

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ACTIVE THERMAL CONTROL FMEA NO 06-JC -0201 -2 REV:08/23/1  
 ASSEMBLY : FREON THERMAL LOOP CRIT. FUNC: 1  
 P/N RI : MC250-0001-0040/0540 CRIT. HDW:  
 P/N VENDOR: SV755517 VEHICLE 102 103 104  
 QUANTITY : 1 EFFECTIVITY: X X X  
 : ONE PER VEHICLE PHASE(S): PL LO X CO X CO X LS  
 :

REUNDANCY SCREEN: A-PASS B-PASS C-PASS  
 PREPARED BY: DES O. TRAN *Out* APPROVED BY: DES *Michael J. ...* APPROVED BY (NASA) *[Signature]*  
 REL D. RISING *B-REL* SSM *[Signature]*  
 QE W. SMITH *ASQE* REL *[Signature]* QE *[Signature]*

ITEM:  
INTERCHANGER, WATER/FREON INTERFACE.

FUNCTION:  
THE INTERCHANGER TRANSFERS CABIN WASTE HEAT FROM EITHER THE PRIMARY OR SECONDARY WATER COOLANT LOOPS TO THE FREON COOLANT LOOPS.

FAILURE MODE:  
INTERNAL LEAKAGE, FREON TO WATER.

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

EFFECT(S) ON:  
 (A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE  
 (A) LEAKAGE OF FREON INTO WATER COOLANT LOOP DUE TO HIGHER PRESSURE IN FREON COOLANT LOOPS. LOSS OF ABILITY TO COLDSOAK AFFECTED FREON LOOP.  
 (B) DECREASED COOLING CAPACITY OF WATER COOLANT LOOP.  
 (C) POSSIBLE LOSS OF MISSION. EARLY MISSION TERMINATION FOR FIRST FAILURE.  
 (D) SECOND ASSOCIATED FAILURE, LEAKAGE OF WATER COOLANT LOOP INTO CABIN (WHICH WILL EXPOSE CREW TO TOXIC FREON VAPORS) OR LOSS OF REDUNDANT WATER COOLANT LOOP (WHICH WILL RESULT IN LOSS OF ALL CABIN COOLING), AND MAY RESULT IN LOSS OF CREW/VEHICLE.

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

(A) DESIGN  
THE INTERCHANGER IS MADE FROM STAINLESS STEEL AND NICKEL BRONZE ALLOYS, WHICH ARE CORROSION RESISTENT AND COMPATIBLE WITH FREON 21 AND WATER, 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 OF 1.5 AND BURST PRESSURE OF 2.0 TIMES MAXIMUM OPERATING PRESSURE.

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(B) TEST

QUALIFICATION TEST - QUALIFICATION TESTED FOR 100 MISSION LIFE. THE INTERCHANGER WAS SUBJECTED TO A PROOF/RUPTURE TEST FOR QUALIFICATION. DESIGN PROOF IS 760 PSIG AND UNIT DID NOT RUPTURE UNTIL 2440 PSIG. (MAXIMUM WATER COOLANT LOOP OPERATING PRESSURE IS 90 PSIG). VIBRATION TESTED AT 0.075 G<sup>2</sup>/HZ FOR 32 MIN/AXIS, SHOCK TESTED AT +/- 20 G EACH AXIS.

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

OMBSD - WCL'S AND FCL'S LEAK CHECKED PRIOR TO EACH FLIGHT. PRESSURE DECAY TESTS PERFORMED. FLUIDS SAMPLED PER SE-S-0073 DURING SERVICING.

(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

ON-BOARD ALARM, WATER LOOP ACCUMULATOR AND WATER LOOP PUMP OUT PRESSURE WILL INDICATE HARDWARE FAILURE. AFFECTED WATER LOOP WILL BE POWERED OFF AND NON-AFFECTED WATER LOOP WILL BE OPERATED. ENTRY AT NEXT PRIM LANDING SITE. IN THE EVENT THAT WATER IS INTRODUCED INTO THE FREON LOOP THE WATER WILL FREEZE IN THE RADIATOR AND DEPOSIT ON FILTERS DOWNSTREAM OF THE RADIATORS RESULTING IN RESTRICTED FLOW OF THE FREON LOOP. DEGRADATION CONTINUES, ON-BOARD ALARM, FREON FLOW, WILL BE ANNUNCIATED. FREON PUMP WILL BE TURNED OFF AND LOSS OF ONE FREON LOOP POWERDOWN WILL BE PERFORMED.