BOMBARDIER CUSTOMER SERVICES BUSINESS AIRCRAFT

ADVISORY WIRE
AW300-24-0085, Rev. 1

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FROM: BOMBARDIER CUSTOMER SERVICES BUSINESS AIRCRAFT

ADVISORY WIRE

REFERENCE NO: AW300-24-0085, Rev. 1

SUBJECT: DC Generator Shaft Spline Wear/Corrosion

EFFECTIVITY: Challenger 300 (20006 - 20999)

ATA: 24

This Advisory Wire contains Maintenance Information

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1.0 INTRODUCTION:

This Advisory Wire provides an update of our investigation into some Auxiliary Power Unit (APU) generator shaft spline failures, first communicated in the original issue of this Advisory.

2.0 DESCRIPTION:

To date there have been five reported events of APU generator shaft spline failures. Several operators have also reported finding corrosion or a lack of lubricant on the splines. An examination performed on three of the failed units found that in each case the end shaft was not seated in the proper position. The shaft is designed with a small groove on the outer diameter and a circlip that locks into another groove on the inner diameter on the main shaft, locating and locking it in place. The shafts on the returned units were found to be protruding out of the generator about 0.29"/ 7.4 mm further then they are supposed to. Wear markings on the shafts indicated that the units had been operating in that condition for some time.

A metallurgical analysis performed on one of the shafts identified "fretting corrosion" as the root cause of the spline wear and failure. Fretting corrosion is a phenomenon by which minute displacements at a specific frequency between two surfaces in contact can result in wearing of the surfaces. The analysis revealed that the relative displacement between the splines was in the axial direction, and not a result of rotational motion or stress. We believe that it was operation with the shafts not properly seated that resulted in the spline wear and failures of these generators.

To test the integrity of the circlip and shaft retention design, several pull tests were performed on a new and a returned generator to measure the force required to overcome the circlip and displace the shaft from its seated position. It was discovered that the force required to unseat the shaft could vary significantly, depending on the condition of the circlip and the shaft. Typically, a generator that has been in service for some time with light corrosion around the shaft will require a higher force (88 lb/ 40 kg as tested) to displace the shaft because the corrosion tends to fuse the parts together.

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A new generator was shown to require about 55 lb/ 25 kg upon initial (first time) removal, but when reassembled with the same circlip the force can drop to around 30 lb / 14 kg. Depending on the condition of the circlip and shaft, some units required as little as 7 lb/ 3 kg.

2.1 INVESTIGATION CONCLUSION:

Our investigation has concluded that these shaft spline failures were the result of “fretting corrosion”, initialized by the shaft either being improperly assembled into the generator, or displaced at some time during operation. As a result of these findings, we are presently working with the vendor to incorporate an improved shaft retention mechanism. In the interim any operator who would like to confirm if the shaft is properly seated when a generator is removed or installed could do a simple dimensional check as outlined in the attached memo from Thales.

With respect to the corrosion in the form of dry rust colour areas of the shaft that several operators have reported, a number of steps have already been taken to address this. In November 2007, Thales issued Service Bulletin A3579-101-24-001 to apply an anti-corrosion coating to all units at overhaul, and are now also applying an anti-seize/lubricating compound when assembling the shaft. This Service Bulletin and the application of anti-seize/lubricating compound can only be accomplished when the unit is returned for overhaul. It is not necessary to remove a generator from service if minor corrosion is discovered on the shaft. We are presently working with Thales to publish allowable limits for the typical shaft corrosion operators have reported.

2.2 APU DRIVE SPLINE LUBRICATION:

Some Operators have also reported finding the APU drive splines and the mating female splines on the APU gearbox drive pad completely dry with no lubricant. While we don’t believe that this was a factor in these spline shaft failures, it is nonetheless important that the splines remain adequately lubricated over the 3000 hr period until the generators are removed for restoration. Following the first report, we revised the Aircraft Maintenance Manual (AMM) to state that anytime the APU generator is removed, the o-ring should be replaced and MIL-PRF-81322 grease should be applied to the splines. We also confirmed that the correct instructions were in place to apply grease during production assembly.

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We are uncertain if these reports of dry splines are isolated cases due to a lack of sufficient grease being applied at installation, or if the grease is not lasting and being lost during normal operation. At the last Industry Steering Committee (ISC) meeting held in July 2008, the Committee discussed the addition of a new APU generator shaft lubrication task at a specific interval. It was decided that additional field data is required to help determine whether a lubrication task is warranted. To that end, we are asking that any Operators who would be willing to participate in a simple field evaluation, to please let us know by contacting Steven Boost by e-mail at steven.boost@aero.bombardier.com. All that would be required is removal of the APU generator and applying sufficient grease to the shaft spline per the AMM (if not already present), followed by subsequent removals at 400 hour intervals to check for the presence of grease and the condition of the shaft and o-ring. The results will help us determine if the lubrication will last the required 3000 hours or if an intermediate scheduled task to apply grease is necessary.

All manuals are available on the CIC website (http://www.cic.bombardier.com) within the Technical Library > Manuals > Maintenance & Flight Manuals > Maintenance and Flight Manuals > for Challenger > Challenger 300 Publications.

3.0 ACTION:

There is no action for Operators to take at this time. We are presently working with the vendor to provide an improved shaft retention mechanism and will inform operators when an improvement becomes available. If an operator has cause to remove their APU generator and would like to verify if the shaft is properly installed, they may do so by performing the dimensional check in the attached memo from Thales.

Operators who would like to participate in the field evaluation are asked to send an e-mail to steven.boost@aero.bombardier.com.

Operators are also reminded that the generator end shaft should not be removed from a unit in the field. Removing and subsequently reinstalling the end shaft in the field could result in reducing the capability of the circlip to ensure that the shaft does not migrate out of position.

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THALES
AVIONICS ELECTRICAL SYSTEMS

MEMO

Dir/Dep DCP/ST

De/From : B. LE GALL

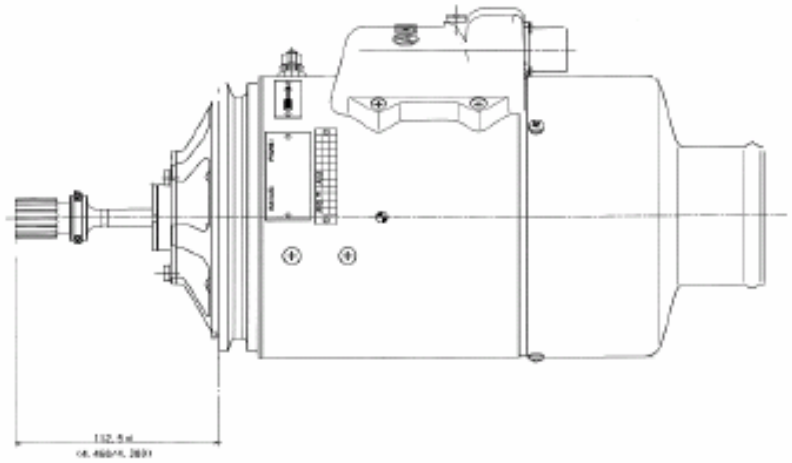
A/To : M. COMBEROUSSE (ECE)
C. COULOMBEL (INS)

Chatou May, 5th 2008

Ref : DC/ST/08/0088

Subject : Drive shaft mounting check on DC generator P/N A3579-101.

Here bellow is the outside dimension to be checked if the drive shaft is correctly connected inside the hollow shaft.



Dimension is 112,5 mm (+/- 1mm).

B. LE GALL
Technical Support Manager
THALES AVIONICS ELECTRICAL SYSTEM