

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ACTIVE THERMAL CONTROL FMEA NO 06-3B -0408 -4 REV: 08/25/88  
 ASSEMBLY : AMMONIA BOILER SUBSYSTEM CRIT. FUNC: 2  
 P/N RI : MC250-0005-0007 CRIT. HDW: 2  
 P/N VENDOR: 75374000-103 VEHICLE 102 103 104  
 QUANTITY : 2 EFFECTIVITY: X X X  
 : ONE PER SYSTEM PHASE(S): PL LO OO DO LS X

PREPARED BY: J MORGAN DES  
 D. RISING REL  
 W. SMITH QE

REDUNDANCY SCREEN: A- B- C-  
 APPROVED BY: [Signature] DES  
 APPROVED BY (NASA): [Signature] SSM  
 REL [Signature] REL  
 QE [Signature] QE

ITEM:  
 SOLENOID VALVE, ISOLATION, AMMONIA TANK.

FUNCTION:  
 RETAINS AMMONIA IN THE TANKS PRIOR TO USAGE. RELEASES AMMONIA TO THE FLOW CONTROL VALVE. THE AMMONIA BOILER SYSTEM IS USED DURING POST-LANDING OPERATIONS, LAUNCH ABORTS, AND AS A BACKUP SYSTEM DURING NORMAL DEORBITS.

FAILURE MODE:  
 FAILS OPEN (MECHANICAL).

CAUSE(S):  
 PHYSICAL BINDING/JAMMING, CORROSION, MECHANICAL SHOCK, VIBRATION, CONTAMINATION.

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

(A) LOSS OF AMMONIA CONTROL - AMMONIA WOULD FLOW INTO BOILER WHEN THE AMMONIA SYSTEM IS TURNED OFF.

(B) POSSIBLE FREEZING OF WATER/FREON INTERCHANGER IF ASSOCIATED NH3 TANK WAS NOT DEPLETED.

(C) EXCESSIVE FLOW OF AMMONIA CAN LOWER THE FREON COOLANT LOOPS TEMPERATURES, WHICH MAY FREEZE THE INTERCHANGER AND RUPTURE THE WATER AND FREON COOLANT LOOPS. LOSS OF COOLING LOOPS WILL CAUSE LOSS OF POSTLANDING PAYLOAD MISSION OBJECTIVES.

(D) NO EFFECT.

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SUBSYSTEM : ACTIVE THERMAL CONTROL FMEA NO 06-3B -0406 -4 REV:08/25/98

DISPOSITION & RATIONALE:

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

(A) DESIGN

SPRING IS DESIGNED TO MAINTAIN CONSTANT PRESSURE ON POPPET SEAT. THE TOLERANCE BETWEEN THE PLUNGER AND THE VALVE BODY PREVENTS MISALIGNMENT OF THE SEALING SURFACE. VALVE HAS A 25 MICRON ABSOLUTE FILTER AT INLET TO PROTECT AGAINST CONTAMINATION. GSE HAS A 15 MICRON ABSOLUTE FILTER TO PROTECT AGAINST CONTAMINATION. MATERIALS USED ARE CRES STAINLESS STEEL, INCONEL, AND TEFLON WHICH ARE CORROSION RESISTANT AND COMPATIBLE WITH AMMONIA.

(B) TEST

QUALIFICATION TEST - QUALIFICATION TESTED FOR 100 MISSION LIFE. VIBRATION TESTED AT 0.01 G<sup>2</sup>/HZ FOR 48 MIN/AXIS AND SHOCK TESTED AT +/- G/AXIS. CYCLE TEST PERFORMED FOR 8000 CYCLES.

ACCEPTANCE TEST - FUNCTIONAL CHECK PRIOR TO INSTALLATION INTO THE BOILER ASSEMBLY VERIFIES PERFORMANCE.

OMRSD - SOLENOID VALVE OPERATION IS VERIFIED EVERY TWO FLIGHTS.

(C) INSPECTION

RECEIVING INSPECTION

RAW MATERIAL AND PROCESS CERTIFICATIONS VERIFIED BY INSPECTION. PARTS PROTECTION IS VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CONTAMINATION CONTROL PROCESSES, CONTAMINATION CONTROL PLAN, AND CORROSION PROTECTION PROVISIONS ARE VERIFIED BY INSPECTION. SYSTEM FLU SAMPLE FOR CONTAMINATION IS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

MANUFACTURING, INSTALLATION AND ASSEMBLY OPERATIONS ARE VERIFIED BY INSPECTION. CRITICAL DIMENSIONS AND FINISH OF SEALING SURFACES ARE VERIFIED BY INSPECTION. SEALS ARE VISUALLY INSPECTED AT 3X TO 7X MAGNIFICATION FOR DAMAGE.

CRITICAL PROCESSES

HEAT TREATING, PASSIVATION, WELDING AND BRAZING PROCESSES ARE VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

RADIOGRAPHIC INSPECTION OF WELDS AND BRAZED JOINTS ARE VERIFIED BY INSPECTION.

TESTING

FUNCTIONAL TESTING PERFORMED DURING ATP IS VERIFIED BY INSPECTION TO BE WITHIN SPECIFIED LIMITS.

HANDLING/PACKAGING

HANDLING AND STORAGE ENVIRONMENTS ARE VERIFIED BY INSPECTION.

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SUBSYSTEM : ACTIVE THERMAL CONTROL FMEA NO 06-3B -0408 -4 REV:08/35/88

(D) FAILURE HISTORY

(CAR 03F025) DURING STS-3 POSTLANDING OPERATIONS, SYSTEM B ISOLATION VALVE FAILED FIRST FAILED TO OPEN WHEN ACTIVATED AND, AFTER IT WAS FINALLY OPENED, FAILED TO CLOSE WHEN AMMONIA SYSTEM WAS DEACTIVATED. THE CAUSE WAS FOUND TO BE AMMONIUM CHLORIDE, CALCIUM CARBONATE, AND SOME RUS PARTICLES LODGED IN THE VALVE. VALVE HANDLING PROCEDURES AT THE SUPPLIER AND AMMONIA FLUID REQUIREMENTS WERE CHANGED TO CONTROL FORMATION OF CONTAMINANTS.

(E) OPERATIONAL USE

FAILURE IS NOT DETECTABLE UNTIL AMMONIA BOILER IS DEACTIVATED WITH RESIDUAL AMMONIA REMAINING IN TANK. AN UNDERTEMPERATURE CONDITION WILL OCCUR, WHICH WILL BE INDICATED BY ON-BOARD ALARM, EVAPORATOR OUT TEMPERATURE. BOTH WATER LOOPS WILL BE ACTIVATED. REACTIVATION OF THE CONTROLLER WILL REGAIN THERMAL CONTROL.