gyroplane flying past above them, which was about to land on the

road. At that time, there was no sound emanating from the gyroplane. During the landing phase, they witnessed the main rotor blades strike the trees on the left side of the road. The gyroplane rolled on its left side twice before it came to rest (on its left side). Thereafter, they ran towards the gyroplane and found the occupants still strapped to their seats. The student pilot was seated on the front seat and was able to communicate with them, whilst the instructor pilot at the back seat was unable to move and complained of pain; one of the eyewitnesses cut the seat belt with a sharp object to free the student pilot. Thereafter, they assisted both the instructor and the student pilot out of the gyroplane and sat them under a tree. The eyewitnesses stated that there was a strong smell of fuel and, later, they identified the source of fuel leak on the gyroplane. A fire-extinguisher was sourced from a vehicle nearby to use in case a post-impact fire erupted. The Emergency Medical Services (EMS) personnel and the South African Police Service (SAPS) officials were dispatched to the scene. The EMS personnel administered first aid to the injured crew and the SAPS personnel secured the scene.

- 1.1.5. The gyroplane was substantially damaged during the accident sequence. The student pilot sustained serious injuries whilst the instructor had minor injuries. According to the South African Police Service (SAPS) officers, an Emergency Medical Service (EMS) helicopter was dispatched to the scene and the student pilot was air-lifted to a hospital in Alberton, Gauteng province. The instructor pilot was transported in an ambulance to the nearby Far East Rand Hospital in the East Rand.
- 1.1.6. The accident occurred at Global Positioning System (GPS) co-ordinates determined to be 26°13'03.8" South and 28°23'11.5" East, at a field elevation of 5 268 feet (ft).



Figure 1: An overview of the accident site. (Source: Google Earth)

1.2 Injuries to Persons

| Injuries | Pilot | Crew | Pass. | Total On-board | Other |
|--------------|----------|----------|----------|----------------|----------|
| Fatal | - | - | - | - | - |
| Serious | 1 | - | - | 1 | - |
| Minor | 1 | - | - | 1 | - |
| None | - | - | - | - | - |
| Total | 2 | - | - | 2 | - |

Note: Other means people on the ground.

1.3 Damage to Aircraft

1.3.1 The gyroplane was substantially damaged.



Figure 2: Damage sustained by the gyroplane.

1.4 Other Damage

1.4.1 None.

1.5 Instructor Pilot Information

| | | | | | |
|---------------------|---|---------------|------|-----|----|
| Nationality | South African | Gender | Male | Age | 40 |
| Licence Type | National Pilot Licence (NPL) | | | | |
| Licence Valid | Yes | Type Endorsed | Yes | | |
| Ratings | CCM Instructor Grade C, Gyro Instructor Grade A | | | | |
| Medical Expiry Date | 28 February 2023 | | | | |
| Restrictions | Corrective lenses | | | | |
| Previous Accidents | Yes | | | | |

Note: Previous accidents refer to past accidents the pilot was involved in, when relevant to this accident.

Flying Experience:

| | |
|---------------------|---------|
| Total Hours | 7 054.5 |
| Total Past 24 Hours | 1.6 |
| Total Past 7 Days | 3.0 |

| | |
|----------------------------|---------|
| Total Past 90 Days | 17.2 |
| Total on Type Past 90 Days | 13.3 |
| Total on Type | 1 606.3 |

- 1.5.1 The instructor pilot had a National Pilot Licence (NPL) that was issued on 1 June 2022 with an expiry date of 26 June 2023. The instructor pilot's logbook and licence had the gyroplane's type and rating endorsements. The instructor pilot's Class 4 medical certificate was issued on 1 June 2022 with an expiry date of 28 February 2023. The medical certificate had a waiver stating that the instructor pilot should wear suitable corrective lenses.
- 1.5.2 The instructor pilot had a Grade A instructor rating under the gyroplane category that was issued on 27 June 2021 with an expiry date of 26 June 2023, as well as a Test Flight rating in line with Part 62.14.7 which was issued on 22 March 2021 with an expiry date of 21 March 2023.

Student Pilot Information:

| | | | | | |
|---------------------|---|---------------|------|-----|----|
| Nationality | South African | Gender | Male | Age | 50 |
| Licence Type | Recreational Student Pilot Licence (RSPL) | | | | |
| Licence Valid | Yes | Type Endorsed | Yes | | |
| Ratings | Y019 and Gyro | | | | |
| Medical Expiry Date | 31 December 2022 | | | | |
| Restrictions | None | | | | |
| Previous Accidents | No | | | | |

Student Pilot Experience

| | |
|----------------------------|------|
| Total Hours | 29.4 |
| Total Past 24 Hours | 0 |
| Total Past 7 Days | 0 |
| Total Past 90 Days | 0 |
| Total on Type Past 90 Days | 0 |
| Total on Type | 27.6 |

- 1.5.3 The student pilot was initially issued a Recreational Student Pilot Licence on 10 February 2021 with an expiry date of 7 February 2023. The student pilot's licence had the gyroplane's type and rating endorsements. The student pilot's Class 2 medical certificate was issued on 9 December 2020 with an expiry date of 31 December 2022 with no restrictions.
- 1.5.4 According to the student pilot's logbook, he last flew on 11 May 2022, approximately six (6) months prior to the accident flight. The student pilot's long break was due to business workload.

