FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 03-1-0502 -X

SUBSYSTEM NAME: MAIN PROPULSION

REVISION: 1 08/10/00

PART DATA

	PART NAME / **VENDOR NAME**	**PART NUMBER** / **VENDOR NUMBER**
LRU	:GH2/GO2 PRE-PRESSURIZATION CHECK VALVE	ME284-0472-0005
	CIRCLE SEAL	P85-180

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
VALVE, CHECK, HELIUM PRESSURIZATION, GH2/GO2 (1.0 INCH DIA)

REFERENCE DESIGNATORS: CV16
CV17

QUANTITY OF LIKE ITEMS: 2
ONE GH2, ONE GO2

FUNCTION:
ACTS AS SERIES REDUNDANT CLOSURE DEVICE WITH THE PREPRESSURIZATION DISCONNECT (PD9, 10) TO PREVENT THE LOSS OF PRESSURANT OVERBOARD.

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE

NUMBER: 03-1-0502-03

REVISION#: 1 08/10/00

SUBSYSTEM NAME: MAIN PROPULSION
LRU: GH2/GO2 PRE-PRESS CHECK VALVE (CV17 & 16) **CRITICALITY OF THIS**
ITEM NAME: GH2/GO2 PRE-PRESS CHECK VALVE (CV17 & 16) **FAILURE MODE:** 1/1

FAILURE MODE:
RUPTURE/LEAKAGE

MISSION PHASE:
PL PRE-LAUNCH
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? NO

REDUNDANCY SCREEN
A) N/A
B) N/A
C) N/A

PASS/FAIL RATIONALE:
A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
GO2, GH2 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).

GH2 FLOW CONTROL VALVES WILL CYCLE TO THE HIGH FLOW POSITION IN AN ATTEMPT TO MAINTAIN ULLAGE PRESSURE. LOSS OF ET LO2/LH2 ULLAGE PRESSURE WILL RESULT IN

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VIOLATION OF TANK MINIMUM STRUCTURAL CAPABILITY REQUIREMENTS. POSSIBLE UNCONTAINED SSME SHUTDOWN DUE TO LOW LH2 NPSP. MASS OF LO2 AND VEHICLE ACCELERATION SHOULD BE SUFFICIENT TO MAINTAIN PROPER ENGINE NPSP, DELAYING PREMATURE SSME SHUTDOWN DUE TO LOW LO2 NPSP UNTIL LATE IN POWERED FLIGHT.

POSSIBLE LOSS OF ADJACENT CRITICAL COMPONENTS DUE TO IMPINGEMENT OF HIGH PRESSURE GAS.

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:
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 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 POPPET 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 21-6-9 CRES. THE END CAP IS THREADED INTO THE HOUSING (TORQUED TO 175 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

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EXAMINATION OF PRODUCT

AMBIENT TEMPERATURE TESTS:
- BODY PROOF PRESSURE (1515 PSIG)
- CLOSURE DEVICE PROOF PRESSURE (1515 PSIG)
- EXTERNAL LEAKAGE (750 PSIG)
- INTERNAL LEAKAGE (5, 25, 100, 750 PSIG)

LOW TEMPERATURE TESTS (-100 DEG F)
- CRACKING PRESSURE(5 PSID MAX)
- RESEATING PRESSURE (2 PSID MIN)
- INTERNAL LEAKAGE (5, 25, 100, 750 PSIG)

CERTIFICATION

FLOW (1.5 LB/SEC HELIUM)
- MAX INLET PRESSURE 425 PSIA
- PRESSURE DROP (167 PSID MAX)

CHATTER TEST (750 TO 0 PSIG)
- RECORD FLOW RATE WHEN CHATTER OCCURS

CRACKING AND RESEAT PRESSURE
- LOW TEMPERATURE (-100 DEG F): 3 CYCLES EACH
  - CRACKING PRESSURE 5 PSID MAX
  - RESEAT PRESSURE 2 PSID MIN

INTERNAL LEAKAGE
- AMBIENT (0 TO 650 PSIG)
- LOW TEMPERATURE (-100 DEG F, 0 TO 650 PSIG)

LIFE CYCLE TEST

58,400 CYCLES (AMBIENT)

ONE CYCLE CONSISTS OF PRESSURIZING (WITH GN2) THE INLET TO 72 PSIG, VENTING THE INLET TO AMBIENT, PRESSURIZING THE OUTLET TO 57 PSIG, AND VENTING THE OUTLET TO AMBIENT.

FOLLOWED BY CRACKING, RESEATING, AND INTERNAL LEAKAGE TESTS

1600 CYCLES (AMBIENT)

ONE CYCLE CONSISTS OF PRESSURIZING (WITH GN2) THE INLET TO 425 PSIA, VENTING THE INLET TO AMBIENT, PRESSURIZING THE OUTLET TO 650 PSIG, AND VENTING THE OUTLET TO AMBIENT.

FOLLOWED BY CRACKING, RESEATING, AND INTERNAL LEAKAGE TESTS

EXTERNAL LEAKAGE TEST (750 PSIG)

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VIBRATION (AMBIENT, 2 AXES)

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

RANDOM
13.3 HOURS FOR EACH OF 2 AXES

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

BURST PRESSURE (3000 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.

CONTAMINATION CONTROL
ALL PARTS ARE MAINTAINED TO CLEANLINESS LEVEL OF 100A. INLET AND OUTLET ARE PROTECTED AFTER TESTS TO MAINTAIN INTERNAL CLEANLINESS.

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 WELDS ARE INSPECTED PER DRAWING SPECIFICATIONS. ELECTROPOLISHING IS PERFORMED PER DRAWING SPECIFICATIONS. TEFLON SPRAY LUBRICANT IS APPLIED TO THREADS PER SPECIFICATIONS. HEAT TREATMENT AND PARTS PASSIVATION ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
HELIUM LEAKAGE DETECTION IS VERIFIED.

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.

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(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