



Airworthiness Bulletin

AWB 32-028 Issue 1 - 6 June 2023

Fokker F28 0070 and 0100 Landing Gear - Hydraulic Line Restrictor Check Valve / Screen Inspection

An Airworthiness Bulletin is an advisory document that alerts, educates and makes recommendations about airworthiness matters. Recommendations in this bulletin are not mandatory.

1. Effectivity

All Fokker F28 MK 070 and 0100 aircraft.

2. Purpose

To advise aircraft operators and maintenance repair organisations of recent events related to Fokker 070 and 0100 aircraft that have been submitted to the CASA Defect Report database involving the landing gear hydraulic line restrictor valve by multiple operators. At this time, the airworthiness concern described in this Airworthiness Bulletin is not considered an unsafe condition that would warrant an Airworthiness Directive to be issued under Part 39 of the Civil Aviation Safety Regulations 1998.

3. Background

CASA has observed a recent trend in defect reports related to Fokker 070 and 0100 slow Main Landing Gear (MLG) extensions and has consequently reached out to the Type Certificate (TC) holder for further clarification. The TC holder is aware of the issue which has a long history and is currently under review via Fokker Safety Board Case number 221-04.

Contamination of the fluid within hydraulic system 1 has been found to be clogging the filter screen of the restrictor check valve located in the hydraulic return line of the Parking Brake Shut-Off Valve (PBSOV). It is believed that this contamination can cause the filter to collapse, leading to a failure of the Landing Gear (LG) Hydraulic Control (Maintenance Significant Item (MSI) reference 323200).



3.1. History

In the cockpit, this condition has historically resulted in any one of the following:

- No green lights for Lefthand (LH) or Righthand (RH) MLG when landing gear lever is selected down; and/or
- 'MAIN LG UNSAFE' alert messages on the Multifunctional Display Unit (MFDU); and/or
- 'MAIN LG DOOR' alert messages on the MFDU; and/or
- 'ANTI-SKID' alert message on the MFDU.

At best, these messages may clear without any resolving action; or could result in slow extension of the MLG. However, if not corrected, this condition has the potential to prevent complete main landing gear extension, possibly resulting in damage to the aeroplane during landing, and consequent injury to occupants.

Historically, there have been two accidents/incidents of note:

- In 2001, during final approach, upon selecting the landing gear lever to the down position the LH and RH MLG failed to extend and lock. Repeated cycling of the landing gear was attempted with no success. The crew initiated a go-around and then attempted to extend the MLG using the alternate landing gear system, again without success. The aircraft diverted to an alternate destination to attempt an emergency landing. On approach, on advice from the operator's maintenance department, the crew turned off the No. 1 Engine Driven Pump. It is important to note that the TC holder states that the effects of this action are "not clear". However, a few seconds later, the MLG green lights illuminated, and the crew completed an otherwise uneventful landing. For further details, refer to the Fokker Service Experience Digest (SED) 32-32-012.
- In 2009, during final approach, upon selecting the landing gear lever to the down position the LH and RH MLG failed to extend and lock. The crew initiated a go-around and flew past the control tower who visually confirmed that the LH MLG was not extended at all, whilst the RH MLG was partially extended. The crew made multiple attempts to extend the MLG with no success. These unsuccessful attempts included use of the alternate landing gear system, as well as flight manoeuvring to induce 2g forces. Ultimately, the crew were forced to make an emergency landing with only the NLG down and locked. Three passengers sustained minor injuries. The aircraft was severely damaged but was ultimately repaired. For further details, refer to the German BFU's Safety Bulletin 2009-09.

It is of concern to note that, in both the above incidents, the Landing Gear Alternate Control (gravity extension) (MSI reference 323300) also failed. This suggests the possibility of a causal link between the condition and *both* the normal and alternate landing gear systems.



3.2. Technical Discussion

The TC holder is aware of the issue and is currently looking for solutions. Actions in the past have included (but are not limited to):

- Introducing a modified PBSOV (refer to SBF100-32-159 and EASA AD 2009-0220).
- Introducing a filter screen in the return line from the PBSOV (refer to SBF100-32-163 and EASA AD 2018-077).

Despite these improvements, CASA has observed a recent trend in ‘MLG slow extension’ events being reported by Australian operators via the Defect Reporting portal.

