

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ACTIVE THERMAL CONTROL FMEA NO 06-3C -0223 -4 REV: 03/09/91

ASSEMBLY : FREON THERMAL LOOP CRIT. FUNC: 15
 P/N RI : MC250-0001-0120 CRIT. HDW: 2
 P/N VENDOR: SV755512 VEHICLE 102 103 104
 QUANTITY : 1 EFFECTIVITY: X X X
 : ONE WITH DUAL LOOP PHASE(S): PL LO X OO X DO X LS
 : OPERATION

REDUNDANCY SCREEN: A-PASS B-FAIL C-PAS

PREPARED BY: DES O. TRAN *O. Tran* APPROVED BY: DES *[Signature]* APPROVED BY (NASA): SSM *[Signature]*
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ITEM:
 HEAT EXCHANGER, PAYLOAD (FREON/PAYLOAD INTERFACE).

FUNCTION:
 THE PAYLOAD HEAT EXCHANGER TRANSFERS WASTE HEAT FROM TWO PAYLOAD COOLANT LOOPS TO THE TWO FREON COOLANT LOOPS.

FAILURE MODE:
 INTERNAL LEAKAGE, FREON TO PAYLOAD COOLANT LOOP.

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

EFFECT(S) ON:
 (A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE

(A) ONE FREON 21 COOLANT LOOP AND ONE PAYLOAD COOLANT LOOP WILL BECOME INTERCONNECTED RESULTING IN POSSIBLE FLUID TRANSFER DUE TO PRESSURE IMBALANCE.

(B) FREON LEAK INTO PAYLOAD COOLING LOOP MAY CAUSE LOSS OF PAYLOAD COOLING CAPACITY.

(C) LOSS OF PAYLOAD COOLING CAPACITY MAY CAUSE PAYLOAD TO OVERHEAT AND BE POWERED DOWN.

(D) SECOND ASSOCIATED FAILURE (EXTERNAL LEAKAGE OF PAYLOAD COOLING LOOP INTO CABIN) CAN RELEASE TOXIC FREON 21 INTO THE CABIN AND RESULT IN LC OF CREW/VEHICLE. REDUNDANCY SCREEN 'B' FAILS BECAUSE, ON MOST FLIGHTS THE PAYLOAD COOLANT LOOP VOLUME IS TOO SMALL TO DETECT A CHANGE ON THE FREON 21 LOOP ACCUMULATOR.

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 ALLOY WHICH ARE COMPATIBLE WITH FREON 21 AND PAYLOAD COOLANTS, AND CONTAINS MOVING PARTS SUBJECT TO WEAR. THE FLOW HEADERS ARE MADE FROM A SINGLE

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PIECE BAR. THE HEADERS ARE WELDED TO THE CORE, WHICH IS MADE OF STACKED PLATE-FIN PARTING SHEETS (THICKNESS = 0.005 INCH). DESIGN PROOF PRESSURE OF 1.5 AND BURST PRESSURE OF 2.0 TIMES MAXIMUM OPERATING PRESSURE.

(B) TEST

QUALIFICATION TEST - QUALIFICATION TESTED FOR 100 MISSION LIFE. THE HEAT EXCHANGER WAS SUBJECTED TO A PROOF/RUPTURE TEST FOR QUALIFICATION. DESIGN PROOF IS 575 PSIG AND UNIT DID NOT RUPTURE UNTIL 2440 PSIG (MAXIMUM PAYLOAD COOLANT OPERATING PRESSURE IS 200 PSIA). VIBRATION TESTED AT 0.075 G²/HZ FOR 52 MIN/AXIS, SHOCK TESTED AT +/- 20 G EACH AXIS.

ACCEPTANCE TEST - CORE IS LEAK TESTED PRIOR TO INSTALLING THE HEADERS AGAIN IN ATP OF ITEM.

OMRSD - FCL'S MONITORED FOR LEAKAGE. PRESSURE DECAY TESTS PERFORMED. PAYLOAD COOLANT LOOPS ARE LEAK CHECKED PRIOR TO EACH FLIGHT. FLUID USE CONTROLLED TO SE-S-0073.

(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 WEL (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.

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(D) FAILURE HISTORY

NO GENERIC FAILURES ON PRIOR PROGRAMS FOR THIS MODE. NO APPLICABLE FAILURE HISTORY.

(E) OPERATIONAL USE

FAILURE MAY OR MAY NOT BE DETECTABLE IN FLIGHT, DEPENDING ON SIZE AND INSTRUMENTATION OF THE PAYLOAD COOLING LOOP. IF FAILURE IS DETECTED, A EARLY MISSION TERMINATION WILL BE REQUIRED.