1.6 Aircraft Information

The information below is an extract from the ELA 07 aircraft type manual (Pilot's Operating Handbook) which is similar to the ELA 08 design:

- 1.6.1 *The ELA 07/08 gyroplane is designed as a two-seater, tandem-configured three-axis aircraft with dual controls and single engine, ideal for flight instruction purposes. In addition to flight training and general recreational flying, the flight characteristics of this gyroplane make such aircraft ideally suited for tasks such as air transportation, forestry, border, livestock and traffic surveillance, electrical pylon inspection, aerial still and film photography, fumigation, crop spray, etc. Its characteristic short take-off and landing runs make it particularly suitable for operation from fields of modest dimension. The airframe is one single part built from stainless steel TIG (tungsten-inert-gas) welded to guarantee lifetime freedom from corrosion. The gyroplane is a tricycle landing gear with front wheel. The cockpit is made from composite materials, ensuring high strength with low weight. The high sided open cockpits have clear polycarbonate windshields to protect the occupants from wind effects but offer excellent all-round visibility. The layout of the instrument panel house switches which fall easily to hand around the desired set of instruments. The rotor blades are made from aluminium and composite materials. The power unit consists of a pusher piston engine and three bladed composite propeller. The tailplane is made from composite materials and consist of a fixed horizontal stabiliser with winglets at the ends and a vertical surface in the centre subdivided into a fixed vertical stabilizer and rudder. (Source: POH)*

Airframe:

| | | |
|--|-------------------------|----------------|
| Manufacturer/Model | ELA Aviation, ELA 08 | |
| Serial Number | 72 | |
| Year of Manufacture | 2006 | |
| Total Airframe Hours (At Time of Accident) | 218.5 | |
| Last Inspection (Date & Hours) | 31 August 2022 | 214.8 |
| Airframe Hours Since Last Inspection | 3.7 | |
| CRS Issue Date | 31 August 2022 | |
| ATF (Issue Date & Expiry Date) | 29 September 2022 | 31 August 2023 |
| C of R (Issue Date) (Present Owner) | 19 April 2021 | |
| Operating Category | Private Part 94 | |
| Type of Fuel Used | Octane 95 Unleaded fuel | |
| Previous Accidents | None | |

Note: Previous accidents refer to past accidents the aircraft was involved in, when relevant to this accident.

Engine:

| | |
|----------------------|--------------|
| Manufacturer/Model | Rotax 914 UL |
| Serial Number | 4418923 |
| Part Number | 892-654 |
| Hours Since New | 2 214.8 |
| Hours Since Overhaul | 214.8 |

Propeller:

| | |
|----------------------|-----------------|
| Manufacturer/Model | Windspoon |
| Serial Number | 3203 |
| Hours Since New | 214.8 |
| Hours Since Overhaul | TBO not reached |

- 1.6.2 According to the information in the gyroplane logbook, the last annual inspection prior to the accident flight was conducted by an approved person (AP) on 31 August 2022 at 214.8 hours. A Certificate of Release to Service (CRS) was issued on 31 August 2022 with an expiry date of 31 August 2023 or at 314.8 hours, whichever comes first. The gyroplane had accrued 3.7 hours since its last inspection. The AP who certified the last inspection was issued an AP licence on 22 March 2022 with an expiry date of 19 May 2024.
- 1.6.3 According to the logbook, the engine (SN: 441985) was removed from the gyroplane on 24 January 2017 at 443.08 hours to service another gyroplane (ZU-DBK) which was owned by the previous owner. On 4 February 2019, the gyroplane (ZU-DYV) was returned to service and the engine with the TBO extension (2 000 hours) upgrade, bearing a serial number 4418923, was installed by the AP. According to the logbook, the Service Bulletin (SB) 914-039 UL was complied with in which the engine casing (SN: 10.0873 PN: 892654) was replaced. New parts were installed (bearings, pushrods, and a set of hydraulic tappets), all other components were overhauled in accordance with the Overhaul Manual section 00-00-00-32 Page 15-1. The engine ground run was conducted, and the engine ran for approximately 1 hour without any defects. The total time since new (from the time of installation) was recorded at 500.0 hours in the logbook. Since the installation, the engine was flown a further 563.2 total hours.
- 1.6.4 According to the flight folio, after the annual inspection was conducted on 31 August 2022, the gyroplane was not flown for nine weeks (from 31 August 2022 to 9 November 2022). According to the engine manual, the manufacturer recommends that preservation of the engine be conducted should the engine be out of service for four weeks or longer. There was no record found on the logbook that indicated that the engine preservation was conducted.

