



Havarikommisjonen

Accident Investigation Board Denmark

Bulletin 2021-120



Serious incident to OY-JEC (Piper PA28-161 Cadet) at Roskilde (EKRK) on 8-4-2021.

ISSUED SEPTEMBER 2021

INTRODUCTION

This bulletin reflects the opinion of the Danish Accident Investigation Board regarding the circumstances of the occurrence and its causes and consequences.

In accordance with the provisions of EU Regulation 996/2010, the Danish Air Navigation Act and pursuant to Annex 13 of the International Civil Aviation Convention, the safety investigation is of an exclusively technical and operational nature, and its objective is not the assignment of blame or liability.

The safety investigation was carried out without having necessarily used legal evidence procedures and with no other basic aim than preventing future accidents and serious incidents.

Consequently, any use of this bulletin for purposes other than preventing future accidents and serious incidents may lead to erroneous or misleading interpretations.

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GENERAL

State file number:	2021-120
UTC date:	8-4-2021
UTC time:	12:03
Occurrence class:	Serious incident
Location:	Roskilde (EKRK)
Injury level:	None
Aircraft registration:	OY-JEC
Aircraft make/model:	Piper PA28-161 Cadet
Current flight rules:	Instrument Flight Rules (IFR)
Operation type:	Instructional
Flight phase:	Approach
Aircraft category:	Fixed wing
Last departure point:	EKRK
Planned destination:	EKRK
Aircraft damage:	Minor
Engine make/model:	Lycoming O-320-D3G

SYNOPSIS

Notification

All time references in this bulletin are Coordinated Universal Time (UTC).

The Aviation Unit of the Danish Accident Investigation Board (AIB) was notified of the serious incident by Copenhagen Airport, Roskilde (EKRK), on 8-4-2021 at 12:09 hours (hrs).

The AIB notified the Danish Civil Aviation and Railway Authority (DCARA), the US National Transportation Safety Board (NTSB), the European Aviation Safety Agency (EASA), and the Directorate-General for Mobility and Transport (DG MOVE)) on 8-4-2021 at 15:17 hrs.

The NTSB accredited a non-travelling representative to the AIB safety investigation.

Summary

The B+ terminal stud on the alternator broke off during flight.

This likely resulted in a voltage and current increase from the alternator aux terminal, which exceeded the alternator out switch design limits, causing smoke in the cockpit.

The Electrical Fire emergency checklist actions removed electrical power from the alternator out switch, which proved to be an effective safety barrier.

The serious incident occurred in daylight and under Visual Meteorological Conditions (VMC).

FACTUAL INFORMATION

History of flight

The serious incident occurred during a local IFR school flight from Roskilde (EKRK). The student pilot and the flight instructor performed some maneuvers close to the airport and then decided to perform an Instrument Landing System (ILS) approach to runway 11, followed by a circling to runway 29.

Established on the ILS final approach descend profile, the “Low volt” indicator light *blinked a couple of times at low rpm setting.*

The student pilot leveled off at the circling altitude of 610 feet above mean sea level and turned right to join the left hand circling.

Shortly after turning onto the left hand downwind for runway 29, the “Low volt” light illuminated and *quite a lot* of white smoke appeared from below the left hand side of the instrument panel.

The flight instructor took control of the aircraft, declared an emergency, performed the Electrical Fire emergency checklist actions, followed by the Forced Landing emergency checklist actions, and turned left and landed on runway 03.

The flight instructor vacated the runway, stopped the aircraft on taxiway D, shut down the engine, and the student pilot and the flight instructor evacuated the aircraft.

Injuries to persons

<i>Injuries</i>	<i>Crew</i>	<i>Passengers</i>	<i>Others</i>
Fatal			
Serious			
None	2		

Damage to aircraft

The technical investigation revealed that the B+ terminal stud on the alternator (Photo no. 1) broke off and that the alternator out switch (Photo no. 2) overheated/burned.



Photo no. 1: Hartzell 14V alternator model no. 10-1051

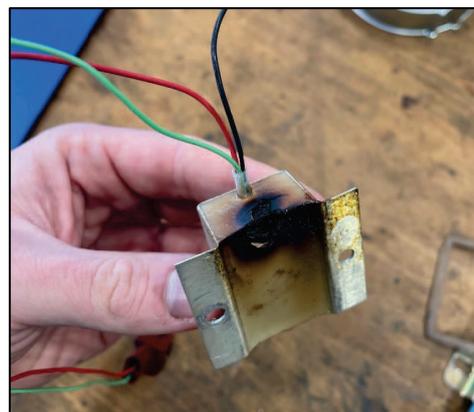


Photo no. 2: Alternator out light solid state switch Piper P/N PAC-587863, Lamar P/N A-00258-1

Personal information

License and medical certificate

The flight instructor – male, 34 years – was the holder of a valid Commercial Pilot License (Airplane) (CPL (A))/Single/Multi Engine Piston Land (SEP/MEP (Land)).

The rating SEP (Land) was valid until 31-12-2021.

The rating MEP (Land)/IR was valid until 31-7-2021.

The rating Flight Instructor/IR was valid until 31-3-2023.

