

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE

NUMBER: 03-1-0202 -X

SUBSYSTEM NAME: MAIN PROPULSION

REVISION: 2 08/10/00

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
LRU	:GHE SUPPLY ISO CHECK VALVE CIRCLE SEAL	ME284-0472-0012 P69-180

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

VALVE, CHECK, HELIUM SUPPLY, 0.375 INCH

REFERENCE DESIGNATORS: CV1
CV2
CV3
CV4

QUANTITY OF LIKE ITEMS: 4

ONE PER SSME HELIUM SYSTEM AND ONE ON PNEUMATIC TANK SYSTEM

FUNCTION:

PREVENTS BACK FLOW OF PRESSURANT FROM GHE TANKS (THREE DEDICATED PER ENGINE, ONE PNEUMATIC ACTUATION) INTO PARALLEL SYSTEM AND ACTS AS A REDUNDANT CLOSURE DEVICE WITH THE HELIUM FILL DISCONNECT TO PREVENT THE LOSS OF HIGH PRESSURE HELIUM OVERBOARD.

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NUMBER: 03-1-0202-03

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SUBSYSTEM NAME: MAIN PROPULSION

LRU: GHE SUPPLY ISO CHECK VALVE (CV1, 2, 3, 4)

CRITICALITY OF THIS

ITEM NAME: GHE SUPPLY ISO CHECK VALVE (CV1, 2, 3, 4)

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:

MATERIAL DEFECT, FATIGUE

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:

RESULTS IN LOSS OF HELIUM FROM ONE MAIN ENGINE'S HELIUM SUPPLY (CV1, 2, 3) OR PNEUMATIC HELIUM SUPPLY (CV4). POSSIBLE OVERPRESSURIZATION OF THE AFT COMPARTMENT (PRELAUNCH, ASCENT, AND ENTRY).

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RUPTURE OF ENGINE SUPPLY CHECK VALVE (CV1, 2, 3) MAY RESULT IN UNCONTAINED ENGINE SHUTDOWN DUE TO LOSS OF ENGINE HELIUM SUPPLY.

RUPTURE OF PNEUMATIC SUPPLY CHECK VALVE (CV4) RESULTS IN LOSS OF PNEUMATIC HELIUM SUPPLY. HOWEVER, THERE IS SUFFICIENT HELIUM REMAINING IN THE PNEUMATIC ACCUMULATOR LEG TO CLOSE THE LO2 PREVALVES AT MECO.

EXCESSIVE HELIUM LEAKAGE WILL BE DETECTABLE USING HAZARDOUS GAS DETECTION SYSTEM (HGDS). POSSIBLE AFT COMPARTMENT OVERPRESSURIZATION AFTER HELIUM FILL. AFTER LIFTOFF, EXCESSIVE ENGINE HELIUM SUPPLY TANK AND/OR REGULATOR PRESSURE DECAY WILL BE INDICATED BY SM (SYSTEM MANAGEMENT) ALERT OR CAUTION AND WARNING.

DURING ENTRY, VENT DOORS ARE CLOSED TO PREVENT INGESTION OF RCS AND APU GASES. THIS FAILURE 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.

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

(C) MISSION:
POSSIBLE LAUNCH SCRUB DUE TO LCC HGDS VIOLATION. POSSIBLE ABORT DUE TO EARLY ENGINE SHUTDOWN.

(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 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 22 FT-LBS) AND EB WELDED TO SEAL THE JOINT.

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(B) TEST:

ATP

EXAMINATION OF PRODUCT
AMBIENT TEMPERATURE TESTS
BODY PROOF PRESSURE (9090 PSIG)
CLOSURE DEVICE PROOF PRESSURE (9090 PSIG)
EXTERNAL LEAKAGE (4500 PSIG)
INTERNAL LEAKAGE (5, 50, 300, 4500 PSIG)

LOW TEMPERATURE TESTS (-160 DEG F)
CRACKING AND RESEAT PRESSURE: 3 CYCLES
CRACKING PRESSURE 5 PSID MAX
RESEAT PRESSURE 2 PSID MIN
INTERNAL LEAKAGE (5, 50, 300, 4500 PSIG)

CERTIFICATION

FLOW TEST (0.05 LB/SEC HE)
MAX INLET PRESSURE 4200 PSIG
PRESSURE DROP (10 PSID MAX)

CHATTER TEST (4200 TO 0 PSIG)
RECORD FLOW RATE WHEN CHATTER OCCURS

CRACKING AND RESEAT PRESSURE
AMBIENT AND LOW TEMPERATURE (-160 DEG F): 3 CYCLES EACH
CRACKING PRESSURE 5 PSID MAX
RESEAT PRESSURE 2 PSID MIN

INTERNAL LEAKAGE
AMBIENT (0 TO 4500 PSIG)
LOW TEMPERATURE (-160 DEG F, 0 TO 4500 PSIG)

LIFE CYCLE TEST

ONE CYCLE CONSISTS OF INLET PRESSURE OF 4200 PSIG FOLLOWED BY CHECKING
PRESSURE OF 4500 PSIG

AMBIENT
4000 CYCLES FOLLOWED BY CRACKING, RESEATING, AND LEAKAGE TESTS

LOW TEMPERATURE (-160 DEG F)
1000 CYCLES FOLLOWED BY CRACKING, RESEATING, INTERNAL LEAKAGE, FLOW,
PRESSURE DROP, AND EXTERNAL LEAK TESTS

EXTERNAL LEAKAGE TEST (1 SCCH MAXIMUM AT 4500 PSIG)

VIBRATION AND SHOCK (AMBIENT TEMPERATURE AND PRESSURE)

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BY SIMILARITY TO VALVE TYPES III, IVR, AND V (RI DASH NUMBERS -0003, - 0005, AND -0014 RESPECTIVELY). THESE UNITS WERE TESTED IN EACH OF TWO AXIS 48 MINUTES FOR RANDOM VIBRATIONS AND SUBJECTED TO A SWEEP CYCLE TO COVER SHOCK REQUIREMENTS.

BURST PRESSURE (18,000 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 -

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