

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ACTIVE THERMAL CONTROL FMEA NO 06-3C -0207 -4 REV:08/23/81
ASSEMBLY : FREON THERMAL LOOP CRIT. FUNC: 10
P/N RI : MC250-0001-0610 CRIT. HDW: 1
P/N VENDOR: SV755519 VEHICLE 102 103 104
QUANTITY : 1 EFFECTIVITY: X X X
: ONE, DUAL LOOP OPERATION PHASE(S): PL LD X OO " DO X LS

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

ITEM:
HEAT EXCHANGER, FUEL CELL - FC-40 COOLANT/FREON.

FUNCTION:
TRANSFERS HEAT FROM FUEL CELL COOLANT LOOPS TO FREON LOOPS SO THAT THE FUEL CELLS CAN BE COOLED TO THE PROPER OPERATING TEMPERATURE.

FAILURE MODE:
RESTRICTED FLOW, FREON LOOP.

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

EFFECT(S) ON:
(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE
(A, B) POSSIBLE LOSS OF ONE FREON COOLANT LOOP FOR VEHICLE COOLING.
(C) POSSIBLE LOSS OF MISSION. EARLY MISSION TERMINATION FOR FIRST FAILURE.
(D) SECOND ASSOCIATED FAILURE (LOSS OF REDUNDANT FREON COOLANT LOOP) WILL CAUSE LOSS OF ALL VEHICLE 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 HEAT EXCHANGER IS MADE FROM STAINLESS STEEL AND NICKEL BRONZE ALLOYS, WHICH ARE CORROSION RESISTANT AND COMPATIBLE WITH FC-40 AND FREON 21, 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 CONTAINS 147 STACKED PLATE-FIN STAINLESS STEEL PARTIAL SHEETS. ALL FINS ARE 0.020 INCHES HIGH AND ARE MADE OF 0.002 INCH THICK STAINLESS STEEL SHEET STOCK. THE FINS ARE RUFFLED AND HAVE A DENSITY OF 32 FLOW PATHS PER INCH. PUMP INLET FILTERS (25 MICRON) PROTECT AGAINST CONTAMINATION.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ACTIVE THERMAL CONTROL FMEA NO 06-3C -0207 -4 REV:08/23/

(B) TEST

QUALIFICATION TEST - QUALIFICATION TESTED FOR 100 MISSION LIFE.
VIBRATION TESTED AT 0.075 G²/HZ FOR 52 MIN/AXIS, SHOCK TESTED AT -/- 3G
EACH AXIS.

ACCEPTANCE TEST - ATP PRESSURE DROP TEST WILL VERIFY THAT PASSAGES ARE
NOT OBSTRUCTED.

OMRSD - FCL FLOWRATES ARE VERIFIED PRIOR TO EACH FLIGHT. FLUID USE
CONTROLLED TO SE-S-0073. VEHICLE FREON IS SERVICED THROUGH A 10 MICRON
(ABS) GSE FILTER.

(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.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :ACTIVE THERMAL CONTROL FMEA NO 06-3C -0207 -4 REV:06/23/8

(E) OPERATIONAL USE

ON-BOARD ALARMS, FREON FLOW WILL INDICATE HARDWARE FAILURE. FREON PUMP
WILL BE TURNED OFF AND LOSS OF ONE FREON LOOP POWERDOWN WILL BE
PERFORMED. ENTRY AT NEXT PRIMARY LANDING SITE.