SOUTH AFRICAN CIVIL AVIATION AUTHORITY

Section/division **Accident and Incident Investigation Division** Form Number: CA 12-40

AIRCRAFT SERIOUS INCIDENT SHORT REPORT

CA18/3/2/1210: ZS-NMI, in-flight engine shutdown during the climb phase

Date and time	**:**	16 May 2018, 0535Z
Occurrence type	**:**	Serious incident
Aircraft registration	**:**	ZS-NMI
Aircraft manufacturer and model	**:**	Bombardier/Canadair Regional Jet CL-600-2B19
Last point of departure	**:**	O.R. Tambo International Airport (FAOR)
Next point of intended landing	**:**	Mafikeng International Airport (FAMM)
Location of incident site with reference to easily defined geographical points (GPS readings if possible)	**:**	The closest aerodrome to the incident was FAOR at GPS Co-ordinates 26° 08' 21" South 028° 14' 46" East
Meteorological information	**:**	METAR FAOR 160530Z 05007KT 9999 FEW007 06/04 Q1027 NOSIG=
Type of operation	**:**	Air Transport Operations (Part 121)
Persons on board	**:**	4 + 19
Injuries	**:**	None
Damage to aircraft	**:**	None

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.

Purpose of the Investigation:

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (2011) this report was compiled in the interests of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and ***not to establish blame or liability****.*

Disclaimer:

1. SYNOPSIS

1.1 On Wednesday 16 May 2018, at 0535Z, a scheduled commercial flight operating under the call sign EXY1123 departed FAOR for FAMM. The runway used for departure was 21R. After take-off, while maintaining runway heading and passing 8 000 feet, the aircraft suddenly yawed to the left. After carrying out troubleshooting, the flight deck crew identified the problem as an engine flame-out. The crew transmitted a PAN-PAN call and requested routing to very high frequency (VHF) omnidirectional range (VOR) beacon MEV in order to follow the *Quick Reference Handbook* (QRH) actions for an engine shutdown. Once configured, an uneventful landing was carried out on runway 21L. There were no injuries reported and the aircraft did not sustain any damage.

Figure 1: The aircraft ZS-NMI (photograph courtesy of *www.jetphotos.net*)

2. FACTUAL INFORMATION

2.1 On Wednesday 16 May 2018, a domestic scheduled flight operating under the provisions of Part 121 (Air Transport Operations), departed from FAOR on an instrument flight rules (IFR) flight plan to FAMM. On-board the aircraft were 4 crew members and 19 passengers. After take-off, passing 8 000 ft. above mean sea level (AMSL) during the climb-out phase, the aircraft yawed to the left and the crew noted that the left-hand engine (number 1) was spooling down due to an engine flame-out (a condition that causes the flame in the combustion chamber to be extinguished). The crew did not pick up any prior indications in the cockpit warning of a possible engine-related problem. The crew did not opt to attempt an engine restart, as they planned on returning to FAOR, which was their maintenance base.

2.2 The crew transmitted a PAN-PAN call (a potential distress condition that does not require immediate assistance), informed air traffic control (ATC) of the engine flameout and requested to be vectored to a holding point. ATC initially routed them to the VOR beacon MEV, where the crew carried out QRH procedures and configured the aircraft for landing.

The aircraft returned to FAOR and completed an uneventful single-engine landing. The crew taxied the aircraft back to the apron, where the passengers disembarked. The duration of the flight was 34 minutes.

2.3 The Accident and Incident Investigation Division (AIID) was notified of the incident and an investigating team was dispatched to the aircraft maintenance organization (AMO) at FAOR, where the aircraft had been towed into a maintenance hangar. The engine did not display any visible damage. The engine fault-finding checklist was followed. It was recommended that the drive shaft between the fuel pump and the fuel management unit (FMU) be inspected for continuity. The FMU was removed where it was attached to the fuel pump, and the drive shaft was found to display signs of excessive wear on the side of the FMU. The gear train on the FMU also displayed evidence of wear that had caused the drive gear to slip in operation. This disrupted the fuel supply to the engine, resulting in an engine shutdown.

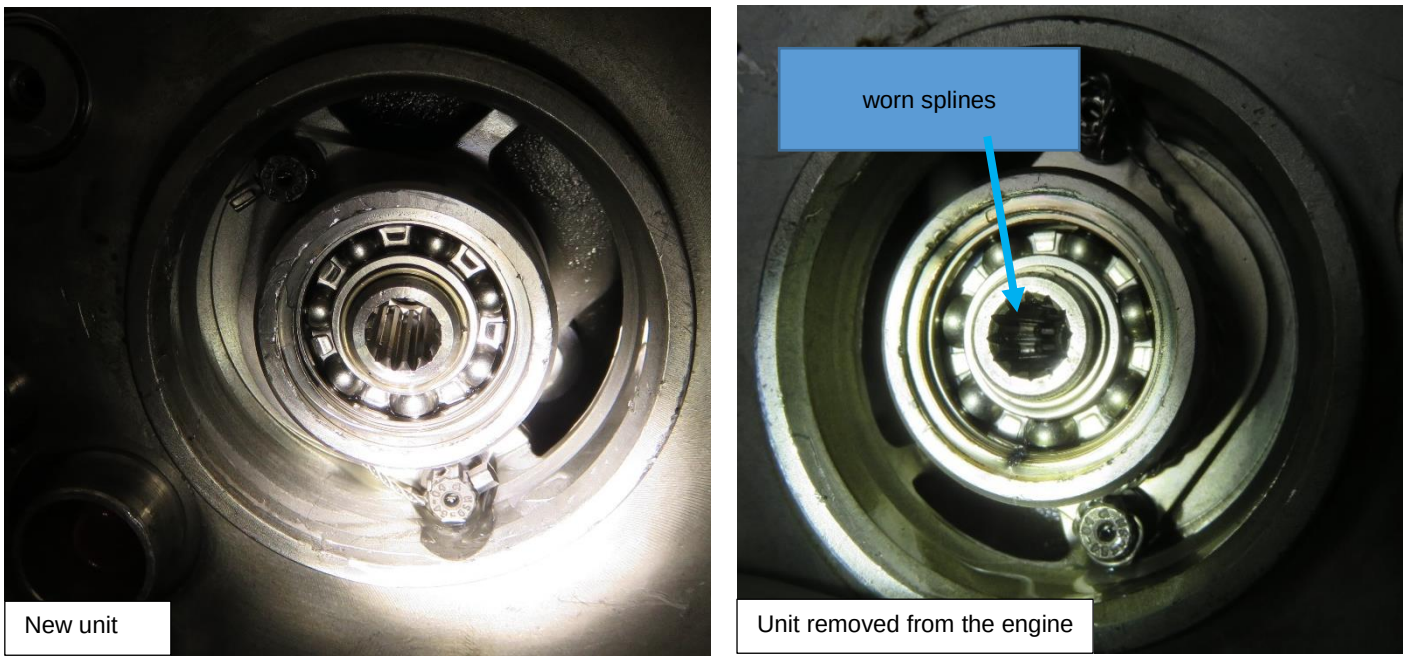


Figure 2: FMU splines of a new unit (left) compared with the unit removed from the engine (right)

