

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ATMOSPHERIC REVIT. FMEA NO 06-1B -0525 -3 REV:09/07/8.

ASSEMBLY : HEAT EXCHANGER, LCG CRIT. FUNC: 1R
 P/N RI : MC621-0008-0020 CRIT. HDW: 2
 P/N VENDOR: SV729791 VEHICLE 102 103 104
 QUANTITY : 1 EFFECTIVITY: X X X
 : ONE PER SUBSYSTEM PHASE(S) FL LO X OO X DO X LB

PREPARED BY: DES N. K. DUONG
 REL N. L. STEISSLINGER
 QE D. STOICA

REDUNDANCY SCREEN A-PASS B-PASS C-PAS
 APPROVED BY: DES *[Signature]* APPROVED BY (NASA):
 REL *[Signature]* SSM
 QE *[Signature]* REL *[Signature]*
 QE *[Signature]* for T. COVERTEN QE *[Signature]*

ITEM:
 HEAT EXCHANGER, LIQUID COOLED GARMENT

FUNCTION:
 PROVIDES COOLING FOR THE LIQUID COOLED GARMENT WATER LOOP. THERE ARE 7 GARMENT LOOPS PASSING THROUGH THIS HEAT EXCHANGER.

FAILURE MODE:
 EXTERNAL LEAKAGE, WCL

CAUSE(S):
 MECHANICAL SHOCK, VIBRATION, CORROSION

EFFECT(S) ON:
 (A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE
 (A) LOSS OF REDUNDANCY - LOSS OF ONE WATER COOLANT LOOP.
 (B) LOSS OF COOLING OF AFFECTED WATER COOLANT LOOP. FREE WATER IN CABIN.
 (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.

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

(A) DESIGN
 HEAT EXCHANGER IS A CRES BRAZED/WELDED PLATE-FIN ASSEMBLY. THE HEAT TRANSFER FLUID IS A HIGH PURITY/LOW OXYGEN CONTENT WATER AND THE SYSTEM CONTAINS A 10/25 MICRON FILTER. SYSTEM COMPONENTS AND SEALS ARE SELECTED TO BE COMPATIBLE WITH WATER AND ALCOHOL. THE FIN GEOMETRY IS 0.020 INCHES IN HEIGHT AND 0.002 INCHES THICK WITH 12 FINS PER INCH.

(B) TEST
 ACCEPTANCE TEST - PROOF PRESSURE TESTED AT 136-139 PSIG FOR 5 MINUTES. ALLOWABLE INTERNAL AND EXTERNAL GHE LEAKAGE RATE OF 3.2 X 10 EXP -5 SCL.

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MAXIMUM AT 90 PSIG. ALLOWABLE PRESSURE DROP OF 2.1 PSI MAXIMUM AT 950 PPH FLOW. VISUAL INSPECTION OF TUBES.

QUALIFICATION TEST - QUALIFIED FOR STRESS AND LIFE BY ANALYSIS AND ALSO BY SIMILARITY TO THE GSE HEAT EXCHANGER. QUALIFIED FOR VIBRATION AND SHOCK BY SIMILARITY TO GSE HEAT EXCHANGER. SUBJECTED TO 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 OF 20 G PEAK AMPLITUDE AND 11 MS DURATION APPLIED IN BOTH DIRECTIONS ALONG EACH OF THREE ORTHOGONAL AXES.

IN-VEHICLE TESTING - SYSTEM DECAY TEST IS PERFORMED AT 85 - 95 PSIG, 8 CC/MIN MAX LEAKAGE. PUMP OUT PRESSURE AND ACCUMULATOR QUANTITY ARE CONTINUOUSLY MONITORED WHEN THE VEHICLE IS POWERED UP AND SERVE AS AN INDICATION OF EXTERNAL LEAKAGE.

OMRSD - PUMP ACCUMULATOR QUANTITY AND OUTLET PRESSURE ARE CONTINUOUSLY MONITORED WHILE THE VEHICLE IS POWERED UP DURING EACH TURNAROUND, AND SERVE AS AN INDICATION OF EXTERNAL LEAKAGE. 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 EXTERNAL LEAKAGE, WCL FAILURE MODE.
THE LCG HEAT EXCHANGER HAS SUCCESSFULLY PERFORMED WITHOUT FAILURE THROUGH
THE DURATION OF THE SHUTTLE PROGRAM.

(E) OPERATIONAL USE

TBS.