

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE

NUMBER: 03-1-0514 -X

SUBSYSTEM NAME: MAIN PROPULSION

REVISION: 1 08/09/00

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
LRU	:GO2 ENGINE I/F ISOLATION CHECK VALVE CIRCLE SEAL	ME284-0479-0023 P61-647

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

VALVE, CHECK, GO2 ENGINE ISOLATION (0.625 INCH DIA). (CV18, CV19, CV20)

REFERENCE DESIGNATORS: CV18
CV19
CV20

QUANTITY OF LIKE ITEMS: 3**FUNCTION:**

PREVENTS LOSS OF PRESSURANT FROM REMAINING OPERATING ENGINES THROUGH AN ENGINE WHICH HAS BEEN SHUT DOWN.

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LRU: GO2 ENGINE I/F ISOLATION CHECK VALVE

ITEM NAME: GO2 ENGINE I/F ISOLATION CHECK VALVE

CRITICALITY OF THIS

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, SEAL WELD JOINT

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 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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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.

-DISPOSITION RATIONALE-

(A) DESIGN:

THE CHECK VALVE IS SPRING LOADED TO THE CLOSED POSITION. UPSTREAM PRESSURE OVERCOMES THE SPRING FORCE TO UNSEAT THE POPPET FOR PRESSURES EXCEEDING 1.0 PSID. IF THE DOWNSTREAM PRESSURE IS GREATER THAN THE UPSTREAM PRESSURE BY MORE THAN 0.2 PSID THE DIFFERENTIAL WILL AID IN SEALING. THE DESIGN OPERATING PRESSURE IS 5500 PSIA. THE CHECK VALVE IS OPEN DURING ENGINE OPERATION. FOR AN ENGINE OUT FAILURE, PRESSURE FROM THE OTHER TWO ENGINES (UP TO 5500 PSIA) CLOSES THE FAILED ENGINE'S CHECK VALVE. THE VALVE IS REQUIRED TO CYCLE ONLY ONCE PER FLIGHT.

THE CHECK VALVE CONTAINS A LEAK DETECTION PORT AND A TRANSDUCER PORT.

THE BODY AND TUBE END ARE MANUFACTURED FROM INCONEL 718. THE ONLY POTENTIAL LEAK PATH IS THE BODY/TUBE INTERFACE. THE TUBE END IS THREADED INTO THE BODY, GAS TUNGSTEN ARC WELDED TO THE BODY, AND LEAK TESTED TO 1 SCCH MAX AT 5500 PSIA.

STRUCTURAL ANALYSIS INDICATES POSITIVE MARGINS OF SAFETY FOR ALL CONDITIONS OF VALVE OPERATION. THE VALVE HAS FACTORS OF SAFETY OF 2.0 PROOF AND 4.0 BURST.

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(B) TEST:

ATP

EXAMINATION OF PRODUCT

PROOF PRESSURE (11,960 PSIA)

CLOSURE PROOF PRESSURE (2000 PSIA)

REVERSE FLOW LEAKAGE (0 TO 600 PSIA, AT AMBIENT AND +530 DEG F)

EXTERNAL LEAKAGE (5500 PSIA, AMBIENT)

CRACK AND RESEAT PRESSURE (BODY TEMPERATURE -150 DEG F, 3 CYCLES)
CRACK PRESSURE 1 PSID MAXIMUM
RESEAT PRESSURE 0.2 PSID MINIMUM

CERTIFICATION

PERFORMANCE TEST

REVERSE PRESSURE LEAKAGE, CRACK PRESSURE, AND RESEAT PRESSURE
TESTS (AMBIENT TEMPERATURE, AIR)

HIGH TEMPERATURE FLOW AND CHATTER TEST

2.75 LB/SEC MIN, GO2 AT 260 DEG F, 3000 PSIA INLET
0.30 LB/SEC MIN, GO2 AT 530 DEG F, 3200 PSIA INLET
RECORD FLOW RATE AT WHICH CHATTER IS DETECTED
REPEAT PERFORMANCE TEST

