LIMITED INVESTIGATION ACCIDENT REPORT

Reference Number	CA18/2/3/10115								
Classification	Accident		**Date**	10 February 2022		**Time**	1130Z		
Type of Operation	Private (Part 94)								
Location									
Place of Departure	Light Flight Aerodrome Cato Ridge, KwaZulu-Natal Province			Place of Intended Landing			Light Flight Aerodrome Cato Ridge, KwaZulu-Natal Province		
Place of Accident	Open grass area at Light Flight Aerodrome								
GPS Co-ordinates	Latitude	29°45'58.48" S		Longitude	030°35'14.35" E		Elevation	2 497 ft	
Aircraft Information									
Registration	ZU-LIZ								
Make / Model	Rotorway Executive 162F (Serial No. 7039)								
Damage to Aircraft	Substantial			Total Aircraft Hours			644.0		
Pilot-in-command									
Licence Valid	Yes			Gender	Male		Age: 71		
Licence Type	Private Pilot Licence (PPL)								
Total Hours on Type	683.0			Total Flying Hours			2 631.0		
People On-board	1 + 0	Injuries	0	Fatalities	0		Other (On Ground)	0	
What Happened									

On Thursday, 10 February 2022, the pilot who was also the owner of the helicopter, a Rotorway Executive 162F registered ZU-LIZ stated that he had just performed some maintenance on the helicopter when he found some play on the swashplate/slider ball assembly. To rectify this, he tightened the slider ball collar bearing. He also cleaned the engine fuel injectors ultrasonically, due to injector problems. He then decided to perform a power check as well as an evaluation flight to confirm if the maintenance intervention had solved the problems. He decided to hover the helicopter in ground effect (IGE) at a height of between 6 and 10 feet (ft) above ground level (AGL) to see what the effect would be like.

The pilot stated that he was in the low hover for approximately 30 minutes to make sure the engine injector problem was resolved (fuel flow indications were normal). He further stated that if the slider ball collar bearing was overly tight, *"it will show straight away if the engine and rotor blades are*

turning, on the cyclic control. But this was not the case, the cyclic control was smooth and steady, even after a 5-minute hover". After 30 minutes in hover, the pilot noticed that the helicopter was pulling slightly towards the left. While hover-taxiing the helicopter back towards the hangar, it became more difficult to keep the helicopter under control, and he realised that he must land immediately.

As he lowered the collective pitch lever for touch down, the cyclic pulled very hard to the left. The left skid contacted the ground while the right skid gear was still in the air. He attempted to level the helicopter off by adding some collective pitch, but this had no effect. At this stage, the helicopter was airborne but out of control and it yawed approximately 170° to the left. Whilst yawing, the left skid impacted the ground and broke off, this caused the helicopter to roll over to the left. Figures 1 and 3 show the main rotor blade markings on the grass surface. The helicopter was substantially damaged. The pilot stated that after all the rotating parts came to a stop, he was able to climb out of the cockpit unassisted. He was not injured but was badly shaken.

An eyewitness had run towards the scene with a fire extinguisher, which he discharged on the engine and exhaust areas as he was afraid of the possibility of grass being set alight after the accident.

Figure 1: The helicopter as it came to rest.

Figure 2: A front view of the helicopter.

Figure 3: Main rotor blade strike markings visible on the ground.

Background on the helicopter:

The pilot/owner stated that he built the helicopter under Build Number CAA 07039. He further stated that he had done most of the maintenance work himself over the past 13 years. The pilot/owner stated that it was common practise by all builders, if necessary, to reduce excessive

clearance on the swashplate after 500 airframe hours or more. The common practise is to turn the collar slightly, in this case, about 20° to 25° to reduce clearance. He stated that he made sure that there was some play left and the slider ball did move freely.

What was done:

Source: Statement by the pilot/owner

"I have dismantled the whole assembly and examined everything. The collar has a fine thread with about 1mm pitch per turn. Before the accident I found about 0.2 mm play. By turning the collar 35° the play would have been reduced to 0.1mm. I made sure there was some play left and the slider ball did move freely. That seemed to be correct before everything got heated up. Apparently, it was too tight to run under heat and prolonged hovering."

