

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE

NUMBER: 06-1B-0401 -X

SUBSYSTEM NAME: ARS - COOLING

REVISION: 1

11/22/00

PART DATA

	PART NAME	PART NUMBER
	VENDOR NAME	VENDOR NUMBER
	: AVIONICS TEMP CONTROL	
LRU	: FAN	MC621-0008-0005
LRU	: FAN (AVIONICS BAY 3A) HAMILTON STANDARD	MC621-0008-0605 SV755524
LRU	: CABIN FAN (AVIONICS BAY 3A) HAMILTON STANDARD	MC621-0008-0805 SV755527

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

FAN, AVIONICS BAY

QUANTITY OF LIKE ITEMS: 7

TWO PER BAY

SIX PER SUBSYSTEM

FUNCTION:

PROVIDES AIR FLOW THROUGH THE AVIONICS COOLING ASSEMBLY. FAN DELTA-P FOR BAY 1 - MML V61P2642A, BAY 2 V61P2647A, BAY 3A V61P2658A.

MC621-0008-0605: MCR 19393 "AVIONICS BAY 3A FAN MOD - LONG LEAD PROCUREMENT" PROVIDES FLEXIBILITY TO INSTALL EITHER CABIN OR AVIONICS FAN IN AVIONICS BAY 3A BASED ON INDIVIDUAL MISSION CONSUMABLES AND PAYLOAD COOLING NEEDS TO IMPROVE CRYO CONSUMABLES MARGIN.

FAILURE MODES EFFECTS ANALYSIS FMEA -- CIL FAILURE MODE

NUMBER: 06-1B-0401- 03

REVISION#: 1 11/22/00

SUBSYSTEM NAME: ARS - COOLING

LRU: AVIONICS COOLING ASSEMBLY

ITEM NAME: FAN, AVIONICS

CRITICALITY OF THIS

FAILURE MODE: 1R2

FAILURE MODE:

EXTERNAL LEAKAGE, AIR

MISSION PHASE:

- LO LIFT-OFF
- OO ON-ORBIT
- DO DE-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY:

- 102 COLUMBIA
- 103 DISCOVERY
- 104 ATLANTIS
- 105 ENDEAVOUR

CAUSE:

MECHANICAL SHOCK, VIBRATION, CORROSION, SEAL MATERIAL DEGRADATION

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN

- A) PASS
- B) N/A
- C) PASS

PASS/FAIL RATIONALE:

A)

B)

SCREEN B IS N/A BECAUSE REDUNDANT FAN IS IN STANDBY UNTIL REQUIRED.

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

DECREASED COOLING AIR FLOW IN THE AFFECTED AVIONICS BAY.

(B) INTERFACING SUBSYSTEM(S):

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(C) MISSION:

POSSIBLE EARLY MISSION TERMINATION FOR SIGNIFICANT DECREASE IN AVIONICS COOLING.

(D) CREW, VEHICLE, AND ELEMENT(S):

NO EFFECT.

(E) FUNCTIONAL CRITICALITY EFFECTS:

SECOND ASSOCIATED FAILURE, LOSS OF REDUNDANT FAN, MAY RESULT IN LOSS OF CREW/VEHICLE DUE TO LOSS OF AVIONICS COOLING.

-DISPOSITION RATIONALE-

(A) DESIGN:

AVIONICS FAN (MC621-0008-0005 AND MC621-0008-0605):
THE FAN IS AN AXIAL 3 PHASE, 400 HZ, 115 VOLT INDUCTION ELECTRIC MOTOR. THE FAN IS DUCT MOUNTED USING A STANDARD CLAMP UPSTREAM, A STRAP ON THE HOUSING, AND A BOLTED FLANGE DOWNSTREAM. THE HOUSING IS MADE OF AL C355-T6 CL12 ANODIZED PER MIL-A-8625 TYPE I. SEALS ARE OF SILICON.

CABIN FAN (MC621-0008-0805) (REFERENCE 06-1B-0301):
FAN IS AXIAL FLOW TYPE DRIVEN BY A 3 PHASE, 400 HZ, 115 VOLTS/PHASE INDUCTION TYPE ELECTRIC MOTOR. FAN HAS A CYLINDRICAL ALUMINUM HOUSING AND ALUMINUM IMPELLER. THE DESIGN OPERATING LIFE IS 20,000 HOURS MINIMUM. THE FANS ARE RUN TO FAILURE. THE MOTOR IS DESIGNED TO MEET A 55C TEMPERATURE RISE. MOTOR WILL CONTINUE TO OPERATE ON TWO PHASES. THE ELECTRICAL DISTRIBUTION SYSTEM DYNAMIC COMPONENTS ARE DERATED EEE PARTS. THE CONNECTORS ARE PER MIL-C-38999.