The medical certificate (class 1) was valid until 28-9-2021.

Flying experience

	Last 24 hours	Last 90 days	Total
All types	4:35	47:00	1819:50
This type	2:55	26:30	1658:25
Landings this type	2	16	-

Aircraft information

General information

Manufacturer:	Piper Aircraft Inc.
Type:	PA28-161 Cadet
Serial number:	2841099
Airworthiness review certificate:	Valid until 5-8-2021
Engine manufacturer:	Lycoming
Engine type:	O-320-D3G
Maximum take-off mass (MTOM):	1055 kilogram (kg)
Aircraft total flight hours:	14,336 Flight Hours (FH)
Latest maintenance:	Performed at 14,313 FH (100 FH check, including engine and generator change)

Aircraft electrical system:

The aircraft Pilot Operating Handbook (POH) section 7.15 described the electrical system (extract):

7.15 ELECTRICAL SYSTEM

The electrical system includes a 14-volt, 60-amp alternator, a 12-volt battery, a voltage regulator, and a master switch relay (Figure 7-11). The battery is in a box mounted on the forward right face of the firewall. The voltage regulator is located on the forward left side of the fuselage behind the instrument panel.

Schematic illustrations of the electrical system from the POH see Figure no. 1 (extract):

Factual information

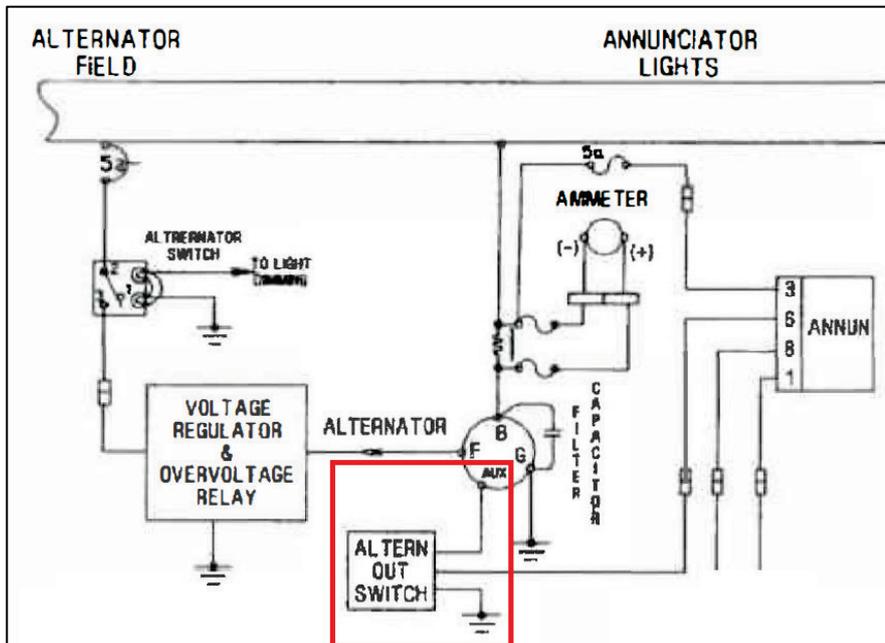


Figure no. 1: POH Figure 7-11 “Alternator and starter schematic” (extract of figure)

The POH section 3.3e contained the emergency procedure for electrical fire in flight (extract):

3.3e FIRE IN FLIGHT (3.15)

Source of Fire CHECK

Electrical fire (smoke in cabin):

BATT MASTR Switch OFF

ALTR Switch OFF

Vents OPEN

Cabin Heat OFF

Land as soon as practical.

Meteorological information

Terminal Aerodrome Forecast (TAF)

TAF ekrk 081124z 0812/0821 28015kt 9999 bkn030 tempo 0812/0813 27015g25kt
becmg 0816/0819 22015kt tempo 0820/0821 22020g30kt 4000 -radz
bkn012=

Aviation Routine Weather Report (METAR)

METAR ekrk 081150z auto 28015g27kt 9999 bkn044/// 06/m04 q1015=

Communication

The instructor and the student pilot were in radio contact with EKRK Tower (118.900 Megahertz).

Aerodrome informationGeneral information

Aerodrome Reference Point:	55 35 08N 012 07 53E
Elevation:	146 feet
Runway directions:	03/21, 11/29
Runway dimensions	1500/1799 meter (m) x 31 m
Runway surface:	Asphalt

Fire

The crew experienced smoke in the cockpit, evolving from the alternator out switch.

Manufacturer Service Bulletin

The original design in the PA28-161 Cadet did not incorporate a fuse in the alternator out switch design.

In January 1996, the aircraft manufacturer published Service Bulletin (SB) 991A, addressing possible smoke formation from a failed alternator out switch. The SB provided instructions for the installation of a fuse on the alternator aux terminal.

The aircraft manufacturer SB 991A (extract) - [see appendix 1](#)

Airworthiness Directive

From a regulatory point of view, compliance with an Airworthiness Directive (AD) was mandatory, whereas compliance with a SB was at the discretion of the owner/operator of the individual aircraft, even though a manufacturer could choose to label a SB as “Considered mandatory”.

