

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ACTIVE THERMAL CONTROL FMEA NO 06-3C -0304 -4 REV:08/29/8

ASSEMBLY : FREON THERMAL LOOP CRIT. FUNC: :  
 P/N RI : MC250-0001-0025 CRIT. HDW: :  
 P/N VENDOR: SV755511 VEHICLE 102 103 104  
 QUANTITY : EFFECTIVITY: X X X  
 : ONE/VEHICLE PHASE(S): PL LO OO DO LS X

PREPARED BY: DES REL QE

APPROVED BY: DES REL QE

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

*O. TRAN*  
*D. RISING*  
*W. SMITH*

*[Signatures]*

ITEM:  
 HEAT EXCHANGER, GSE.

FUNCTION:  
 THE GSE HEAT EXCHANGER TRANSFERS ORBITER WASTE HEAT VIA FREON COOLANT LOOPS TO GROUND SUPPORT EQUIPMENT DURING GROUND TURNAROUND. THE HEAT EXCHANGER WAS DESIGNED WITH REDUNDANT GSE LOOPS. THE REDUNDANT GSE LOOP IS CAPPED AND NOT IN USE.

FAILURE MODE:  
 RESTRICTED FLOW, GSE FREON 114.

CAUSE(S):  
 CONTAMINATION, MECHANICAL SHOCK, CORROSION.

- EFFECT(S) ON:  
 (A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE
- (A) POSSIBLE LOSS OF FLOW IN THE GSE FREON 114 LOOP.
  - (B) LOSS OF GSE COOLING CAPABILITY.
  - (C) POSSIBLE LOSS OF MISSION.
  - (D) NO EFFECT.

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

(A) DESIGN  
 THE HEAT EXCHANGER IS MADE FROM STAINLESS STEEL AND NICKEL BRONZE ALLOYS, WHICH ARE CORROSION RESISTANT AND COMPATIBLE WITH FREON 21 AND FREON 114, AND CONTAINS NO MOVING PARTS SUBJECT TO WEAR. THE FLOW HEADERS ARE MACHINED FROM A SINGLE PIECE STAINLESS STEEL BAR. THE HEADERS ARE WELDED TO THE CORE, WHICH IS MADE OF STACKED PLATE-FIN STAINLESS STEEL PARTING SHEETS (THICKNESS = 0.005 INCH). ALL FINS ARE 0.030 INCHES HIGH AND ARE MADE OF 0.002 INCH THICK STAINLESS STEEL SHEET STOCK. THE FINS ARE RUFFLED AND HAVE A DENSITY OF 32 FLOW PATHS PER INCH. FILTRATION IN THE GSE WILL MINIMIZE CONTAMINATION.

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**(B) TEST**

**QUALIFICATION TEST - QUALIFICATION TESTED FOR 100 MISSION LIFE. VIBRATION TESTED AT 0.075 G<sup>2</sup>/HZ FOR 52 MIN/AXIS, SHOCK TESTED AT +/- 2 EACH AXIS.**

**ACCEPTANCE TEST - PRESSURE DROP TEST WILL VERIFY THAT PASSAGES ARE NOT OBSTRUCTED DURING ATP.**

**OMRSD - FREON CHEMICAL ANALYSIS PER SE-8-0073 DURING SERVICING. GSE FREON 114 LOOP IS SERVICED THROUGH A 50 MICRON GSE FILTER. GSE LOOP FLOWRATE IS VERIFIED PRIOR TO EACH FLIGHT.**

**(C) INSPECTION**

**RECEIVING INSPECTION**

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

**CONTAMINATION CONTROL**

**SYSTEMS FLUID ANALYSIS 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.**

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SUBSYSTEM : ACTIVE THERMAL CONTROL FMEA NO 06-3C -0104 -4 REV:08/29/83

(E) OPERATIONAL USE

FAILURE IS INDICATED BY ELEVATED EVAPORATOR OUT TEMPERATURE. IF COOLIN  
CANNOT BE REGAINED, THE ORBITER WILL BE POWERED DOWN. POSSIBLE LOSS OF  
PAYLOADS WHICH REQUIRE ORBITER COOLING.