

PRINT DATE: 02/17/89

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SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 06-1B3-0557-X

SUBSYSTEM NAME: ARS - COOLING

REVISION : 0 02/17/89 W

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	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU :	HEAT EXCHANGER, IMU HAMILTON STANDARD	MC621-0008-0017 SV767215

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QUANTITY OF LIKE ITEMS: 1

DESCRIPTION/FUNCTION:

HEAT EXCHANGER, INERTIAL MEASUREMENT UNITS (IMU)

PROVIDES FOR REMOVAL OF IMU HEAT. BY MEANS OF COOLING THE CIRCULATION  
~~AIR THAT PASSES OVER THE EQUIPMENT~~ *THIS HEAT EXCHANGER COOLS THE IMU'S*  
*BEFORE RETURNING*  
*AFTER PASSING*  
*TO THE CABIN. HEAT EXCHANGER TRANSFERS THE*  
*HEAT TO THE WATER COOLANT LOPS.*

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 06-1B3-0557-02

SUBSYSTEM: ARS - COOLING  
LRU HEAT EXCHANGER, IMU  
ITEM NAME: HEAT EXCHANGER, IMU

REVISION: 0 02/17/89 W

CRITICALITY OF THIS  
FAILURE MODE: 1R2

FAILURE MODE:  
RESTRICTED FLOW, WCL

MISSION PHASE:  
LO LIFT-OFF  
CO ON-ORBIT  
DO DE-ORBIT

VEHICLE/PAYLOAD/KIT EFFECTIVITY: 102 COLUMBIA  
: 103 DISCOVERY  
: 104 ATLANTIS

CAUSE:  
CONTAMINATION, CORROSION, VIBRATION, MECHANICAL SHOCK

CRITICALITY 1/1 DURING INTACT ABORT ONLY? N

REDUNDANCY SCREEN A) PASS  
B) N/A  
C) PASS

PASS/FAIL RATIONALE:

A)

B)

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

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:  
REDUCED OR LOST COOLING CAPABILITY OF ONE WATER COOLANT LOOP.

(B) INTERFACING SUBSYSTEM(S):  
NO EFFECT. REDUNDANT LOOP WILL PROVIDE COOLING TO IMU.

(C) MISSION:  
POSSIBLE EARLY MISSION TERMINATION FOR LOSS OF ONE WATER COOLANT LOOP  
FOR COOLING OF CABIN AND AVIONICS.

(D) CREW, VEHICLE, AND ELEMENT(S):  
POTENTIAL LOSS OF CREW/VEHICLE UPON SUBSEQUENT LOSS OF REDUNDANT WATER

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COOLANT LOOP.

(E) FUNCTIONAL CRITICALITY EFFECTS

- DISPOSITION RATIONALE -

(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. HOUSING IS 0.09 INCH THICK. THE HEAT EXCHANGER CORE HAS ALTERNATE LAYERS OF ONE AIR FIN AND A PAIR OF WATER FIN (ONE PRIMARY AND ONE SECONDARY). THERE ARE A TOTAL OF 42 FIN LAYERS WITH 28 WATER FIN (14 PRIMARY AND 14 SECONDARY) AND 14 AIR FIN. WATER FIN ARE 0.050 IN HIGH X 0.002 IN THICK X 28 FIN PER INCH. AIR FIN ARE 0.2 INCH HIGH X 0.002 INCH THICK X 24 FIN PER INCH. PARTING SHEETS ARE 0.005 INCH THICK.

(B) TEST:

ACCEPTANCE TEST - PERFORMANCE TEST, INCLUDING FLOW VS. DELTA-P, PERFORMED. NET Q (BTU/HR) OF 1553 AT OPERATING FLOW CONDITIONS. PROOF PRESSURE TEST AT 135 PSID. LEAKAGE TEST: INTERNAL AT 90 PSID, 3.2 X 10 EXP -5 SCCS GHE MAX; EXTERNAL AT 90 PSID, 3.2 X 10 EXP -4 SCCS GHE MAX. VISUAL INSPECTION OF AIR AND COOLANT CIRCUITS PERFORMED.

CERTIFICATION - CERTIFIED BY ANALYSIS AND BY SIMILARITY TO AVIONICS BAY HEAT EXCHANGER: VIBRATION CERTIFIED TO A LEVEL OF 20 - 150 HZ, INCREASING AT 6 DB/OCTAVE; 150 - 1000 HZ CONSTANT AT 0.03 G\*\*2/HZ; 1000 - 2000 HZ DECREASING AT 6 DB/OCTAVE FOR 48 MINUTES PER AXIS. SHOCK CERTIFIED TO 20 G TERMINAL SAWTOOTH PULSE OF 11 MS DURATION IN EACH OF THREE ORTHOGONAL AXES. BURST PRESSURE - CERTIFIED BY ANALYSIS TO 150 PSI. HUMIDITY - CERTIFIED BY ANALYSIS TO 200,000 HOURS AT 100% RELATIVE HUMIDITY.

IN-VEHICLE TESTING - PUMP CHECKS ARE PERFORMED AND PUMP OUT PRESSURE IS CONTINUOUSLY MONITORED WHEN THE VEHICLE IS POWERED UP; SERVES AS AN INDICATION OF BLOCKAGE IN THE LOOP.

OMRSD - PUMP OUTLET PRESSURE IS CONTINUOUSLY MONITORED WHEN THE VEHICLE IS POWERED UP DURING EACH TURNAROUND AND SERVES AS AN INDICATION OF BLOCKAGE IN THE LOOP. WATER IS SAMPLED PER SPEC SE-5-0073 DURING SERVICING.

(C) INSPECTION:

RECEIVING INSPECTION

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

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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  
MANUFACTURING, 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.

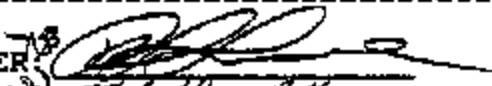

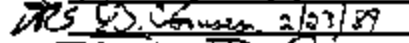
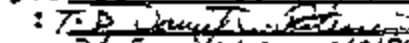
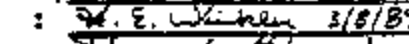

TESTING  
INSPECTION VERIFIES THAT RESULTS OF ACCEPTANCE TESTING AND FLOWRATES  
ARE WITHIN SPECIFIED LIMITS.

HANDLING/PACKAGING  
HANDLING AND PACKAGING REQUIREMENTS VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:  
NO FAILURE HISTORY APPLICABLE TO RESTRICTED FLOW, WCL FAILURE MODE.  
THE IMU HEAT EXCHANGER HAS SUCCESSFULLY PERFORMED WITHOUT FAILURE  
THROUGH THE DURATION OF THE SHUTTLE PROGRAM.

(E) OPERATIONAL USE:  
TBS.

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- APPROVALS -  
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RELIABILITY ENGINEERING:	N. L. STEISSLINGER	
DESIGN ENGINEERING	: N. K. DUONG	
QUALITY ENGINEERING	: D. R. STOICA	 2/27/89
NASA RELIABILITY	:	 3/2/89
NASA SUBSYSTEM MANAGER	:	 3/5/89
NASA QUALITY ASSURANCE	:	 3/7/89