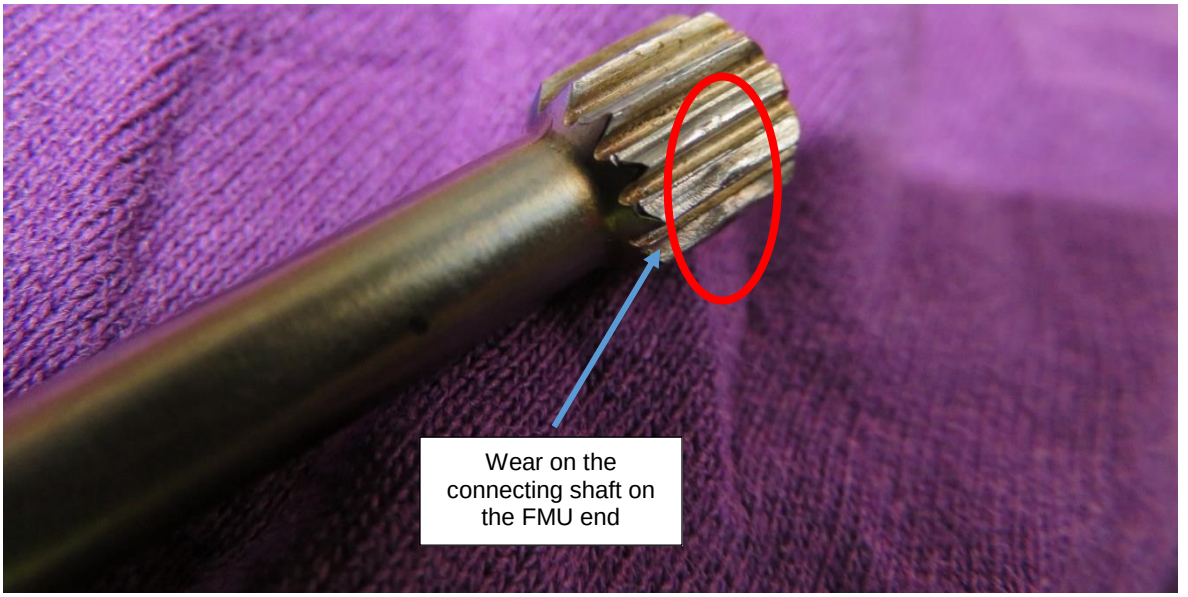


Figure 3: The interconnecting drive shaft that links the fuel pump to the FMU. The FMU side of the shaft is shown.

3. FINDINGS

3.1 The pilot-in-command (PIC) held a valid airline transport pilot licence (ATPL) which was initially issued on the 27th September 1996 and expiring on the 31st January 2019. The pilot had aircraft type endorsed on his licence. He was also in possession of a valid class 1 aviation medical certificate which expires on the 31st October 2018. He had accumulated a total of 18 422.0 flying hours at the time, of which 8 890.0 were on the aircraft type.

3.2 The pilot who acted as the first officer (FO) on this flight was also a captain with the airline. He was the pilot flying (PF) this sector and held a valid ATPL which was initially issued on the 13th January 1999 and expiring on the 28th February 2019. He was also in possession of a valid class 1 aviation medical certificate which expired on the 31st May 2018 (note: this medical was valid at the time of the incident). He had accumulated a total of 10 216.5 flying hours at the time, of which 171.3 were on the aircraft type.

3.3 The aircraft held a valid Certificate of Release to Service which was issued on the 7th May 2018 and Certificate of Airworthiness (date of issue: 10th October 1997, expiry date: 9th October 2018). The company held a valid Air Operator's Certificate.

3.4 The engine that experienced the flame-out (see 3.5 below) was a leased engine. The engine came into the possession of the AMO on 13 January 2017. It had initially been installed on the aircraft with registration markings ZS-NMF. On 14 July 2017, it was removed from ZS-NMF and fitted to ZS-NMI. The last A-check inspection carried out on the engine was dated 7 May 2018.

3.5 The engine details were as follows:

- General Electric (GE) CF34-3B1
- Serial number: 807321C
- Hours since new: 40 904
- Cycles since new: 35 877

3.6 The FMU details are:

- Part number: 6078T55P23
- Serial number: WYG95991

3.7 The above engine had the ASB embodied at 27 437.3 engine hours since new. The ASB required inspection to be routinely carried out every 10 000 hours for operators in Africa. Operators in North America were only required to carry out the inspection at every workshop visit. The engine was previously operated in the United States of America (USA) and had therefore not complied with the 10 000-hour schedule as it was not mandatory in the USA. The South African AMO took possession of the engine at 38 049.6 hours. The engine shutdown occurred at 40 904.0 hours since new. Therefore, the engine was in operation for approximately 13 466,7 hours since the last ASB was implemented.

3.8 On 2 November 2004, General Electric released an Alert Service Bulletin (ASB) for an inspection of the main fuel control input drive shaft spline, main fuel pump control drive shaft spline and main fuel pump secondary drive shaft spline (ASB: 73-A0035-R6). The operator did not incorporate the SB as required by the manufacturer prior to the incident

3.9 The aircraft was equipped with a flight data recorder (FDR) and a cockpit voice recorder (CVR), and these units were removed from the aircraft to be downloaded.

3.10 The interconnecting drive shaft as well as the FMU were replaced on this engine. Thereafter, a ground run was carried out and the aircraft was returned to service the following day (17 May 2018).

3.11 The gear train also showed excessive wear, which caused the drive gear to slip in operation, disrupting the fuel supply to the engine and resulting in the engine shutting down.

