Australian Government
Civil Aviation Safety Authority

AIRWORTHINESS BULLETIN

Fokker F28 Mk100 Fuel Pump Wiring

AWB 28-014 **Issue** : 3
Date : 20 November 2015

1. Effectivity

Fokker B.V. F28 MK0100 aircraft.

2. Purpose

Alert operators and maintainers to incorrect fuel pump wiring installation in order to reduce the possibility of fuel explosion.

3. Background

During scheduled maintenance, an operator identified burnt fuel boost-pump wiring. The wiring harness for the LH rear fuel boost pump canister was removed for access to allow defect rectification of a fuel leak (see Figure 1).

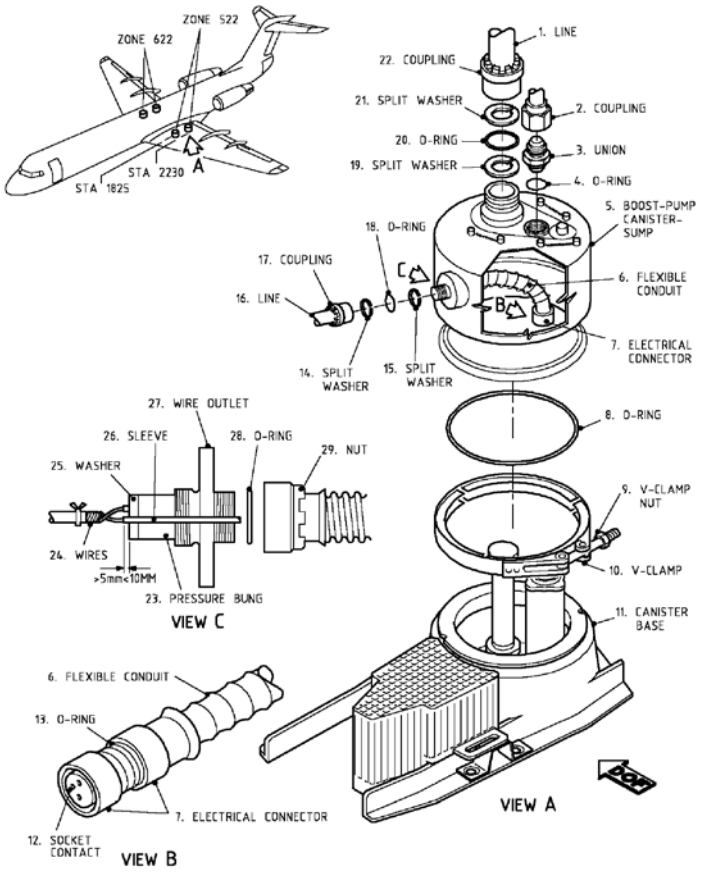

Figure 1 - Fuel boost pump

Wire number AWH0001 (red wire contact A) from Connector P 0664B (see Figure 2) was found with a burn mark on the insulation (see Figure 3).

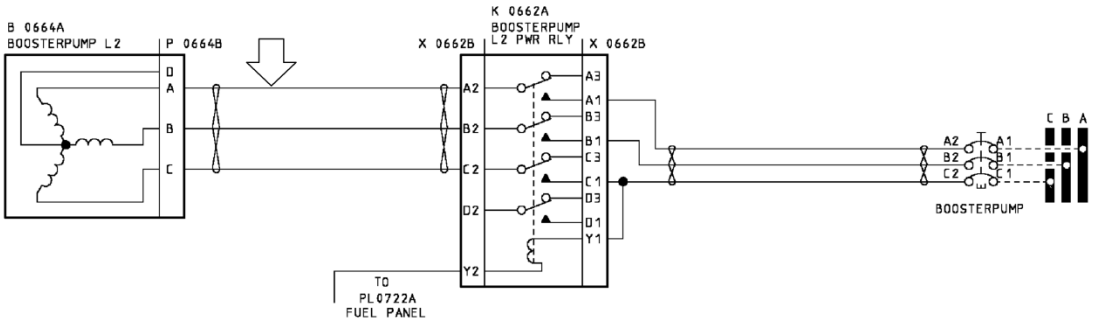

Figure 2 – Booster pump schematic

Figure 3 - Burnt A phase wiring

The wiring harness had fuel present within the harness conduit and the rubber insulation on the plug was found severely damaged (see Figure 4).

Figure 4 – Damaged Plug and broken flexible conduit

The harness attached to the canister end was found with a deformed O-ring as it was not seated correctly (see Figure 5). It was determined that the damage found was due to incorrect installation of the fuel canister harness backshell.