- 1.6.5 According to available information, the gyroplane was registered as a production built with the Regulator as ELA 08 in 2005.
- 1.6.6 The gyroplane was registered to the current owner on 19 April 2021 according to the Certificate of Registration (C of R).
- 1.6.7 There was no checklist found on-board the gyroplane as required by the regulation.

SACAR Part 91.03.3

(1) The owner or operator of an aircraft shall establish and make available to the flight crew and other personnel in his or her employ needing the information, a checklist system for the aircraft, to be used by such flight crew and other personnel for all phases of the operation under normal, abnormal and emergency conditions.

(2) The PIC shall ensure the checklists used on board the aircraft are complied with and utilised having due regard to human factors principles.

(3) The checklists required in terms of sub-regulation (1) shall be designed having due regard to human factors principles as prescribed in Document SA-CATS 91.

1.7 Meteorological Information

1.7.1 The weather information below was obtained from the Meteorological Aerodrome Report (METAR) that was issued by the South African Weather Service (SAWS), recorded at Springs Aerodrome (FASI) on 30 November 2022 at 0800Z. FASI is located 1.7 nautical miles (nm) from the accident site.

| | | | | | |
|----------------|------|-------------|----------|------------|---------|
| Wind Direction | 290° | Wind Speed | 5kt | Visibility | 9999m |
| Temperature | 23°C | Cloud Cover | Unknown | Cloud Base | Unknown |
| Dew Point | 13°C | QNH | 1026 hPa | | |

1.8 Aids to Navigation

1.8.1 The gyroplane was equipped with standard navigational equipment as approved by the Regulator (SACAA). There were no records indicating that the navigational system was unserviceable prior to the flight.

1.9 Communication

1.9.1 The gyroplane was equipped with a standard communication system as approved by the Regulator. There were no recorded defects with the communication system prior to the flight.

1.10 Aerodrome Information

1.10.1 The gyroplane accident occurred outside the aerodrome (FASI) within a radius of 2nm south east.

| | | | |
|---------------------------|----------------------------------|-------|-------|
| Aerodrome Location | Springs, Gauteng Province | | |
| Aerodrome Status | Licensed | | |
| Aerodrome GPS coordinates | 26°14'54" South, 028°23'51" East | | |
| Aerodrome Elevation | 5 340 ft | | |
| Runway Headings | 03/21 | 14/32 | 04/22 |
| Dimensions of Runway Used | 03 | | |
| Heading of Runway Used | 030° | | |
| Surface of Runway Used | Asphalt | | |
| Approach Facilities | None | | |
| Radio Frequency | 122.4 | | |

1.11 Flight Recorders

1.11.1 The gyroplane was not equipped with a flight data recorder (FDR) or a cockpit voice recorder (CVR), nor was it required by regulation to be fitted to the aircraft type.

1.12 Wreckage and Impact Information

1.12.1 The Fuselage

The gyroplane accident occurred near a quarry, and was found lying on its left side with the nose pointing north. The wreckage was contained in a radius of approximately 32m. The embankment located east of the wreckage appeared disturbed, which indicated that the nose cone came in to contact with it prior to the gyroplane's roll. On the ground, there was evidence of fuel leak from the tank breather port because of the manner in which the gyroplane came to rest. The tank was not ruptured, only fuel sipped out. It was estimated that ten (10) litres of fuel remained in the tanks. The fuel pumps were still in their respective position and the fuel filter appeared clean. The fuel pump switch and the master switch were in the "off" position. Fuel piping appeared normal and still connected to the tanks, fuel pumps and the engine. The fuel inside the tanks was green in colour, characterised by its strong smell (automotive fuel). The horizontal stabiliser was still intact; however, the rudder was broken

and had detached from the attachment points. The rudder cables were still secured. Continuity could not be verified as one of the rudder pedals was stuck in the “applied” position. This was attributed to the accident sequence damage.

