BOEING

737

BREAKOUT SESSION

Center Tank Fuel Pumps

Terry Sheehan
737NG Procedures Manager
Boeing Commercial Airplanes
May 2004

Hydro-Aire Fuel Pumps

Background

- Two areas of concern were identified on Hydro-Aire fuel pumps installed on 737-600/-700/-800/-900 airplanes
  - Wire chafing
  - Localized overheating
- Two separate Airworthiness Directives issued
  - Both mandated similar operational restrictions

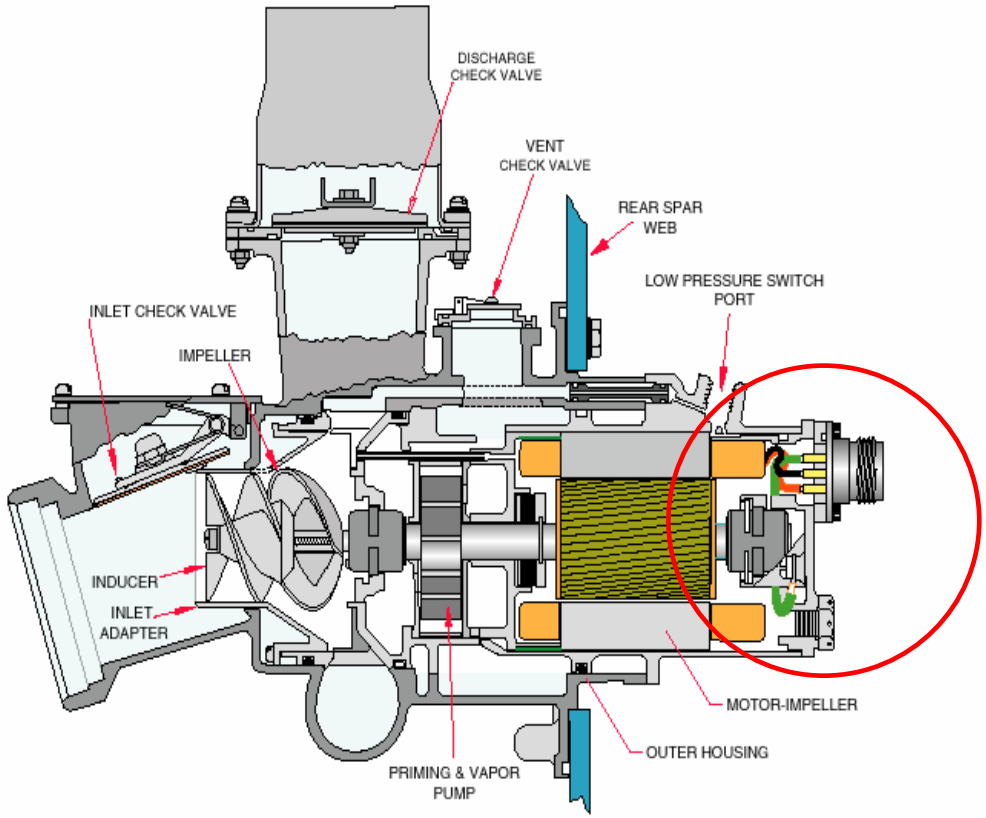
Background

Wire Chafing

- In August 2002, teardown of several failed Hydro-Aire fuel pumps indicated the potential existed for wires to come in contact with the rotor as a result of installation errors
- Evidence of arcing due to chafed wires was discovered

