

INCIDENT

Aircraft Type and Registration:	Piper PA-28-161, G-BZDA	
No & Type of Engines:	1 Lycoming O-320-D3G piston engine	
Year of Manufacture:	2000 (Serial no: 2842087)	
Date & Time (UTC):	13 September 2020 at 1742 hrs	
Location:	White Waltham, Berkshire	
Type of Flight:	Training	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Landing gear collapsed. Bent propeller blade and left wing root skin creased	
Commander's Licence:	Private Pilot's Licence with Flying Instructor rating	
Commander's Age:	60 years	
Commander's Flying Experience:	1,008 hours (of which 574 were on type) Last 90 days - 71 hours Last 28 days - 35 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and enquiries by the AAIB	

Synopsis

Climbing through 100 ft after takeoff from Runway 29R at White Waltham Airfield, G-BZDA's engine abruptly ran down. The instructor took control from the student, lowered the aircraft's nose and looked for a suitable landing area ahead. As the nose was lowered, the engine recovered to full power, so the instructor raised the nose to climb away again but the engine ran down a second time and stopped. The instructor turned the aircraft left towards open ground and carried out a forced landing. The student and instructor were unhurt and vacated the aircraft without assistance.

The loss of power resulted from the gascolator drain being inadvertently locked open leading to partial fuel starvation. Following this accident, the CAA released a Safety Notice reminding owners and operators of this potential hazard for aircraft fitted with lockable gascolator drains and recommending replacement with '*suitable, non-locking alternatives*.' The CAA also undertook to review the risk associated with lockable gascolator drains against current Airworthiness Directive criteria.

History of the flight

The accident flight was the fourth instructional flight of the day in G-BZDA for the instructor who was also the PIC. While his student undertook cockpit preparation, the instructor

carried out a Transit Check in accordance with the PA-28 checklist. In addition to the Transit Check, he sampled fuel from both wing tank fuel drains and from the gascolator.

During the after-start checks it was noted that fuel pressure dropped when the fuel pump was turned off but stayed within the green range on the gauge, indicating to the instructor that the system was functioning satisfactorily.

The engine parameters were in the normal range during the before takeoff power check. On the takeoff roll the aircraft accelerated as expected but as G-BZDA climbed through 100 ft its engine abruptly ran down. The instructor took control, lowered the nose and looked for a suitable landing area while simultaneously transmitting a brief MAYDAY call. The engine then recovered to full power, so the instructor gently raised the nose to climb away. He had just started cancelling the MAYDAY when the engine ran down for a second time and stopped. With a railway line ahead, the instructor turned the aircraft hard left towards open ground and executed a forced landing. Although the nosewheel collapsed during the landing, the student and instructor were unhurt and able to vacate the aircraft without assistance.

The airfield fire service were the first responders on scene and observed fuel leaking from the aircraft's gascolator drain.

Gascolator drain valves

Background

The gascolator is a combined fuel filter and sump located upstream of the engine fuel inlet, normally at the lowest point of an aircraft's fuel supply system. It is designed to trap water and debris present in the fuel to prevent it from entering the engine fuel system. Gascolators are typically fitted with drain valves so that fuel can be drawn off to check for the presence of contaminants. These drains have an internal plunger which, when pushed inwards using a cross bar (Figure 1a), opens a valve allowing fuel to be drawn off through the body of the drain. On lockable variants the plunger mechanism can be held in the open position by rotating the cross bar into a locking detent (Figure 1b).

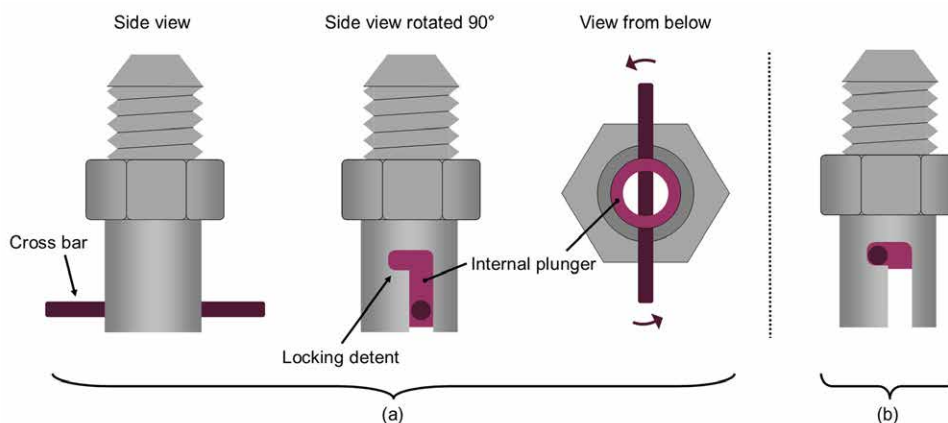


Figure 1

Lockable drain valve (a) closed (b) locked open (schematic)

With the drain valve in the open position fuel can leak from, and air can be drawn into, the gascolator leading to the risk of engine fuel starvation at high power settings, especially in climb attitudes.