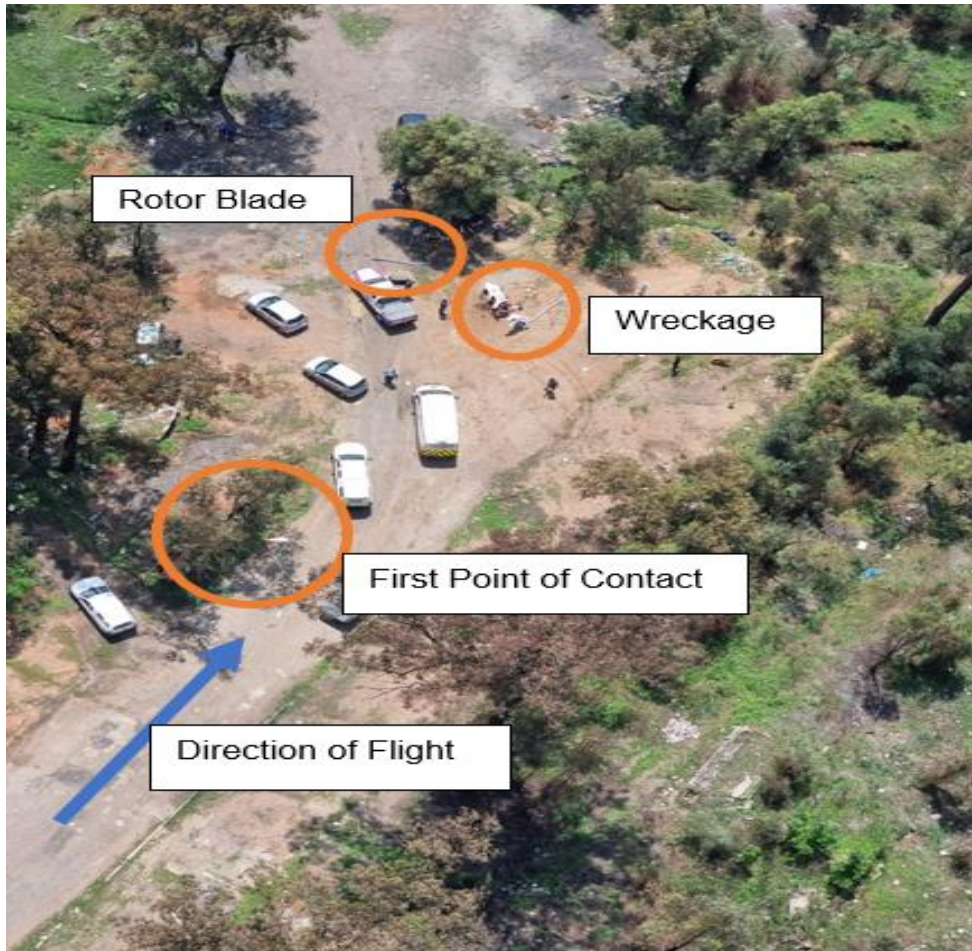


Figure 3: Aerial view of the accident site. (Source: Pilot)



Figure 4: Final resting position of the aircraft, and stained ground due to fuel spillage.



Figure 5: Fuel pumps and master switches in the “off” position at the accident site. (Source: Pilot)

1.12.2 The Landing Gear Strut

The landing gear strut was still intact; however, evidence of fracture along the middle was visible. Both main tyres were still attached to the axle. The nose gear had collapsed into the wheel well.



Figure 6: Fractured strut.

1.12.3 Flight and Engine Controls

The front seat was in place and secured, whereas the rear seat had dislodged from its attachment point; the front seat safety harness was intact and the rear safety harness was cut (indicative of a cut in which a sharp object was used, in this instant, by the eyewitnesses who helped the crew out of the gyroplane). Both control sticks were still secured in their

respective positions. The throttle arm levers were still in place (found in the “off” position); the cable was checked for functionality, and it corresponded with the movement of the throttle. All instruments in the panel were still secured in their respective receptacles.



Figure 7: The control tubes.

1.12.4 The Mast and Rotor Blades

The mast was severed and was found hanging by the wire harness, indicative of impact fracture. Both the control tubes that control disc tilt were severed at the bottom. The pre-rotating gearbox and its associated hardware were still intact. The drivebelt was still attached to the pulley. One of the main rotor blades had detached from the hub and was found 7.8m from the other blades which were still attached to the hub. The detached main rotor blade had evidence of fracture on the tip and in the middle section, indicative of contact with the hard object. This fracture was attributed to impact.



Figure 8: The rotor blade after it was removed from the mast.

1.12.5 The Engine

The condition of the exterior of the engine was good. The engine was still attached to the cradle. There were no visible signs of oil or fuel leak. The wiring harness was still intact. All three propeller blades were still attached to the hub, however, one of the blades was damaged and dirt was found on the washout. The exhaust muffler was still intact and there was no visible oil leak on the turbo assembly. The pre-rotator belt was still intact and attached to the gearbox. The pre-rotator piston was still attached to the engine. The engine was fitted with a turbo unit. The exterior condition of the turbo unit was in good condition with no signs of oil leak.



Figure 9: Engine condition with propeller blades still attached.

1.12.6 Trees

Before the gyroplane made contact with the ground, the rotor blades impacted a tree on the left side of the road. There was a clean cut on one of the trees, an indication of a blade cut. This was evidenced by the blade outboard section which separated and was found at the accident site.



Figure 10: The trees that were severed by the rotor blades. The inset picture shows a close up of the stump.

1.13 Medical and Pathological Information

1.13.1 None.

1.14 Fire

1.14.1 There was no evidence of a pre-or post-impact fire.

1.15 Survival Aspects

1.15.1 The accident was considered survivable because the cabin structure was still intact. The occupants had made use of the gyroplane-fitted safety harnesses. After the accident, the eyewitnesses assisted the occupants out of the gyroplane.

1.16 Tests and Research

1.16.1 Following the accident, the engine was removed from the airframe and was subjected to an engine teardown examination at the approved facility by an approved person (AP). A technical report was made available following the teardown examination.