(B) TEST:

AVIONICS FAN (MC621-0008-0005 AND MC621-0008-0605):
ACCEPTANCE TEST. - THE FAN SHALL NOT LEAK MORE THAN 20 SCC PER MINUTE OF AIR WHEN PRESSURIZED INTERNALLY TO A MINIMUM OF 20 INCHES OF WATER OVER EXTERNAL PRESSURE.

QUALIFICATION TEST - LEAK RATE OF 20 SCC/MIN MAX AT 20 IN H2O PRESSURE. BURST PRESSURE OF 180 +5/-0 PSIG. VIBRATION SPECTRUM ENVELOPE OF 20 TO 150 HZ INCREASING AT 6 DB/OCTAVE TO 0.09 G**2/HZ AT 150 HZ, CONSTANT AT 0.09 G**2/HZ FROM 150 TO 900 HZ, DECREASING AT 9 DB/OCTAVE FROM 900-2000 HZ FOR 48 MINUTES PER AXIS IN 3 ORTHOGONAL AXES. DESIGN SHOCK - THREE TERMINAL SAWTOOTH

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PULSES OF 20 G PEAK AMPLITUDE AND 11 MS DURATION APPLIED IN BOTH DIRECTIONS ALONG EACH OF THREE ORTHOGONAL AXES.

IN-VEHICLE TESTING - AVIONICS BAY FAN DELTA-P IS MONITORED CONTINUOUSLY WHEN THE VEHICLE IS POWERED UP AND SERVES AS AN INDICATION OF LEAKAGE.

GROUND TURNAROUND TEST - ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD

CABIN FAN (MC621-0008-0805) (REFERENCE 06-1B-0301):
ACCEPTANCE TEST - PROOF PRESSURE AT 10 IN H₂O 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 G²/HZ, CONSTANT AT 0.09 G²/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.

GROUND TURNAROUND TEST - ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD

(C) INSPECTION:

AVIONICS FAN (MC621-0008-0005 AND MC621-008-0605):
RECEIVING INSPECTION
INCOMING PARTS ARE VERIFIED FOR MATERIALS AND PROCESS CERTIFICATION.

CONTAMINATION CONTROL
CLEANLINESS LEVEL IS VERIFIED PER H.S. REQUIREMENTS.

ASSEMBLY/INSTALLATION
SURFACE FINISHES AND DIMENSIONS VERIFIED BY INSPECTION. SUPER KOROPON TREATED SURFACE OVERCOATED WITH POLYURETHANE IS VERIFIED BY INSPECTION. MANDATORY INSPECTION POINTS ARE INCLUDED IN MANUFACTURING PROCESS.

CRITICAL PROCESSES
DRY FILM LUBRICANT APPLICATION IS VERIFIED BY INSPECTION. SURFACE ANODIZE TREATMENT IS VERIFIED.

NONDESTRUCTIVE EVALUATION
LEAK TEST IS VERIFIED BY INSPECTION.

TESTING

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ATP, INCLUDING FLOW RATE TEST, IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING
PACKAGING FOR SHIPMENT IS VERIFIED BY INSPECTION.

CABIN FAN (MC621-0008-0805):
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.


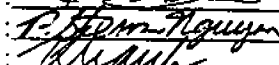
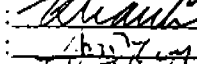
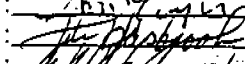
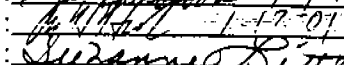
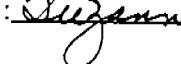

(D) FAILURE HISTORY:

CURRENT DATA ON TEST FAILURES, FLIGHT FAILURES, UNEXPLAINED ANOMALIES, AND
OTHER FAILURES EXPERIENCED DURING GROUND PROCESSING ACTIVITY CAN BE
FOUND IN THE PRACA DATA BASE.

(E) OPERATIONAL USE:

TBS.

- APPROVALS -

S&RE ENGINEERING	: P. CHAN	
S&RE ENGINEERING ITM	: P. STENGER-NGUYEN	
DESIGN ENGINEERING	: K. DUONG	
DESIGN ENGINEERING SSM	: S. NGUYEN	
MOD	: P. HASBROOK	 1/12/01
USA / SAM	:	 1-12-01
USA ORBITER ELEMENT	:	 1-12-01