

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ACTIVE THERMAL CONTROL FMEA NO 06-3E -0330 -2 REV: 03/09/88

ASSEMBLY : FLASH EVAPORATOR CRIT. FUNC: 12  
P/N RI : MC250-0017-0970 CRIT. HDW: 3  
P/N VENDOR: VEHICLE 102 103 104  
QUANTITY : 2 EFFECTIVITY: X X X  
: TWO SUPPLY LINES PHASE(S): PL LO OO X DO X LS  
:

REDUNDANCY SCREEN: A-PASS B-FAIL C-PASS  
PREPARED BY: APPROVED BY: APPROVED BY (NASA):  
DES J. MORGAN DES *[Signature]* SSM *[Signature]* 4/19/88  
REL D. RISING REL *[Signature]* REL *[Signature]*  
QE W. SMITH QE *[Signature]* QE *[Signature]*

ITEM:  
FEEDWATER COMPONENTS.

FUNCTION:  
PROVIDES WATER TO THE FLASH EVAPORATORS FOR VEHICLE COOLING. EACH WATER LINE HAS AN ACCUMULATOR TO REDUCE THE PRESSURE PULSES CAUSED BY "WATER HAMMER". THE ACCUMULATOR HAS A BELLOWS POSITION SWITCH WHICH PROVIDES A FULL ACCUMULATOR INDICATION. EACH FEEDWATER LINE AND ACCUMULATOR HAS REDUNDANT HEATERS, TEMPERATURE SENSORS AND THERMOSTATS.

FAILURE MODE:  
JAMMED BELLOWS/ACCUMULATOR.

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

EFFECT(S) ON:  
(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE

- (A) LOSS OF WATER HAMMER DAMPING IN FEEDWATER SUPPLY CAUSING IMPROPER SPRAY PATTERN IN FLASH EVAPORATOR AT LOW HEAT LOADS.
- (B) POSSIBLE SHUTDOWN OF TOPPING EVAPORATOR CAUSED BY ICING IN EVAPORATOR AT LOW HEAT LOADS
- (C) NO EFFECT.
- (D) NO EFFECT.
- (E) FUNCTIONAL CRITICALITY EFFECT - POSSIBLE LOSS OF TOPPING EVAPORATOR 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 FAILURE IS NOT DETECTABLE IN FLIGHT BY VEHICLE INSTRUMENTATION.

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SUBSYSTEM : ACTIVE THERMAL CONTROL FMEA NO 06-1E -0130 -2 REV: 07/22/83

DISPOSITION & RATIONALE:

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

(A) DESIGN

INCONEL BELLOWS. ACCUMULATOR DESIGNED WITH LONG RULON GUIDES WHICH ALIGN AND DIRECT BELLOWS WITHIN STAINLESS STEEL HOUSING AND PREVENT STICKING. ALL WELDED CONSTRUCTION. MATERIALS ARE COMPATIBLE WITH WATER, NITROGEN, AND HELIUM.

(B) TEST

QUALIFICATION TEST - QUALIFICATION TESTED FOR 100 MISSION LIFE. VIBRATION TESTED AT 0.3 G<sup>2</sup>/HZ FOR 60 MIN/AXIS AND SHOCK TESTED AT +/- 20 G/AXIS. CYCLE TESTING: OPERATING LIFE - PARTIAL CYCLE - 90,000 CYCLES WITH A 0.284 INCH STROKE LENGTH @ 1 HZ; OPERATING LIFE - FULL STROKE - 500 CYCLES @ 3.16 INCH; OPERATING LIFE - INCREMENTAL CYCLES - 49.91 X 10<sup>3</sup> CYCLES WITH A 0.020 INCH STROKE @ 38 HZ.

ACCEPTANCE TEST - THE ACCUMULATOR IS SUBJECT TO 10 CYCLES FROM 17 PSIA TO 200 PSIA TO 17 PSIA.

OMRSD - BELLOWS CYCLE AND SWITCH VERIFICATION EVERY FIVE FLIGHTS.

(C) INSPECTION

RECEIVING INSPECTION

RAW MATERIAL CERTIFICATIONS ARE VERIFIED BY INSPECTION. INSPECTED FOR EVIDENCE OF DAMAGE.

CONTAMINATION CONTROL

CONTAMINATION CONTROL PROCESSES, CONTAMINATION CONTROL PLAN AND CORROSIVE PROTECTION PROVISIONS ARE VERIFIED BY INSPECTION. SYSTEM FLUID SAMPLE ANALYSES FOR CONTAMINATION ARE VERIFIED IN INSPECTION.

ASSEMBLY/INSTALLATION

MANUFACTURING, INSTALLATION, AND ASSEMBLY OPERATIONS ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

X-RAY INSPECTION OF WELDS IS VERIFIED BY INSPECTION.

CRITICAL PROCESSES

WELDING PROCESS IS VERIFIED BY INSPECTION.

TESTING

FUNCTIONAL PERFORMANCE TESTING AND PROOF PRESSURE CHECK ARE VERIFIED BY INSPECTION.

HANDLING/PACKAGING

HANDLING AND STORAGE ENVIRONMENTS ARE VERIFIED BY INSPECTION. PARTS PROTECTION IS VERIFIED BY INSPECTION.

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SUBSYSTEM : ACTIVE THERMAL CONTROL FMEA NO 06-3E -0130 -2 REV: 05/09/08

(D) FAILURE HISTORY  
NO APPLICABLE FAILURE HISTORY.

(E) OPERATIONAL USE  
NO CREW ACTION REQUIRED FOR FIRST FAILURE. AFTER SECOND SEQUENTIAL FLAS  
EVAPORATOR SHUTDOWN, CREW SHOULD SWITCH TO REDUNDANT PRIMARY CONTROLLER  
AND FEEDWATER SYSTEM.