What was found:

(i) The pilot had a valid National Pilot Licence as well as a Private Pilot Licence on helicopters.

(ii) The last annual inspection that was carried out on the helicopter prior to the accident flight was certified on 2 March 2021 by an Approved Person at 592.5 airframe hours. A further 51.5 hours were flown since the inspection. The AP was not the pilot/owner of the helicopter.

(iii) The helicopter was issued an Authority to Fly on 14 February 2018 with an expiry date of 28 February 2022.

(iv) The pilot, who was also the owner, had conducted maintenance on the helicopter prior to the accident flight, which was documented in the aircraft logbook and comprised cleaning the engine fuel injectors and tightening the slider ball adjustment collar on the swashplate.

(v) The pilot/owner of the helicopter, who was also the builder of the helicopter, did not have an Approved Person Certificate or Aircraft Maintenance Engineer (AME) qualification.

(vi) The pilot/owner stated that he performed the maintenance on the slider ball adjustment collar in accordance with the guidance as per the maintenance manual, pages 60 and 61 (insets/attachments below).

(vii) This was a private flight conducted under the provisions of Part 94 of the Civil Aviation Regulations (CAR) 2011 as amended.

(viii) The pilot was the sole occupant on-board; the weight and balance was not compromised.

(ix) Loss of control occurred after the helicopter was in hover flight for approximately 30 minutes.

(x) The pilot/owner of the helicopter was not in compliance with Part 66.04.2(1) of the Civil Aviation Regulations 2011, *"No person shall act as an approved person on any aircraft mentioned in Part 24 and referred to in regulation 66.04.3, unless such person is the holder of a valid approved person certificate with the appropriate rating issued by the Director or, if applicable, the body or institution designated for the purpose in terms of Part 149, as the case may be."*

(xi) **Part 44.01.4 Persons to carry out maintenance**

(1) No person may carry out maintenance on an amateur built aircraft or a production-built non-type certificated aircraft, or any component thereof, unless such person—

(a) is appropriately rated or approved on type by the Director or the organisation designated for the purpose in terms of part 149, as the case may be, to carry out maintenance; or

(b) carries out the maintenance under the prescribed supervision of a person authorised by the Director or by the organisation referred to in paragraph (a). A dual check of the maintenance carried out must be performed by a person referred to in subparagraph (a); or

(c) is the owner of the aircraft provided that an appropriately rated approved AMO, AME or Approved Person, rated in accordance with subpart 4 of part 66, performs a dual check on the maintenance which was carried out; or

(d) is an appropriately rated approved AMO, AME or approved person, rated in accordance with subpart 4 of part 66.

ROTOR HUB: SLIDER BALL ADJUSTMENT COLLAR

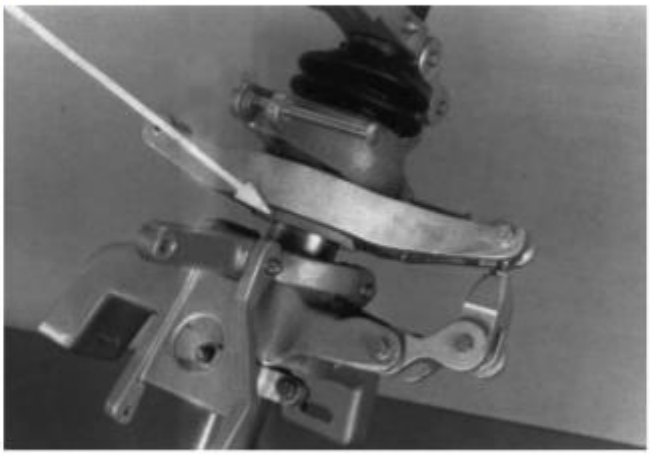
The Slider Ball Adjustment Collar (part no. E49-3230) is adjusted and set on the swash plate assembly at the factory. However, it may need to be re-adjusted occasionally if the helicopter is exposed to severe or radical temperature changes.