Background

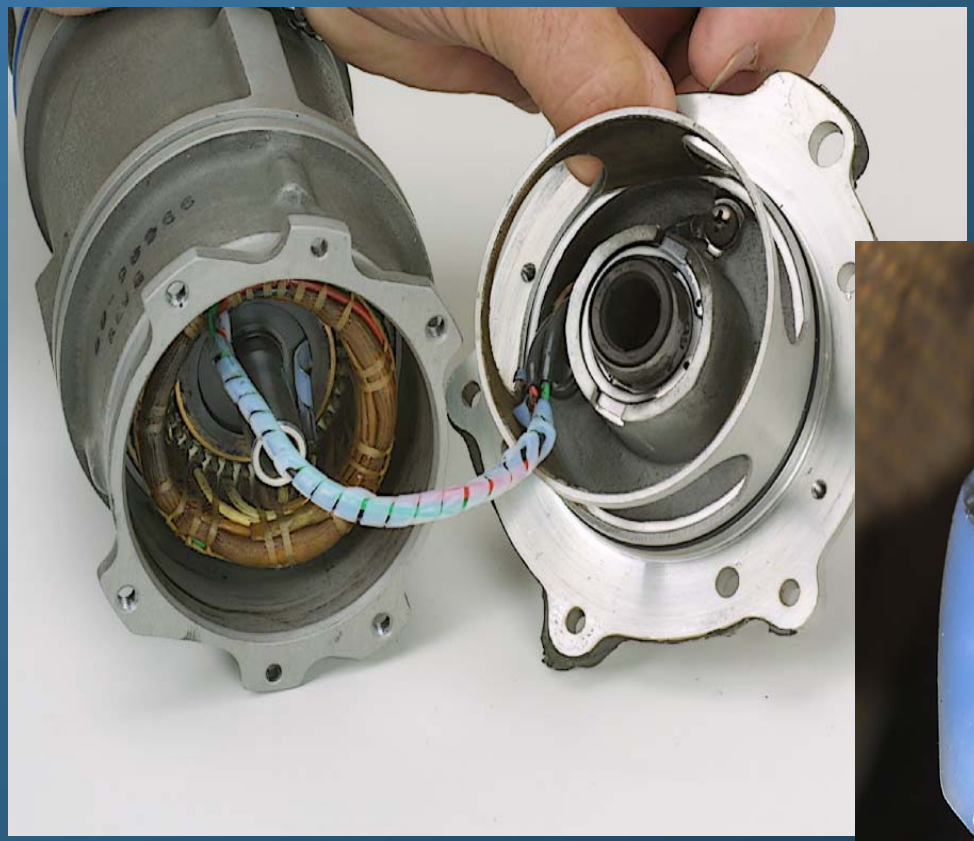
Wire Chafing



Fuel Pump Cross-Section

Background

Wire Chafing



Background

Wire Chafing

- In response, the FAA released AD 2002-19-52 which mandated operational restrictions
- The AD provided terminating action
  - Inspection of pumps per Boeing or Hydro-Aire Service Bulletin required prior to installation
  - Once center tank fuel pumps inspected and found to be in compliance, the operational restrictions could be removed on an airplane-by-airplane basis