Previous accidents

The AAIB investigated a gascolator drain-related accident involving a PA-28, G-BPBM, in December 1988¹. The accident report referenced a service bulletin² issued in 1975 by the CAA's Chief Service Engineer (CSE) recommending removal of the locking feature on drain valves fitted to gascolators. This was to be achieved by filing away a portion of the valve body, thereby removing the detent, so that it could remain open only if actively held in that position (Figure 2).

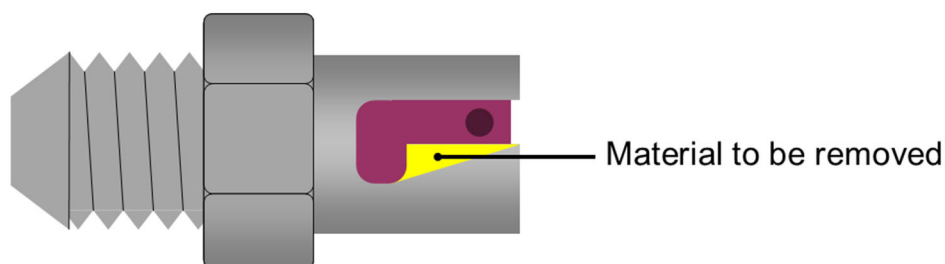


Figure 2

Drain valve with material to be removed indicated in yellow

The CAA publication, *General Aviation Safety Information Leaflet 12/88* (GASIL 12/88), also commented on the drain valve hazard and reiterated the recommendation that the CSE service bulletin be implemented. Following the G-BPBM accident, the AAIB recommended that the CAA require the deletion of the valve locking feature on any aircraft on the British register that could be affected adversely by this type of drain being left open.

A subsequent accident, involving G-BHFL in November 1989³, appeared to have been caused by the same lockable gascolator drain problem. Since the drain locking feature was still present on G-BHFL, the AAIB reiterated its previous recommendation to modify such valves. In 1990 the CAA issued Emergency Airworthiness Directive (EAD) 001-02-90 which required affected aircraft to be placarded, alerting pilots to check the fuel drain was closed after use (Figure 3). G-BZDA was placarded in accordance with the EAD.

Footnote

¹ Piper PA28-161 Warrior, G-BPBM, 11 December 1988. Available at <https://www.gov.uk/aaib-reports/piper-pa28-161-warrior-g-bpbm-11-december-1988> [accessed 17 December 2020].

² Chief Service Engineer Service Bulletin 6/75.

³ https://assets.publishing.service.gov.uk/media/5422ebd140f0b613460000b3/Piper_PA-28-180_G-BHFL_02-90.pdf [accessed March 2021].



Figure 3

Placard wording introduced by EAD 001-02-90

In a 1993 Progress Report on their response to AAIB Safety Recommendations,⁴ the CAA declared the following intention:

'In the absence of a manufacturer's Service Bulletin the CAA is preparing an Additional Airworthiness Directive, intended to replace EAD001-02-90, that will require the replacement of the existing 'Curtis' gascolator drain valves with alternative, non-lockable Curtis units on PA28 variants with fuel systems similar to those on the accident aircraft.'

Documents pertaining to the 1993 Airworthiness Directive (AD) proposal were no longer in the CAA archive, so it could not be determined why the proposed additional AD was not published. Following this accident, the CAA undertook to re-assess the issue of lockable gascolator drain valves against the current AD criteria⁵ to determine if issuing one would be appropriate.

Manufacturer action

The PA-28-Warrior III design, as documented in the aircraft manufacturer's Illustrated Parts Catalogues (IPC) dated October 1987, shows a non-locking valve⁶ for the gascolator drain and a locking valve⁷ for the wing tank drains. Prior to this, the manufacturer's IPC called for the same lockable drain in all three locations.

Footnote

⁴ CAP 625 Progress Report 1993: CAA Responses to Air Accidents Investigation Branch (AAIB) Safety Recommendations. Available at <https://publicapps.caa.co.uk/modalapplication.aspx?catid=1&pagetype=65&appid=11&mode=detail&id=132> [accessed February 2021].