1. Using a protractor level, set the swash plate perpendicular to the main shaft. Rotating the blades may help you in achieving the fore and aft angles. If a protractor level is not available, centering the cyclic stick should place the swash plate at a relative perpendicular angle to the shaft. Loosen the two set screws (part no. E00-9302, Ref. 16 on print E49-2002) three full turns. With your fingers, loosen the adjustment collar approximately 2 full turns in a counter clockwise direction, until it can be turned easily. Again using your fingers, turn the collar in a clockwise direction until it comes to a stop. Make an index mark on the adjustment collar and non-rotating swashplate with a pencil or marker. Back off the adjustment collar counter clockwise 1/2". Then tighten the two set screws. See photos #14-16. Note: Use silicone on the set screws to help lock them in position and prevent them from backing out. Do NOT use loctite.

Photo #14: Placing an index mark.

Photo #15: View after the collar has been backed off.

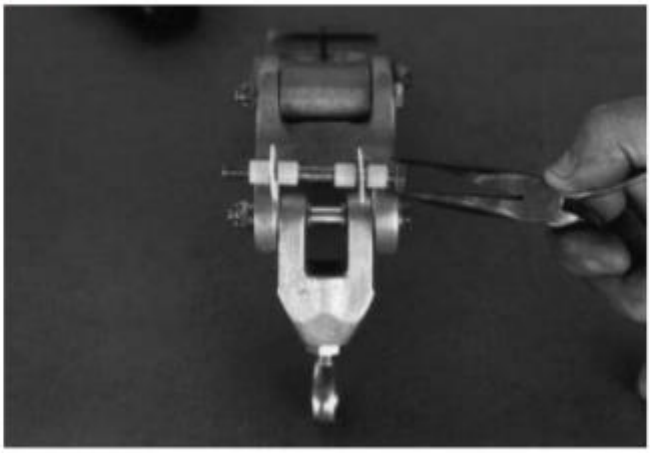
Photo #16: Tighten set screws in collar.

