1 PRINT DATE: 02/27/

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

SUBSYSTEM NAME: ARS - COOLING

REVISION : 0 02/17/89 W

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

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~~ THIS HEAT EXCHANGER COOLS THE IMU'S BEFORE RETURNING AFTER PASSING OVER THE ~~EQUIPMENT~~ TO THE CABIN. HEAT EXCHANGER TRANSFERS THE HEAT TO THE WATER COOLANT LOOPS.

11 PRINT DATE: 02/17/89

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 06-1B3-0557-05

REVISION: 0 02/17/89 W

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

CRITICALITY OF THIS FAILURE MODE: 2/2

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

CAUSE:
MECHANICAL SHOCK, VIBRATION, CORROSION

CRITICALITY 1/1 DURING INTACT ABORT ONLY? N

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

PASS/FAIL RATIONALE:
A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LEAK AT HEAT EXCHANGER INLET RESULTS IN DECREASED AIR FLOW THROUGH IMU HEAT EXCHANGER.

(B) INTERFACING SUBSYSTEM(S):
INCREASED CABIN TEMPERATURE DUE TO AIR BYPASSING IMU HEAT EXCHANGER AND RETURNING DIRECTLY TO CABIN.

(C) MISSION:
HIGHER CABIN TEMPERATURE MAY REQUIRE TURNING OFF AMBIENT AIR COOLED (NOT DEDICATED) PAYLOADS.

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

NO EFFECT.

(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. WATER FINS ARE 0.050 IN HIGH X 0.002 IN THICK X 28 FINS PER INCH. AIR FINS ARE 0.2 INCH HIGH X 0.002 INCH THICK X 24 FINS PER INCH. PARTING SHEETS ARE 0.005 INCH THICK. DUE TO LOW OPERATING PRESSURE (APPROXIMATELY 5 IN OF H2O), EXTERNAL LEAKAGE IS CONSIDERED TO BE UNLIKELY.

(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 180 PSI. HUMIDITY - CERTIFIED BY ANALYSIS TO 200,000 HOURS AT 100% RELATIVE HUMIDITY.

IN-VEHICLE TESTING - IMU FAN DELTA-P IS MONITORED CONTINUOUSLY WHEN IMU'S ARE POWERED UP AND SERVES AS AN INDICATION OF LEAKAGE.

OMRSD - IMU FAN DELTA-P IS MONITORED CONTINUOUSLY WHEN IMU'S ARE POWERED UP DURING EACH TURNAROUND AND SERVES AS AN INDICATION OF LEAKAGE.

(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.

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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 EXTERNAL LEAKAGE, AIR FAILURE MODE. THE IMU HEAT EXCHANGER HAS SUCCESSFULLY PERFORMED WITHOUT FAILURE THROUGH THE DURATION OF THE SHUTTLE PROGRAM.

(E) OPERATIONAL USE:
TBS.

- APPROVALS -

RELIABILITY ENGINEERING	N. L. STEISSLINGER	
DESIGN ENGINEERING	N. K. DUONG	
QUALITY ENGINEERING	D. R. STOICA	
NASA RELIABILITY		2/9/89
NASA SUBSYSTEM MANAGER		3/8/89
NASA QUALITY ASSURANCE		3/7/89