The TC holder has initiated changes to the aircraft instructions for continued airworthiness and flight manuals, namely the Approved Maintenance Manual (AMM), Aircraft Operating Manual (AOM) and Quick Reference Handbook (QRH). These changes introduce an on-condition regime of mitigating the impacts of this condition. This requires the pilots to report any slow MLG extension, including any transitory “MAIN LG UNSAFE” or “MAIN LG DOOR” alert messages on the MFDU. The subsequent troubleshooting requires the aircraft to be on jacks, and among other actions, an inspection of the restrictor valve. Depending on the condition of the valve, a flush of the hydraulic MLG retraction/extension may be required.

Based on discussions with the TC holder, CASA has noted that:

- Contaminated hydraulic fluid (for example, from degraded o-rings) is believed to increase the likelihood of the condition developing.
- Based on the TC holder’s analysis of Flight Data Recorder (FDR) data, system performance (time taken for MLG extension) does NOT degrade gradually, rather, the onset of the condition can be quite rapid.

This rapid onset could be that the contamination gradually builds up until it results in a pressure differential across the filter screen large enough to cause it to collapse. If this is the case, it is plausible that an inspection of the restrictor valve filter screen for signs of contamination and/or collapse could help reduce the likelihood of LG Hydraulic Control failures.



3.3. Operational Impact

The effectiveness of this current, on-condition response to the issue depends on the vigilance of the operators and maintainers. For example, the TC holder states evidence indicates that:

“... more adverse consequences can be avoided if the first signs of slow extensions are taken seriously and adequate pilot reporting and maintenance actions are in place...”

On the other hand, this regime could create costly aircraft recovery situations, as it leaves the operator vulnerable at ports where appropriate aircraft jacking equipment, facilities, and personnel may not be available.

3.4. Discussions with TC holder and other NAAs

In order to better understand the issue, CASA has reached out to the TC holder as well as National Aviation Authorities (NAAs) of other States of Registry for Fokker F28 Mk0070 and 0100 aircraft. As a result of these discussions, CASA has noted that:

- The TC holder is actively working on different options to resolve the issue.
- At least one (international) operator has introduced a repeat inspection of the restrictor valve across their fleet, accomplished every 3 months or 400FC, whichever occurs first. Refer to Appendix 2 for more information.

4. Recommendations

1. CASA asks that all operators and maintainers of Fokker F28 0070 and 0100 be vigilant on the subject and take all signs of potential slow MLG extensions seriously. All instructions for continuing airworthiness must be followed, including troubleshooting and rectification steps as included by the TC holder in the revised manuals (AMM, AOM, QRH) and current revision of Fokker's All Operators Message reference AOF100.229.
2. CASA asks that all operators consider an appropriate level of preventative maintenance, taking into account their reliability data, operational requirements, and maintenance capabilities. For example, in addition to the on-condition regime currently in place, operators could adopt an inspection of the restrictor check valve and filter at an interval that aligns with other major inspections.



5. Related data

- Fokker Safety Board Case No: 221-04
- EASA AD 2018-077
- Fokker All Operators Message AOF100.229 Sequence #3 or later
- Fokker SBF100-32-163
- Fokker Service Experience Digest (SED) 32-32-012
- German Federal Bureau of Aircraft Accident Investigation (BFU) Safety Bulletin 2009-09
- F0070 / F0100 AMM task 29-00-00-170-813

6. Reporting

Please report any relevant defects and / or incidents via the Defect Reporting System, including but not limited to:

- MLG failing to extend and lock into place.
- Slow MLG extensions.
- Defects discovered because of inspecting the restrictor valve or filter screen.