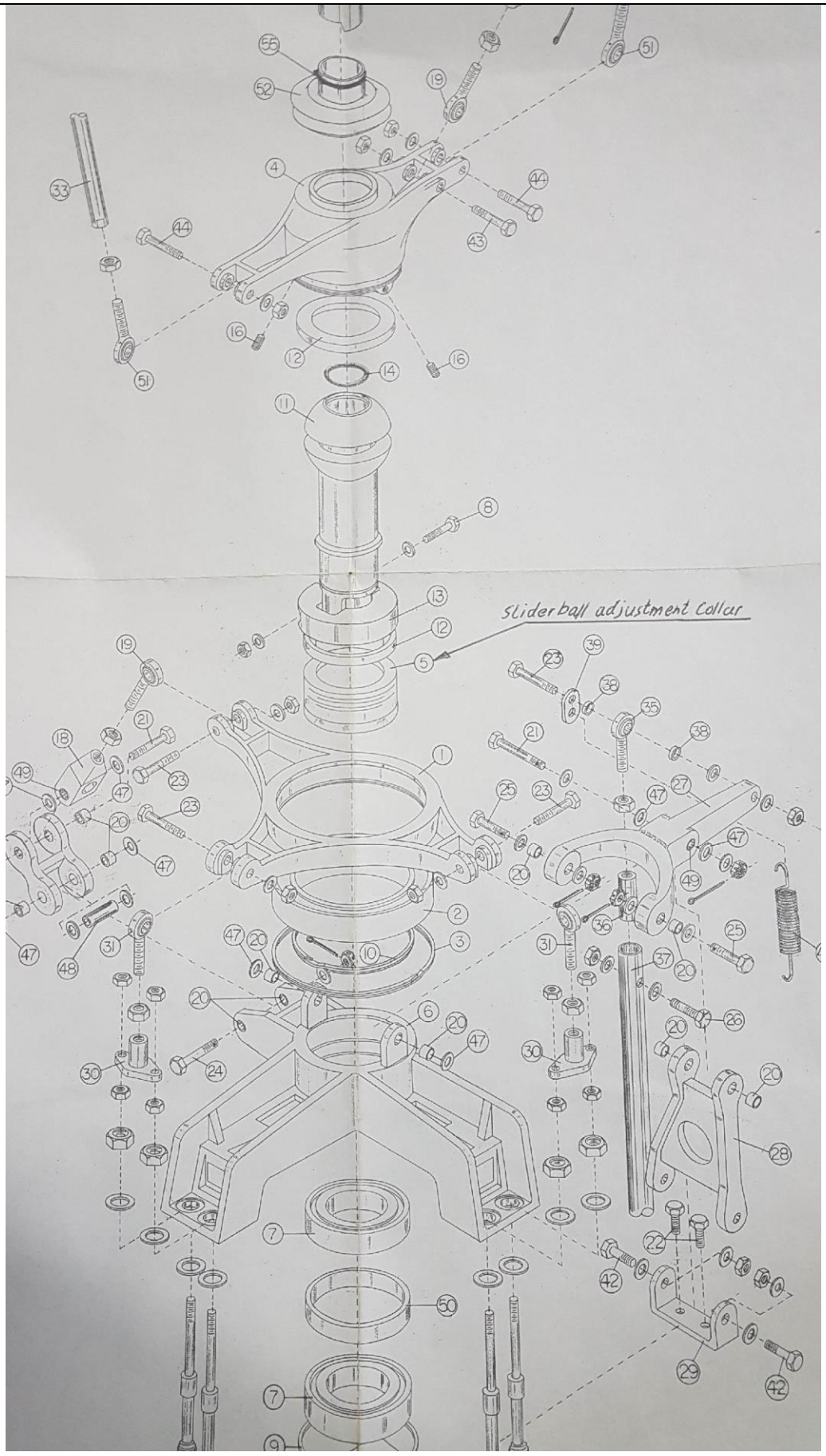


If incorrectly adjusted, the slider ball adjustment collar will produce a feedback through the cyclic controls that feels like the cyclic wants to travel in any one direction independent of any input from the pilot. The amount of feedback felt by the pilot indicates how much the collar is incorrectly adjusted. (Feedback usually means the collar is too tight rather than too loose). If feedback through the cyclic continues, you may back off the adjustment collar another 1/4", for a total 3/4" maximum from the starting index mark. If an undesirable condition still exists, contact the factory.

Photo #17 illustrates the positioning of the nylon bushings in the swash plate assembly. To determine if the castings need new bushings, measure the lateral deflection of the parts. If a total of .125 inch or greater is indicated, the nylon bushings should be replaced. The maximum the castellated nut should be tightened is two flats past finger tight. Further tightening may damage the aluminum castings.

Photo #17: Position of bushings.





Schematic of the main rotor drive assembly.

