

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ATMOSPHERIC REVIT. FMEA NO 06-1B -0505 -2 REV: 09/07/88

ASSEMBLY : WATER COOLANT LOOP CRIT. FUNC: 1R  
P/N RI : MC250-0001-0440/0540 CRIT. HDW: 2  
P/N VENDOR: SV755517 VEHICLE 102 103 104  
QUANTITY : 1 EFFECTIVITY: X X X  
: DUAL LOOP PHASE(S): PL LO X OO X DO X LS  
: ONE PER SUBSYSTEM

PREPARED BY: DES N. K. DUONG APPROVED BY: REDUNDANTY SCREEN A-PASS B-N/A C-PASS  
REL N. L. STEISSLINGER REL [Signature] APPROVED BY (NASA): SSM [Signature]  
QE D. STOICA QE [Signature] REL [Signature] QE [Signature]

ITEM:  
INTERCHANGER, WATER/FREON INTERFACE

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

FAILURE MODE:  
RESTRICTED FLOW, WCL

CAUSE(S):  
CORROSION, CONTAMINATION, MECHANICAL SHOCK

EFFECT(S) ON:  
(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE  
(A) REDUCED OR LOST COOLING CAPABILITY OF ONE WATER COOLANT LOOP.  
(B) NO EFFECT. REDUNDANT LOOP PROVIDES COOLING.  
(C) POSSIBLE EARLY MISSION TERMINATION FOR LOSS OF ONE WATER COOLANT LOOP.  
(D) POTENTIAL LOSS OF CREW/VEHICLE UPON SUBSEQUENT LOSS OF REDUNDANT WATER COOLANT LOOP. SCREEN B IS N/A BECAUSE THE REDUNDANT COOLANT LOOP IS IN STANDBY UNTIL REQUIRED.

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 RESISTANT 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 STAINLESS STEEL PLATE-PIN 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

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

QUALIFICATION TEST - QUALIFICATION TESTED FOR 100 MISSION LIFE. THE INTERCHANGER WAS SUBJECTED TO A PROOF/RUPTURE TEST FOR QUALIFICATION. DESIGN PROOF IS 575 PSIG AND UNIT DID NOT RUPTURE UNTIL 2440 PSIG. (MAXIMUM WATER COOLANT LOOP OPERATING PRESSURE IS 90 PSIG). SUBJECTED RANDOM VIBRATION SPECTRUM ENVELOPE OF 20 TO 80 HZ INCREASING AT 6 DB/OCTAVE TO 0.075 G\*\*2/HZ, CONSTANT AT 0.075 G\*\*2/HZ FROM 80 TO 700 HZ DECREASING AT 6 DB/OCTAVE FROM 700 TO 2000 HZ FOR 48 MINUTES PER AXIS IN THREE ORTHOGONAL AXES. DESIGN SHOCK - THREE TERMINAL SAWTOOTH PULSES C 20 G PEAK AMPLITUDE AND 11 MS DURATION APPLIED IN BOTH DIRECTIONS ALONG EACH OF THREE ORTHOGONAL AXES. INTERNAL LEAKAGE MAX OF 0.001 SCC/HR AT 70 F AND 120 PSID FOR BOTH FREON AND WATER.

IN-VEHICLE TESTING - PUMP CHECKS ARE PERFORMED AND PUMP OUT PRESSURE IS CONTINUOUSLY MONITORED WHEN THE VEHICLE IS POWERED UP; SERVES AS AN INDICATION OF BLOCKAGE IN THE LOOP.

OMRSD - PUMP OUTLET PRESSURE IS CONTINUOUSLY MONITORED WHEN THE VEHICLE IS POWERED UP AND SERVES AS AN INDICATION OF BLOCKAGE IN THE LOOP. WATER IS SAMPLED PER SPEC 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.

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HANDLING/PACKAGING

HANDLING AND PACKAGING REQUIREMENTS VERIFIED BY INSPECTION.

(D) FAILURE HISTORY

NO FAILURE HISTORY APPLICABLE TO RESTRICTED FLOW, WCL FAILURE MODE. THE INTERCHANGER HAS SUCCESSFULLY PERFORMED WITHOUT FAILURE THROUGH THE DURATION OF THE SHUTTLE PROGRAM.

(E) OPERATIONAL USE

TBS.