

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE  
NUMBER: 06-1B-0563 -X**

**SUBSYSTEM NAME: ARS - COOLING**

**REVISION: 1 11/22/00**

**PART DATA**

<b>PART NAME</b>	<b>PART NUMBER</b>
<b>VENDOR NAME</b>	<b>VENDOR NUMBER</b>
LRU : HEAT EXCHANGER, AV BAY	MC621-0008-0005
LRU : HEAT EXCHANGER (AVIONICS BAY 3A) HAMILTON STANDARD	MC621-0008-0705 SV755522

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:  
HEAT EXCHANGER, AVIONICS BAY**

**QUANTITY OF LIKE ITEMS: 4**  
ONE PER BAY  
THREE PER SUBSYSTEM

**FUNCTION:**

REMOVES EXCESS HEAT FROM AVIONICS EQUIPMENT BY COOLING CIRCULATED AIR IN BAY AND TRANSFERRING THE HEAT TO THE WATER COOLANT LOOPS.

MC621-0008-0705: 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-0563- 03**

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**SUBSYSTEM NAME: ARS - COOLING**  
**LRU: HEAT EXCHANGER, AV BAY**  
**ITEM NAME: HEAT EXCHANGER, AV BAY**

**CRITICALITY OF THIS FAILURE MODE: 1R2**

**FAILURE MODE:**  
INTERNAL LEAKAGE, WCL TO WCL

**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, MATERIAL DEFECT

**CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO**

**REDUNDANCY SCREEN**        A) PASS  
    B) PASS  
    C) PASS

**PASS/FAIL RATIONALE:**

A)

B)

C)

**- FAILURE EFFECTS -**

**(A) SUBSYSTEM:**  
TRANSFER OF COOLANT FROM ONE WATER LOOP TO THE OTHER UNTIL PRESSURE IN BOTH LOOPS IS EQUALIZED.

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**(B) INTERFACING SUBSYSTEM(S):**  
NO EFFECT.

**(C) MISSION:**  
POSSIBLE EARLY MISSION TERMINATION FOR FIRST FAILURE.

**(D) CREW, VEHICLE, AND ELEMENT(S):**  
SECOND ASSOCIATED FAILURE (LEAKAGE OF ONE WATER COOLANT LOOP) WILL CAUSE LOSS OF ALL CABIN COOLING AND MAY RESULT IN LOSS OF CREW/VEHICLE.

**(E) FUNCTIONAL CRITICALITY EFFECTS:**

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**-DISPOSITION RATIONALE-**

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**(A) DESIGN:**  
HEAT EXCHANGER IS AN OVEN-BRAZED CRES PLATE-FIN UNIT. HEADER, BOSSES AND FLUID LINES WELDED ON THE PLATE-FIN CORE. THE HEAT TRANSFER FLUID IS HIGH PURITY/LOW OXYGEN CONTENT WATER. AIR FINS ARE 0.2 INCH HIGH X 0.002 INCH THICK X 24 FINS PER INCH. WATER FINS ARE 0.05 INCH HIGH X 0.002 INCH THICK X 28 FINS PER INCH. PARTING SHEETS ARE 0.004 INCH THICK.

**(B) TEST:**  
ACCEPTANCE TEST - LEAKAGE: AIR SIDE AT 5 IN OF H2O 0.18 LB/MIN GN2 MAX, WATER SIDE 0.001 CC/HR AT 75 PSIG. PROOF PRESSURE AT 5 IN OF H2O ON AIR SIDE AND 135 PSIG ON H2O SIDE. TUBES INSPECTED. FLOW VS. DELTA-P CHECK PERFORMED.

QUALIFICATION TEST - LEAKAGE: AIR SIDE AT 5 IN OF H2O 0.18 LB/MIN GN2 MAX. PROOF PRESSURE AT 5 IN OF H2O ON AIR SIDE AND 135 PSIG ON H2O SIDE. TUBES INSPECTED. SUBJECTED TO RANDOM VIBRATION SPECTRUM ENVELOPE OF 20 TO 150 HZ INCREASING 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.

IN-VEHICLE TESTING - SYSTEM LEAK TEST IS PERFORMED AT 85 - 95 PSIG, 8 CC/MIN MAX LEAKAGE. LOOPS ARE SERVICED WITH A DELTA OF APPROXIMATELY 10% BETWEEN THEIR ACCUMULATOR QUANTITIES TO ENABLE DETECTION OF INTERLOOP LEAKAGE.

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

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**(C) INSPECTION:**

**RECEIVING INSPECTION**

RAW MATERIAL AND PURCHASED COMPONENTS REQUIREMENTS ARE VERIFIED BY INSPECTION. PARTS PROTECTION IS VERIFIED BY INSPECTION.

**CONTAMINATION CONTROL**

SYSTEMS FLUID ANALYSES FOR CONTAMINATION ARE VERIFIED BY INSPECTION. CONTAMINATION CONTROL PLAN IS VERIFIED BY INSPECTION. CONTAMINATION CONTROL PROCESSES AND CLEAN AREAS ARE VERIFIED BY INSPECTION.

**ASSEMBLY/INSTALLATION M**

ANUFACTURING, INSTALLATION AND ASSEMBLY OPERATIONS ARE VERIFIED BY INSPECTION. SHEET METAL PARTS ARE INSPECTED AND VERIFIED BY INSPECTION. SURFACE FINISHES VERIFIED BY INSPECTION. DIMENSIONS VERIFIED BY INSPECTION.

**CRITICAL PROCESSES**

WELDING IS VERIFIED BY INSPECTION. ALL WELDS ARE STRESS RELIEVED AFTER WELDING, VERIFIED BY INSPECTION. BRAZING IS VERIFIED BY INSPECTION.

**NONDESTRUCTIVE EVALUATION**

HEADER WELDS TO THE TUBES ARE PENETRANT AND X-RAY INSPECTED. OTHER WELDS (MOUNTING PADS AND HEADER WELDS TO THE CORES) ARE PENETRANT AND 10X MAGNIFICATION VISUALLY INSPECTED. BRAZES ARE VERIFIED BY PROOF AND LEAK TESTS.

**TESTING**

INSPECTION VERIFIES THAT RESULTS OF ACCEPTANCE TESTING AND FLOWRATES ARE WITHIN SPECIFIED LIMITS.

**HANDLING/PACKAGING**

HANDLING AND PACKAGING REQUIREMENTS VERIFIED BY INSPECTION.

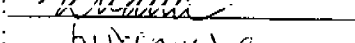
**(D) FAILURE HISTORY:**

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

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USA / SAM :  
USA ORBITER ELEMENT :

*A. H. H. 1-12-01*  
*Suzanne Biele 1-12-01*