Details of the engine:

Rotax 914UL

SN: 4418923

Engine Casing PN: 892-654 SN:10-0873

What was found:

- *The technical report found that there was oil in the combustion chamber exhausts ports and exhaust inlet side,*
- *The rings used were not new, and*
- *The scraper ring was installed upside down, which resulted in the oil being pushed to the top and not down.*

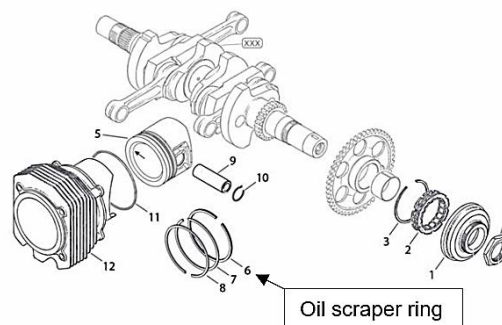


Diagram 1: Illustrated parts catalogue (IPC) showing the oil scraper ring. (Source: 914 Series IPC manual)



Figure 11: Indication of oil in the intake pipe.



Figure 12: The upper part of the cylinder shows discolouration of the exhaust valve port due to oil in the mouth.

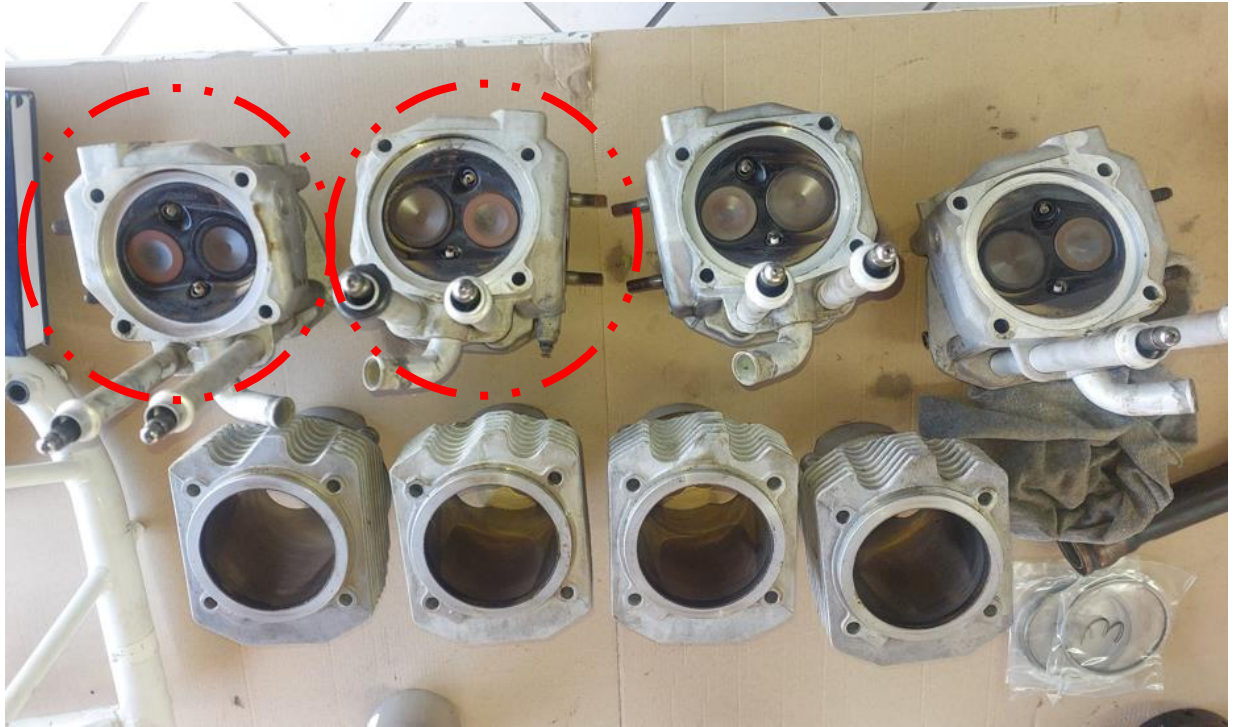


Figure 13: Red circles show cylinder head discolouration as a result of oil.



Figure 14: Discolouration on the piston crowns due to oil.

1.16 2. **The electrical fuel pumps (PN: 881365 SN: 996738)**

The fuel pumps which were connected in series were recovered and subjected to operational testing at an AMO facility by an AP using an external power supply. When energised, they both operated effectively. The fuel filter did not have evidence of sediments or blockages.