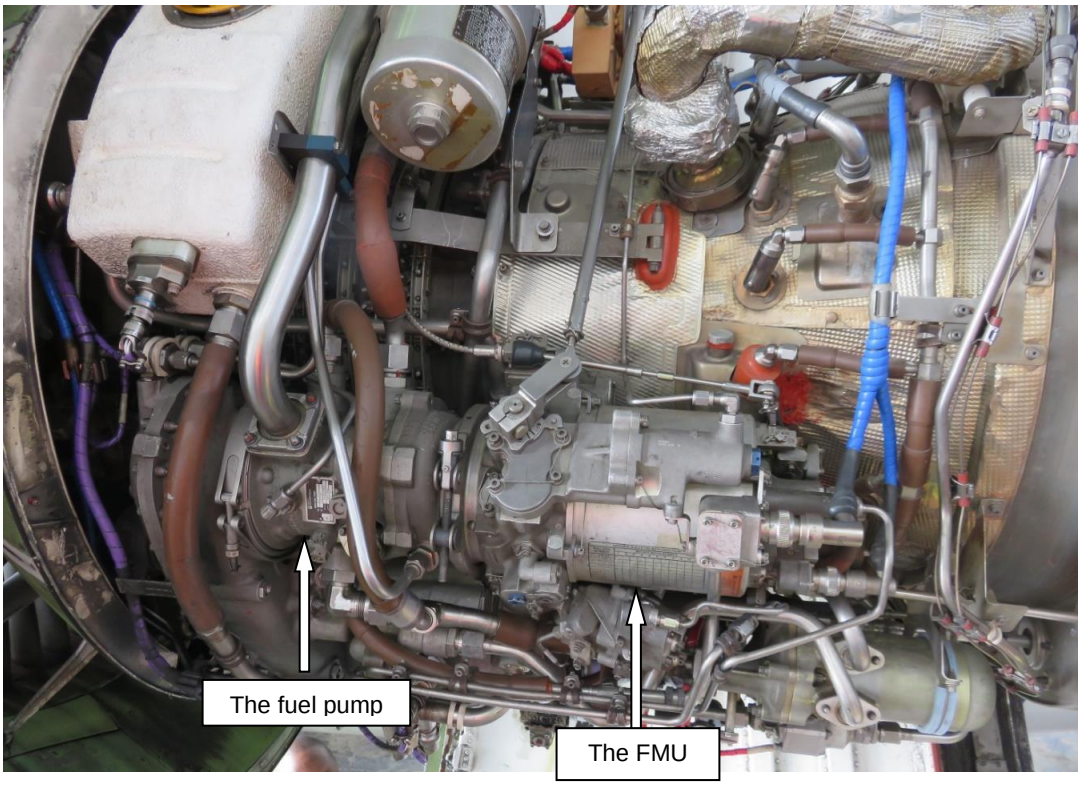


Figure 4: Side view of the engine with the fuel pump and FMU visible as indicated

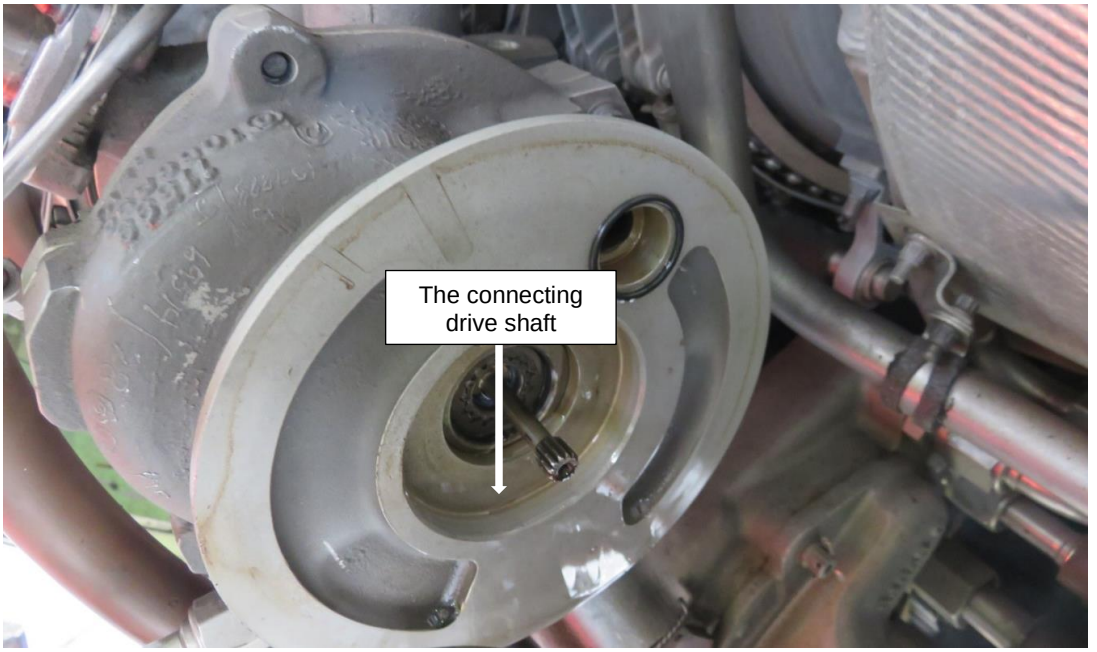


Figure 5: The connecting drive shaft still inserted in the main fuel pump drive train

4. PROBABLE CAUSE

4.1 Failure of the FMU drive gear and shaft splines leading to engine flame out

5. CONTRIBUTING FACTOR

None

6. REFERENCES USED IN THE REPORT

6.1 ASB: 73-A0035-R6

6.2 Technical logbooks and documentation from the AMO

7. SAFETY RECOMMENDATION

7.1 Safety Message: The operator needs to review their maintenance control to ensure that safety alerts (SB/AD) are incorporated to prevent incidents such as this one from reoccurring.

9. APPENDICES

9.1 Appendix A: Action taken by the operator in response to the incident

9.2 Appendix B: (ASB: 73-A0035-R6): The copy of this ASB has been adapted for representation purposes only and may not be the latest version.

Appendix A

SOUTH AFRICAN EXPRESS

WORK ORDER

SX 370894 Life limit

Opened on	Cny	Center	Place		Type	Reference
16/05/2018	SAX	JNB	SAX	JNB	4	720000R

ATA	Control	Repetitive W.O.	H.I.L	KARDEX Pos.	720000R
720000	Inspection requested	NO		CF34-3B1 ENGINE	RH

A/C Reg	Part Number	Serial Number	Description
NMK	6089T11G01	GE-E-872334	CF34-3B1 ENGINE

Skill	Station	Phase	Zone

	FH	CY	Check	Date	Estimated Time
Scheduled	37 742				

REQUESTED WORK	PERFORMED WORK	Mec.	Rating
INSPECTION OF MFC DRIVE INPUT DRIVE SHAFT SPLINE, MAIN FUEL PUMP CONTROL DRIVE SHAFT SPLINE AND MAIN FUEL PUMP SECONDARY DRIVE SHAFT PER ALERT VAB CF34-73-A0035.	W/O SX 370894 CARRIED OUT IAW CF34-73-A0035. ALL SHAFTS MENTIONED INSPECTED AND FOUND SERVICEABLE AT TIME OF INSPECTION		

Position	P/N OFF	S/N OFF	P/N ON	S/N ON
R/H Engine (MFU)	6503-8063-494	WYG96734	6503-8063-494	WYG96734
R/H Engine (Fuel Pump)	6078T39P04	CGWT1930	6078T39P04	CGWT1930

LABOUR

	Mechanical	Avionics	Trimming	Composite	Paint	Structure	NDT
Stamp Certified							
Stamp Uncertified							
Third Party							
Man hours							

Issue Slips:

All the work specified was performed in accordance with the applicable Civil Aviation Regulations, and in respect of that work, the aircraft is considered fit for return to service.

