SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 06-1B1-0301-X

SUBSYSTEM NAME: ARS COOLING

REVISION : 11/07/88

CLASSIFICATION		NAME	PART NUMBER
LRU	:	CABIN FAN & DEBRIS TRAP	MC621-0008-0311
SRU	:	FAN	SV755527

QUANTITY OF LIKE ITEMS: 2

DESCRIPTION/FUNCTION:
FAN AND DEBRIS TRAP ASSY - CABIN AIR REVITALIZATION

TWO INDEPENDENTLY CONTROLLED FANS LOCATED IN A COMMON FAN PACKAGE TO CIRCULATE CREW CABIN AIR FOR CO2 AND HUMIDITY REMOVAL, TEMPERATURE CONTROL AND FLIGHT DECK AVIONICS COOLING DURING GROUND AND ORBITAL OPERATIONS. ONE FAN PROVIDES THE REQUIRED FLOW DURING NORMAL OPERATIONS.

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 06-1B1-0301-04

REVISION: 11/07/88

SUBSYSTEM: ARS COOLING
LRU :CABIN FAN & DEBRIS TRAP
ITEM NAME: FAN

CRITICALITY OF THIS FAILURE MODE:2 2

FAILURE MODE:
EXTERNAL LEAKAGE

MISSION PHASE:

LO	LIFT-OFF
OO	ON-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY:

102		COLUMBIA
103		DISCOVERY
104		ATLANTIS

CAUSE:
MECHANICAL SHOCK, VIBRATION, CORROSION, SEAL MATERIAL DEGRADATION

CRITICALITY 1/1 DURING ANY MISSION PHASE OR ABORT? N

REDUNDANCY SCREEN A) N/A

B) N/A

C) N/A

A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
DECREASE IN CABIN FAN DELTA PRESSURE. REDUCED AIR CIRCULATION.

(B) INTERFACING SUBSYSTEM(S):
REDUCED AIR FLOW RESULTS IN INCREASED CABIN TEMP, CO2 PARTIAL PRESSURE AND CABIN HUMIDITY FOR LEAK DOWNSTREAM OF FANS (INCREASED CABIN TEMPERATURE WILL EVENTUALLY DEGRADE AVIONICS COOLING CAPABILITY). LEAK UPSTREAM OF FANS RESULTS IN DECREASED FLIGHT DECK AVIONICS COOLING, POSSIBLE LOSS OF SMOKE DETECTION CAPABILITY AND INCREASED TEMPERATURE OF FLIGHT DECK AVIONICS LRU'S.

(C) MISSION:
POSSIBLE EARLY MISSION TERMINATION FOR SIGNIFICANT DECREASE OF AVIONICS COOLING.

(D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT. EARLY MISSION TERMINATION WILL PRECLUDE LOSS OF CREW/VEHICLE.

RATIONALE FOR CRITICALITY:

- DISPOSITION RATIONALE -

(A) DESIGN:
FAN AND DEBRIS TRAP PACKAGE IS CONSTRUCTED OF 6061-T6 ALUMINUM BOLTED AND WELDED TOGETHER. STAINLESS STEEL 40/70 MICRON FILTER (CABIN FAN DEBRIS TRAP) UPSTREAM OF FANS. DESIGN FLOW RATE IS 1316-1528 LB/HR WITH DELTA P OF 4.96 - 6.14 IN H20. THE OPERATING PRESSURE WITHIN THE ASSEMBLY IS LOW, SUCH THAT THE OCCURRENCE OF GROSS EXTERNAL LEAKAGE RESULTING IN LOSS OF AVIONICS COOLING CAPABILITY IS REMOTE.

CABIN FAN PACKAGE SEAL MATERIALS:
A. PARTS SUBJECTED TO NEGATIVE DIFFERENTIAL PRESSURE (PRESSURE INSIDE ASSEMBLY IS LOWER THAN CABIN PRESSURE)
   1. DEBRIS TRAP/FILTER DOOR - CLOSED-CELL SILICONE RUBBER SPONGE.
   2. FRAME FLEXIBLE CONNECTIONS UPSTREAM OF FAN INLETS - VITON (FLUOROCARBON RUBBER) BONDED TO FRAME PARTS.
   3. RUBBER LINING IN CLAMP AT FAN INLET - CLOSED-CELL SILICONE RUBBER SPONGE BONDED TO CLAMP.
   4. TWO TUBE SUPPORT CLAMP SCREWS THAT PENETRATE INLET PLENUM - WASHERS OF CLOSED-CELL SILICONE RUBBER SPONGE.
B. PARTS SUBJECTED TO POSITIVE DIFFERENTIAL PRESSURE
   1. FRAME FLEXIBLE CONNECTIONS DOWNSTREAM OF CHECK VALVE OUTLETS - VITON BONDED TO FRAME PARTS.
   2. GASKET FOR FAN DELTA-P SENSOR AND UNDER COVER STRAP WHERE DFI

PRESSURE SENSOR REMOVED - CLOSED-CELL SILICONE RUBBER SPONGE BONDED TO FRAME.