Figure 5 - Deformed O-ring

Damage to the booster pump cable assembly D43700-XXX, including the fractured flexible conduit HA 2053 and the plug 8525-16R10B6SND071 deteriorated green grommet, has been reported before.

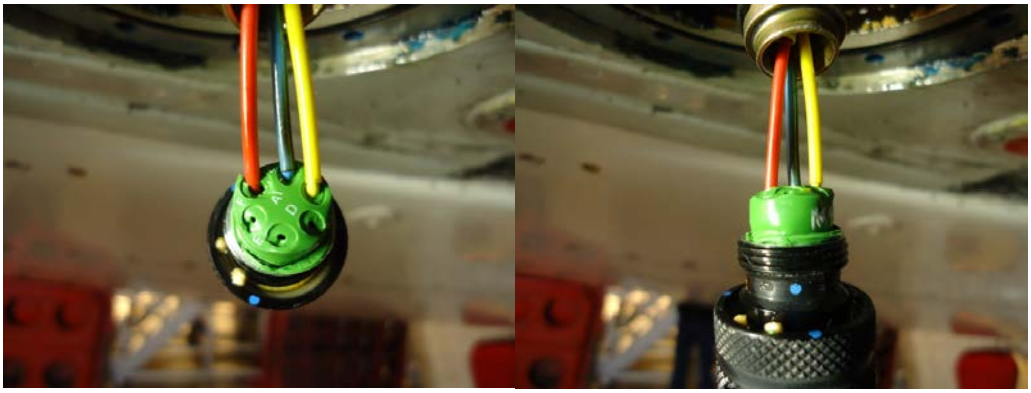

Figure 6 - Discolouration of the wire

One operator reported a case of discoloured (overheated) electrical wiring at the plug location (see Figure 6), which may have been caused by a conductivity issue (high resistance) between the contact on the pump receptacle and socket due to the presence of fuel. According to Fokker the heat build-up at the socket can be released through the plug but the heat build-up in the wire cannot be sufficiently released and leads to a colour change of the insulation material. Fokker indicates there is no immediate safety risk as long as the fuel pump remains submerged in fuel that prevents the presence of oxygen.

On October 21st 2013, Fokker Services issued a manual change notification MCNM F100-165 which stated “to reduce the risk associated with dry running of the boost-pumps during maintenance activities, ***the circuit-breakers of the boost-pumps must be pulled*** and tagged when the collector tanks are defueled to a remaining fuel quantity of 200 litres or less. In addition, to reduce the risk associated with dry-running of the centre-wing transfer-pumps, an

instruction is added to switch-off these pumps immediately when the centre-wing tank is defueled completely".

There is no requirement to seal the booster pump cable assembly to prevent fuel leaks into the cable assembly flexible conduit see Figure 7. The coupling nut, which is part of the flexible conduit, can untwist slightly from the plug due to booster pump vibration or during maintenance when replacing a booster pump; therefore allowing some fuel to enter the flexible conduit. The coupling nut is not self-locking and does not need to be safety-wired. The observed damage to the plug part number 8525-16R10B6SND071, may be the result of poor maintenance practice when replacement of a booster pump is carried out. Whenever a booster pump is replaced or installed the LAME should ensure that the coupling nut is sufficiently tightened to minimize the chance for untwisting while over tightening can lead to fractures. Furthermore, the LAME should ensure that the strain acting on the flexible conduit following the installation of the booster pump is minimal to avoid damage due to stresses developing over time.

Figure 7 - Booster pump canister. Flexible conduit and plug

All materials used in the design should have sufficient resistance to fuel; therefore degradation as a result of contact with fuel is normally not expected. However, based on the feedback Fokker has received from operators so far, degradation of the green grommet (see Figure 7) due to fuel saturation cannot fully be excluded. The AMM boost pump canister installation task 28-13-01-400-814-A and boost pump installation task 28-22-02-400-814-A are currently under review by Fokker to eliminate any possible misunderstandings as to the inspection requirements during removal and installation.

Figure 8 – Green grommet failure

No fuel should enter the flexible conduit assembly if the O-ring, referenced in IPC 28-13-01-01 items 176 & 196, PN MS29513-013 as per drawing specification (see Figure 8), is correctly installed. This may be true when the cable assembly and conduit are undamaged and assembled correctly; however the coupling nut can untwist during maintenance activities when replacing a booster pump, which may cause some fuel to enter the flexible conduit, as the O-ring sealing capacity is affected. Incorrect installation of the

coupling nut may lead to a damaged O-ring with subsequent risk of fuel ingress.

