FAILURE MODES EFFECTS ANALYSIS (FMEA) – CIL HARDWARE
NUMBER: M4-1BG-RV031 -X

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

PART DATA

	PART NAME **VENDOR NAME**	**PART NUMBER** **VENDOR NUMBER**
SRU	: RELIEF VALVE, H2 MANIFOLD PARKER HANNIFIN	MC284-0440-0004 5750004-101

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
RELIEF VALVE, H2 MANIFOLD

REFERENCE DESIGNATORS: 40V45RV031
40V45RV041

QUANTITY OF LIKE ITEMS: 2
ONE PER H2 MANIFOLD

FUNCTION:
PROVIDES OVERPRESSURIZATION PROTECTION OF H2 MANIFOLD AND LINES.

FAILURE MODES EFFECTS ANALYSIS FMEA – NON-CIL FAILURE MODE
NUMBER: M4-1BG-RV031- 01

REVISION#: 2 08/09/96
SUBSYSTEM NAME: ELECTRICAL POWER GENERATION - CRYO, GENERIC
LRU:
ITEM NAME: RELIEF VALVE, H2 MANIFOLD
CRITICALITY OF THIS FAILURE MODE: 1R3

FAILURE MODE:
FAILS OPEN OR INTERNAL LEAKAGE

MISSION PHASE:
LO LIFT-OFF
OO ON-ORBIT
DO DE-ORBIT

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

CAUSE:
MECHANICAL SHOCK, VIBRATION, CONTAMINATION

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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

PASS/FAIL RATIONALE:
A)

B)
REDUNDANCY SCREEN B - N/A SINCE RELIEF VALVE IS CONSIDERED STANDBY REDUNDANT.

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
NO EFFECT AFTER FIRST FAILURE. FAILED CONDITION WOULD NOT BE DETECTED DURING NORMAL SYSTEM OPERATION.

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- NON-CIL FAILURE MODE
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(B) INTERFACING SUBSYSTEM(S):
SAME AS (A)

(C) MISSION:
SAME AS (A)

(D) CREW, VEHICLE, AND ELEMENT(S):
SAME AS (A)

(E) FUNCTIONAL CRITICALITY EFFECTS:
AN ADDITIONAL FAILURE OF THE ASSOCIATED TANK RELIEF VALVE, FAILING OPEN, MAY RESULT IN LOSS OF SYSTEM PRESSURE IF BOTH MANIFOLD ISOLATION VALVES FAIL TO CLOSE. LOSS OF SYSTEM PRESSURE RESULTS IN LOSS OF ALL THREE FUEL CELL POWERPLANTS (LOSS OF CREW/VEHICLE).

-DISPOSITION RATIONALE-

(A) DESIGN:
POPPET TRAVEL IS PERPENDICULAR TO LAUNCH ACCELERATION FORCES. CRACK PRESSURE IS 50 PSI GREATER THAN THE TANK UPPER CONTROL PRESSURE. VALVE IS CONSTRUCTED OF CRES METALS, CARBON COMPOSITION (VESPEL), AND 6061-T651 ALUMINUM WHICH IS NOT IN CONTACT WITH THE WORKING FLUID. ALL MOVING PARTS ARE CRES.

(B) TEST:
QUALIFICATION TESTS INCLUDED; MECHANICAL SHOCK (20 G), SINUSOIDAL VIBRATION (+/- 0.25 G PEAK), RANDOM VIBRATION (0.05 G SQ/HZ MAXIMUM FOR 48 MINUTES), OPERATING CYCLES (1500 AT AMBIENT AND 1400 AT LH2 TEMP), AND THERMALLY CYCLED 5 TIMES (START INITIALLY AT +220 DEG F AND FLOW UNTIL INLET TEMP DROPS TO -360 DEG F).

ACCEPTANCE INCLUDES FUNCTIONAL TEST WITH THERMAL CYCLES (AMBIENT TO +220 DEG F TO AMBIENT TO -300 DEG F TO AMBIENT). VALVE IS FURTHER FUNCTIONALLY VERIFIED DURING PANEL MODULAR ASSEMBLY AND SUBSYSTEM CHECKOUT.

OMRSD: RELIEF VALVE CRACK AND RESEAT TEST PERFORMED DURING EVERY ORBITER MAINTENANCE DOWN PERIOD (OMDP) OR IF VALVE OPERATED DURING THE PREVIOUS FLIGHT OR TURNAROUND.

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(C) INSPECTION:
RECEIVING INSPECTION
TEST REPORTS AND MATERIALS CERTIFICATIONS ARE MAINTAINED CERTIFYING MATERIALS AND PHYSICAL PROPERTIES.

CONTAMINATION CONTROL
CLEANLINESS PER SPECIFICATION TO LEVEL 200A IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
ALL PARTS ARE PROTECTED FROM DAMAGE AND CONTAMINATION. DIMENSIONAL AND SURFACE FINISH ARE VERIFIED. ALL SURFACES REQUIRING CORROSION PROTECTION ARE CERTIFIED. MANDATORY INSPECTION POINTS ARE INCLUDED IN THE ASSEMBLY PROCEDURE.

CRITICAL PROCESSES
PASSIVATION AND APPLICATION OF BRAYCOTE LUBE IS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
ALL INTERNAL WELDS ARE VERIFIED BY THE FOLLOWING INSPECTIONS: 4X VISUAL, DIMENSIONAL, DYE PENETRANT, AND RADIOGRAPHIC EXAMINATION.

TESTING
PROOF PRESSURE TESTING DURING ATP VERIFIES STRUCTURAL INTEGRITY OF THE VALVE AND IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING
PACKAGING FOR SHIPMENT IS VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:
THERE HAVE BEEN NO ACCEPTANCE TEST, QUALIFICATION TEST, FIELD OR FLIGHT FAILURES ASSOCIATED WITH THIS FAILURE MODE.

(E) OPERATIONAL USE:
NO CREW ACTION AFTER FIRST FAILURE. CREW WOULD ATTEMPT TO ISOLATE SUBSEQUENT TANK LEAK BY CLOSING MANIFOLD VALVE.

- APPROVALS -

EDITORIALLY APPROVED	: RI	: Laura D Lewis 8/12/96
EDITORIALLY APPROVED	: JSC	: Tom Tracy 9-3-96
TECHNICAL APPROVAL	: VIA JSC	:96-CIL-012