

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE

NUMBER: 03-1-0247 -X

SUBSYSTEM NAME: MAIN PROPULSION

REVISION: 3 02/21/01

PART DATA

PART NAME	PART NUMBER
VENDOR NAME	VENDOR NUMBER
LRU : ORIFICE, GHE, RTLS DUMP BOEING	V070-415545-001

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

ORIFICE, HELIUM, RTLS DUMP REPRESSURIZATION, 0.120 INCH DIAMETER (RP9).

REFERENCE DESIGNATORS:

QUANTITY OF LIKE ITEMS: 1

FUNCTION:

THE ORIFICE CONTROLS THE HELIUM FLOW RATE FROM THE LH2 FEED MANIFOLD RTLS PRESSURIZING SOLENOID VALVES (LV74,75) (750 PSIA) FOR PRESSURIZED LH2 DUMP DURING AN RTLS AND TAL ABORT.

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NUMBER: 03-1-0247-02

REVISION#: 2 02/21/01

SUBSYSTEM NAME: MAIN PROPULSION

LRU: ORIFICE,GHE,RTLS DUMP

ITEM NAME: ORIFICE,GHE,RTLS DUMP

CRITICALITY OF THIS

FAILURE MODE: 1R2

FAILURE MODE:

RUPTURE/LEAKAGE

MISSION PHASE:

LO LIFT-OFF
DO DE-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY:

102 COLUMBIA
103 DISCOVERY
104 ATLANTIS
105 ENDEAVOUR

CAUSE:

FATIGUE, MATERIAL DEFECT

CRITICALITY 1/1 DURING INTACT ABORT ONLY? YES

RTLS RETURN TO LAUNCH SITE
TAL TRANS-ATLANTIC LANDING

REDUNDANCY SCREEN

A) PASS
B) FAIL
C) PASS

PASS/FAIL RATIONALE:

A)

B)

FAILS B SCREEN BECAUSE FAILURE CANNOT BE DETECTED WITH CURRENT INSTRUMENTATION.

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

NO EFFECT FOR NOMINAL MISSION. REDUNDANT COMPONENTS WILL PREVENT FLOW OF HYDROGEN OR HELIUM THROUGH LINE.

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DURING RTLS AND TAL ABORTS, THE PNEUMATIC HELIUM SUPPLY WILL BE LOST. ESCAPING HELIUM MAY OVERPRESSURIZE THE AFT COMPARTMENT.

(B) INTERFACING SUBSYSTEM(S):

SAME AS A.

(C) MISSION:

NO EFFECT FOR NOMINAL MISSION. POSSIBLE LOSS OF CREW/VEHICLE DURING RTLS AND TAL ABORTS.

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

SAME AS C.

(E) FUNCTIONAL CRITICALITY EFFECTS:

CASE 1:

1R/2 2 SUCCESS PATHS. TIME FRAME - POST-MECO.

- 1) ORIFICE (RP9) RUPTURES/EXTERNAL LEAKAGE.
- 2) CHECK VALVE (CV30) FAILS TO CHECK.

AT MECO, THE LH2 FEEDLINE RELIEF ISOLATION VALVE (PV8) WILL OPEN AND HYDROGEN FROM THE LH2 MANIFOLD WILL LEAK THROUGH THE RUPTURED LINE. POSSIBLE FIRE/EXPLOSION HAZARD AND POSSIBLE LOSS OF CRITICAL ADJACENT COMPONENTS DUE TO EXPOSURE TO CRYOGENICS.

POSSIBLE LOSS OF CREW/VEHICLE.

CASE 2:

1R/3 3 SUCCESS PATHS. TIME FRAME - PRELAUNCH, ASCENT, ENTRY

- 1) ORIFICE (RP9) RUPTURES/EXTERNAL LEAKAGE.
- 2,3) BOTH RTLS SUPPLY VALVES (LV74,75) FAIL TO REMAIN CLOSED.

DURING ASCENT, THE PNEUMATIC HELIUM SUPPLY WILL BE LOST. ESCAPING HELIUM MAY OVERPRESSURIZE THE AFT COMPARTMENT.

WHEN THE CROSSOVER VALVE (LV10) OPENS AT MECO, THE PNEUMATIC HELIUM DISTRIBUTION SYSTEM WILL BE FED FROM THE LEFT ENGINE HELIUM SUPPLY. WHEN THE INTERCONNECT "OUT" VALVES OPEN AT MECO PLUS 20 SECONDS, THE ENGINE HELIUM SUPPLIES WILL LEAK THROUGH THE FAILED LINE.