Name W. ENGELBRECHT Signature Stamp Date 18 MAY 2018

WO SX370894

ALERT SERVICE BULLETIN

ENGINE FUEL AND CONTROL - Fuel System (73-00-00) - Inspection of Main Fuel Control Input Drive Shaft Spline, Main Fuel Pump Control Drive Shaft Spline, and Main Fuel Pump Secondary Drive Shaft Spline

Table 1 - Information Data Sheet

Operator	Aircraft Tail Number	Engine Serial Number	Left or Right Engine	Inspection Date
S.A. EXPRESS	ZS-NMK	GE-E-872334	RIGHT	18 MAY 2018

Main Fuel Control Input Drive Spline Inspection						
MFC Serial Number	MFC Part Number	Spline Wear Yes/No	Describe Amount of Wear (inches worn or percent of tooth missing)	Is a step visible or felt with scribe (Yes or No)	MFC Time Since New	MFC Time Since Repair
WYG96234	6503-8063-4914	NO	NO WEAR OR TOOTH MISSING	NO	UNKNOWN	UNKNOWN.

MFP Control Drive Shaft Spline Inspection						
MFC Spline End			MFP Spline End			Hours Accumulated on Control Drive Shaft
Spline Wear Yes/No	Describe Amount of Wear (inches worn of percent of tooth missing)	Is a step visible or felt with scribe (Yes or No)	Spline Wear Yes/No	Describe Amount of Wear (inches worn of percent of tooth missing)	Is a step visible or felt with scribe (Yes or No)	
NO	NO WEAR NO TOOTH MISSING	NO	NO	NO WEAR NO TOOTH MISSING	NO	UNKNOWN

Main Fuel Pump Secondary Drive Shaft Spline Inspection						
MFP Serial Number	MFP Part Number	Spline Wear Yes/No	Describe Amount of Wear (inches worn or percent of tooth missing)	Is a step visible or felt with scribe (Yes or No)	MFP Time Since New	MFP Time Since Repair
CGWT 1930	6078T3980	NO	NO WEAR NO TOOTH MISSING	NO	UNKNOWN	UNKNOWN.

SOUTH AFRICAN EXPRESS

WORK ORDER

SX 370886 Life limit

Opened on	Cny	Center	Place		Type	Reference
16/05/2018	SAX	JNB	SAX	JNB	4	720000L

ATA	Control	Repetitive W.O.	H.I.L	KARDEX Pos.	
720000	Inspection requested	NO		720000L CF34-3B1 ENGINE	LH

A/C Reg	Part Number	Serial Number	Description
NME	6089T11G01	GE-E-872488	CF34-3B1 ENGINE

Skill.	Station	Phase	Zone

	FH	CY	Check	Date	Estimated Time
Scheduled	37 927				

REQUESTED WORK	PERFORMED WORK	Mec.	Rating
INSPECTION OF MFC DRIVE INPUT DRIVE SHAFT SPLINE, MAIN FUEL PUMP CONTROL DRIVE SHAFT SPLINE AND MAIN FUEL PUMP SECONDARY DRIVE SHAFT PER ALERT VAB CF34-73-A0035.	INSPECTION OF MFC DRIVE INPUT DRIVE SHAFT SPLINE, MAIN FUEL PUMP CONTROL DRIVE SHAFT SPLINE & MAIN FUEL PUMP SECONDARY SHAFT AS PER VAB CF34-73-A0035. NIL FINDINGS AT TIME OF INSPECTION		

Position	P/N OFF	S/N OFF	P/N ON	S/N ON
#1 Engine	6650 3 - 8063-495	WVG 84756	6650 3 - 8063 -495	WVG 84 756
#1 Engine	6078T39P04	CGWT0842	6078T39P04	CGWT0842

LABOUR

	Mechanical	Avionics	Trimming	Composite	Paint	Structure	NDT
Stamp Certified	SA EXPRESS 355						
Stamp Uncertified							
Third Party							
Man hours	5						

Issue Slips:

All the work specified was performed in accordance with the applicable Civil Aviation Regulations, and in respect of that work, the aircraft is considered fit for return to service

Name Y. NAIDOO Signature Stamp SA EXPRESS 355 Date 17 MAY 2018

WO SX370886

FR V1.0_07JUL05 Printed on May 16,2018 Page 1/1

Appendix B

CF34RJ ALERT SERVICE BULLETIN - 73- A0035 R06

Revised: 09/07/2016

SB 73-A0035 R06 ENGINE FUEL AND CONTROL - FUEL SYSTEM (73-00-00) - INSPECTION OF MAIN FUEL CONTROL INPUT DRIVE SHAFT SPLINE, MAIN FUEL PUMP CONTROL DRIVE SHAFT SPLINE, AND MAIN FUEL PUMP SECONDARY DRIVE SHAFT SPLINE

Issued 02/11/2004

GE PROPRIETARY INFORMATION

TRANSMITTAL INFORMATION

REVISION 6 to Alert SERVICE BULLETIN 73-A0035

Revision 6 is issued to update paragraphs 2., MATERIAL INFORMATION and 3., ACCOMPLISHMENT INSTRUCTIONS.

Revision 5 was issued April 05, 2013. Revision 4 was issued September 28, 2011. Revision 3 was issued April 25, 2008. Revision 2 was issued October 10, 2007. Revision 1 was issued September 27, 2004. The original was issued February 11, 2004. Revision bars in the left margin identify changes.

1. PLANNING INFORMATION

A. Effectivity

This Alert Service Bulletin is applicable to all CF34-3 turbofan engine main fuel controls (MFCs) and main fuel pumps (MFPs).

B. Concurrent Requirements

It is recommended that CF34-AL S/B 73-0020 is accomplished concurrently with this Service Bulletin.

C. Description

This Alert Service Bulletin introduces an inspection for spline

teeth wear on the MFC input drive spline, MFP control drive shaft spline, and MFP secondary drive shaft spline.

This Service Bulletin provides a procedure for field replacement of the MFC input drive spline, MFP secondary drive shaft and the control drive shaft if splines are found to be out of limits.

This Service Bulletin applies to all part numbers of MFCs and MFPs.

D. Compliance

Category 2

NOTE:It is the responsibility of the Operator to monitor the MFC and to determine the regions of the world in which the MFC has been operated.

GE recommends that you do this Alert Service Bulletin as soon as possible without effect on revenue service, as follows:

(1) For MFCs that have been operated in the regions shown in Table 1:

These regions apply to operators re-fueling in that region more than 50 percent of the time.

(a) Do as soon as possible without effect on revenue service but before the MFC has accumulated the hours shown in Table 1. For MFCs that have already accumulated the hours shown in Table 1, do within 500 operating hours of the date of this Service Bulletin.

(b) Repeat this Service Bulletin inspection procedure at intervals shown in Table 1.

