

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL HARDWARE
NUMBER: 04-1A-0105 -X

SUBSYSTEM NAME: ELECTRICAL POWER (FCP)

REVISION: 0 04/07/88

PART DATA

| PART NAME | PART NUMBER |
|------------------------------------|-----------------|
| VENDOR NAME | VENDOR NUMBER |
| LRU : PORT HYDROGEN PURGE ASSEMBLY | V070-454720-004 |

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
PORT HYDROGEN PURGE ASSEMBLY

REFERENCE DESIGNATORS: 40V45VP052

QUANTITY OF LIKE ITEMS: 1
ONE

FUNCTION:
VENTS HYDROGEN FROM THREE FUEL CELLS DURING PURGE OPERATION AND PROVIDES PATH FOR H2 REGULATOR RELIEF VENTING

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REVISION#: 1 03/27/96

SUBSYSTEM NAME: ELECTRICAL POWER GENERATION: FUEL CELL

LRU: PORT HYDROGEN PURGE ASSEMBLY

CRITICALITY OF THIS

ITEM NAME: PORT HYDROGEN PURGE ASSEMBLY

FAILURE MODE: 1R2

FAILURE MODE:

PLUGGED, FAILS TO VENT HYDROGEN DURING PURGE OPERATION OR REGULATOR VENTING DUE TO CONTAMINATION AND/OR BY FREEZING CLOSED.

MISSION PHASE:

PL PRE-LAUNCH
 LO LIFT-OFF
 OO ON-ORBIT
 DO DE-ORBIT
 LS LANDING/SAFING

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

CAUSE:

CONTAMINATION, VENT HEATER FAILURE. (REFERENCE FMEA 04-1A-0149.)

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN A) PASS
 B) N/A
 C) PASS

PASS/FAIL RATIONALE:

A)

B)

PASSED FOR PURGE OPERATION AND IS N/A FOR REGULATOR RELIEF FUNCTION WHICH IS STANDBY REDUNDANCY.

C)

- FAILURE EFFECTS -

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(A) SUBSYSTEM:

SUBSYSTEM DEGRADATION - POWER OUTPUT FROM ALL FUEL CELL POWER PLANTS WOULD BE DEGRADED AND EVENTUALLY UNUSABLE. INABILITY OF H2 PRESSURE REGULATOR TO RELIEVE PRESSURE IF REQUIRED. EXTERNAL LEAKAGE OF FUEL CELL MAY RESULT (REFERENCE FMEA 04-1A-0101-4).

(B) INTERFACING SUBSYSTEM(S):

DEGRADATION OF INTERFACE FUNCTION - POWER AVAILABLE TO OTHER SYSTEMS WOULD DECREASE.

(C) MISSION:

ABORT DECISION.

(D) CREW, VEHICLE, AND ELEMENT(S):

NO EFFECT - SUFFICIENT TIME FOR ABORT IF REQUIRED. CREW ACTION IS REQUIRED TO SHUTDOWN FUEL CELL IF PRESSURE REGULATOR FAILURE OCCURS REQUIRING RELIEVING CAPABILITY. FUEL CELL OVERPRESSURIZATION COULD RESULT IN CATASTROPHIC FAILURE.

(E) FUNCTIONAL CRITICALITY EFFECTS:

-DISPOSITION RATIONALE-

(A) DESIGN:

REDUNDANT PURGE PORT HEATERS ARE INSTALLED TO PREVENT BLOCKAGE DUE TO MOISTURE FREEZING. THE PURGE PORT IS FABRICATED FROM INCONEL 718 WITH A MINIMUM INTERNAL DIAMETER OF 0.145 INCHES TO MINIMIZE POTENTIAL FOR BLOCKAGE BY CONTAMINATION.

(B) TEST:

VACUUM CHAMBER TESTS VERIFIED THERMAL DESIGN. OV-102 DEVELOPMENT FLIGHT TEST PERFORMED FOR ADDITIONAL THERMAL DESIGN VERIFICATION.

FLOW THROUGH TEST PER ML0720-4501 IS VERIFIED AFTER INSTALLATION.

OMRSD: PRELAUNCH GROUND OPERATIONS VERIFY CONTINUOUS FLOW THROUGH CAPABILITY. PURGING ABILITY IS VERIFIED DURING PRELAUNCH FUEL CELL STARTUP

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AND FUEL CELL PERFORMANCE ON DC BUS OPERATIONS. FUEL CELL PURGE HEATERS ARE VERIFIED EACH MISSION CYCLE.

(C) INSPECTION:

RECEIVING INSPECTION

HARDWARE IS INSPECTED IN ACCORDANCE WITH QUALITY PLANNING REQUIREMENTS DOCUMENT WHICH HAS BEEN APPROVED BY NASA. MATERIAL USED IS VERIFIED BY INSPECTION ON PURCHASE ORDER FROM SPACE DIVISION CONTROLLED DRAWINGS.

CONTAMINATION CONTROL

CLEANED TO LEVEL 200A OF THE CLEANLINESS SPECIFICATION. PART IS ASSEMBLED IN A CONTROLLED ENVIRONMENT AREA. CLEANLINESS IS MAINTAINED DURING ASSEMBLY AND VERIFIED BY INSPECTION ON MANUFACTURING ORDERS.

ASSEMBLY/INSTALLATION

PROTECTION OF CONNECTOR SEALING SURFACES (8 RMS FINISH) IS MAINTAINED DURING MACHINING OPERATIONS. MACHINE TOLERANCES ARE PER DRAWING AND MACHINING SPECIFICATIONS AND ARE VERIFIED BY INSPECTION. CORROSION PROTECTION IS PER DRAWING AND APPLICABLE SPECIFICATION AND IS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

PENETRANT INSPECTION IS REQUIRED AND VERIFIED BY INSPECTION.

CRITICAL PROCESSES

ALL CRITICAL PROCESSES AND CERTIFICATIONS ARE MONITORED AND VERIFIED BY INSPECTION. CRITICAL PROCESSES ARE MACHINING AND CORROSION PROTECTION.

TESTING

PREFLIGHT FUNCTIONAL TEST IS MONITORED TO VERIFY THAT FLOW RATE DURING PURGE OPERATION IS WITHIN SPECIFIED LIMITS.

(D) FAILURE HISTORY:

CURRENT DATA ON TEST FAILURES, FLIGHT FAILURES, UNEXPLAINED ANOMALIES, AND OTHER FAILURES EXPERIENCED DURING GROUND PROCESSING ACTIVITY CAN BE FOUND IN THE PRACA DATA BASE.

THERE HAVE BEEN NO ACCEPTANCE TEST, QUALIFICATION TEST, FIELD OR FLIGHT FAILURES ASSOCIATED WITH THIS FAILURE MODE.

(E) OPERATIONAL USE:

CREW CAN MANUALLY TURN ON PURGE HEATERS TO ELIMINATE POSSIBLE ICE BLOCKAGE. POWER DOWN PROCEDURES MAY BE EMPLOYED TO REDUCE REQUIREMENT FOR PURGING IF NECESSARY.

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- APPROVALS -

PAE MANAGER : D. F. MIKULA
 PRODUCT ASSURANCE ENGR : L. X. DANG
 DESIGN ENGINEERING : MUSTIN, LLOYD
 NASA SSMA :
 NASA SUBSYSTEM MANAGER :

D.F. Mikula 29 MAR 96
L.X. Dang 3/29/96
Mustin, Lloyd 3-28-96
SSMA 6/18/97
Approved / 7/6/96 6/1/97