

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE

NUMBER: 03-1-0631 -X

SUBSYSTEM NAME: MAIN PROPULSION

REVISION: 1 08/10/00

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
LRU	:GO2 PRESSURIZATION SYSTEM REPRESSURIZATION ISOLATION CHECK VALVE CIRCLE SEAL	ME284-0472-0011 P196-180

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

VALVE, CHECK, LO2. HELIUM PURGE SYSTEM ISOLATION

REFERENCE DESIGNATORS: CV10

QUANTITY OF LIKE ITEMS: 1

FUNCTION:

PREVENTS GO2 FROM ENTERING THE HELIUM PURGE SYSTEM PRIOR TO THE INITIATION OF SYSTEM DUMP.

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REVISION#: 1 08/10/00

SUBSYSTEM NAME: MAIN PROPULSION

LRU: GO2 PRESS SYS REPRESS ISO C/V (CV10)

ITEM NAME: GO2 PRESS SYS REPRESS ISO C/V (CV10)

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:

DURING ASCENT, GO2 FROM THE ET PRESSURIZATION SYSTEM WILL ENTER THE AFT COMPARTMENT. POSSIBLE AFT FUSELAGE FIRE/EXPLOSION HAZARD.

LEAKAGE OF GHE IS DETECTABLE ON THE GROUND USING HAZARDOUS GAS DETECTION SYSTEM (HGDS).

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(CHECK VALVE (CV10) RUPTURE PRELAUNCH IS NOT AN AFT COMPARTMENT OVERPRESSURIZATION CONCERN SINCE THE 0.015 INCH ORIFICE (RP1) WILL PRECLUDE SUFFICIENT FLOW RATE.)

(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:
1R/2 2 SUCCESS PATHS. TIME FRAME - PRELAUNCH
1) CHECK VALVE (CV10) RUPTURES/EXTERNAL LEAKAGE
2) CHECK VALVE (CV12) FAILS TO CHECK

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 OVERPRESSURIZATION AND FIRE/EXPLOSION HAZARD.

LO2 LEAKAGE DETECTABLE ON GROUND DOWN TO T-31 SECONDS USING HAZARDOUS GAS DETECTION SYSTEM (HGDS).

POSSIBLE LAUNCH SCRUB DUE TO LCC VIOLATION.

POSSIBLE LOSS OF CREW/VEHICLE.

-DISPOSITION RATIONALE-

(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 12 FT-LBF) AND EB WELDED TO SEAL THE JOINT.

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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 TEMPERATURE TESTS:

BODY PROOF PRESSURE (1313 PSIG)
CLOSURE DEVICE PROOF PRESSURE (1313 PSIG)
EXTERNAL LEAKAGE (650 PSIG)
INTERNAL LEAKAGE (5, 25, 100, 650 PSIG)

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, 650 PSIG)

CERTIFICATION

FLOW (0.005 LB/SEC HELIUM, MIN)

MAXIMUM INLET PRESSURE OF 100 PSIG
PRESSURE DROP (11 PSID MAX)

CHATTER TEST (650 TO 0 PSIG)

RECORD FLOW RATE WHEN CHATTER OCCURS

CRACKING AND RESEAT PRESSURE (CRYO: -300 DEG F): 3 CYCLES

CRACKING PRESSURE 5 PSID MAX
RESEAT PRESSURE 2 PSID MIN

INTERNAL LEAKAGE

AMBIENT (0 TO 650 PSIG)
CRYO (-300 DEG F, 0 TO 650 PSIG)

LIFE CYCLE TEST

ONE CYCLE CONSISTS OF INLET PRESSURE OF 100 PSIG FOLLOWED BY CHECKING PRESSURE OF 650 PSIG

AMBIENT

7000 CYCLES FOLLOWED BY CRACKING, RESEATING, AND LEAKAGE TESTS

CRYO (-300 DEG F)

3000 CYCLES FOLLOWED BY CRACKING, RESEATING, INTERNAL LEAKAGE, FLOW, PRESSURE DROP, AND EXTERNAL LEAK TESTS

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VIBRATION (-300 DEG F, 2 AXES)

QUALIFIED BY SIMILARITY TO TYPE III CHECK VALVE. TYPE III VALVES ARE CERTIFIED BY THE FOLLOWING TESTS:

TRANSIENT

5 TO 35 HZ AT +/- 0.25 GS PEAK

RANDOM

48 MINUTES FOR EACH OF 2 AXES

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

EXTERNAL LEAKAGE TEST (650 PSIG)

BURST PRESSURE (2600 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.

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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.

- 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	: 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