

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE

NUMBER: 03-1-0608 -X

SUBSYSTEM NAME: MAIN PROPULSION

REVISION: 1 02/22/01

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
LRU	: ORIFICE,LH2 RECIRCULATION MANIFOLD BOEING	V070-415135-001

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

ORIFICE, REPRESSURIZATION LH2 RECIRCULATION MANIFOLD 0.060 DIAMETER.

REFERENCE DESIGNATORS: RP10

QUANTITY OF LIKE ITEMS: 1

FUNCTION:

RESTRICTS THE FLOW RATE OF HELIUM INTO THE LH2 RECIRCULATION MANIFOLD. THIS PRECLUDES EXCESSIVE RECIRCULATION MANIFOLD PRESSURE WHICH WOULD RESTRICT THE FLOW OF HYDROGEN FROM THE ENGINES THROUGH THE TOPPING VALVE DURING MPS DUMP. HOWEVER, MANIFOLD REPRESS NO LONGER UTILIZED DURING MPS DUMP.

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SUBSYSTEM NAME: MAIN PROPULSION

LRU: LH2 RECIRC MANF REPRESS ORIFICE

ITEM NAME: LH2 RECIRC MANF REPRESS ORIFICE

CRITICALITY OF THIS

FAILURE MODE: 1/1

FAILURE MODE:

RUPTURE/LEAKAGE.

MISSION PHASE:

PL PRE-LAUNCH

LO LIFT-OFF

VEHICLE/PAYLOAD/KIT EFFECTIVITY:

102 COLUMBIA

103 DISCOVERY

104 ATLANTIS

105 ENDEAVOUR

CAUSE:

FATIGUE, MATERIAL DEFECT

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN

A) N/A

B) N/A

C) N/A

PASS/FAIL RATIONALE:

A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

RESULTS IN LH2 FROM THE RECIRCULATION LINE LEAKING INTO THE AFT FUSELAGE. POSSIBLE LOSS OF CRITICAL FUNCTIONS DUE TO COMPONENT EXPOSURE TO CRYOGENICS. POSSIBLE AFT FUSELAGE OVERPRESSURIZATION AND FIRE HAZARD. LEAKAGE DETECTABLE ON GROUND PRIOR TO T-31 SECONDS USING HAZARDOUS GAS DETECTION SYSTEM (HGDS).

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(B) INTERFACING SUBSYSTEM(S):
SAME AS A.

(C) MISSION:
POSSIBLE LAUNCH SCRUB DUE TO LCC VIOLATION.

(D) CREW, VEHICLE, AND ELEMENT(S):
POSSIBLE LOSS OF CREW/VEHICLE.

(E) FUNCTIONAL CRITICALITY EFFECTS:
NONE.

-DISPOSITION RATIONALE-

(A) DESIGN:
THE LH2 DUMP PRESSURIZATION ORIFICE IS A LINE MOUNTED FITTING MADE FROM 304L CRES. THE ORIFICE IS BRAZED INTO THE LH2 DISCONNECT PANEL AT EACH END USING A 304L CRES UNION AND A BRAZE ALLOY PREFORM (81.5 AU, 16.5 CU, 2 NI). IT IS DESIGNED TO A MINIMUM FACTOR OF SAFETY 2.0 PROOF AND 4.0 BURST (55 PSIG MAXIMUM OPERATING PRESSURE.

STRUCTURAL ANALYSIS INDICATES A POSITIVE MARGIN OF SAFETY FOR ALL OPERATIONAL CONDITIONS. THE ONE PIECE DESIGN ELIMINATES INTERNAL AND EXTERNAL JOINTS OR SEALS AND THEIR POTENTIAL LEAKAGE.

(B) TEST:
ATP

EXAMINATION OF PRODUCT
DIMENSION AND MATERIAL

THE ORIFICE WAS PROOF PRESSURE TESTED TO 66 PSIG AND LEAK CHECKED TO 30 PSIG AFTER INSTALLATION INTO THE VEHICLE.

CERTIFICATION

THE ORIFICE WAS CERTIFIED WITH THE MAIN PROPULSION TEST ARTICLE (MPTA) WHICH INCORPORATES ALL CONFIGURATIONS UTILIZED IN THE MPS SYSTEM. MPTA EXPERIENCED NUMEROUS FULL DURATION STATIC FIRINGS OF THE MAIN ENGINE AT DIFFERENT PERFORMANCE LEVELS. THESE STATIC FIRINGS IMPARTED WORST CASE ENVIRONMENTS AT MAXIMUM OPERATING TEMPERATURES AND PRESSURES.

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VERIFICATION

QUALIFICATION TESTING OF A COMPLETED ORIFICE WAS NOT PERFORMED, BUT THE ORIFICE WAS VERIFIED BY ANALYSIS. FOR OV103 REFER TO REPORT STS85-0254 (STRUCTURAL ANALYSIS FOR 6.0 LOADS, DATED APRIL 1988), VOLUME 10 (THRUST STRUCTURE, MPS, AND SECONDARY STRUCTURE). THE ORIFICE DESIGN FOR OV102 AND OV104 IS IDENTICAL TO OV103.

OMRSD

ANY TURNAROUND CHECKOUT IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

(C) INSPECTION:

RECEIVING INSPECTION

RAW MATERIAL IS VERIFIED FOR MATERIAL AND THE PROCESS CERTIFICATIONS.

CONTAMINATION CONTROL

MATERIAL CLEANLINESS IS MAINTAINED AND VERIFIED TO LEVEL 100A. INSPECTION EXAMINES CORROSION PROTECTION PER REQUIREMENT.

ASSEMBLY/INSTALLATION

ALL MATERIALS ARE VISUALLY EXAMINED FOR DEFECTS UNDER 10X MAGNIFICATION DURING MANUFACTURING. PART SURFACES MACHINED TO 63 RMS ARE VERIFIED BY INSPECTION. MANDATORY INSPECTION POINTS ARE INCLUDED IN THE ASSEMBLY PROCEDURE.

CRITICAL PROCESS

ELECTROPOLISHING OF PART SURFACE IS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

PART IS INSPECTED BY DYE PENETRANT IN ACCORDANCE WITH SPECIFICATION.

TESTING

ATP IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING

PACKAGING FOR SHIPPING IS VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:

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

(E) OPERATIONAL USE:

FLIGHT: NO CREW ACTION CAN BE TAKEN.

GROUND: GROUND OPERATIONS SAFING PROCEDURES CONTAIN SAFING SEQUENCE OF EVENTS FOR MAJOR LEAKS IN THE HYDROGEN SYSTEM.

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- APPROVALS -

S&R ENGINEERING	: W.P. MUSTY	:/S/ W.P. MUSTY
S&R ENGINEERING ITM	: P. A. STENGER-NGUYEN	:/S/ P.A. STENGER-NGUYEN
DESIGN ENGINEERING	: LEE DURHAM	:/S/ LEE DURHAM
MPS SUBSYSTEM MGR.	: TIM REITH	:/S/ TIM REITH
MOD	: JEFF MUSLER	:/S/ JEFF MUSLER
USA SAM	: MIKE SNYDER	:/S/ MIKE SNYDER
USA ORBITER ELEMENT	: SUZANNE LITTLE	:/S/ SUZANNE LITTLE
NASA SR&QA	: ERICH BASS	:/S/ ERICH BASS