

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ATMOSPHERIC REVIT. FMEA NO 06-1B -0421 -2 REV:08/12

ASSEMBLY : IMU COOLING
 P/N RI : MC621-0008-0016 CRIT. FUNC: 2
 P/N VENDOR: SV767350 HAM STD CRIT. HDW: 2

QUANTITY : 1	VEHICLE 102	103	104
: 1 FAN PACKAGE	EFFECTIVITY: X	X	X
: 3 FANS	PHASE(S): PL	LO X	OO X DO X LS

PREPARED BY: DES N. K. DUONG
 REL N. L. STEISSLINGER
 QE D. STOICA

REDUNDANCY SCREEN
 APPROVED BY: *[Signature]*
 YLOES
 REL
 QE

A- APPROVED BY (NASA):
 B-
 C-
 SSM
 REL
 QE

ITEM:
 IMU FAN PACKAGE

FUNCTION:
 PROVIDES AIR CIRCULATION FOR COOLING IMU'S. THERE ARE THREE FANS CAPABLE OF DRAWING AIR FROM THE CABIN THROUGH THE IMU'S AND DISCHARGING THROUGH THE HEAT EXCHANGER BACK INTO THE CABIN. ONE FAN PROVIDES THE REQUIRED FLOW.

FAILURE MODE:
 EXTERNAL LEAKAGE

CAUSE(S):
 MECHANICAL SHOCK, VIBRATION, CORROSION, SEAL MATERIAL DEGRADATION

- EFFECT(S) ON:
 (A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE
- (A) FOR LEAKAGE UPSTREAM OF IMU FANS, THE FANS WOULD PULL IN AMBIENT AIR IN ADDITION TO PULLING AIR THROUGH THE IMU'S. FOR LEAKAGE DOWNSTREAM OF THE FANS, THE WARM AIR WOULD BE RETURNED TO THE CABIN THROUGH THE LEAK PATH, BYPASSING THE IMU HEAT EXCHANGER.
- (B) REDUCED IMU COOLING. INCREASED TEMPERATURE OF IMU'S.
- (C) ABORT DECISION FOR DECREASED AIR COOLING TO IMU'S.
- (D) NO EFFECT. EARLY MISSION TERMINATION WILL PRECLUDE LOSS OF CREW/VEHICLE.

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

(A) DESIGN
 SIGNIFICANT LEAKAGE IN THE IMU AIR FLOW SYSTEM IS CONSIDERED REMOTE. FAN PACKAGE IS CONSTRUCTED OF 6061-T6 ALUMINUM BOLTED AND WELDED TOGETHER. STAINLESS STEEL 1600 MICRON SCREEN UPSTREAM TO PROTECT FANS. ALL AIR ENTERING THE SYSTEM PASSES THROUGH THE IMU INLET AIR FILTERS. DESIGN FLOW RATE IS 129-161 LB/HR WITH MAX DELTA-P OF 3.4 - 4.3 INH2O.

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IMU FAN PACKAGE SEAL MATERIALS:

- A. PARTS SUBJECTED TO NEGATIVE DIFFERENTIAL PRESSURE
 1. FAN INLET SEALS - VITON (FLUOROCARBON RUBBER).
 2. MOTOR SPEED SENSOR SEALS - VITON.
- B. PARTS SUBJECTED TO POSITIVE DIFFERENTIAL PRESSURE
 1. FAN DISCHARGE SEALS - SPECIAL ELECTRICALLY CONDUCTING COMPOUND (CHIMERICS, INC.).
 2. DUCT FLEXIBLE CONNECTIONS - VITON.

(B) TEST

ACCEPTANCE TEST - LEAK TEST WITH GN2 VERIFIES EXTERNAL LEAKAGE OF 0.05 LB/MIN MAX AT 7.5 IN H2O AND OUTLET CHECK VALVE REVERSE LEAKAGE OF LESS THAN 0.05 LB/MIN WITH DELTA-P OF +7.5 INH2O.

QUALIFICATION TEST - RANDOM VIBRATION SPECTRUM OF 20 TO 150 HZ INCREASE AT 6 DB/OCTAVE TO 0.03 G**2/HZ, CONSTANT AT 0.03 G**2/HZ FROM 150 TO 1000 HZ, DECREASING AT 6 DB/OCTAVE FROM 1000 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. ATP PERFORMED TO VERIFY LEAKAGE AFTER SHOCK AND VIBRATION TESTING. ✓

IN-VEHICLE TESTING - IMU FAN DELTA-P IS MONITORED CONTINUOUSLY WHEN IMU ARE POWERED UP.

OMRSD - IMU FAN OPERATION IS VERIFIED EVERY TURNAROUND BY MONITORING IMU FAN DELTA-P WHICH WILL INDICATE EXTERNAL LEAKAGE.

(C) INSPECTION

RECEIVING INSPECTION

INCOMING MATERIALS ARE VERIFIED FOR MATERIAL AND PROCESS CERTIFICATION.

CONTAMINATION CONTROL

INTERNAL AND EXTERNAL SURFACE CLEANLINESS IS VERIFIED PER H.S. REQUIREMENTS. INSPECTION VERIFIES CORROSION PROTECTION PROVISIONS.

ASSEMBLY/INSTALLATION

TORQUE APPLICATION IS VERIFIED BY INSPECTION. MANUFACTURING PROCESSES, INSTALLATION AND ASSEMBLY OPERATIONS ARE VERIFIED BY INSPECTION. SCREWS AND WASHERS COATED WITH WET SUPER KOROPON AND KRYTOX COATED O-RING ARE CHECKED PER REQUIREMENT.

CRITICAL PROCESSES

ELECTRICAL TERMINATIONS ARE VERIFIED BY INSPECTION. WELDING VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

LEAK TEST IS VERIFIED BY INSPECTION.

TESTING

ACCEPTANCE TEST VERIFIED BY INSPECTION.

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HANDLING/PACKAGING
PACKAGING FOR SHIPMENT IS VERIFIED BY INSPECTION.

(D) FAILURE HISTORY

NO FAILURE HISTORY APPLICABLE TO EXTERNAL LEAKAGE FAILURE MODE. THE IMU FAN PACKAGE HAS SUCCESSFULLY PERFORMED WITHOUT FAILURE THROUGH THE DURATION OF THE SHUTTLE PROGRAM.

(E) OPERATIONAL USE

1. CREW ACTION

- A. IMU FAN PERFORMANCE DEGRADATION TROUBLESHOOTING.
- B. IMU ELEVATED TEMPERATURE OR PERFORMANCE DEGRADATION TROUBLESHOOTING.

2. TRAINING

CURRENT ECLSS AND GNC (GUIDANCE NAVIGATION AND CONTROL) TRAINING COVERS THE EFFECT OF THIS FAILURE.

3. OPERATIONAL CONSIDERATIONS

- A. REAL TIME DATA SYSTEM ALLOWS FOR GROUND MONITORING.
- B. ALTERNATE POWERING OF EACH IMU IS POSSIBLE.