Table 1

Region/Country	*Inspection Interval*
Asia (1)	*4,000 hours*
– China (2,3)	*Shop visit*
– India (2,3)	*Shop visit*
– Japan	*1,500 hours*
Middle East (2)	*10,000 hours*
Commonwealth of Independent States (CIS) (2)	*10,000 hours*
Africa (2)	*10,000 hours*
North America (2,3)	*Shop visit*
Central America and the Caribbean (1)	*10,000 hours*
– US Virgin Islands	*4,000 hours*
South America (2)	*10,000 hours*
Europe (2)	*10,000 hours*
Australia (2)	*10,000 hours*
Unknown	*1,500 hours*

1 Exceptions to the Asian, Central American and the Caribbean regions are provided below.

2 If the aircraft is re-fueled in the Asian region more than 50 percent of the time since the initial Service Bulletin inspection, re-inspect per the Asian region inspection intervals.

3 If the aircraft is re-fueled outside this region since the initial Service Bulletin inspection, and has not been operated in the Asian region, re-inspect every 10,000 hours.

E. Reason

(1) Objective:

This Service Bulletin introduces a field program to inspect for spline teeth wear on the MFC input drive spline, control drive shaft, and MFP secondary drive shaft.

This Service Bulletin provides a procedure to replace MFC input drive spline by replacing the MFC offset driver assembly, if parts are found unserviceable.

This procedure also replaces the MFP control drive shaft and secondary

drive shaft if parts are found unserviceable.

(2) Condition:

Inflight shutdowns, which have been associated with disengagement of the MFP control drive shaft spline from the MFC input drive spline, have been linked to wear-out of the MFC input drive spline teeth.

(3) Cause:

The worn spline teeth, most of which have been found on MFCs that were operated in the European and some Asian regions, may be attributable to fuel lubricity and/or MFC to MFP alignment.

(4) Improvement:

The inspection provided in this Service Bulletin is recommended to capture MFCs that may have spline wear that could result in MFC spline disengagement.

This Service Bulletin provides a field procedure to replace the MFC input drive spline and MFP secondary drive shaft.

(5) Substantiation:

Substantiation is by field experience and analysis.

F. Approval

This Alert Service Bulletin has been reviewed by the FAA and the repair(s) and modification(s) herein comply with the applicable Federal Aviation Regulations and are FAA APPROVED for installation in the model(s) listed in this Alert Service Bulletin.

G. Manpower

(1) The approximate time required to inspect the MFC input drive spline, MFP control drive shaft spline, and MFP secondary drive shaft spline (if control removed from spare engine) is 0.5 man-hour.

(2) The approximate time required to replace the MFC offset driver assembly, which contains the input drive spline is 0.5 man-hour. The time required to replace the MFP secondary drive shaft is 1 man-hour.

(3) The approximate time required to remove and replace a MFC on a spare engine is 2 man-hours.

(4) The approximate time required for the on-wing MFC removal and installation, once the MFC is exposed, is 4 man-hours for the left engine and 6 man-hours for the right engine.

(5) The approximate time required for the MFP removal and replacement on a spare engine or the left engine on wing is 1 man-hour and the right engine on wing is 2 man-hours.

H. Weight and Balance

Weight and balance are not changed.

I. References (Use the latest version of these documents)

CF34-AL S/B 73-0018, ENGINE FUEL AND CONTROL - Rework of Main Fuel Control to Add Forward Flange Vent Groove

CF34-AL S/B 73-0020, FUEL SYSTEM - Improved Preformed Packings on the Main Fuel Control-to-Fuel Pump Interface SEI-756, CF34 Turbofan Engine Manual (EM)

J. Publications Affected None.

K. Interchangeability Not applicable.

L. Electrical Load Data Not applicable.

M. Software Accomplishment Summary Not applicable.

2. MATERIAL INFORMATION

A. Material - Price and Availability

(1) Parts necessary to do this Service Bulletin:

Part Number	Qty/ Eng	Part Name	Unit Price ($)	Pkg Qty	Lead Time Days
8928-7062	*(1)*	*Kit, Assembly Offset Driver*	*Quote*	*(1)*	*Quote*
MS20995C25	*(-)*	*Lockwire*	*Quote*	*(-)*	*Quote*

Kit necessary only if worn out of limits.

This kit is purchased from Woodward Inc.

(2) Consumables required to install MFC (If MFC was removed from engine):

Part Number	Qty/ Eng	Part Name	Unit Price ($)	Pkg Qty	Lead Time Days
182625	*(1)*	*Packing, Preformed (Post S/B 73-0034)*	*Quote*	*(-)*	*Quote*
M83485/1-020	*(1)*	*Packing, Preformed (Post S/B 73-0032)*	*Quote*	*(-)*	*Quote*
37B201714P130	*(1)*	*Packing, Preformed (Post S/B 73-0018)*	*Quote*	*(-)*	*Quote*
MS24665-151	*(2)*	*Pin, Cotter*	*Quote*	*(-)*	*Quote*

(3) MFP Control Drive Shaft Replacement Parts:

Part Number	Qty/ Eng	Part Name	Unit Price ($)	Pkg Qty	Lead Time Days
116177-1	*(1)*	*Control Drive Shaft Kit*	*Quote*	*(-)*	*Quote*
NOTE: Parts contained in this kit are:					
*106722**		*Control Drive Shaft*	*Quote*	*(-)*	*Quote*
78172-014		*Packing, Preformed*	*Quote*	*(-)*	*Quote*

(*) Part necessary only if worn out of limits.

These parts are purchased from Goodrich Company.

(4) MFP Secondary Drive Shaft Replacement Parts:

Part Number	Qty/ Eng	Part Name	Unit Price ($)	Pkg Qty	Lead Time Days
116178-1	(1)	Secondary Drive Shaft Kit	Quote	(-)	Quote
NOTE: Parts contained in this kit are:					
*78172-017	(1)	Packing, Preformed	Quote	(-)	Quote
*78172-159	(1)	Packing, Preformed	Quote	(-)	Quote
*106723	(1)	Shaft, Secondary Drive	Quote	(-)	Quote

(*) Part necessary only if worn out of limits.

These parts are purchased from Goodrich Company.

(5) Consumables required to install MFP:

Part Number	Qty/ Eng	Part Name	Unit Price ($)	Pkg Qty	Lead Time Days
R1312P210	*(1)*	*Packing, Preformed*	*Quote*	*(-)*	*Quote*

B. Industry Support Information

None.

C. Configuration Chart Not applicable.

D. Parts Disposition

Discard worn unserviceable parts.

E. Tooling - Price and Availability

Description

Masking Tape

3. ACCOMPLISHMENT INSTRUCTIONS

A. Removal of Main Fuel Control (MFC)

NOTE:It is recommended that operators avoid performing maintenance on both engines installed on the same aircraft at the same time if at all possible. If it is not possible to avoid maintenance on more than one engine at the same time, it is recommended that different maintenance teams service each engine.