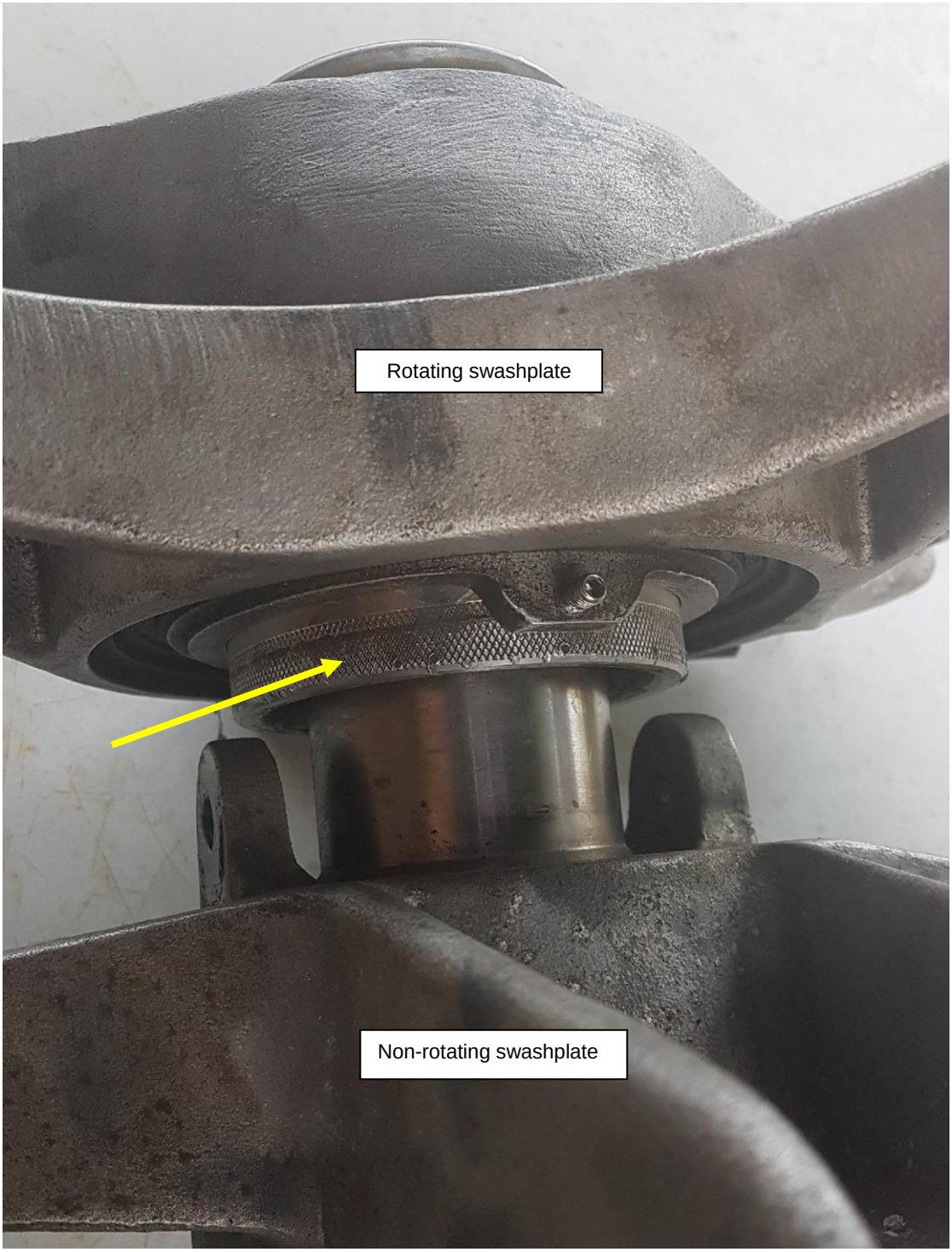


Figure 4: The swashplate assembly with the slider ball adjustment collar prior to disassembly. (Source: Helicopter pilot/owner)

Figure 5: The slider ball adjustment collar assembly. (Source: Helicopter pilot/owner)

