

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : EPD&C - MAIN PROP. FMEA NO 05-6J -2033 -2 REV:06/20/88

ASSEMBLY : AFT PCA - 4, 5, 6
 P/N RI : MC455-0129-0001
 P/N VENDOR:
 QUANTITY : 6
 : SIX
 :

VEHICLE	102	103	104
EFFECTIVITY:	X	X	X
PHASE(S):	PL	LO X OO	DO LS

CRIT. FUNC: 1R
 CRIT. HDW: 3

REDUNDANCY SCREEN: A-PASS B-FAIL C-PASS

PREPARED BY:	APPROVED BY:	APPROVED BY (NASA):
DES <u>J BROWN</u>	DES <u>[Signature]</u>	EPDC SSM <u>[Signature]</u>
REL <u>F DEFENSOR</u>	REL <u>J. Korman 6/27/88</u>	MPS SSM <u>[Signature]</u>
QE <u>D. D. MASAI</u>	QE <u>[Signature] 6/27/88</u>	EPDC REL <u>[Signature]</u>
		MPS REL <u>[Signature]</u>
		QE <u>[Signature]</u>

ITEM:
 RELAY, GENERAL PURPOSE, GH2/GO2 FLOW CONTROL VALVE (LV53/54/55/56/57/58),
 CLOSE SOLENOID.

FUNCTION:
 PROVIDES THE SIGNAL CONDITIONER WITH OUTPUT FROM EITHER PRIMARY OR
 STANDBY ULLAGE PRESSURE TRANSDUCER.
 54V76A134K1, K2. 55V76A135K1, K2. 56V76A136K1, K2.

FAILURE MODE:
 CLOSED, FAILS TO OPEN, INADVERTENTLY CLOSES, SHORTS (CONTACT-TO-CONTACT).

CAUSE(S):
 PIECE PART FAILURE, CONTAMINATION, VIBRATION, MECHANICAL SHOCK,
 PROCESSING ANOMALY.

EFFECT(S) ON:
 (A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE (E) FUNCTIONAL
 CRITICALITY

(A) INADVERTENT SWITCHING OF NO. 4 TRANSDUCER.

(B,C,D) NO EFFECT - FIRST FAILURE.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : EPD&C - MAIN PROP. FMEA NO 05-6J -2033 -2 REV:06/20/88

(E) CASE I: LO2/LH2 "LOW" FAILURES.

1R/3, 2 SUCCESS PATHS AFTER FIRST FAILURE.
TIME FRAME - ASCENT.

- 1) RELAY FAILS CLOSED CAUSING NO. 4 TRANSDUCER TO REPLACE PRIMARY ULLAGE TRANSDUCER.
- 2) NO. 4 TRANSDUCER FAILS WITH ERRONEOUS LOW OUTPUT.
- 3) INADVERTENT DEACTUATION OF SECOND FLOW CONTROL VALVE CLOSE SOLENOID.

RESULTS IN EXCESSIVE ULLAGE PRESSURE CAUSING ET VENT VALVE TO RELIEVE EXCESS PRESSURE. POTENTIAL FIRE/EXPLOSION HAZARD EXTERIOR TO THE VEHICLE. POSSIBLE VIOLATION OF THE ET MAXIMUM STRUCTURAL CAPABILITY REQUIREMENTS. POSSIBLE LOSS OF CREW/VEHICLE.

CASE II: LH2 "HIGH" FAILURES.

1R/3, 2 SUCCESS PATHS AFTER FIRST FAILURE.
TIME FRAME - ASCENT.

- 1) RELAY FAILS CLOSED CAUSING NO. 4 TRANSDUCER TO REPLACE PRIMARY ULLAGE TRANSDUCER.
- 2) NO. 4 TRANSDUCER FAILS WITH ERRONEOUS HIGH OUTPUT.
- 3) INADVERTENT ACTUATION OF SECOND FLOW CONTROL VALVE CLOSE SOLENOID.

RESULTS IN INSUFFICIENT PRESSURIZATION GAS TO MAINTAIN LH2 ULLAGE PRESSURE IN THE REQUIRED FLIGHT CONTROL BAND (32-34 PSIA). POSSIBLE VIOLATION OF TANK MINIMUM STRUCTURAL CAPABILITY REQUIREMENTS AND UNCONTAINED SSME SHUTDOWN DUE TO LOW NPSP. POSSIBLE LOSS OF CREW/VEHICLE.

CASE III: LO2 "HIGH" FAILURES.

1R/3, 2 SUCCESS PATHS AFTER FIRST FAILURE.
TIME FRAME - ASCENT.

- 1) RELAY FAILS CLOSED CAUSING NO. 4 TRANSDUCER TO REPLACE PRIMARY ULLAGE TRANSDUCER.
- 2) NO. 4 TRANSDUCER FAILS WITH ERRONEOUS HIGH OUTPUT.
- 3) INADVERTENT ACTUATION OF SECOND FLOW CONTROL VALVE CLOSE SOLENOID.

LOSS OF ET LO2 ULLAGE PRESSURE WILL RESULT IN VIOLATION OF TANK MINIMUM STRUCTURAL CAPABILITY REQUIREMENTS. MASS OF LO2 AND VEHICLE ACCELERATION SHOULD BE SUFFICIENT TO MAINTAIN PROPER ENGINE NPSP, DELAYING UNCONTAINED SSME SHUTDOWN DUE TO LOW NPSP UNTIL LATE IN POWERED FLIGHT. POSSIBLE LOSS OF CREW/VEHICLE.

FAILS B SCREEN BECAUSE NO INSTRUMENTATION IS AVAILABLE TO DETECT FAILURE.

05-6J-47

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :EPD&C - MAIN PROP. FMEA NO 05-6J -2033 -2 REV:06/20/88

DISPOSITION & RATIONALE:

(A)DESIGN (B)TEST (C)INSPECTION (D)FAILURE HISTORY (E)OPERATIONAL USE

(A-D) DISPOSITION AND RATIONALE:

REFER TO APPENDIX C, ITEM NO. 2 - GENERAL PURPOSE RELAY.

(B) GROUND TURNAROUND TEST

PRESS CNTL REDUNDANCY W/ET SIM V41ACO.030A, V41ACO.060A EVERY FLIGHT

(E) OPERATIONAL USE

NO CREW ACTION CAN BE TAKEN FOR LOSS OF GO2 ULLAGE PRESSURE CONTROL OR FAILURES WHICH RESULT IN EXCESSIVE GH2 ULLAGE PRESSURE. THE FOLLOWING ACTIONS CAN BE TAKEN FOR LOW GH2 ULLAGE PRESSURE:

LH2 ULLAGE PRESSURE IS ON SYSTEMS MANAGEMENT (SM) ALERT. CREW WILL OPEN THE LH2 FLOW CONTROL VALVES (VIA COCKPIT SWITCH S53 ON PANEL R2) FOR A LOW LH2 ULLAGE PRESSURE CONDITION.

IF THE LH2 NPSF DROPS BELOW THE PRE-FLIGHT ACCEPTED LEVELS (PER FLIGHT RULES), THE CREW WILL MANUALLY THROTTLE THE ENGINES TO KEEP THE NPSF HIGH ENOUGH TO PREVENT LH2 TURBOPUMP CAVITATION.