⁵ Aircraft Regulatory Framework Part 21 for aircraft previously managed by the EASA.

⁶ Manufacturer's part number 492-312.

⁷ Manufacturer's part number 492-022.

In 1989 the aircraft manufacturer determined that non-locking gascolator drain valves provided a '*higher level of safety*' and initiated a change to their technical drawings to replace the original valve with a non-locking variant. At that time the manufacturer determined no service action was required and that product improvement would be implemented using their IPCs and service replacement parts.

Remote from the engine fuel system, an open wing fuel tank drain would not lead to fuel starvation in the same way as an open gascolator drain, hence lockable variants are a permitted specification. Anecdotal evidence is that leaks from open wing tank drains are more obvious than those from gascolators.

G-BZDA's gascolator

G-BZDA would have been equipped with a non-lockable gascolator drain as standard when built, but when inspected after the accident it was found to have a lockable version (Figure 4). The investigation was not able to identify how, when or why the original drain had been replaced with the wrong variant.



Figure 4

Gascolator and drain removed from G-BZDA after the accident

Regulatory action

When the EASA was established in 2003, EAD 001-02-90 was cancelled and there was no replacement publication. The cancellation of the EAD was '*in the interests of harmonisation*' rather than an indication that the issue was fully resolved.

Two similar accidents involving New Zealand-registered aircraft in 2010 and 2011 prompted the CAA of New Zealand to issue ADs requiring the replacement of lockable gascolator drains with non-locking variants on PA-28⁸ and PA-38⁹ aircraft. While the aircraft manufacturer's technical support department knew of the accidents in New Zealand, they only became aware of the ADs following correspondence with the UK AAIB in relation to this investigation.

As a result of this accident, and after consultation with the AAIB, the UK CAA released Safety Notice SN-2021/005¹⁰ reminding owners and operators of this potential hazard for aircraft fitted with lockable gascolator drains and recommending replacement with '*suitable, non-locking alternatives*.' The Safety Notice was later amended to further recommend that aircraft are checked at the next scheduled maintenance point, and where a non-lockable gascolator drain valve is fitted, any associated placard is removed to minimise the potential for confusion.

Discussion

This accident resulted from the aircraft's gascolator drain valve being inadvertently locked open after a fuel sample had been taken. The open drain caused partial fuel starvation leading to a loss of power when the aircraft was climbing shortly after takeoff.

The investigation found evidence dating back to 1975 that lockable gascolator drains were an identified hazard. The aircraft manufacturer changed their design standards in the late 1980s to eradicate the risk to new build aircraft and the New Zealand regulator later issued ADs as mitigation for older aircraft. G-BZDA was built to the revised design standard but had been fitted with a lockable drain valve at some point during its service life. The investigation was not able to determine how, why or when this maintenance error had occurred. The commonality of wing and gascolator drain fittings was considered one possible error pathway for which maintenance procedures were the primary barrier.

The investigation did not establish how many aircraft in the UK might remain at similar risk, but the CAA undertook to review the risk against current AD criteria. A CAA Safety Notice was published to raise awareness of the issue among owners and operators.

Footnote

⁸ Airworthiness Directive Schedule Aeroplanes Piper PA-28 Series (Cherokee, Cruiser, Warrior, Archer, Pathfinder, Dakota and Arrow), dated 28 January 2021. Available at <https://www.aviation.govt.nz/assets/aircraft/airworthiness-directives/aeroplanes/PA28.pdf> [accessed 12 February 2021].

⁹ Airworthiness Directive Schedule Aeroplanes Piper PA-38-112 (Tomahawk), dated 27 October 2011. Available at <https://www.aviation.govt.nz/assets/aircraft/airworthiness-directives/aeroplanes/pa38.pdf> [accessed 12 February 2021].

¹⁰ CAA Safety Notice SN-2021/005: Lockable Gascolator Drain Valves on General Aviation Aircraft, issued 4 February 2021. Available at <https://publicapps.caa.co.uk/modalapplication.aspx?catid=1&pagetype=65&appid=11&mode=detail&id=10140> [accessed 12 February 2021].

Safety action

Following this event, the UK CAA undertook the following Safety Action.

Safety Notice SN-2021/005 was released, highlighting to owners, operators and pilots, the risks associated with lockable gascolator drains and recommending replacement with '*suitable, non-locking alternatives.*' This was later amended to include a recommendation that aircraft be checked for appropriate placarding at the next scheduled maintenance event.

Due to the lack of documentary evidence available to them regarding the decision not to replace EAD001-02-90, the CAA undertook to review the issue of lockable gascolator drains against current AD criteria.