A380 Fuel Pumps update

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Agenda

Type 20124 Feed Pump

PN 568-1-30750-101/151/102/103 (105)

Type 20126 Transfer Pump

PN 568-1-30760-101/102/200

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Issue/Application

- Platform
  - Airbus A380
- Aircraft Problem/ impact
  - Premature failures in-Service
- Description of problem
  - Pump inoperative
- Identify assembly/part number
  - Feed PN 568-1-30750-101/151/102/103 (105)
  - Transfer PN 568-1-30760-101 / 102 / 200 / 201
- Consequence
  - Requirement for MEL or flight delay

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Feed Pump Background

- Airbus A380 Feed pump is subject to premature failure in-Service
- Eaton receives approximately 30 pumps per month through our repairs facility in Titchfield, with a significant portion covered under warranty
- There are two versions of the pump in service, the MK102 and the MK103
  - The MK102 has a reliability of approx. 15,000 hours
  - The MK103 has a reliability of approx. 35,000 hours, but this is declining rapidly towards the average of 15,000 hours due to the young average age of the MK103 design
- Eaton has developed a new MK105 in collaboration with Airbus, based on the technology introduced into the MK201 Transfer pump
- The MK105 is currently undergoing Stringent qualification testing.

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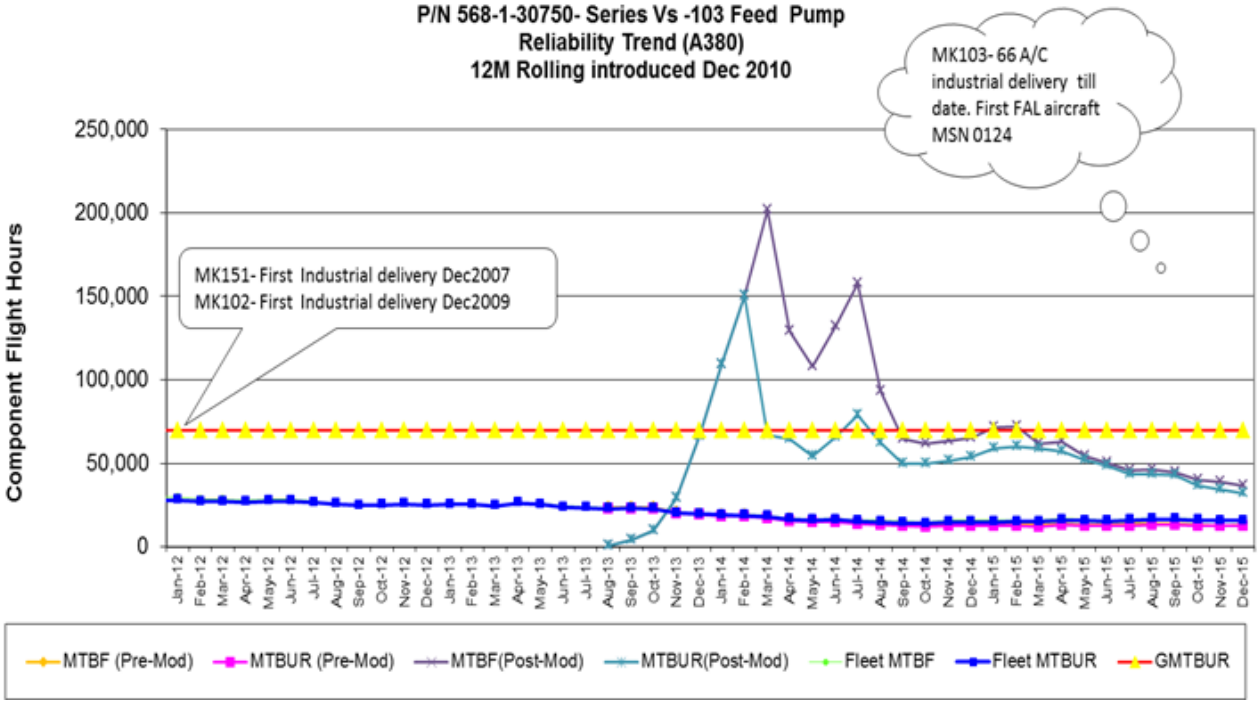
Feed Pump Reliability



