

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE****NUMBER: 03-1-0603 -X****SUBSYSTEM NAME:** MAIN PROPULSION**REVISION:** 1 08/10/00

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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	:LO2 MANIFOLD REPRESSURIZATION ISOLATION CHECK VALVE CIRCLE SEAL	ME284-0472-0013  P197-180

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**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:**

VALVE, CHECK, LO2 MANIFOLD REPRESS, ISOLATION, 0.5 INCH DIA.

**REFERENCE DESIGNATORS:** CV12**QUANTITY OF LIKE ITEMS:** 1**FUNCTION:**

THE CHECK VALVE PREVENTS LO2 FROM THE FEEDLINE MANIFOLD FROM ENTERING THE HELIUM PURGE, REPRESS AND GO2 PRESSURIZATION SYSTEMS VIA THE HELIUM PURGE LINES.

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

**NUMBER: 03-1-0603-04**

**REVISION#:** 1 08/10/00

**SUBSYSTEM NAME:** MAIN PROPULSION

**LRU:** LO2 MANIF REPRESS ISO CHECK VALVE (CV12)

**CRITICALITY OF THIS**

**ITEM NAME:** LO2 MANIF REPRESS ISO CHECK VALVE (CV12)

**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:**

DURING PRELAUNCH AND ASCENT, RUPTURE OF THE CHECK VALVE RESULTS IN LO2 FROM THE MANIFOLD LEAKING INTO THE AFT FUSELAGE. POSSIBLE LOSS OF CRITICAL FUNCTIONS DUE TO COMPONENT EXPOSURE TO CRYOGENICS. POSSIBLE AFT FUSELAGE FIRE/EXPLOSION HAZARD.

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LEAKAGE DETECTABLE ON GROUND DOWN TO T-31 SECONDS USING HAZARDOUS GAS DETECTION SYSTEM (HGDS).

**(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.

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**-DISPOSITION RATIONALE-**

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**(A) DESIGN:**  
THE CHECK VALVE IS A POPPET TYPE, SPRING LOADED AND PRESSURE ASSISTED TO THE CLOSED POSITION. THE POPPET AND SPRING ARE CONTAINED IN A THREADED HOUSING AND END CAP. THE SEAL IS A SELF-CENTERING TEFLON O- RING. THE VALVE BODY PROVIDES A GUIDE FOR THE POPPET TRAVEL. THE VALVE BODY IS DESIGNED TO A FACTOR OF SAFETY OF 2.0 PROOF AND 4.0 BURST.

THE THREADED HOUSING AND END CAP ARE MANUFACTURED FROM INCONEL 718. THE END CAP IS THREADED INTO THE HOUSING (TORQUED TO 45 FT-LBS) AND EB WELDED TO SEAL THE JOINT.

STRUCTURAL ANALYSIS, PERFORMED BY THE CHECK VALVE SUPPLIER, INDICATES POSITIVE MARGINS OF SAFETY FOR ALL CONDITIONS OF CHECK VALVE OPERATION.

**(B) TEST:**  
ATP

EXAMINATION OF PRODUCT

AMBIENT TESTS  
BODY PROOF PRESSURE (1717 PSIG)  
CLOSURE DEVICE PROOF PRESSURE (1717 PSIG)  
EXTERNAL LEAKAGE (850 PSIG)  
INTERNAL LEAKAGE (5, 25, 100, 850 PSIG)

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CRYOGENIC TESTS (-300 DEG F)  
    CRACKING AND RESEAT PRESSURE: 3 CYCLES  
        CRACKING PRESSURE 5 PSID MAX  
        RESEAT PRESSURE 2 PSID MIN  
    INTERNAL LEAKAGE (5, 25, 100, 850 PSIG)

CERTIFICATION

FLOW TEST (0.08 LB/SEC GHE)  
    MAX INLET PRESSURE OF 715 PSIG  
    PRESSURE DROP (10 PSID MAX)