(1) Remove MFC (1-560) from engine, if installed. Refer to SEI-756, 72-00-00, Special Procedure 07.

B. Main Fuel Control Input Drive Spline Inspection

(1) Lay MFC on its side on a clean working surface and cover cavity opening and inlet dowel port with masking tape or equivalent (figure 1).

NOTE:Inspection with a 0.24 inch (6 mm) borescope will provide the best inspection results.

(2) Use a 0.24 inch (6 mm) (or smaller) borescope or bright light, a 5X magnifying glass (if borescope is not available), and a 0.020 inch (0.5 mm) ball scribe to inspect MFC input drive spline for a step on the face of the female spline teeth. If present, the wear will be located in the middle third of the spline.

(a) Visually inspect for a step in the spline.

(b) Drag a 0.020 inch (0.5 mm) ball scribe axially along the face of the spline teeth on at least two spline faces.

(3) Replace offset driver assembly (20), if a step is visible or can be felt with a 0.020 inch (0.5 mm) ball scribe. Refer to paragraph C.

(4) Record Service Bulletin compliance as instructed in of MFC Service Bulletin paragraph D., Marking Data Plate.

(5) Deleted

(6) Deleted

C. Replacement of MFC Offset Driver Assembly

(1) Lay MFC on its side on a clean working surface (figure 1, figure 2, and figure 3). *Cover cavity opening and inlet port dowel with masking tape or equivalent to prevent debris from falling into control.*

CAUTION:MAKE SURE THAT PIECES OF LOCKWIRE THAT ARE REMOVED DO NOT FALL INTO CONTROL CAVITY OR DAMAGE TO THE MFC MAY OCCUR.

(2) Carefully remove lockwire from two screws (45, figure 3) that fasten *offset driver assembly (20) to MFC. Make sure that pieces of lockwire that are removed do not fall into control cavity.*

CAUTION: MAKE SURE DRIVE SHAFT (5, FIGURE3) IS NOT REMOVED DURING REPAIR

PROCESS. DO NOT ATTEMPT TO PULL ON THE DRIVE SHAFT. IF SHAFT IS MOVED, INTERNAL PARTS WILL BE LIBERATED AND THE MFC WILL MALFUNCTION. IF THE DRIVE SHAFT IS MOVED, THE CONTROL MUST BE RETURNED TO WOODWARD. SEE FIGURE 2**.**

(3) Remove two screws (45) and two washers (40) that retain the offset driver assembly (20) to assembly housing (10).

(4) Carefully pull the offset driver assembly (20) straight out from MFC.

(5) Install new offset driver assembly (20) as follows:

(a) Carefully install offset driver assembly (20) as you rotate drive spline to engage gear teeth.

(b) Make sure offset driver assembly (20) is fully seated.

(c) Install two washers (40) and two screws (45) in the offset driver assembly flange.

(d) Torque two screws (45) to 22-25 lb in. (2.5-2.8 N.m).

(e) Lockwire screws (45) together. Use lockwire 0.025 inch (0.635 mm) *diameter (MS20995C25) or safety cable. Lockwire per GEK 9250 Standard Practices Manual, 70-11-00, Fastener Retention Procedures.*

(6) Record Service Bulletin compliance as instructed in paragraph D.

(7) Remove any protective covering that was applied to the cavity area.

(8) Deleted

D. Marking of MFC Service Bulletin Data Plate

(1) When a MFC input drive spline has been inspected and found serviceable or replaced due to wear, mark the Service Bulletin Data Plate as follows and *as shown in* figure 5.

(2) Using a ball-point pen or equivalent instrument, scribe Service Bulletin *number 73-0035 in the bulletin number column.*

(3) Scribe the date in the first modification square using the month and the last two digits of the year. If it is necessary to repeat this Service Bulletin, scribe the date in the second modification square.

NOTE:Use the month and only the last two digits of the year.

Example: 0104 = first month of 2004 Example:
1014 = tenth month of 2014

E. MFP Control Drive Shaft Spline Inspection

NOTE:If necessary, remove the MFP from the engine. Refer to SEI-756, 73-00-00, Removal 001.

(1) Remove control drive shaft (01-730) from the MFP (1-710) if not removed (figure 2).

(a) Remove the preformed packing (1-740, 73-00-00) from the groove on the secondary drive shaft using a non-metallic tool and discard packing.

(b) Remove the control drive shaft (01-730) from the aft bore of the MFP (01-710).

(2) Use a bright light and a 5X magnifying glass, to inspect both ends of the shaft for abnormal wear on the male spline teeth.

(a) Visually inspect for abnormal wear in the splines.

(b) Drag a 0.020 inch (0.5 mm) ball scribe axially along the face of the spline teeth on at least two spline faces.

(3) Replace control drive shaft if abnormal wear is visible or can be felt with

a 0.020 inch (0.5 mm) ball scribe. Refer to paragraph 3.G., for *replacement of the MFP secondary drive shaft and control drive shaft.*

(4) Deleted

F. MFP Secondary Drive Shaft Spline Inspection

NOTE:A 0.24 inch (6 mm) (or smaller) borescope is required for this inspection.

(1) Use a 0.24 inch (6 mm) (or smaller) borescope and a 0.020 inch (0.5 mm) inch ball scribe to inspect the MFP secondary drive shaft spline for wear on the face of the female spline teeth (figure 4).

(a) Using a 0.24 inch (6 mm) (or smaller) borescope visually inspect for a step in the spline teeth.

(b) Drag a 0.020 inch (0.5 mm) ball scribe axially along the face of the spline teeth on at least two spline faces.

(2) Replace the secondary drive shaft if a step is visible or can be felt with *a 0.020 inch (0.5 mm) ball scribe. Refer to replacement of* paragraph 3.G., for *the secondary drive shaft.*

(3) Deleted

G. MFP Secondary Drive Shaft Replacement Procedure

(1) Invert pump so that the secondary housing end of pump is facing up (figure 4). Install pump on suitable holding fixture that protects main drive shaft from axial or radial hyperextension.

(2) Remove bolts PN *MS9557-12, nuts PN NAS1291C4M, and washers PN NAS620C416L, and separate secondary housing from main housing assembly. Set main housing assembly aside for later reassembly.*

(3) Remove and discard preformed packings PN secondary *78172-017 and PN 78172-159 from* housing interface.

(4) Remove the secondary drive shaft PN 106723.

(5) Install a new or serviceable control drive shaft PN 106722, into a new or *serviceable secondary drive shaft PN 106723. Make sure that the long spline on the secondary spline shaft is engaged in the internal spline on the secondary drive shaft. Install packing PN 78172-014 to retain the control drive shaft. Install the assembly into the MFP with the short spline of the secondary drive shaft engaging in the main housing gear spline.*

CAUTION:MAKE SURE THAT THE SHORTER SPLINE ON THE CONTROL DRIVE SHAFT PN 106722 IS THE EXPOSED END THAT WILL ENGAGE THE FUEL CONTROL INTERNAL SPLINE.