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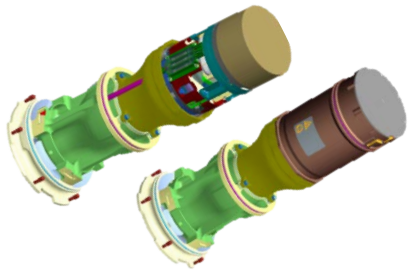
MK105 Technical Update

- To increase electronics maturity, EATON will implement the following five improvements to Mk105 issue B Feed Pump:
  - Incorporate diode to prevent MOSFET overvoltage generated by the inductance of the T401 primary coil
  - Add additional gate turn off resistor and diode to avoid undesirable stress of IGBTs due to shoot-through
  - Redesign current sense transformer (T401)
  - Increase maximum duty cycle limit to allow for more motor phase voltage – potential for No Fault Found
  - Redesign mechanical packaging of MOSFET and IGBT hybrids
- Plus the 10 amendment 2 EDES changes introduced on Mk200/Mk201 Transfer Pump
  - EDES 2091,2092,2093,2094,2095,2096,2097,2098,2099 & 2100
  - Changes to be realized by end of Q4-2015 – Complete
  - MK105 issue A vibration failure. Corrective actions implemented into Issue B
  - Issue B Pump passed vibration test
  - MK105 Production Availability end June 2016



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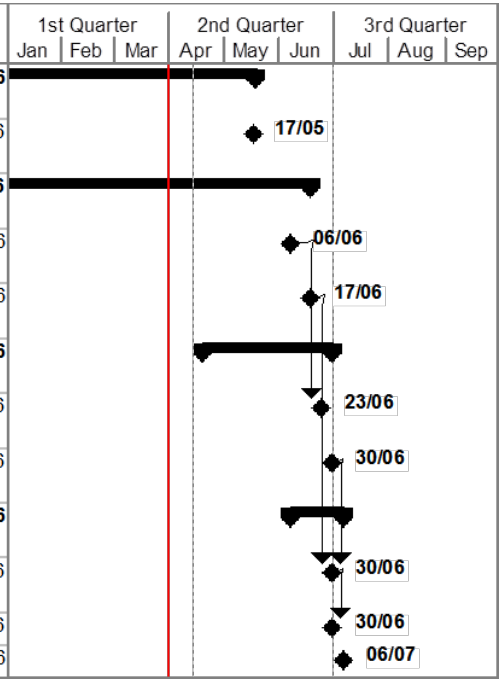
Qualification Test Plan

ID	Unavailable	% Complete	Task Name	Start	Finish
302		**31%**	**Qualification Testing**	**Thu 01/09/11**	**Wed 18/05/16**
345		0%	All Qualification Tests Complete	Tue 17/05/16	Tue 17/05/16
347		**63%**	**Qualification Test Reports**	**Tue 12/05/15**	**Fri 17/06/16**
402		0%	All Test Reports Submitted	Mon 06/06/16	Mon 06/06/16
403		0%	All Test Reports Approved by AUK	Fri 17/06/16	Fri 17/06/16
404		**0%**	**DDP Activities**	**Mon 18/04/16**	**Thu 30/06/16**
410		0%	DDP Final Release	Thu 23/06/16	Thu 23/06/16
413		0%	DDP Approved by AUK	Thu 30/06/16	Thu 30/06/16
414		**0%**	**Certification and Clearance**	**Mon 06/06/16**	**Wed 06/07/16**
415		0%	Qualification Reports and DDP Approved by Airbus	Thu 30/06/16	Thu 30/06/16
416		0%	Pump Cleared for FAL deliveries (Prototype)	Thu 30/06/16	Thu 30/06/16
420		0%	Pump cleared for Aftermarket deliveries	Wed 06/07/16	Wed 06/07/16