At the time of publication of the SB, the United States Federal Aviation Administration (FAA) did not mandate the SB by an AD. The AIB asked the FAA about the reason for this decision.

Internal FAA records did not provide an answer to the basis of the FAA decision.

Because of the serious incident, the FAA informed the AIB of the following initiative:

We are actively engaged with Piper to determine if this issue requires additional consideration in light of the reported accident. We are not currently aware of any other incident/accident related to this issue, but will actively seek our databases to assess the fleet and if additional actions stemming from this report is required. We will address the issue using our current processes to determine if FAA action is required.

ANALYSIS

General

Probably just before the aircraft joined the downwind leg for runway 29, the B+ terminal stud on the alternator broke off during flight. The technical safety investigation did not reveal the cause of the broken terminal.

The broken terminal likely caused the voltage regulator to sense a voltage drop and increased the field voltage.

The result was an increase in alternator voltage output on the aux terminal, which was in excess of the alternator out switch design limitations.

An overheat/burn of the alternator out switch resulted in smoke formation in the cockpit.

Safety barrier

Upon illumination of the Low Volt light and the appearance of smoke, the flight instructor took control of the aircraft and performed the actions on the Electrical Fire emergency checklist.

The checklist actions removed electrical power from the alternator, and put the alternator “offline”.

Power was thus removed to the alternator out switch, subsequently ending the overheat/burn and the associated smoke.

The Electrical Fire emergency checklist actions proved to be an effective safety barrier.

Service Bulletin vs. Airworthiness Directive

The AIB recognised that the Electrical Fire emergency checklist proved to be an effective safety barrier. This safety barrier probably was the reason why the FAA chose not to mandate the SB by an AD. In addition, the limited number of related occurrences downgraded the severity of this specific technical issue

However, to the AIB, the level of perceived smoke described by the flight instructor as *quite a lot*, makes compliance with the SB 991A worth considering.

CONCLUSIONS

Summary

The B+ terminal stud on the alternator broke off during flight.

This likely resulted in a voltage and current increase from the alternator aux terminal, which exceeded the alternator out switch design limits, causing smoke in the cockpit.

The Electrical Fire emergency checklist actions removed electrical power from the alternator out switch, which proved to be an effective safety barrier.

Preventive safety measures

The FAA decided to re-evaluate whether the SB 991A should be mandated by an AD.

At the time of publication of this bulletin, the outcome of the re-evaluation was not available to the AIB

APPENDIX 1

[Return to manufacturer Service Bulletin](#)

Appendix 1



The New Piper Aircraft, Inc.
 2926 Piper Drive
 Vero Beach, Florida, U.S.A. 32960

SERVICE No. 991A BULLETIN

**PIPER CONSIDERS
 COMPLIANCE MANDATORY**

DATE: January 29, 1996 (S/M)

(Service Bulletin No. 991A supercedes and voids Service Bulletin No. 991 dated January 10, 1996)

REASON FOR REVISION: To correct a typographical error on page 3 item 3. Piper P/N 461-623 should be P/N 461-643.

SUBJECT: Replacement or Modification of the Alternator Out Light Fuse

MODELS AFFECTED:	SERIAL NUMBERS AFFECTED:
PA-23 - 250/250(6) Aztec	27 - 4794 through 27- 8154030
PA-28-161 Cadet	2841001 through 2841365
PA-28R-201 Arrow & Arrow III	2837001 through 2837061 & 2844001
PA-28R-201T Turbo Arrow III	2803001 through 2803015
PA-31, 300, 325 Navajo & Navajo CR	31-793 through 8312019
PA-31-350 Chieftain	31-7305005 through 7405497 and
	31-7552001 through 8452021
PA-31-350 T1020	31-8253001 through 8553002
PA-31P Pressurized Navajo	31P-3 through 31P-80 and 31P-7300110
	through 7730012
PA-38-112 Tomahawk	38-78A0801 through 82A0124

COMPLIANCE TIME: At the next regularly scheduled inspection event, but not to exceed the next one hundred (100) hours time in service.

APPROVAL: The technical contents of this Service Bulletin have been approved by the F.A.A.

PURPOSE: Reports indicate that a condition may exist where smoke may enter the cockpit and cabin, should the alternator out light solid state switch fail. This condition is caused by an increasing electrical current drawn by the failed solid state device, heating the device and aircraft wiring. Although most of the affected aircraft are protected by an inline fuse installation, these fuses are rated at a value to protect wiring and not the the solid state device. In addition some aircraft do not have fuse protection. Left uncorrected, smoke may be released from the failed solid state device and/or over heated aircraft wiring.

This Service Bulletin provides the necessary instructions to alter the fuse protecting the solid state alternator out light switch in some aircraft and mandate the installation of a new fuse and an inline fuse holder kit in others.

INSTRUCTIONS:

1. The necessary instructions are listed by model. Proceed to the appropriate instruction as determined by the model and serial number as listed in Model Affected above.
2. Upon successful completion of the applicable instruction, make an appropriate Logbook entry of compliance with this Service Bulletin.

(OVER)
 ATA: 2437