FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE
NUMBER: M4-1BG-LV033-X

SUBSYSTEM NAME: ELECTRICAL POWER GENERATION - CRYO, GENERIC
REVISION : 1 11/12/91

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
■ SRU :	SOLENOID VALVE, H2 REACTANT	MC284-0429-4200
■	EATON CONSOLIDATED CONTROLS	74405-4200
■ SRU :	SOLENOID VALVE, H2 REACTANT	MC284-0429-4201
■	EATON CONSOLIDATED CONTROLS	74405-4201

PART DATA

■ EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
SOLENOID VALVE, H2 REACTANT

■ REFERENCE DESIGNATORS: 40V45LV033
: 40V45LV043
: 40V45LV044

■ QUANTITY OF LIKE ITEMS: 3
ONE PER H2 MANIFOLD #1
TWO PER H2 MANIFOLD #2

■ FUNCTION:
PROVIDES CAPABILITY TO ISOLATE H2 FROM ASSOCIATED FUEL CELL.

FAILURE MODES EFFECTS ANALYSIS FMEA – CIL FAILURE MODE
NUMBER: M4-1BG-LV033- 02

REVISION#: 2 03/27/96
SUBSYSTEM NAME: ELECTRICAL POWER GENERATION - CRYO, GENERIC
LRU: CRITICALITY OF THIS
ITEM NAME: SOLENOID VALVE, H2 REACTANT FAILURE MODE: 1R2

FAILURE MODE:
FAILS CLOSED

MISSION PHASE: LO LIFT-OFF
DO DE-ORBIT

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

CAUSE:
MECHANICAL SHOCK, VIBRATION

CRITICALITY 1/1 DURING INTACT ABORT ONLY?

REDUNDANCY SCREEN
A) PASS
B) PASS
C) PASS

PASS/FAIL RATIONALE:
A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
SUBSYSTEM DEGRADATION - SYSTEM CAN NO LONGER PROVIDE H2 TO THE ASSOCIATED FUEL CELL.

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(B) INTERFACING SUBSYSTEM(S):
DEGRADATION OF INTERFACE FUNCTION - LOSS OF ASSOCIATED FUEL CELL. REDUCED ELECTRICAL POWER SUPPLY TO EPD&C.

(C) MISSION:
NO EFFECT AFTER FIRST FAILURE. MINIMUM DURATION MISSION INVOKED. (CAPABILITY EXISTS FOR SAFE RETURN ON 1 OF 3 FUEL CELLS).

(D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT ON CREW OR VEHICLE AFTER LOSS OF ONE FCP.

(E) FUNCTIONAL CRITICALITY EFFECTS:
POSSIBLE LOSS OF CREW/VEHICLE AS A RESULT OF LOSS OF TWO FCP'S DURING ASCENT. LOSS OF TWO FUEL CELLS DURING DESCENT LOSES CREW/VEHICLE IF INSUFFICIENT TIME IS AVAILABLE FOR AN ELECTRICAL LOAD RECONFIGURATION RESULTING IN THE INABILITY OF THE SINGLE REMAINING FUEL CELL TO SUPPLY ADEQUATE ELECTRICAL POWER.

-DISPOSITION RATIONALE-

(A) DESIGN:
VALVE IS MAGNETICALLY LATCHED OPEN. 50 MICRON ABS FILTER AT THE INLET. VALVE CONTAINS NO SOFT GOODS IN CONTACT WITH THE FLUID. MOVING PARTS ARE GOLD PLATED TO REDUCE FRICTION. HOUSING IS CONSTRUCTED OF CRES 304 TO PREVENT CORROSION. ALL VALVE COMPONENTS ARE COMPATIBLE WITH WORKING FLUIDS. VALVE IS MOUNTED WITH BODY AXIS PERPENDICULAR TO VEHICLE X-AXIS TO MINIMIZE VIBRATION EFFECTS. THIS FAILURE MODE IS ON CAUTION AND WARNING. VALVE IS DESIGNED TO OPEN WITH A MINIMUM OF 18 VOLTS (NOMINAL ORBITER BUS VOLTAGE IS 28 VOLTS).

(B) TEST:
QUALIFICATION TEST VERIFIED NORMAL OPERATION DURING SHOCK (20 G) AND VIBRATION (0.1 G SQ/HZ MAXIMUM RANDOM, +/- 0.25 G PEAK SINUSOIDAL) AND THERMAL OPERATING LIFE TEST (TOTAL OF 3000 CYCLES FROM -410 TO +220 DEG F AT OPERATING PRESSURE).

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ACCEPTANCE TEST VERIFIES FUNCTIONAL OPERATION OF MAGNETIC LATCHES AND THAT PRESSURE DROP IS WITHIN LIMITS. VALVE IS VERIFIED CLEANED TO LEVEL 200 BY PARTICLE COUNT. VALVE IS FURTHER VERIFIED DURING PANEL MODULAR ASSEMBLY AND SUBSYSTEM CHECKOUT.

OMRSD: VALVE OPERATION VERIFIED EVERY TURNAROUND.

(C) INSPECTION:
RECEIVING INSPECTION
MATERIAL AND PROCESS CERTIFICATION DOCUMENTS ARE REVIEWED FOR COMPLIANCE WITH PROGRAM REQUIREMENTS.

ASSEMBLY/INSTALLATION
ALL DETAIL PARTS ARE INSPECTED UNDER 40X MAGNIFICATION FOR SURFACE FINISH BURRS AND DAMAGE. THREAD LUBRICATION, TORQUING AND LOCKWIRE IS VERIFIED BY INSPECTION. DOCUMENTATION IS REVIEWED TO VERIFY RECORDING OF SHIM AND GAP DIMENSIONS USED TO OBTAIN AND MEASURE ARMATURE STROKE.

TESTING
ALL SPRINGS ARE LOAD TESTED AT DETAIL LEVEL AND ARE LOT TRACEABLE. LATCH FORCES ARE CALIBRATED AND VERIFIED BY INSPECTION DURING FINAL ACCEPTANCE OF THE MAGNETIC LATCH. VALVE ACCEPTANCE TEST REQUIREMENTS, INCLUDING INTERNAL/EXTERNAL LEAKAGE AND PRESSURE DROP ARE VERIFIED BY INSPECTION. VALVE PRESSURE DROP/FLOWRATE IS VERIFIED DURING ACCEPTANCE TEST.

HANDLING/PACKAGING
HANDLING, PACKAGING, STORAGE AND SHIPPING PROVISIONS ARE VERIFIED BY INSPECTION.

(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.

(E) OPERATIONAL USE:
CREW WILL PERFORM MAIN BUS TIE, ATTEMPT TO REOPEN REACTANT VALVE, AND SHUT DOWN ASSOCIATED FUEL CELL IF UNSUCCESSFUL.

- APPROVALS -

PAE MANAGER	: D. F. MIKULA	: D.F. Mikula 3/29/96
PRODUCT ASSURANCE ENGR	: L. X. DANG	: Lan Dang 3/29/96

PRINT DATE: 03/28/96

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NUMBER: M4-1BG-LV033-02

DESIGN ENGINEERING	: G. AVILA	: 3/28/96
NASA SSMA	:	:
NASA SUBSYSTEM MANAGER	:	: 6/6/97