

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ACTIVE THERMAL CONTROL FMEA NO 06-3E -0323 -4 REV: 03/89

ASSEMBLY : FLASH EVAPORATOR ASSY CRIT. FUNC:
P/N RI : MC250-0017-0970 CRIT. HDW:
P/N VENDOR: SV767675 VEHICLE: 102 101 104
EFFECTIVITY: X X X
QUANTITY : 2 PHASE(S): PL LO X OO X DO X LS
: TWO MODULES
: ONE PER WATER LINE

REDUNDANCY SCREEN: A-PASS B-FAIL C-PASS
PREPARED BY: APPROVED BY: APPROVED BY (NASA):
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ITEM:

TOPPING VALVE MODULE, TOPPING EVAPORATOR WATER CONTROL VALVES AND SPRAY NOZZLE.

FUNCTION:

THE PULSING VALVES METER AND THE NOZZLES SPRAY WATER OVER THE EVAPORATOR HEAT TRANSFER SURFACE. VALVE ASSEMBLY CONSISTS OF A FILTER, PULSER VALVE, SPRAY NOZZLE, ISOLATION VALVE AND CAPPED TEST PORT. ISOLATION VALVE REMAINS OPEN DURING TOPPING EVAPORATOR OPERATION.

FAILURE MODE:

FAILS TO CLOSE, ISOLATION VALVE.

CAUSE(S):

ELECTRICAL SHORT, CONTAMINATION, CORROSION, VIBRATION, MECHANICAL SHOCK

EFFECT(S) ON:

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

(A, B) LOSS OF ONE REDUNDANT ISOLATION CAPABILITY TO PREVENT FREEZING OF THE TOPPING EVAPORATOR.

(C, D) NO EFFECT.

(E) FUNCTIONAL CRITICALITY EFFECT - LOSS OF WATER FLOW CONTROL CAN CAUSE LOSS OF TOPPING EVAPORATOR VEHICLE COOLING. ANY TWO ADDITIONAL FAILURES (ONE FREON COOLANT LOOP, HIGH LOAD EVAPORATOR, RADIATORS, AMMONIA BOILER SYSTEM) WILL CAUSE LOSS OF VEHICLE COOLING AND RESULT IN LOSS OF CREW, VEHICLE. REDUNDANCY SCREEN 'B' FAILS BECAUSE PULSING VALVE WILL CONTINUE WATER FLOW MAKING FIRST FAILURE UNDETECTABLE.

DISPOSITION & RATIONALE:

(A) DESIGN (B) TEST (C) INSPECTION (D) FAILURE HISTORY (E) OPERATIONAL USE

(A) DESIGN

DESIGN SAFETY FEATURE - DUAL VALVE OPERATION WITH DUAL, POTTED, COIL WITH SEPARATE CONTROLLERS ON EACH VALVE. STAINLESS STEEL HOUSING. CONTAMINATION PROTECTION BY 40 MICRON INLET SCREEN. POPPET IS SPRING LOADED CLOSED UTILIZING A WAVE-TYPE SPRING. VALVES ARE NON-JAMMING AND

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THEY ARE DIRECT, ELECTRO-MECHANICALLY ACTUATED VALVES WITH ONLY ONE MOVING PART TO EFFECT OPERATION. THE ISOLATION VALVE IS SELF-RELIEVING IN THE REVERSE PRESSURE DIRECTION TO PRECLUDE DAMAGE CAUSED BY TRAPPED FLUID EXPANSION BETWEEN IT AND THE PULSER VALVE. VALVE IS STAINLESS STEEL, WHICH IS COMPATIBLE WITH WATER.

(B) TEST

QUALIFICATION TEST - QUALIFICATION TESTED FOR 100 MISSION LIFE. QUALIFICATION TEST AT COMPONENT AND FES ASSEMBLY LEVELS. CYCLE TEST OF 10 MILLION CYCLES ON VALVE. RANDOM VIBRATION TESTED AT $0.3 \text{ G}^2/\text{Hz}$ FOR 60 MINUTES PER AXIS AND SHOCK TESTED AT $\pm 20 \text{ G}$ PER AXIS.

ACCEPTANCE TEST - FUNCTIONAL TEST DURING ATP VERIFIED VALVE INTEGRITY. THERMAL VACUUM VERIFICATION TEST. ATP CYCLE TEST AT VALVE ASSEMBLY LEVEL PERFORMED FOR MORE THAN 10,000 CYCLES. DIELECTRIC STRENGTH TEST PERFORMED AT 500 V.

OMRSD - ISOLATION VALVES LEAK CHECKED EVERY FIVE FLIGHTS. WATER SAMPLED PRIOR TO EACH FLIGHT AND CONTROLLED TO SE-S-0073. ELECTRICAL CURRENT LEVELS TO THE VALVES VERIFIED EVERY FIVE FLIGHTS.

(C) INSPECTION

RECEIVING INSPECTION

RAW MATERIAL VERIFIED BY INSPECTION. VERIFICATION OF MATERIAL AND EQUIPMENTS CONFORMANCE TO SPECIFICATION ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CONTAMINATION CONTROL PLAN IS VERIFIED BY INSPECTION. ANALYSIS OF FLUID SAMPLES FOR CONTAMINATION IS VERIFIED BY INSPECTION. CORROSION PROTECTION PROVISIONS AND INTERNAL CLEANLINESS ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

MANUFACTURING, INSTALLATION AND ASSEMBLY OPERATIONS ARE VERIFIED BY INSPECTION. TORQUING PERFORMANCE PER DRAWING REQUIREMENTS IS VERIFIED BY INSPECTION.

NONDESTRUCTIVE INSPECTION

ELECTRON BEAM WELDS ARE RADIOGRAPHIC AND PENETRANT INSPECTED AND VERIFIED.

CRITICAL PROCESSES

SOLDERING AND POTTING PROCESSES ARE VERIFIED BY INSPECTION. ELECTRON BEAM WELDING VERIFIED BY INSPECTION.

TESTING

FUNCTIONAL OPERATION IS VERIFIED BY INSPECTION TO BE WITHIN SPECIFIED LIMITS. RESULTS OF FUNCTIONAL PERFORMANCE TESTING AND ATP ARE VERIFIED BY INSPECTION.

HANDLING/PACKAGING

PROPER HANDLING AND STORAGE ENVIRONMENTS ARE VERIFIED BY INSPECTION. PART PROTECTION VERIFIED BY INSPECTION.

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(D) FAILURE HISTORY

NO APPLICABLE FAILURE HISTORY.

(E) OPERATIONAL USE

PULSER VALVE WILL CONTROL WATER FLOW FOR NORMAL OPERATION OF TOPPING
EVAPORATOR. NO CREW ACTION REQUIRED.