

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE**

**NUMBER: 03-1-0609 -X**

**SUBSYSTEM NAME:** MAIN PROPULSION

**REVISION:** 1 02/22/01

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**PART DATA**

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	<b>PART NAME</b>	<b>PART NUMBER</b>
	<b>VENDOR NAME</b>	<b>VENDOR NUMBER</b>
LRU	: ORIFICE, .015 INCH BOEING	V070-415552-001

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**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**

ORIFICE, GHE, GO2 MANIFOLD REPRESSURIZATION (0.015 INCH).

**REFERENCE DESIGNATORS:** RP1

**QUANTITY OF LIKE ITEMS:** 1

**FUNCTION:**

THE ORIFICE CONTROLS THE FLOW RATE OF HELIUM FOR THE GO2 REPRESSURIZATION LINE DURING THE DUMP SEQUENCE AND ENTRY.

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

**NUMBER: 03-1-0609-02**

**REVISION#: 1 02/22/01**

**SUBSYSTEM NAME: MAIN PROPULSION**

**LRU: LO2 MANIFOLD REPRESS ORIFICE, 0.015 INCH**

**CRITICALITY OF THIS**

**ITEM NAME: LO2 MANIFOLD REPRESS ORIFICE, 0.015 INCH**

**FAILURE MODE: 1/1**

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**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**

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**REDUNDANCY SCREEN**

A) N/A

B) N/A

C) N/A

**PASS/FAIL RATIONALE:**

A)

B)

C)

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**- FAILURE EFFECTS -**

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**(A) SUBSYSTEM:**

GO2 AND/OR GHE LEAKAGE INTO THE AFT COMPARTMENT. POSSIBLE OVERPRESSURIZATION OF THE AFT COMPARTMENT AND FIRE/EXPLOSION HAZARD. GHE LEAKAGE FROM ANTI-ICING PURGE DETECTABLE ON GROUND USING HAZARDOUS GAS DETECTION SYSTEM (HGDS).

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THE FLOW CONTROL VALVES WILL OPEN IN AN ATTEMPT TO MAINTAIN ET ULLAGE PRESSURE. LOSS OF ET LO2 ULLAGE PRESSURE WILL RESULT IN VIOLATION OF TANK MINIMUM STRUCTURAL CAPABILITY REQUIREMENTS. POSSIBLE LOSS OF ADJACENT CRITICAL COMPONENTS DUE TO IMPINGEMENT OF HIGH PRESSURE GAS. POSSIBLE UNCONTAINED SSME SHUTDOWN DUE TO LOW NPSP LATE IN ENGINE OPERATION.

ALSO RESULTS IN POSSIBLE LOSS OF HELIUM SUPPLY DURING MANIFOLD REPRESSURIZATION CAUSING LOSS OF AFT COMPARTMENT PURGE.

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

**(C) MISSION:**  
ON GROUND, VIOLATION OF HGDS LCC WILL RESULT IN LAUNCH SCRUB.

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

**(E) FUNCTIONAL CRITICALITY EFFECTS:**  
NONE.

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**-DISPOSITION RATIONALE-**

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**(A) DESIGN:**  
THE GO2 PRESSURE MANIFOLD REPRESSURIZATION ORIFICE INCORPORATES AN ORIFICE ELEMENT AND A 304 CRES FILTER (75 MICRONS ABSOLUTE) INSIDE A TWO PIECE HOUSING MADE FROM 304L CRES. THE HOUSING PIECES ARE THREADED TOGETHER, TORQUED TO 10 TO 15 INCH-POUNDS, AND SEALED WITH A FILLET WELD. IT IS DESIGNED TO A MINIMUM FACTOR OF SAFETY 2.0 PROOF AND 4.0 BURST.

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

LEAKAGE IS MINIMIZED BY THE FILLET WELD AFTER ORIFICE ASSEMBLY.

**(B) TEST:**  
ATP

EXAMINATION OF PRODUCT

PROOF PRESSURE TEST  
PRESSURE: 840 PSIG HELIUM

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LEAK TEST

PRESSURE: 250 PSIG  
NO GREATER THAN  $5 \times 10^{-6}$  SCCS.

THE ORIFICE IS PROOF PRESSURE TESTED TO 950 PSIG AND LEAK CHECKED AT 550 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.

OMRSD

ANY TURNAROUND CHECKOUT IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

**(C) INSPECTION:**

RECEIVING INSPECTION

RAW MATERIALS ARE VERIFIED FOR MATERIALS AND THE PROCESS CERTIFICATIONS.

CONTAMINATION CONTROL

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

ASSEMBLY/INSTALLATION

ALL DETAIL PARTS ARE VISUALLY EXAMINED FOR DEFECTS UNDER 10X MAGNIFICATION DURING MANUFACTURING. PART SURFACES MACHINED TO 32 RMS ARE VERIFIED BY INSPECTION. MANDATORY INSPECTION POINTS ARE INCLUDED IN THE ASSEMBLY PROCEDURE.

CRITICAL PROCESS

ELECTROPOLISHING OF PART SURFACE IS VERIFIED BY INSPECTION. FUSION WELDS ARE EXAMINED PER SPECIFICATION.

NONDESTRUCTIVE EVALUATION

PARTS ARE INSPECTED BY DYE PENETRANT IN ACCORDANCE WITH SPECIFICATION. HELIUM LEAK DETECTION IS VERIFIED BY INSPECTION.

TESTING

PROOF PRESSURE TEST IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING

PACKAGING FOR SHIPPING IS VERIFIED BY INSPECTION.

**(D) FAILURE HISTORY:**

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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.

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**- APPROVALS -**

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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