(6) Inspect mating faces of MFP and secondary housing for cleanliness and free of debris.

(7) Install replacement preformed packings PN *78172-017* and PN *78172-159 on secondary housing interface with VV-P-236 Petrolatum or equivalent lubricant for retention.*

(8) Position secondary housing over primary housing, while engaging external splines of secondary drive shaft with splines in secondary housing, and lower into position on locating dowels. Make sure secondary housing is fully seated onto primary housing.

(9) Install bolts PN *MS9557-12, nuts PN NAS1291C4M, and washers PN NAS620C416L, and torque nuts and bolts to 60-80 lb in. (6.7-9 N.m) above running torque.*

(10) Deleted

H. Marking of MFP Data Plate

(1) When a MFP spline has been inspected and found serviceable or replaced due to wear, mark the Data Plate using vibropeen. Refer to SEI-756, 72-09-01, Special Procedure 41.

(2) Vibropeen Service Bulletin number and date as shown in figure 6.

(a) Mark Service Bulletin number followed by the month and the last two digits of the year.

(b) If it is necessary to repeat this Service Bulletin, mark the new date after the last date of inspection.

NOTE:Use the month and only the last two digits of the year.

Example: 0104 = first month of 2004 Example:
1014 = tenth month of 2014

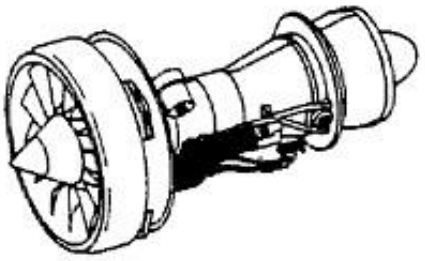
I. Installation of MFP

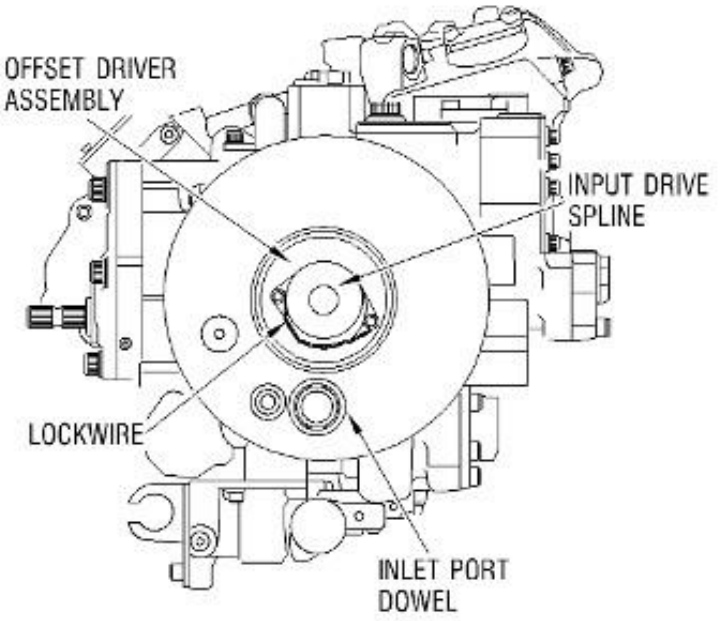
(1) Install the MFP, if it was removed. Refer to SEI-756, 72-00-00, Special Procedure 01.

J. Installation of MFC

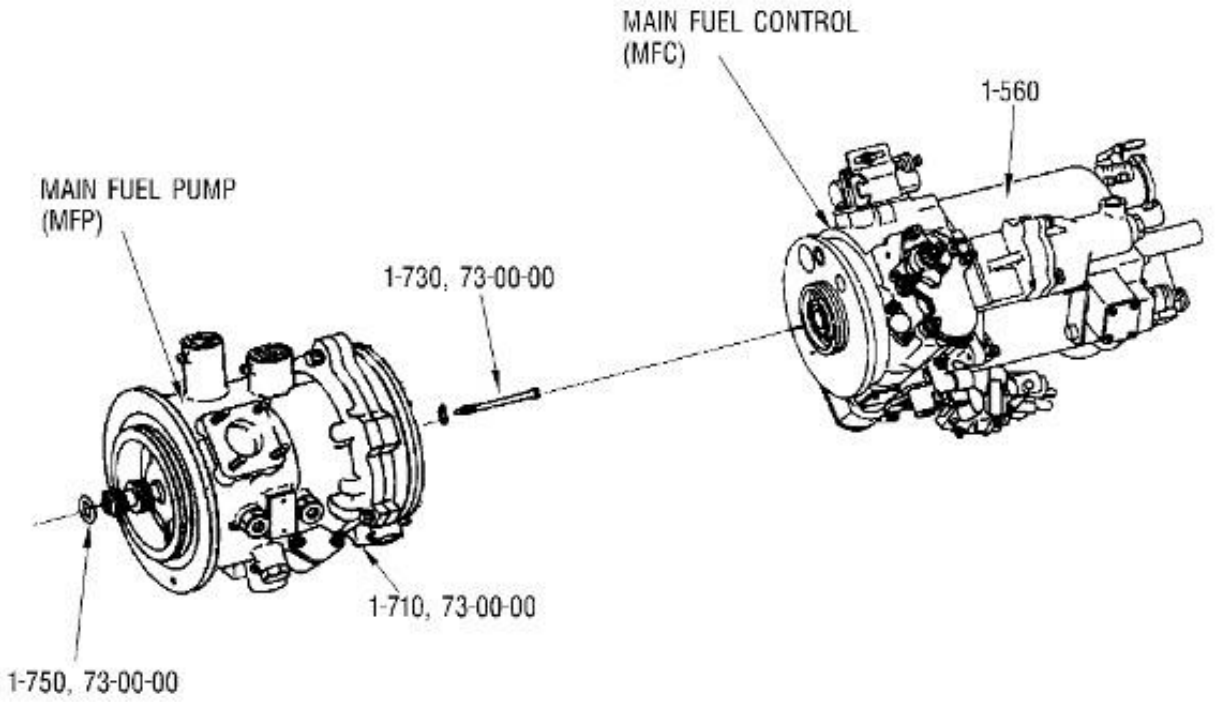
(1) Install the MFC, if it was removed. Refer to SEI-756, 72-00-00, Special Procedure 07.

