

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE

NUMBER: M4-1BG-PC010-X

SUBSYSTEM NAME: ELECTRICAL POWER GENERATION - CRYO, GENERIC

REVISION : 1 11/12/91

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
■ LRU :	PRÉSSURE CAP, O2	MC276-0010-0160
■	FAIRCHILD	74347000-0160

PART DATA

■ EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
PRESSURE CAP, O2 FILL, VENT AND HORIZONTAL DRAIN

- REFERENCE DESIGNATORS: 40V45P0010
- : 40V45P0011
- : 40V45P0020
- : 40V45P0021
- : 40V45P0025
- : 40V45P0410
- : 40V45P0411
- : 40V45P0500
- : 40V45P0501
- : 40V45P0600
- : 40V45P0601

■ QUANTITY OF LIKE ITEMS: 11
ELEVEN

■ FUNCTION:
PROVIDES A SECONDARY SEAL TO THE O2 FILL, VENT AND HORIZONTAL DRAIN
DISCONNECTS.

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
 NUMBER: M4-1BG-PC010-01

SUBSYSTEM: ELECTRICAL POWER GENERATION - CRYO, GENERIC
 LRU :PRESSURE CAP, O2
 ITEM NAME: PRESSURE CAP, O2

REVISION# 1 11/12/91 R
 CRITICALITY OF THIS FAILURE MODE:1R3

FAILURE MODE:
 EXTERNAL LEAKAGE

MISSION PHASE:

- ~~PL~~ ~~PRELAUNCH~~
- LJ LIFT-OFF
- OO ON-ORBIT
- OO OE-ORBIT
- ~~LS~~ ~~LANDING SAFING~~

- VEHICLE/PAYLOAD/KIT EFFECTIVITY: 102 COLUMBIA
- : 103 DISCOVERY
- : 104 ATLANTIS
- : 105 ENDEAVOUR

- CAUSE:
 VIBRATION, SEAL FAILURE, CONTAMINATION
- CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

- REDUNDANCY SCREEN A) PASS
- B) FAIL
- C) PASS

PASS/FAIL RATIONALE:

- A)
- B)
 REDUNDANCY SCREEN B - FLIGHT CAP SEALING INTEGRITY IS NONVERIFIABLE DUE TO THE INTERFACING DISCONNECT'S POPPET SEAL.
- C)

- FAILURE EFFECTS -

- (A) SUBSYSTEM:
 SUBSYSTEM DEGRADATION - LOSS OF O2 REACTANT NO GREATER THAN THE ASSOCIATED DISCONNECTS' ACCEPTED PREFLIGHT LEAK RATE. MAXIMUM ALLOWABLE LEAKAGE FOR THE FILL, VENT AND HORIZONTAL DRAIN DISCONNECTS

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
 NUMBER: M4-1BG-PC010-01

IS 900 SCOM.

- (B) INTERFACING SUBSYSTEM(S):
 DEGRADATION OF INTERFACE FUNCTION - LEAK ISOLATION MAY RESULT IN LOSS OF O2 REACTANT SUPPLY TO ONE FUEL CELL POWERPLANT.
- (C) MISSION:
 MINIMUM DURATION MISSION INVOKED.
- (D) CREW, VEHICLE, AND ELEMENT(S):
 NO EFFECT AFTER FIRST FAILURE.
- (E) FUNCTIONAL CRITICALITY EFFECTS:
 GROSS LEAKAGE AS A RESULT OF FAILURES OF A FLIGHT CAP AND THE ASSOCIATED DISCONNECT, MAY RESULT IN LOSS OF ALL THREE FUEL CELL POWERPLANTS DUE TO LOSS OF SYSTEM PRESSURE IF BOTH MANIFOLD ISOLATION VALVES FAIL TO CLOSE. LOSS OF SYSTEM PRESSURE WITH GROSS LEAKAGE OF FLIGHT CAP ON FILL OR VENT ALSO REQUIRES FAILS OPEN OF TANK CHECK VALVES.

 - DISPOSITION RATIONALE -

- (A) DESIGN:
 PRESSURE-ASSISTED TEFLON SEAL IS REPLACED PRIOR TO EVERY CAP INSTALLATION. POSITIVE LOCKING DESIGN. BODY IS CONSTRUCTED OF INCONEL 718 CORROSION RESISTANT STEEL. ALL MATERIALS ARE COMPATIBLE WITH WORKING FLUIDS.
- (B) TEST:
 QUALIFICATION TESTS INCLUDED; SINE (0.25 G PER AXIS AT 5 TO 35 HZ) AND RANDOM VIBRATION (34 MINUTES AT 1.0 G SQ/HZ, 14 MINUTES AT 0.5 G SQ/HZ) WITH THE UNIT PRESSURIZED (1060 PSIG) AND FLIGHT HALF MATED, 3 THERMAL CYCLES (-150 TO +350 DEG F) AND MATE/DEMATE CYCLES (100 AT AMBIENT TEMP). BURST TESTED AT 2045 PSI FOR 5 MINUTES.

 ACCEPTANCE TESTS INCLUDE; PROOF PRESSURE AT 1525 +/- 25 PSIG FOR 5 MINUTES AND LEAK TESTED FOR EXTERNAL LEAKAGE WITH THE UNIT PRESSURIZED AT 1060 +/- 25 PSIG.

 OMRSD: FLIGHT CAP LEAK CHECK PERFORMED EVERY TURNAROUND.
- (C) INSPECTION:
 RECEIVING INSPECTION
 TEST REPORTS AND MATERIALS CERTIFICATIONS ARE MAINTAINED CERTIFYING MATERIALS AND PHYSICAL PROPERTIES.