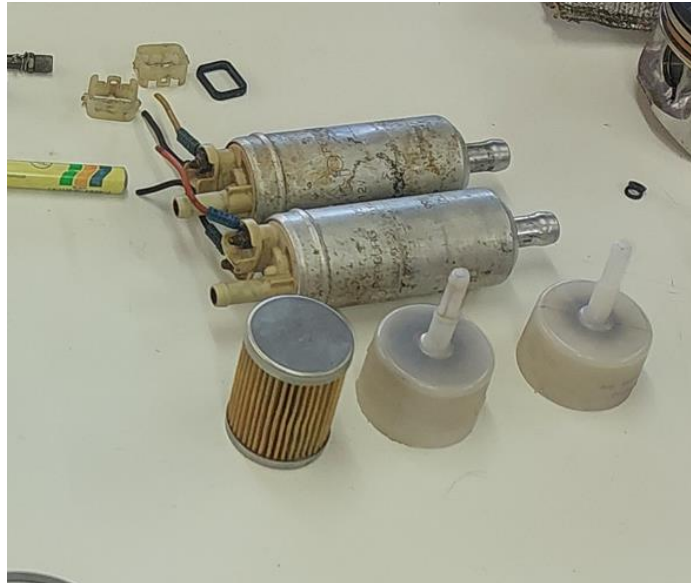


Figure 15: The electrical fuel pumps and filter.

1.16.3 The following observations were noted:

- Big end bearing showed no signs of overheating.
- Crank shaft in good condition, no signs of broken gear teeth.
- Main bearing journals were in good condition and oil passageways were not blocked.
- Stator motor rotor assembly showed signs of discolouration.
- Hydraulic lifters were all in good condition.
- Carburettor bowls were empty.

1.17 Organisational and Management Information

1.17.1 This was a training flight conducted under the provisions of Part 141 of the CAR 2011 as amended.

1.17.2 The ATO was issued the ATO Certificate, however, the dates could not be verified after the investigator had made numerous follow-ups to acquire the information without success.

1.17.3 The student pilot was the owner of the gyroplane, which was registered on 19 April 2021.

1.17.4 The AP who certified the last inspection was issued an AP Licence on 22 March 2022 with an expiry date of 19 May 2024.

1.18 Additional Information

1.18.1 Engine Failure In-flight (Source: ELA 08 Pilot's Operating Handbook [POH])

INSTRUCTIONS:

1. Close throttle. Engine failure may be sudden or accompanied by misfiring, typical of fuel starvation.
2. Lower the nose to keep best glide speed of 105 kph (65 mph/57 kts) and look for an area for landing into the wind.
3. If time allows, an engine restart can be attempted. See "Engine restart procedure".
4. If the area for landing is rough or there are obstacles, make a higher flare over the obstacles to reduce forward speed.
5. Once on the ground, ignition and fuel pumps OFF.
6. Rotor brake ON.
7. Master OFF

1.18.2 Carburettor Icing Chart

According to the weather report provided by the SAWS, the temperature on the day was 23°C with dew point depression of 13°C. The dew point depression was found to be 10°C with 52% humidity level. When the figures are plotted on the chart, they placed the gyroplane in moderate icing in cruise power and serious icing condition at descent power (see chart 1).

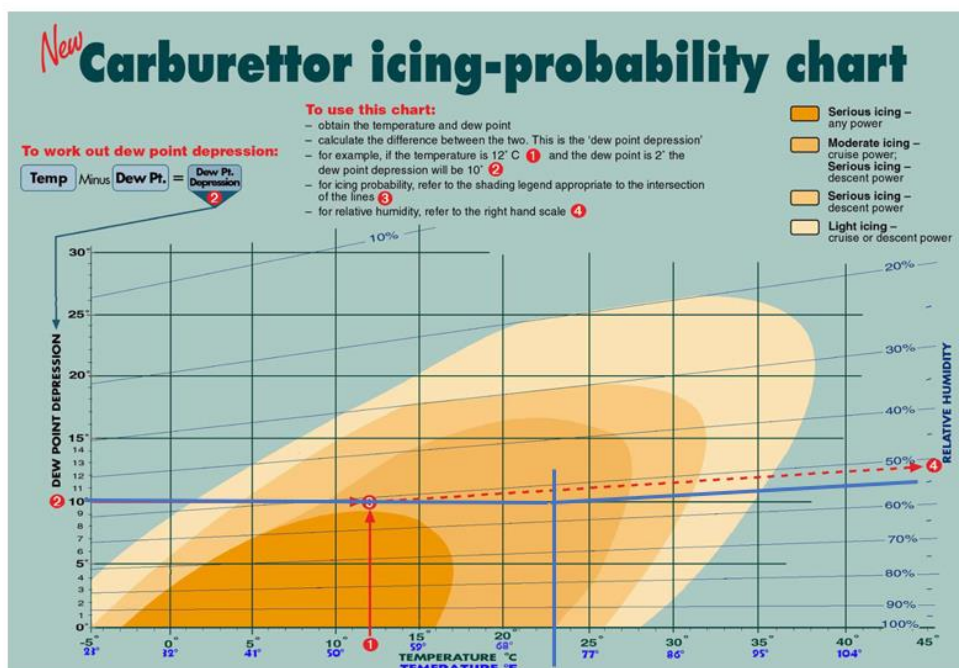


Chart 1: Carburettor icing-probability chart. (Source: [Carburettor Icing – Disciples of Flight](#))

1.18.3 Extract from the engine operator's manual

Icing in the air intake system

Icing due humidity

Carburetor icing due to humidity may occur on the venturi and on the throttle valve due to fuel evaporation and leads to performance loss and change in mixture.