Table 2 - Deleted





Main Fuel Control Inspection
Figure 1

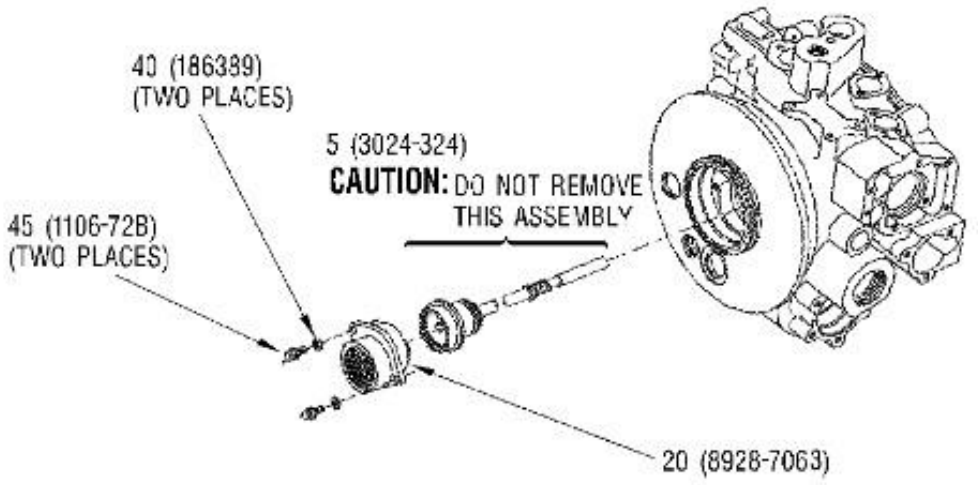


NOTES:

1. ALL REFERENCES FROM CMM UNLESS SPECIFIED DIFFERENTLY, EXCEPT IPC REFERENCES 73-00-00.
2. MAIN FUEL PUMP SHOWN IS GOODRICH.

1222883-00

Main Fuel Control - Removal/Installation Figure 2

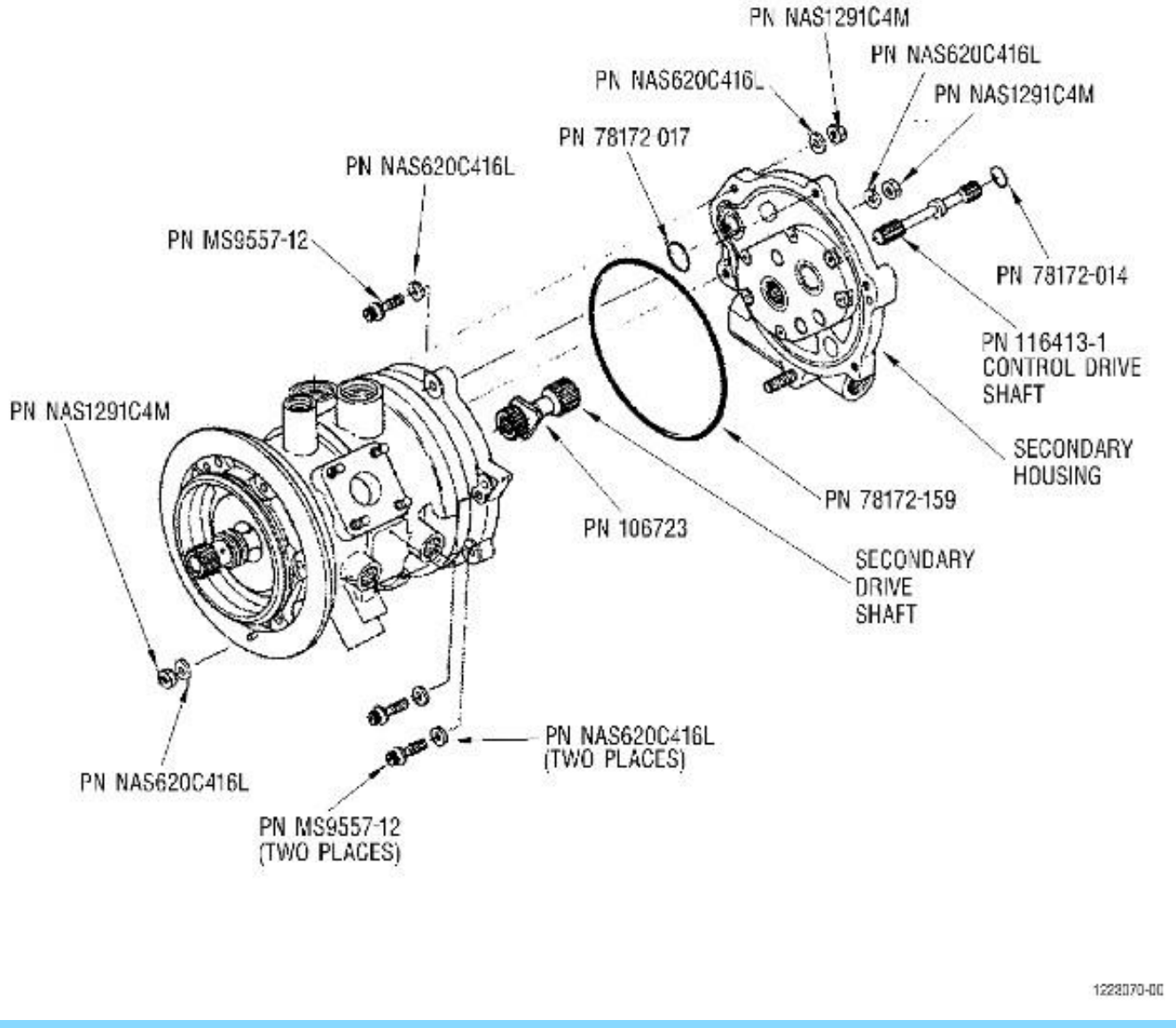


NOTES:

1. THIS FIGURE APPLIES ONLY TO MAIN FUEL CONTROLS LISTED IN TABLE 2.
2. ALL REFERENCES FROM CMM, UNLESS SPECIFIED DIFFERENTLY, EXCEPT IPC REFERENCES 73-00-00.

1228572-00

Main Fuel Control - Offset Driver Assembly, Removal/Installation Figure 3



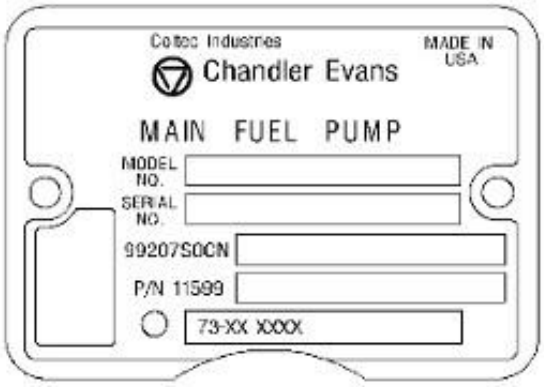
Main Fuel Pump - Secondary Drive Shaft and Control Drive Shaft, Removal/Installation
Figure 4

SERVICE BULLETIN INTRODUCTION

BULLETIN NUMBER	MODIFICATION NUMBER										
	1	2	3	4	5	6	7	8	9	10	COMP
73-XXXX											

1223071-00

MFC Data Plate
Figure 5



1223820-01

MFP Data Plate
Figure 6