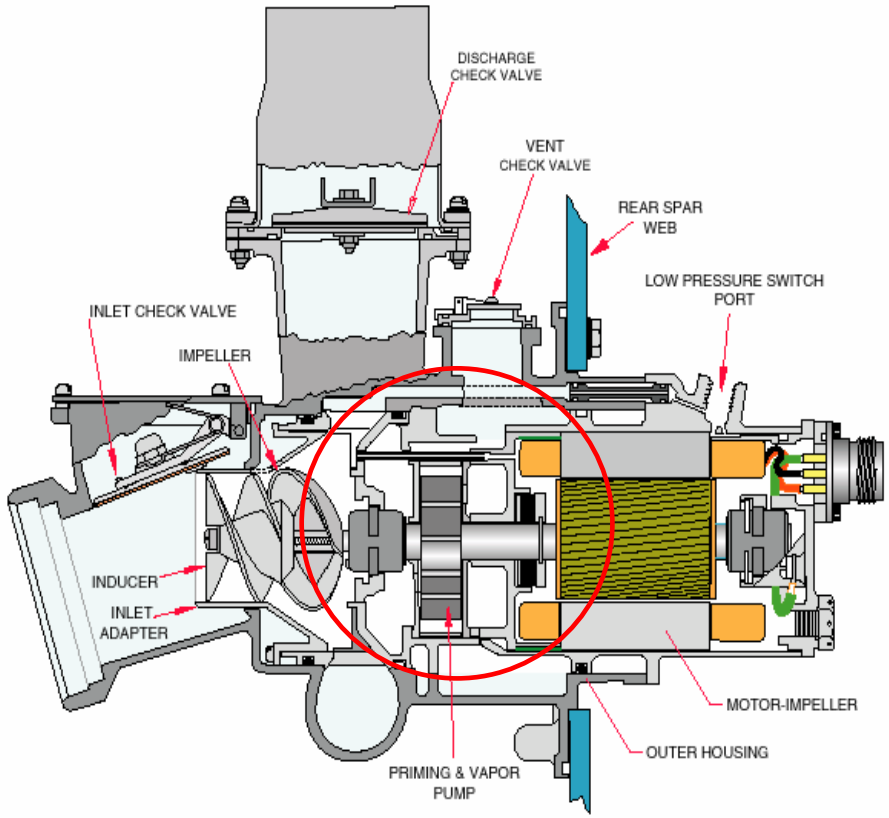
Background

Localized Overheating

- In October 2002, evidence of extreme localized overheating in the area of the primer impeller was found on several in-service fuel pumps
- Further investigations indicated the potential for extreme over-temperature exposure outside the explosion proof chamber of the fuel pump existed

Background

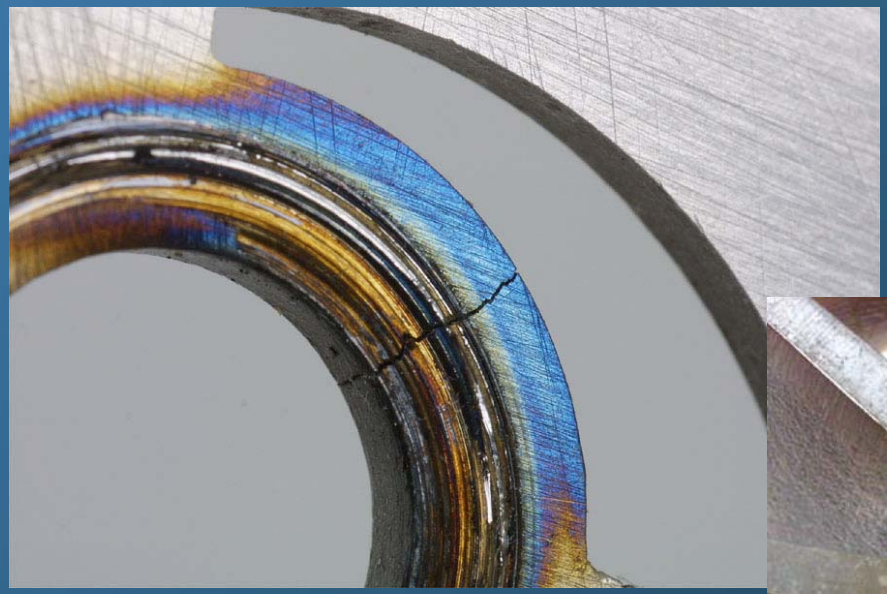
Localized Overheating



Fuel Pump Cross-Section

Background

Localized Overheating



Background

Localized Overheating

- The FAA released AD 2002-24-51 which reinstated the requirement to maintain minimum fuel levels to keep center fuel tank pump inlets covered
- No terminating action defined

Background

Alternative Method of Compliance (AMOC)

- In June 2003, the FAA issued Approval Letter 140S-03-189 to allow a “staged shutoff” following approved X-ray inspection of center tank fuel pumps
  - Allows all fuel in the center tank to be used
- A Flight Crew Operations Manual Bulletin was released to provide operating instructions
  - Either the AD procedures or the AMOC procedures to be used at the discretion of the airline

Design Improvements

Master Caution System

- Original Master Caution system logic requires both center tank fuel pumps to indicate low pressure before the Master Caution and FUEL annunciation illuminate
- With the new system logic, a low pressure condition for either center tank fuel pump will illuminate the Master Caution and FUEL annunciation