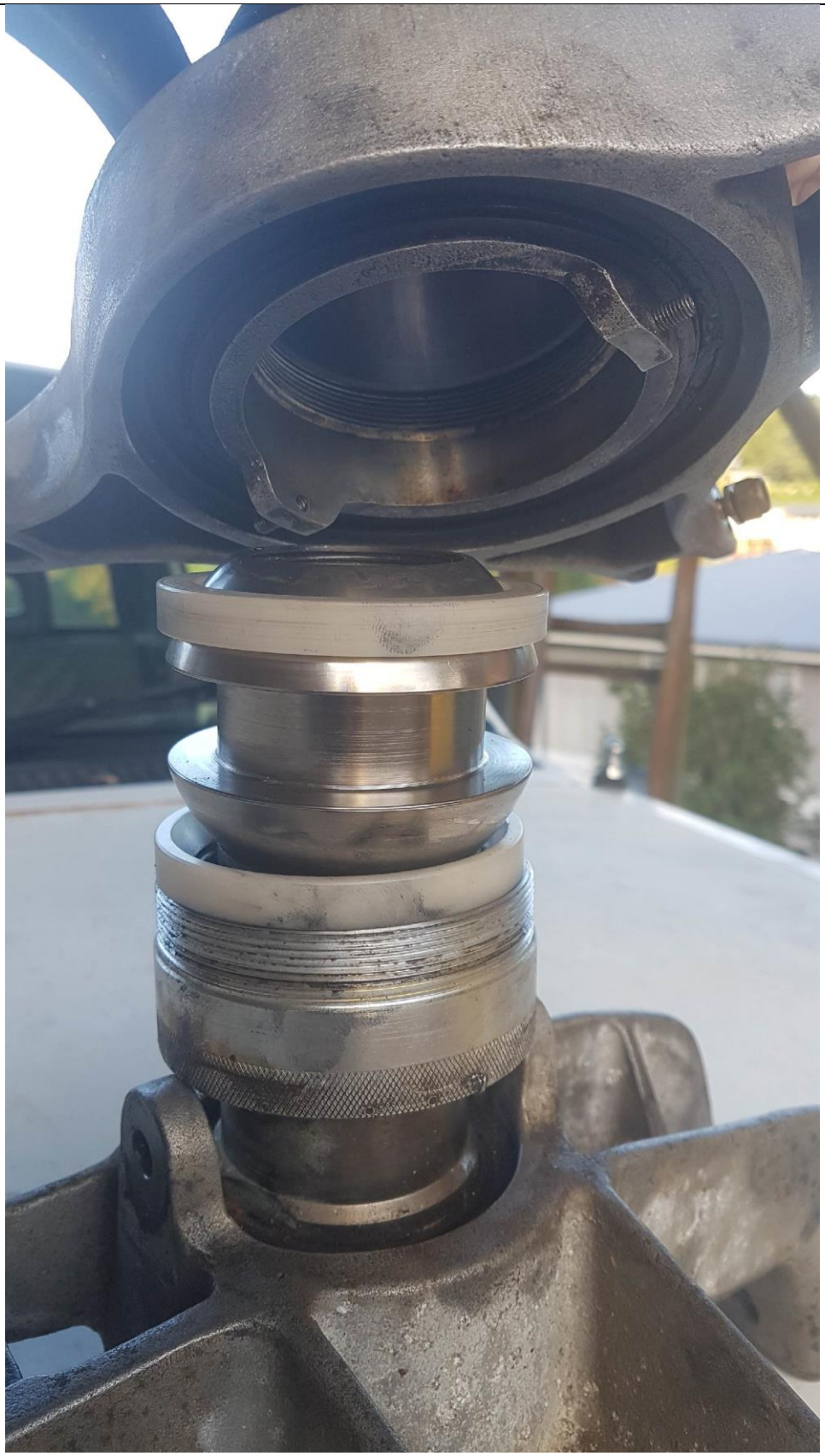


Figure 6: The slider ball adjustment collar assembly with the rotating swashplate at the top.
(Source: Helicopter pilot/owner)

Probable cause

The owner/pilot carried out maintenance on the slider ball adjustment collar which resulted in loss of control of the helicopter during a check flight. The loss of control occurred when the cyclic control stick suddenly pulled to the left (and the helicopter got out of control) during an attempted forced landing; the helicopter rolled over to the left.

Contributory factor

The pilot performed maintenance on the helicopter without the required qualifications as called for in Part 44.01.4 and Part 66.04.2(1) of CAR 2011 as amended, even though he was the builder.

Safety Action

None.

Safety Message

Aircraft owners must ensure that only authorised personnel who are licensed or the holder of an Approved Person Certificate that was issued by the Director of Civil Aviation may conduct maintenance on aircraft as per the provisions contained in CAR 2011 as amended.

Purpose of the Investigation

In terms of Part 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****.*

About this Report

Decisions regarding whether to investigate, and the scope of an investigation are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, no investigation has been conducted, and the Accident and Incident Investigations Division (AIID) has relied on the information submitted by the affected person/s and organisation/s to compile this brief report. The report has been compiled using information supplied in the initial notification, as well as follow-up information to bring awareness of potential safety issues to the industry in respect of this occurrence, as well as possible safety action/s that the industry might want to consider in preventing a recurrence of a similar accident.

This report provides an opportunity to share safety message/s in the absence of an investigation.

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