SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :LIFE SUPPORT FMEA NO 06-2F -311000-1 REV:10/29/87

ASSEMBLY :SMOKE DETECTION
P/N RI :MC431-0127-0103/-1103
P/N VENDOR:
QUANTITY :9
:3 IN CREW CABIN
:2 IN EACH OF 3 AV BAYS

CRIT. FUNC: 1R
CRIT. HDW: 2

VEHICLE EFFECTIVITY:	102	103	104
	X	X	X

PHASE(S): PL X LO X OO X DO X LS X

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

PREPARED BY:		APPROVED BY:	APPROVED BY (NASA):
DES	D. WADA	DES	SSM 10/29/
REL	D. RISING	REL	REL 10/29/
QE	W. SMITH	QE 10/28/87	QE 11-3-87

ITEM:
SMOKE DETECTOR ASSEMBLY
CABIN AND AVIONIC BAY AREAS.

FUNCTION:
TO PROVIDE A WARNING TO CREW DURING THE INCIPIENT STAGE OF A POTENTIAL FIRE CONDITION. CONSISTS OF THREE DETECTOR HEADS IN THE CABIN AREA AND TWO IN EACH AVIONICS BAY, EACH WITH A BUILT IN LOGIC DEVICE WHICH ACTUATES AN EXTERNAL ALARM.

FAILURE MODE:
FAILS TO OPERATE/ALARM

CAUSE(S):
MECHANICAL SHOCK, PIECE-PART STRUCTURAL FAILURE, RESTRICTED AIR FLOW, ELECTRICAL OPEN (28, 15, 8 VDC CIRCUITS), CONTAMINATION (ELECTRICAL SHORT)

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

(A) LOSS OF ONE OF TWO REDUNDANT SMOKE DETECTORS IN AVIONICS BAY OR CABIN.

(B) LOSS OF ONE ALARM SIGNAL AND POSSIBLE TIME DELAY TO DETECT SMOKE.

(C) NO EFFECT.

(D) SECOND ASSOCIATED FAILURE (REDUNDANT SMOKE DETECTOR) WOULD RESULT IN LOSS OF ALL SMOKE DETECTION IN AVIONICS BAY. UNDETECTABLE FIRE MAY CAUS LOSS OF CREW/VEHICLE.
REDUNDANCY SCREEN B FAILS BECAUSE FAILURE IS NOT READILY DETECTABLE IN FLIGHT UNTIL SELF-TEST IS PERFORMED OR AN ALARM IS REQUIRED.

DISPOSITION & RATIONALE:
(A)DESIGN (B)TEST (C)INSPECTION (D)FAILURE HISTORY (E)OPERATIONAL USE

(A) DESIGN
CONVENTIONAL VANE PUMP; CORROSION RESISTANT MATERIALS PER QQ-7-763 AND QQ-P-35; GOLDPLATED VANE BEARING SURFACES TO PREVENT CORROSION;

AIR INLET SCREEN -50 MICRON AND LARGE SURFACE (2 1/2 " DIA); DUAL SENSE CHAMBERS TO COMPENSATE FOR ENVIRONMENTAL CHANGES- PRESSURE, TEMPERATURE, RADIATION; SELF-TEST CIRCUITRY - VERIFIES, PUMP ROTATION/CONTROLLER, ALARM LOGIC AND SIGNAL (VCO, LSI); HIGH RELIABILITY, SOLID STATE HARDWARE; EEE PARTS MEET MF0004-400 REQUIREMENTS; CLEANLINESS PER MC999-0096 (CLEAN ROOM 300,000); TORQUE CONTROL; SOLDERING PER ATLANTIC RESEARCH SPECIFICATION. ST-41204; CONFORMAL COATING.

(B) TEST

QUAL TEST-FOR 100 MISSION LIFE; 20,000 HRS MOTOR AND BEARING OPERATING LIFE; PRESSURE 8 TO 14.7 PSIA; ELECT. BONDING; ACCELERATION - 5G; 20G SHOCK/AXIS AND 100 MISSION VIBRATION (0.09G SQ/HZ FOR 48 MIN/AXIS); RANDOM VIBRATION (.067G SQ/HZ FOR 5 MIN/AXIS), 5% SALT AND 85% RH. FOR 120 HRS,30-24 HR. TEMP. CYCLE TEST (65 TO 135 DEG.F). ACCEPTANCE TEST - FUNCTIONAL TESTS, 48 HRS @ 24, 28, 32 VDC (INCLUDES SMOKE TESTS); DIELECTRIC STRENGTH AT 500 V/SEC MAX TO 1250 VOLTS RMS; INSULATION RESISTANCE AT 500 VDC; BURN-IN/RUN-IN ; VIBRATION (0.04G SQ/HZ FOR 0.5 MIN/AXIS). TURNAROUND: SELF TEST EVERY FLIGHT; VISUAL INSPECTION OF INLET SCREEN FOR DEBRIS EVERY TEN FLIGHTS.

(C) INSPECTION

RECEIVING INSPECTION
RAW MATERIAL AND VENDOR PURCHASE COMPONENTS ARE VERIFIED BY RECEIVING INSPECTION.

CONTAMINATION CONTROL
CORROSION PROTECTION PROVISIONS AND CONTAMINATION CONTROL PLAN ARE VERIFIED BY INSPECTION.

CRITICAL PROCESSES
SOLDERING PROCESS IS VERIFIED BY INSPECTION. COATING AND PLATING PROCESSES ARE VERIFIED BY INSPECTION. CONFORMAL COATING IS VERIFIED BY INSPECTION. WELDING AND PLATING PROCESSES ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
DIMENSIONS AND LOCKWIRE ARE VERIFIED BY INSPECTION. PARTS PROTECTION, MANUFACTURING PROCESSES, INSTALLATION AND ASSEMBLY ARE VERIFIED BY INSPECTION. TORQUING IS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
WELDING IS VERIFIED BY RADIOGRAPHIC INSPECTION.

TESTING
ACCEPTANCE TESTING IS VERIFIED BY INSPECTION.

(D) FAILURE HISTORY

(1) EXCESSIVE RUN TORQUE ON BEARINGS AFTER 800 HOURS. NEW BEARING LUBE PASSED 20,000 OPERATING HOURS. (CAR #AB6996)
(2) TWO DIFFERENT DETECTORS FAILED TO SELF-TEST (EACH ON A DIFFERENT FLIGHT) BECAUSE THE PUMP BEARING SEIZED DUE TO EXCESSIVE TEMPERATURE ON LUBRICANT. BOTH DETECTORS WERE IN THE SAME AVIONICS BAY WHICH HAD ITS AIR CIRCULATION TURNED OFF DURING SEVERAL OTHER FLIGHTS PRIOR TO THESE FAILURES. ANALYSIS INDICATED THAT THE TEMPERATURE IN THE AVIONICS BAY

EXCEEDED THE CERTIFICATION TEMPERATURE OF THE DETECTOR LUBRICANT. A NEW HIGH TEMPERATURE LUBRICANT WAS SELECTED FOR NEW DETECTORS. (CAR #24P004 26F006)

(E) OPERATIONAL USE
FIRST FAILURE IS NO EFFECT - REDUNDANT SMOKE DETECTOR WILL PROVIDE SMOKE DETECTION. NO CREW ACTION REQUIRED.