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Eaton Customer Support Plan

- Eaton has built & deployed additional pumps to the field – 40 Transfer, 65 Feed & 3 Trim
- Loan agreements in place with 80% of the fleet at this time
- All operators can benefit from Loan agreements
  - Quantity of Loan units based on IP calculation
- Flat-rate repair will help mitigate repair costs for out of warranty failures
- Eaton and Airbus working together to define the optimum EIS Strategy for MK105
- Continuation of In-service Support Plan on MK102/3 will ensure operators have loan units on-hand during transition to MK105
- Once reliability improvements are fully demonstrated (on both MK105 and Mk201), Eaton will agree with operators the return of FOC loan units

Eaton commit to continuing the support plan until such time that the MK105/MK201 performance is confirmed

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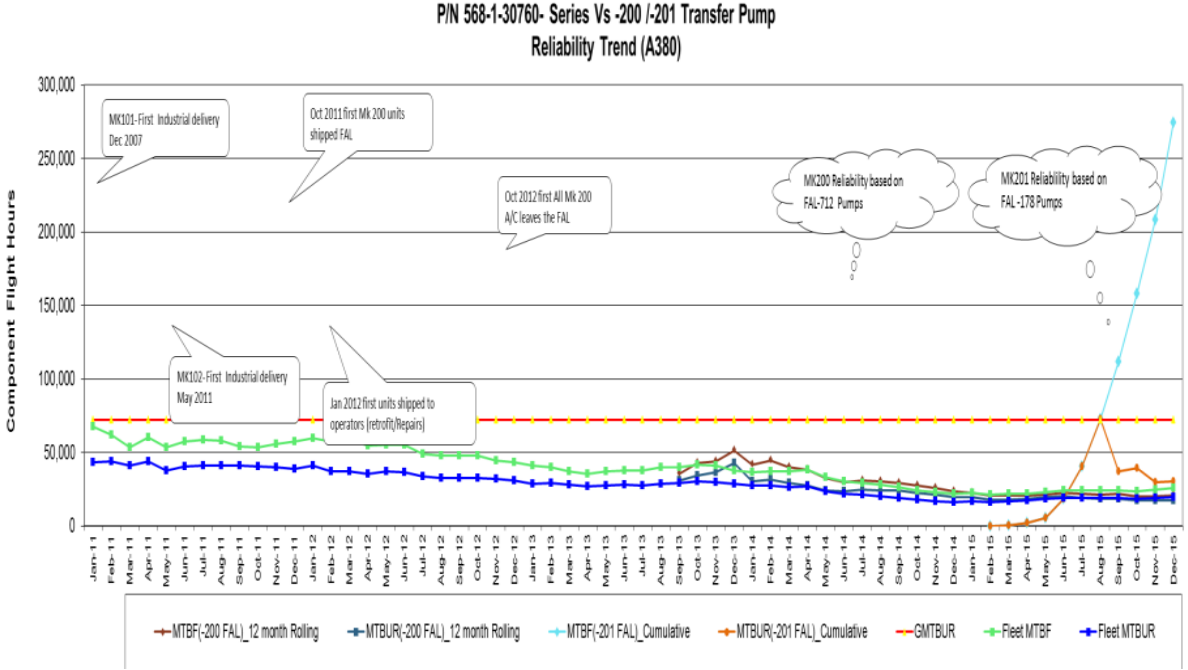
Transfer Pump Background

- MK200 upgrade introduced as a result of EASA directive to move the electronics “outside of fuel tank” as an additional safety layer
- Required complete redesign of electronics using hybrid technology to improve reliability - development fully funded by Airbus
- Eaton began delivering Mk200 pumps in Oct 2011
- In 2013 the Mk200 showed signs of early failure and higher return rates
- Airbus and Eaton suspended the Mk200 retrofit and launched the Task Force (Oct 13) with the aim of rapidly redesigning the Mk200
- In mid 2014 the improved Mk201 was introduced and the retrofit resumed, and completed in 2015
- Airbus content to let the Mk200s be converted to Mk201s by attrition. There are currently circa 650 Mk200s in-service still to be upgraded

Transfer Pump Reliability



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Questions/Comments

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