

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ACTIVE THERMAL CONTROL FMEA NO 06-3C -0304 -5 REV:08/29/
 ASSEMBLY : FREON THERMAL LOOP CRIT. FUNC:
 P/N RI : HC250-0001-0025 CRIT. HDW:
 P/N VENDOR: SV755511 VEHICLE 102 103 104
 QUANTITY : 1 EFFECTIVITY: X X X
 : ONE/VEHICLE PHASE(S): PL LO OO DO LS X

PREPARED BY: DES O. TRAN *cat* DES APPROVED BY: *[Signature]* REDUNDANCY SCREEN: A- B- C-
 REL D. RISING *DR* REL APPROVED BY (NASA): SSM *[Signature]*
 QE W. SMITH *WJS* REL *[Signature]*

ITEM:
 HEAT EXCHANGER, GSE.

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

FAILURE MODE:
 EXTERNAL LEAKAGE, GSE FREON 114.

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

EFFECT(S) ON:
 (A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE
 (A) POSSIBLE LOSS OF FREON 114 FROM GSE FREON 114 LOOP.
 (B) POSSIBLE LOSS OF GSE COOLING CAPABILITY DURING GROUND OPERATIONS.
 (C) POSSIBLE LOSS OF MISSION. LOSS OF PAYLOAD POSTLANDING COOLING.
 (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). DESIGN PROOF PRESSURE IS 1.5 AND BURST PRESSURE IS 2.0 TIMES MAXIMUM OPERATING PRESSURE.

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(B) TEST

QUALIFICATION TEST - QUALIFICATION TESTED FOR 100 MISSION LIFE. THE HE EXCHANGER WAS SUBJECTED TO A PROOF/RUPTURE TEST FOR QUALIFICATION. DESIGN PROOF IS 575 PSIG AND UNIT DID NOT RUPTURE UNTIL 2440 PSIG (MAXIMUM GSE FREON 114 OPERATING PRESSURE IS 250 PSIG). VIBRATION TEST AT 0.075 G²/HZ FOR 52 MIN/AXIS, SHOCK TESTED AT +/- 20 G EACH AXIS.

ACCEPTANCE TEST - CLOSURE BAR AND CORE STACK IS LEAK TESTED BEFORE HEAD ASSEMBLY IS WELDED. HEAT EXCHANGER ASSEMBLY IS LEAK TESTED DURING ACCEPTANCE TESTING TO VERIFY INTEGRITY OF COMPLETE COMPONENT.

OMRSD - FLUID USE CONTROLLED TO SE-S-0073. GSE LOOP IS LEAK CHECKED 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 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.

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(E) OPERATIONAL USE

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