HIGH PRESSURE EXPOSURE TEST (4 CYCLES)

10 MINUTES FLOW AT 1.0 LB/SEC MIN, GO2 AT +530 DEG F, 4800 PSIA INLET
REPEAT PERFORMANCE TEST AFTER TEST COMPLETION

ENDURANCE FLOW TEST (5 CYCLES EACH)

10 MINUTES FLOW AT 1.13 LBS/SEC MIN, GO2 AT +390 DEG F, 3600 PSIA INLET
10 MINUTES FLOW AT 2.6 LBS/SEC MIN, GO2 AT +390 DEG F, 3600 PSIA INLET
REPEAT PERFORMANCE TEST AFTER TEST COMPLETION

HIGH TEMPERATURE EXPOSURE TEST (4 CYCLES)

10 MINUTES FLOW AT 1.0 LBS/SEC MIN, GO2 AT +710 DEG F, 1500 PSIA INLET
REDUCE INLET PRESSURE TO 0 PSIG AND OUTLET PRESSURE TO 600 PSIG
REPEAT PERFORMANCE TEST AFTER TEST COMPLETION

VIBRATION

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RANDOM (AMBIENT TEMPERATURE)

10 HOURS FOR EACH OF 2 AXES (12 TO 15 PSIG INLET, AIR AT AMBIENT)

REPEAT PERFORMANCE TEST AFTER COMPLETION OF EACH AXIS OF VIBRATION

RANDOM (+530 DEG F)

2.66 HOURS FOR EACH OF 2 AXES (12 TO 15 PSIG INLET, GO2 AT +250 DEG F)

REPEAT PERFORMANCE TEST AFTER COMPLETION OF EACH AXIS OF VIBRATION

RANDOM (+710 DEG F)

0.66 HOURS FOR EACH OF 2 AXES (12 TO 15 PSIG INLET, GO2 AT +250 DEG F)

REPEAT PERFORMANCE TEST AFTER COMPLETION OF EACH AXIS OF VIBRATION

TRANSIENT SHOCK TEST

ALONG X AND Y AXIS, SINUSOIDAL SWEEP, 5 TO 35 HZ, +/-0.25 G

REPEAT PERFORMANCE TEST AFTER TEST COMPLETION

LIFE CYCLE TEST (1800 CYCLES)

ONE CYCLE CONSISTS OF: FLOW AT 60 SCFM (CLEAN DRY AIR), THEN REDUCE FLOW AND INLET PRESSURE TO ZERO WHILE INCREASING OUTLET PRESSURE TO 600 PSID.

REPEAT PERFORMANCE TEST AFTER EVERY 50 CYCLES

BURST TEST (24,000 PSIG, AMBIENT TEMPERATURE)

CLOSURE BURST TEST (2631 PSIG, AMBIENT TEMPERATURE)

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 100A.

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ASSEMBLY/INSTALLATION

DIMENSIONS AND SURFACE FINISHES ARE VERIFIED BY INSPECTION. DETAIL PARTS ARE PROTECTED FROM DAMAGE AND CONTAMINANTS BY PRODUCTION PROCEDURES DURING MANUFACTURING AND TESTING. POPPET-TO-BODY CLEARANCE AND SEALING SURFACES ARE CHECKED AND VERIFIED. SURFACES AND WELD ARE INSPECTED UNDER 10X MAGNIFICATION. MANDATORY INSPECTION POINTS ARE ESTABLISHED TO VERIFY ASSEMBLY PROCESS.

CRITICAL PROCESSES

THE WELD IS VISUALLY INSPECTED. ELECTRO-NICKEL PLATED TUBE SURFACE IS VERIFIED. HEAT TREATMENT AND PARTS PASSIVATION ARE VERIFIED BY INSPECTION. DRY FILM LUBRICANT APPLIED TO THREADS ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

HELIUM LEAKAGE DETECTION IS VERIFIED PER REQUIREMENT.

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.

- 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	: MICHAEL FISCHER	:/S/ MICHAEL 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