CONTAMINATION CONTROL

PAGE: 4

PRINT DATE: 04/01/92

129

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
NUMBER: M4-1BG-PC010-01

THE PART IS CLEANED PER REQUIREMENTS OF MA0110-301 LEVEL 200A AS A PART OF THE ATP. CORROSION PROTECTION AND COMPLIANCE WITH THE CONTAMINATION CONTROL PLAN ARE VERIFIED.

ASSEMBLY/INSTALLATION
MANUFACTURING PROCESSES, ASSEMBLY AND INSTALLATION REQUIREMENTS ARE VERIFIED BY INSPECTION.

CRITICAL PROCESSES
PASSIVATION AND APPLICATION OF DRY-LUBE ARE VERIFIED BY INSPECTION.

TESTING
CAP EXTERNAL LEAKAGE IS VERIFIED DURING ATP.

■ (D) FAILURE HISTORY:

CAR NO. A7391-010 H2 SUPPLIER, ATP
A7392-000 O2 SUPPLIER, ATP
A7393-000 H2 SUPPLIER, ATP
A7414-000 H2 SUPPLIER, ATP
A7767-010 O2 SUPPLIER, ATP
A7768-000 O2 SUPPLIER, ATP

3 O2 AND 3 H2 FLIGHT CAPS HAVE BEEN REPORTED LEAKING DURING ACCEPTANCE TESTING AS A RESULT OF A DEFORMED RACCO TEFLON SEAL. DEFORMATION OCCURRED AS A RESULT OF THE LOCKING NUT ASSEMBLY BEING TORQUED TO 20-30 IN/LBS VERSUS THE REQUIRED 150-180 IN/LBS. CORRECTIVE ACTION INCLUDED A REVISION TO THE MASTER ROUTE SHEET TO INCLUDE PROPER TORQUE INSTRUCTIONS PRIOR TO RUNNING PRESSURE TEST.

CAR NO. A6275-C10 O2 SUPPLIER, ATP
AN O2 FLIGHT CAP WAS REPORTED LEAKING AS A RESULT OF A DEFECTIVE RACCO SEAL. THE INSPECTION PROCEDURES WERE REVIEWED AND DETERMINED TO BE ADEQUATE.

EACH ITEM IN THE LOT WAS REINSPECTED AND FOUND TO BE ACCEPTABLE, INDICATING ADEQUACY OF THE MANUFACTURING PROCESSES AND CONTROLS. IT WAS THEREFORE CONCLUDED THAT THE FAILURE WAS A RANDOM OCCURRENCE.

NOTE: A REQUIREMENT WAS IMPOSED REQUIRING THE INSPECTION OF EVERY SEAL IN FUTURE LOTS.

CAR NO. A9555-010 H2 SUPPLIER, QUALIFICATION
AN H2 FLIGHT CAP EXHIBITED OUT OF SPECIFICATION LEAKAGE IMMEDIATELY FOLLOWING THE FIRST CYCLE OF MATING AT CRYOGENIC TEMPERATURE (-423 DEG F) DURING QUALIFICATION TESTING. THE FAILURE WAS DETERMINED TO BE PRIMARILY ATTRIBUTED TO THE TEST TECHNIQUE AND FAULTY TEST EQUIPMENT, AND NOT A FAILURE OF THE PRESSURE CAP.
CORRECTIVE ACTION INCLUDED: A TEST FIXTURE REDESIGN, INCORPORATION OF

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
NUMBER: M4-196-PC010-01

A HELIUM PURGE DURING CHILLDOWN AND A REVISED METHOD FOR DETERMINING LEAKAGE. ALSO, THE PRESSURE CAP WAS TESTED AT -150 DEG F INSTEAD OF -123 DEG F (ANALYSIS INDICATED THAT BOTH O2 AND H2 FLIGHT CAPS WILL NEVER EXPERIENCE TEMPERATURES BELOW -150 DEG F).

CAR NO. AC1246-G10 O2 SUPPLIER, ATP
AN O2 FLIGHT CAP EXHIBITED OUT OF SPECIFICATION LEAKAGE DURING ITS ACCEPTANCE TEST. THE PROBLEM WAS CLOSED AS AN ATP SCREENABLE FAILURE.

NOTE: GENERAL REQUIREMENTS HAVE BEEN INCORPORATED TO THE FILE !!! EPG/ PRSD OMRSD REQUIRING THE FLUSHING OF ALL APC/GHC INTERFACES WITH FRESH TF PRIOR TO DISCONNECT MATING AND TO REPLACE CAP INTERFACE SEALS PRIOR TO EACH INSTALLATION.

- (E) OPERATIONAL USE:
CREW WILL PERFORM CRYO ISOLATION PROCEDURE AND ISOLATE LEAK TO AFFECTED MANIFOLD AFTER TWO FAILURES. *(APPLICABLE TO HORIZONTAL DRAW ONLY)*.

- APPROVALS -

RELIABILITY ENGINEERING: M. D. WEST
 DESIGN ENGINEERING : M. M. SCHEIERN
 QUALITY MANAGER : O. J. BUTTNER
 NASA RELIABILITY :
 NASA SUBSYSTEM MANAGER :
 NASA QUALITY ASSURANCE :

: *M. D. West*
 : *M. M. Scheiern*
 : *O. J. Buttner*
 : *Tom J. Standinger*
 : *Edward Vance 2/1/92*
 : *Jeff M. ... 2/9/92*