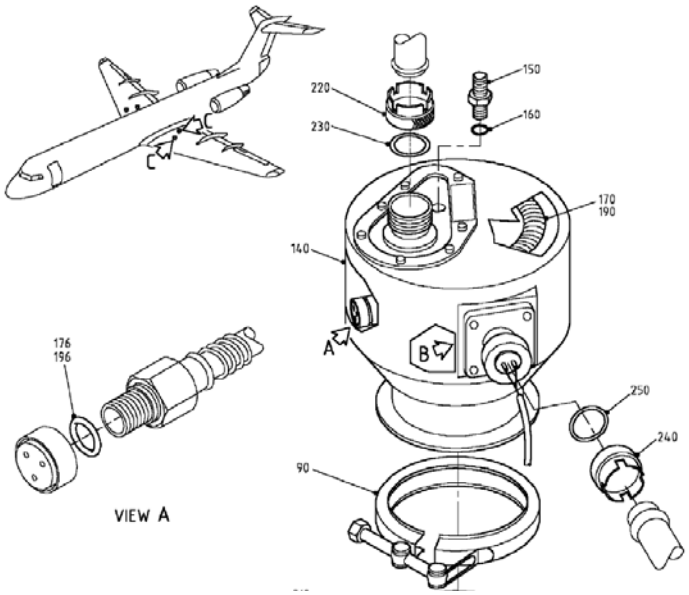

Figure 9 – O-ring installation

The other end of the booster pump cable assembly D43700-XXX consists of a sealing pressure bung of which the castellated nut needs to be torque tightened and safety-wired to ensure a perfect seal in combination with O-ring PN MS29513-011 for the canister external conduit where no fuel is allowed to enter.

If the cable assembly conduit and the associated plug 8525-16R10B6SND071 is found damaged, it must be replaced with new components. However, if only the green grommet of the plug is found damaged you can replace the plug that includes the green grommet.

4. Fokker Service Experience Digest

Fokker has released a Service Experience Digest 28-13 (SED) which addresses this issue.

The reported findings do not pose a safety risk because the fuel pump remains submerged in fuel during all normal operations. An array of jet pumps in the main tank continuously transfers fuel from main tank to collector tank.

The flexible conduit is prone to damage during removal and installation of the boost pump. Degradation and/or damage to grommet and O-ring at the plug interfacing with the boost pump receptacle can occur if the coupling nut of the flexible conduit is disconnected from the electrical plug and reconnected. The fluorosilicone grommet will swell when exposed to fuel, which in itself is not a

problem provided the assembly is not taken apart. Exposure to fuel can be expected over time because the parts used in the cable assembly are not designed to be hermetically sealed. The ambient pressure differences between ground and cruise level then will be enough to allow minute quantities of fuel to enter the conduit each time the conduit is at a lower pressure see Figure 10.

Figure 10 - Fuel in receptacle

As a result of the Fokker fuel tank safety project, measures are in place such as resetting of fuel systems related circuit breakers after tripping to prevent dry running of fuel pumps, during flight operation and during aircraft maintenance.

The potential consequences of the reported findings do not represent additional safety risks over and above those identified in and addressed by the Fokker fuel tank safety project.

No fleet wide measures are considered by Fokker at this time; however the reported findings are obviously undesirable from a general quality and reliability viewpoint.

5. Recommendations

1. Whenever a boost pump needs to be removed an inspection of the cable assembly flexible conduit for obvious damages should be performed. However, if there are no obvious damages observed, do not unnecessarily remove the flexible conduit coupling nut from the plug, as the grommet can easily be torn apart with the result that the plug needs to be replaced. Report any issues relating to degradation of the green grommet in the plug to CASA and Fokker.
2. If in the process of troubleshooting boost pump malfunction discoloured/ damaged wiring is observed the entire cable assembly must be replaced. Lack of slack in the wiring will obstruct any repair attempt within the available clearance.

3. The plug can be replaced if available and the SED allows for rework of the locking teeth and re-identification of the plug. Refer to the SED for accomplishment details.
4. Follow instructions in MCNM F100-165 to reduce the risk associated with dry running of the boost-pumps during maintenance activities, the ***circuit-breakers of the boost-pumps must be pulled and tagged*** when the collector tanks are defueled to a remaining fuel quantity of 200 litres or less. Switch-off these pumps immediately when the centre-wing tank is defueled completely.

6. Reporting

Operators are encouraged to report any findings on this matter to CASA via SDR online:

http://casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC_90818

Report any issues with this finding to Fokker Services B.V.

7. Enquiries

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

AirworthinessBulletin@casa.gov.au

or in writing, to:

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