Remedy

- Intake air pre-heating is the only effective remedy. See Flight Manual supplied by the aircraft manufacturer.
 - The turbocharger will heat up the intake air. If however a intake air pre-heating is necessary, observe the aircraft manufacturers engine installation and operating instruction.
-

1.19 Useful or Effective Investigation Techniques

1.19.1 None.

2. ANALYSIS

2.1. General

From the available evidence, the following analysis was made with respect to this accident. This shall not be read as apportioning blame or liability to any organisation or individual.

2.2. Analysis

2.2.1. Man

The instructor pilot had a valid National Pilot Licence (NPL) that was issued on 1 June 2022 with an expiry date of 26 June 2023. The type and rating of the gyroplane were endorsed on his licence. The instructor pilot's medical certificate, which was a Class 4, was issued on 1 June 2022 with an expiry date of 28 February 2023. The medical certificate had a waiver stating that the pilot should wear corrective lenses.

The student pilot had a valid Recreational Student Pilot Licence that was issued on 10 February 2021 with an expiry date of 7 February 2023. The type and rating of the gyroplane were endorsed on his licence. The student pilot's medical certificate, which was a Class 2, was issued on 9 December 2020 with an expiry date of 31 December 2022 with no restrictions.

The gyroplane was piloted from the rear seat by the instructor pilot at the time of the accident. The rear cockpit does not have secondary or primary instrumentation to facilitate safe operation and it had limited forward view due to the person (student pilot) seating in front in this accident. The instructor had to lean on the side to have better view of the front of the gyroplane.

2.2.2. **Machine**

The last annual inspection prior to the accident flight was conducted by the AP on 31 August 2022 at 214.8 hours. A Certificate of Release to Service (CRS) was issued on 31 August 2022 with an expiry date of 31 August 2023 or at 314.8 airframe hours, whichever comes first. The gyroplane had accrued 3.7 airframe hours since its last inspection. The engine was overhauled by an AP on 4 February 2019.

2.2.3. **Medium**

The weather data at the time of the flight indicated that the relative humidity level was above 52% which would likely cause serious icing conditions on descent power in the carburettor.

2.2.4. **Conclusion**

The investigation ruled out possible engine failures systematically:

Incorrect installation of the scraper rings during the overhaul would result in improper flow of oil inside the cylinder head and cause smoke emissions during engine operation; this was not reported by the pilot or the AP. Incorrect fitting of the scraper rings was an oversight by the AP who indicated poor workmanship. However, there was no evidence which would suggest that the incorrect installation of the scraper rings caused the engine stoppage.

Fuel pumps testing yielded satisfactory result as there were no anomalies found during testing, and fuel filters were clean. Fuel was checked and it was of a correct grade with no evidence of contamination, sediments or presence of water. The fuel pump switches at the accident site were in the “off” position and, thus, the investigation could not confirm with certainty whether or not they were switched off after the accident or were [inadvertently switch off in-flight](#). Fuel piping revealed no anomalies. The carburettor bowls were empty, however, there was no evidence which would suggest fuel restriction during operation.

The gyroplane was on ground for almost nine weeks without being preserved as required by the manufacturer; if the engine is operated prior to a maintenance service after being on ground for a long time might cause challenges. This indicates poor maintenance practises by the owner or operator.

3. CONCLUSION

3.1 General

From the available evidence, the following findings, causes and contributing factors were made with respect to this accident. These shall not be read as apportioning blame or liability to any organisation or individual.

To serve the objective of this investigation, the following sections are included in the conclusion heading:

- **Findings** — are statements of all significant conditions, events, or circumstances in this accident. The findings are significant steps in this accident sequence, but they are not always causal or indicate deficiencies.
- **Causes** — are actions, omissions, events, conditions, or a combination thereof, which led to this accident.
- **Contributing factors** — are actions, omissions, events, conditions or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of the accident occurring, or would have mitigated the severity of the consequences of the accident. The identification of contributing factors does not imply the assignment of fault or the determination of administrative, civil, or criminal liability.

