

FAILURE MODES EFFECTS ANALYSIS (FMEA) - CIL HARDWARE
NUMBER: M4-1BG-RV011 -X

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

PART DATA

PART NAME	PART NUMBER
VENDOR NAME	VENDOR NUMBER
SRU : RELIEF VALVE, O2 MANIFOLD PARKER HANNIFIN	MC284-0440-0003 575003-101

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
RELIEF VALVE, O2 MANIFOLD

REFERENCE DESIGNATORS: 40V45RV011
40V45RV021

QUANTITY OF LIKE ITEMS: 2
ONE PER O2 MANIFOLD

FUNCTION:
PROVIDES OVERPRESSURIZATION PROTECTION OF O2 MANIFOLD AND LINES.

FAILURE MODES EFFECTS ANALYSIS FMEA -- NON-CIL FAILURE MODE

NUMBER: M4-1BG-RV011- 01

REVISION#: 2 08/09/96

SUBSYSTEM NAME: ELECTRICAL POWER GENERATION - CRYO, GENERIC

LRU:

CRITICALITY OF THIS

ITEM NAME: RELIEF VALVE, O2 MANIFOLD

FAILURE MODE: 1R3

FAILURE MODE:

FAILS OPEN OR INTERNAL LEAKAGE

MISSION PHASE:

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:

MECHANICAL SHOCK, VIBRATION

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.

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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 100 PSI GREATER THAN THE TANK UPPER CONTROL PRESSURE. VALVE IS CONSTRUCTED OF CRES METALS, CARBON COMPOSITES (VESPEL), AND 6061-T651 ALUMINUM WHICH IS NOT IN CONTACT WITH THE WORKING FLUID. ALL MOVING PARTS ARE CRES.

(B) TEST:
QUALIFICATION TESTS INCLUDE; 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 LO2 TEMP), AND THERMALLY CYCLED 5 TIMES (START INITIALLY AT +200 DEG F AND FLOW UNTIL INLET TEMP DROPS TO -297 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 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:

CAR NO. AC0124-010 KSC, OV-102, GROUND CHECK

EXCESSIVE LOSS OF MANIFOLD PRESSURE WAS DETECTED DURING OV-102 SUBSYSTEM CHECKOUT. LEAKAGE WAS ISOLATED TO THE MANIFOLD RELIEF VALVE AND/OR CHECK VALVE. THIS LEAKAGE FELL WITHIN SPECIFICATION WITH FURTHER OPERATION WHICH PROMPTED MONITORING OF SYSTEM PERFORMANCE WITH FURTHER USE. THE LEAKAGE WAS SUSPECTED TO BE CAUSED BY A CONTAMINANT WHICH CLEARED ITSELF WITH SUBSEQUENT USE.

(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
EDITORIALLY APPROVED : JSC
TECHNICAL APPROVAL : VIA JSC

: *Kayra G. Leman 8/12/96*
: *Tom Scary 9-3-96*
: 98-CIL-012