7. Enquiries

Enquiries with regard to the content of this Airworthiness Bulletin should be made via the direct link email address:

AirworthinessBulletin@casa.gov.au

or in writing, to:

Airworthiness and Engineering Branch
National Operations and Standards
Civil Aviation Safety Authority
GPO Box 2005, Canberra, ACT, 2601

Appendix 1

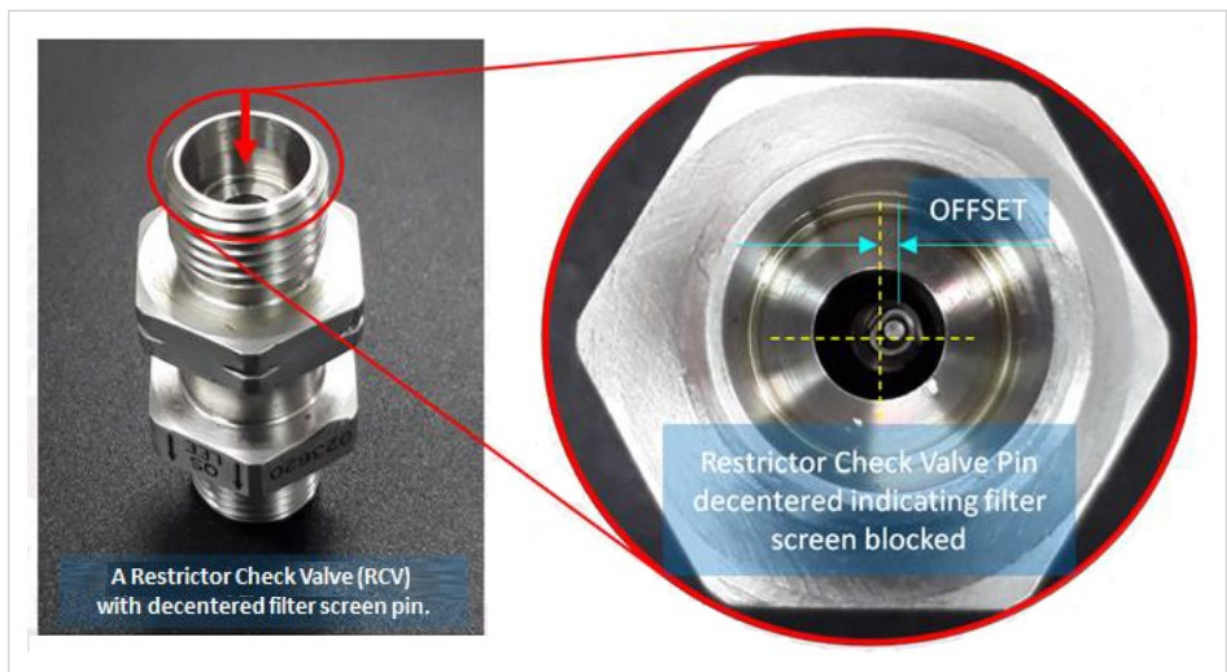
Figure 1:

Aftermath of 2009 Mk0100 emergency, belly landing¹. The MLG failed to extend and lock, even after attempts with the alternate landing gear system as well as multiple '2g' manoeuvres. Please refer to the German Federal Bureau of Aircraft Accident Investigation (BFU) Safety Bulletin 2009-09 for details about the accident.



Figure 2:

A decentred filter screen pin is indicative of a blocked or possibly even a collapsed filter screen.



¹ Photo credits to Alexander Blum, as shared by <https://aviation-safety.net> under a Creative Commons Attribution – Share Alike 3.0 License.



Appendix 2

The following (de-identified) maintenance task has been shared with CASA as an example of preventive maintenance implemented in 2021. The information contained within is not to be regarded as approved maintenance data and is shared simply to illustrate the range of approaches being taken, from this preventative approach through to on-condition monitoring.

Pending final investigation outcomes, [REDACTED] is introducing a precautionary repeat inspection.

Maintenance Action:

Carry out the following every 3 months or 400 cycles, whichever occurs first.

1. Inspect the Hydraulic System Restrictor Check Valve in the return line of the Parking Brake Shut-Off Valve for contamination, and condition of the internal pin. Ref: IPC 29-13.-08-24, Item 160.
2. If found contaminated and/or has a bent internal pin:
 - a. Remove the check valve and O-ring in accordance with AMM 32-44-05-000-814-B and AMM 20-11-00-000-81-A. Seal in a bag in original (uncleaned) condition and route it to Technical Services.
 - b. Install a new valve and O-ring in accordance with AMM 32-44-05-400-814-B and AMM 20-14-06-910-822-A.
 - c. Flush and fill the hydraulic systems IAW AMM 12-12-01-610-813-A.
3. Carry out the Landing Gear Extension and Retraction Test for both Normal and Alternate Extension in accordance with AMM 32-00-00-720-815-A.