

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ACTIVE THERMAL CONTROL FMEA NO 06-3C -0207 -3 REV:08/23/8

ASSEMBLY : FREON THERMAL LOOP
P/N RI : MC250-0001-0610
P/N VENDOR: SV755519
QUANTITY : 1
: ONE, DUAL LOOP OPERATION

VEHICLE	102	103	104
EFFECTIVITY:	X	X	X
PHASE(S):	PL	LO X CO	DO LS

CRIT. FUNC:
CRIT. MDW:

PREPARED BY: O. TRAN *O. Tran* APPROVED BY: *Michael James Latta* REDUNDANCY SCREEN: A-PASS B-PASS C-PASS
DES D. RISING *D. Rising* DES APPROVED BY (NASA): *W. Smith*
REL W. SMITH *W. Smith* REL SSM
QE W. SMITH *W. Smith* QE REL

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, FC-40.

CAUSE(S):

CONTAMINATION, CORROSION, MECHANICAL SHOCK.

EFFECT(S) ON:

(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE

(A) NO EFFECT.

(B) LOSS OF ONE FUEL CELL BECAUSE OF OVERHEATING.

(C) POSSIBLE LOSS OF MISSION. EARLY MISSION TERMINATION FOR FIRST FAILURE.

(D) SECOND ASSOCIATED FAILURE (LOSS OF ONE OF TWO REMAINING FUEL CELLS) CAN CAUSE LOSS OF CREW/VEHICLE DURING LAUNCH PHASE.

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.

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(B) TEST

QUALIFICATION TEST - QUALIFICATION TESTED FOR 100 MISSION LIFE.
VIBRATION TESTED AT 0.075 G²/HZ FOR 52 MIN/AXIS, SHOCK TESTED AT +/- 20
EACH AXIS.

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

OMRSD - FC-40 FLOW RATE VERIFIED 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
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.

(E) OPERATIONAL USE

ON-BOARD ALARM, FUEL CELL STACK TEMPERATURE, WILL INDICATE HARDWARE
FAILURE. NO EFFECT TO FREON LOOPS. THE FUEL CELL WILL BE SHUT DOWN
CAUSING AN EARLY END OF MISSION.