STORED HELIUM PRESSURE IN THE ACCUMULATOR LEG SHOULD BE ADEQUATE TO OPERATE THE LO2 PREVALVES AT MECO. LOSS OF HELIUM MAY PREVENT OPERATION OF VALVES FOR MPS DUMP.

PURGE OF AFT COMPARTMENT AND LH2/LO2 SYSTEMS WOULD DEPEND SOLELY ON THE LEFT ENGINE HELIUM SYSTEM RESIDUALS.

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DURING ENTRY, VENT DOORS ARE CLOSED TO PREVENT INGESTION OF RCS AND APU GASES. RUPTURE DURING THE TIME PERIOD THAT THE VENT DOORS ARE CLOSED MAY RESULT IN OVERPRESSURIZATION OF AFT COMPARTMENT. VENT DOORS ARE OPENED WHEN VEHICLE VELOCITY DROPS BELOW 2400 FT/SEC.

EXCESSIVE HELIUM LEAKAGE WILL BE DETECTABLE USING HAZARDOUS GAS DETECTION SYSTEM (HGDS).

POSSIBLE LAUNCH SCRUB DUE TO LCC VIOLATION.

POSSIBLE LOSS OF CREW/VEHICLE.

-DISPOSITION RATIONALE-

(A) DESIGN:

THE RTLS DUMP HELIUM REPRESSURIZATION ORIFICE IS A LINE MOUNTED FITTING MADE FROM 304L CRES. IT IS SUBJECT TO HIGH PRESSURE (790 PSIA MAX) ONLY DURING ACTIVATION OF A RTLS DUMP. DURING NORMAL OPERATIONS THE ORIFICE IS NOT PRESSURIZED. IT IS DESIGNED TO A MINIMUM FACTOR OF SAFETY 2.0 PROOF AND 4.0 BURST (790 PSIA MAXIMUM OPERATING PRESSURE).

STRUCTURAL ANALYSIS INDICATES A POSITIVE MARGIN OF SAFETY FOR ALL OPERATING CONDITIONS.

THE ONE PIECE DESIGN MINIMIZES EXTERNAL LEAKS.

(B) TEST:

ATP

EXAMINATION OF PRODUCT
DIMENSION AND MATERIAL

THE ORIFICE IS LEAK CHECKED AT 22 PSIG AFTER INSTALLATION INTO THE VEHICLE.

VERIFICATION

QUALIFICATION TESTING OF A COMPLETED ORIFICE WAS NOT PERFORMED, BUT THE ORIFICE WAS VERIFIED BY ANALYSIS. FOR OV103/OV104 REFER TO REPORT STS85-0254 (STRUCTURAL ANALYSIS FOR 6.0 LOADS, DATED APRIL 1988), VOLUME 10 (THRUST STRUCTURE, MPS, AND SECONDARY STRUCTURE). FOR OV102 REFER TO REPORT SD77-SH-0178 (DESIGN STRESS ANALYSIS OV102), DATED JULY 1988), VOLUME 10; AND REPORT SOD80-0173 (OV102 STRESS ANALYSIS AND 5.4 LOADS ASSESSMENT, DATED JULY 1980), VOLUME 10.

OMRSD

ANY TURNAROUND CHECKOUT IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

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(C) INSPECTION:

RECEIVING INSPECTION

RAW MATERIAL IS VISUALLY INSPECTED FOR MATERIAL AND PROCESS CERTIFICATION.

CONTAMINATION CONTROL

CORROSION PROTECTION IS VERIFIED.

ASSEMBLY/INSTALLATION

MATERIAL IS VISUALLY EXAMINED FOR DEFECTS UNDER 10X MAGNIFICATION DURING MANUFACTURE. PART EXTERNAL AND INTERNAL SURFACES FINISHED TO 63 RMS AND WETTED SURFACES OF ORIFICE TO 32 RMS ARE VERIFIED BY INSPECTION. MANDATORY INSPECTION POINTS ARE INCLUDED IN THE ASSEMBLY PROCEDURE.

CRITICAL PROCESSES

N/A.

NONDESTRUCTIVE EVALUATION

PART IS INSPECTED BY DYE PENETRANT IN ACCORDANCE WITH SPECIFICATION.

TESTING

ATP EXAMINATION OF PRODUCT DIMENSION AND MATERIAL 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:

NO CREW ACTION CAN BE TAKEN.

- 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	: BILL PRINCE	:/S/ BILL PRINCE