CHATTER TEST (850 TO 0 PSIG)  
    RECORD FLOW RATE WHEN CHATTER OCCURS

CRACKING AND RESEAT PRESSURE  
    AMBIENT AND CRYO (-300 DEG F): 3 CYCLES EACH  
        CRACKING PRESSURE 5 PSID MAX  
        RESEAT PRESSURE 2 PSID MIN

INTERNAL LEAKAGE  
    AMBIENT (0 TO 850 PSIG)  
    CRYO (-300 DEG F, 0 TO 850 PSIG)

EXTERNAL LEAKAGE (AMBIENT, 850 PSIG)

LIFE CYCLE TEST

ONE CYCLE CONSISTS OF PRESSURIZING THE INLET TO 715 PSIA, VENTING THE INLET TO AMBIENT, PRESSURIZING THE OUTLET TO 850 PSIG, AND VENTING THE OUTLET TO AMBIENT.

AMBIENT  
    36,000 CYCLES, FOLLOWED BY CRACKING, RESEATING, AND INTERNAL LEAKAGE TESTS

CRYO (-300 DEG F)  
    24,000 CYCLES, FOLLOWED BY CRYO CRACKING, RESEATING, INTERNAL LEAKAGE TESTS

UPON COMPLETION OF BOTH AMBIENT AND CRYO TESTS PERFORM AMBIENT FLOW, PRESSURE DROP, AND EXTERNAL LEAKAGE TESTS.

VIBRATION (-300 DEG F, 2 AXES)

TRANSIENT  
    5 TO 35 HZ AT +/- 0.25 GS PEAK

RANDOM  
    48 MINUTES FOR EACH OF 2 AXES

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UPON COMPLETION OF VIBRATION TESTS PERFORM CRACK, RESEAT, AND INTERNAL LEAKAGE TEST.

BURST PRESSURE (3400 PSIG)

GROUND TURNAROUND TEST  
ANY TURNAROUND CHECKOUT IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

**(C) INSPECTION:**

RECEIVING INSPECTION

ALL RAW MATERIALS ARE VERIFIED FOR MATERIAL AND PROCESS CERTIFICATION. RECEIVING INSPECTION VERIFIES CERTIFICATION OF SPRING HEAT TREATMENT AND PERFORMS LOAD TEST OF SPRINGS.

CONTAMINATION CONTROL

ALL PARTS AND ASSEMBLIES ARE MAINTAINED TO CLEANLINESS LEVEL OF 100A.

ASSEMBLY/INSTALLATION

DIMENSIONS AND SURFACE FINISHES ARE VERIFIED BY INSPECTION. REQUIRED TORQUES ARE VERIFIED PRIOR TO WELDING. INSPECTION POINTS ARE ESTABLISHED TO VERIFY ASSEMBLY PROCESS. WELDS ARE VISUALLY VERIFIED BY 10X MAGNIFICATION.

CRITICAL PROCESSES

ALL WELDING, ELECTROPOLISHING AND PARTS PASSIVATION ARE VERIFIED BY INSPECTION. DRY FILM LUBRICANT COATED THREADS ARE VERIFIED PER DRAWING REQUIREMENT.

NONDESTRUCTIVE EVALUATION

HELIUM LEAKAGE DETECTION IS PERFORMED.

TESTING

ATP IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING

PACKAGING FOR SHIPMENT 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.

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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	: MIKE FISCHER	:/S/ MIKE FISCHER
MPS SUBSYSTEM MGR.	: TIM REITH	:/S/ TIM REITH
MOD	: BILL LANE	:/S/ BILL LANE
USA SAM	: MIKE SNYDER	:/S/ MIKE SNYDER
USA ORBITER ELEMENT	: SUZANNE LITTLE	:/S/ SUZANNE LITTLE
NASA SR&QA	: ERICH BASS	:/S/ ERICH BASS