Design Improvements

Automatic Shutoff

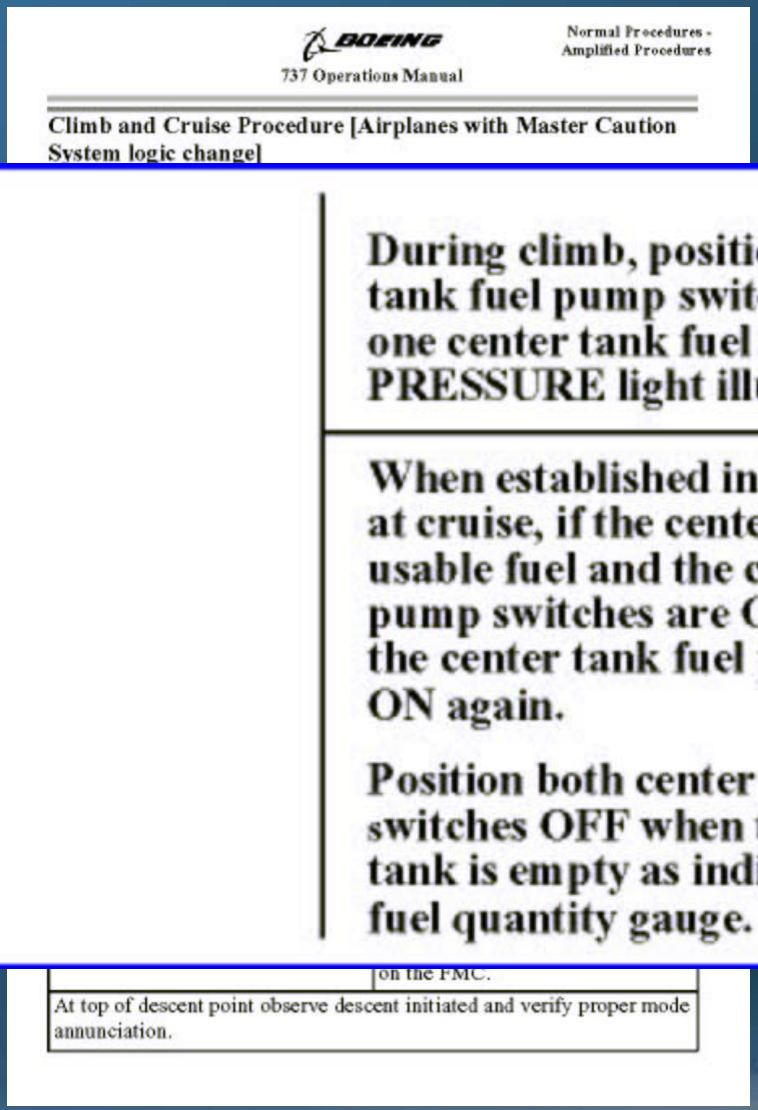
- A center tank fuel pump is automatically shut off after approximately 15 seconds of continuous low pressure
  - No indication to the flight crew
- Considered a backup to normal flight crew actions
- If fuel remains in the center tank, the system can be reset by turning the fuel pump switch OFF, then ON

Design Improvements

CONFIG Alert

- In the original design, the alert is displayed if the center fuel tank contains more than 1600 pounds/726 kilograms of fuel and both center tank pumps are producing low or no pressure
- In the new design, the alert will be displayed if the center tank contains more than 1600 pounds/726 kilograms of fuel and both center tank pumps are OFF

Revised Normal Procedures



FAA Action

- Boeing has proposed the Master Caution system logic change and center tank fuel pump automatic shutoff feature as terminating action for AD 2002-24-51
- Boeing believes the FAA will mandate these changes and propose a 36-month compliance time after release of the Service Bulletin
- FAA decision is imminent

Design Improvements

Availability – 737 NG

- All three design changes will be available in production in May 2004 (Line Number 1494 and on)
- Available via Service Bulletin in 4th Qtr 2004

Design Improvements

Availability – 737-200 through -500

- Master Caution system logic change will be available via Service Bulletin in 4th Qtr 2004
- Automatic shutoff feature will be available via Service Bulletin in 3th Qtr 2005

Design Improvements

Future Design Features

- Wire retention system
  - Prevents wires from contacting rotor due to installation errors
  - Scheduled to be available in 2nd Qtr 2005
  - Boeing is proposing this change as terminating action for AD 2002-19-52
- Replacement fuel pump
  - Scheduled to be available in 24 to 36 months