3.2 Findings

- 3.2.1 The instructor pilot had a National Pilot Licence (NPL) that was issued on 1 June 2022 with an expiry date of 26 June 2023. The instructor pilot had a Class 4 aviation medical certificate that was issued on 1 June 2022 with an expiry date of 28 February 2023 with a medical waiver to wear corrective lenses. The pilot also had a Grade A instructor rating under gyroplane category which was issued on 27 June 2021 with an expiry date of 26 June 2023, as well as a Test Flight rating in line with Part 62.14.7 that was issued on 22 March 2021 with an expiry date of 21 March 2023. At the time of the engine stoppage, the gyroplane was piloted from the rear seat by the instructor pilot.
- 3.2.2 The student pilot had a valid Recreational Student Pilot Licence that was issued on 10 February 2021 with an expiry date of 7 February 2023. The type and rating of the gyroplane were endorsed on his licence. The student pilot had a valid Class 2 medical certificate that was issued on 9 December 2020 with an expiry date of 31 December 2022 with no restrictions. The student pilot had not flown for five months.
- 3.2.3 The last annual inspection prior to the accident flight was conducted by an AP on 31 August 2022 at 214.8 hours. A Certificate of Release to Service (CRS) was issued on 31 August 2022 with an expiry date of 31 August 2023 or at 314.8 hours, whichever comes first. The gyroplane had accrued 3.7 hours since its last inspection at the time of the accident flight.
- 3.2.4 The engine preservation was not conducted between 31 August 2022 and 9 November 2022 as required by the maintenance manual.
- 3.2.5 The AP who conducted the last annual inspection was issued an AP Certificate on 22 March 2022 with an expiry date of 19 May 2024.

- 3.2.6 The gyroplane was issued an Authority to Fly (ATF) on 29 September 2022 with an expiry date of 31 August 2023.
- 3.2.7 The ATO was issued the ATO Certificate, however, the dates could not be verified after the investigator had made numerous follow-ups to acquire the information without success.
- 3.2.8 The Certificate of Registration (C of R) was issued to the present owner on 19 April 2021.
- 3.2.9 The engine was recovered and was subjected to a teardown examination. During the teardown examination, the following was discovered: scrapper rings were installed incorrectly which caused oil to flow into the cylinder and air intake; and oil was found in the combustion chamber exhaust ports and exhaust inlet side.
- 3.2.10 The fuel pumps were tested and found serviceable.
- 3.2.11 The engine stopped without warning whilst overhead the quarry in Brakpan during a late right base leg due to fuel starvation, likely due to the fuel pumps being inadvertently switched off.
- 3.2.12 The instructor and student pilot suffered minor to serious injuries during the accident.

3.3 Probable Cause/s

- 3.3.1 Unsuccessful forced landing following an in-flight engine stoppage due to fuel starvation; this was likely due to the fuel pumps being inadvertently switched off.

3.4 Contributory Factor/s

- 3.4.1 None.

4 SAFETY RECOMMENDATIONS

4.1. General

The safety recommendations listed in this report are proposed according to paragraph 6.8 of Annex 13 to the Convention on International Civil Aviation and are based on the conclusions listed in heading 3 of this report. The AIID expects that all safety issues identified by the investigation are addressed by the receiving States and organisations.

4.2. Safety Message

- 4.2.1. Owners and operators of this type of aircraft are required to adhere to maintenance practises that are issued by the manufacturers for safe operation.

5 APPENDICES

5.1. Appendix 1: Engine preservation.

**This report is issued by:
Accident and Incident Investigations Division
South African Civil Aviation Authority
Republic of South Africa**

Appendix 1

5.1 Engine preservation

At out of service periods or storage periods of engine for longer than 4 weeks up to 1 year

- Proceed with preservation prior to engine stop and on the engine at operating temperature.
- Let the engine run at an increased idle speed.
- Remove air filters and inject approximately 6 cm³ of preservation oil or equivalent oil into the air intake of each carburettor.
- Stop the engine.
- Remove spark plugs and inject approximately 6cm³ preservation oil or equivalent oil into each cylinder and slowly turn crankshaft 2 to 3 turns by hand to lubricate top end parts. Refit spark plugs.
- Drain gasoline from the float chambers, fuel tank and fuel lines.
- Drain coolant on liquid cooled engines, to prevent any damage by freezing.

WARNING: Generally comply with standard rules for handling of chemicals. Dispose of chemicals as per local environment regulations.

- Lubricate all carburettor linkages.
- Close all openings of the engine like exhaust and pipe, venting tube and air intake to prevent entry of dirt and humidity.

8.1) Engine preservation

General note



Risk of burnings and scalds!

Hot engine parts!

Always allow engine to cool down to ambient temperature before start of any work.

Due to the special material of the cylinder wall, there is no need for extra protection against internal cylinder corrosion for the RO-TAX aircraft engines. At extreme climatic conditions and for long out of service periods we recommend the following to protect the valve guides against corrosion:

| Step | Procedure |
|------|--|
| 1 | Operate the engine until the temperatures have stabilized for a period of 5 min (engine oil temperature between 50 to 70 °C (122 to 160 °F)). |
| 2 | Switch the engine OFF. |
| 3 | Allow the engine to cool down. |
| 4 | Change oil. |
| 5 | Remove the air intake filters and insert approx. 30 cm ³ (1 fl oz) of corrosion inhibiting oil into the carburetor throat with the engine running at increased idle speed. Shut off engine. |
| 6 | Drain carburetor float chamber. |
| 7 | Apply oil to all joints on carburetors. |
| 8 | Close all openings on the cold engine, such as exhaust end pipe, venting tube, air filter etc. against entry of dirt and humidity. |
| 9 | Spray all steel external engine parts with corrosion inhibiting oil. |

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