3. SIGNAL CONDITIONER MOUNTING BOLT PENETRATION INTO DISCHARGE PLENUM - PLATE-NUT ENCAPSULATED WITH RTV.
4. TWO TUBE SUPPORT AND ONE HARNESS SUPPORT CLAMP SCREWS PENETRATING INTO DISCHARGE PLENUM - WASHERS OF CLOSED-CELL SILICONE RUBBER.
5. SMOKE DETECTOR MOUNT HAS A SILICONE RUBBER SEAL.
6. THE FOLLOWING INTERFACES ARE NOT SEALED (METAL TO METAL CONTACT). ANY LEAKAGE IS WITHIN ATP ALLOWANCE: CO2 SENSOR BOLTED FLANGE, FAN TO CHECK VALVE JOINTS V BAND FLANGES AND CLAMP; CHECK VALVE TO PLENUM JOINTS, BOLTED FLANGES AND SMOKE DETECTOR CHECK-OUT PLUG.

(B) TEST:
ACCEPTANCE TEST - PROOF PRESSURE AT 10 IN H20 FOR 5 MINUTES. FAN PACKAGE LEAKAGE TEST VERIFIES LESS THAN 0.1 LB/MIN LEAKAGE OF GN2 AT 70 F WITH DELTA-P OF +10 INH2O ON OUTLET PLENUM AND 0.233 LB/MIN AT DELTA-P OF -3 INH2O ON INLET (TESTS CHECK VALVE, FANS AND INLET PLENUM).

QUALIFICATION TEST - RANDOM VIBRATION SPECTRUM OF 20 TO 150 HZ INCREASING AT 6 DB/OCTAVE TO 0.09 G**2/HZ, CONSTANT AT 0.09 G**2/HZ FROM 150 TO 900 HZ, DECREASING AT 9 DB/OCTAVE FROM 900 TO 2000 HZ FOR 48 MINUTES PER AXIS IN THREE ORTHOGONAL AXES. DESIGN SHOCK - THREE TERMINAL SAWTOOTH PULSES OF 20 G PEAK AMPLITUDE AND 11 MS DURATION APPLIED IN BOTH DIRECTIONS ALONG EACH OF THREE ORTHOGONAL AXES. TEMPERATURE/HUMIDITY TESTED WITH HUMIDITY KEPT BETWEEN 80% AND 90% AND TEMPERATURE CYCLED BETWEEN 60 AND 125 F FOR 120 HOURS. ATP TO VERIFY LEAKAGE WAS PERFORMED AFTER SHOCK AND VIBRATION TESTING.

IN-VEHICLE TESTING - CABIN FAN DELTA-P IS MONITORED CONTINUOUSLY WHEN THE VEHICLE IS POWERED UP.

OMRSD - CABIN FAN DELTA-P IS MONITORED CONTINUOUSLY WHEN THE VEHICLE IS POWERED UP DURING EVERY TURNAROUND.

(C) INSPECTION:
RECEIVING INSPECTION
RAW MATERIAL CERTIFICATIONS ARE VERIFIED BY INSPECTION.

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

ASSEMBLY/INSTALLATION
PARTS PROTECTION, MANUFACTURING PROCESSES, INSTALLATION AND ASSEMBLY VERIFIED BY INSPECTION. ELECTRICAL TERMINATIONS VERIFIED BY INSPECTION. TORQUE IS VERIFIED BY INSPECTION. LUBRICANT APPLICATION

IS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
DYE PENETRANT AND X-RAY OF WELDS IS VERIFIED BY INSPECTION.

CRITICAL PROCESSES
WELDING IS VERIFIED BY VERIFIED BY INSPECTION.

TESTING
ATP WITNESSED BY INSPECTION AND CLEANLINESS VERIFIED BY INSPECTION.

HANDLING/PACKAGING
HANDLING AND PACKAGING REQUIREMENTS VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:
NO FAILURE HISTORY APPLICABLE TO EXTERNAL LEAKAGE FAILURE MODE. THE CABIN FAN AND DEBRIS TRAP ASSEMBLY HAS SUCCESSFULLY PERFORMED WITHOUT FAILURE THROUGH THE DURATION OF THE SHUTTLE PROGRAM.

(E) OPERATIONAL USE:
1. CREW ACTION
   FAN PERFORMANCE DEGRADATION TROUBLESHOOTING AND APPROPRIATE FOLLOW ON PROCEDURES (POWERDOWN).

2. TRAINING
   A. CURRENT ECLSS TRAINING COVERS THE GENERIC EFFECT OF THIS FAILUR
   B. CURRENT FDF CONTAINS APPLICABLE CONTINGENCY PROCEDURES FOR THE EFFECT OF THE FAILURE.

3. OPERATIONAL CONSIDERATIONS
   A. REAL TIME DATA SYSTEM ALLOWS FOR GROUND MONITORING.
   B. REFERENCE CURRENT LOSS/FAILURE FLIGHT RULES.
   C. POTENTIAL LOSS OF CO2 CONTROL; USE OF LES MAY BE REQUIRED.

= APPROVALS =

RELIABILITY ENGINEERING	N. L. STEISSLINGER	
DESIGN ENGINEERING	N. K. DUONG	
QUALITY ENGINEERING	D. R. STOICA	
NASA RELIABILITY		
NASA DESIGN		
NASA QUALITY ASSURANCE		