

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ACTIVE THERMAL CONTROL FMEA NO 06-3B -0408 -2 REV:03/09/98

ASSEMBLY : AMMONIA BOILER SUBSYSTEM	ABORT,	CRIT. FUNC: 1
P/N RI : MC250-0005-0007	ACA, RTLS, TAL	CRIT. MOD: 1
P/N VENDOR: 75374000-103	VEHICLE	102 103 104
QUANTITY : 2	EFFECTIVITY: X X X	
: ONE PER SYSTEM	PHASE(S): PL LO X OO X DO X LS	

PREPARED BY:	REDUNDANCY SCREEN:	A-	B-	C-
DES J. MORGAN	APPROVED BY:	SSM	APPROVED BY (NASA):	
REL D. RISING	REL		2/15/98	
QE W. SMITH	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:  
INTERNAL LEAKAGE.

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

EFFECT(S) ON:

- (A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE
- (A) LEAKAGE OF AMMONIA FROM ONE SUPPLY TANK WHEN SYSTEM IS DEACTIVATED.
- (B) POSSIBLE FREEZING OF WATER/FREON INTERCHANGER IF LEAKAGE IS SUFFICIENT TO LOWER THE FREON 21 TEMPERATURE BELOW 32 F.
- (C) POSSIBLE LOSS OF MISSION DUE TO LOSS OF PAYLOAD, POSTLANDING COOLING
- (D) EXCESSIVE INTERNAL LEAKAGE 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 VEHICLE COOLING AND CAN RESULT IN LOSS OF CREW/VEHICLE.

DISPOSITION & RATIONALE:  
(A) DESIGN (B) TEST (C) INSPECTION (D) FAILURE HISTORY (E) OPERATIONAL USE

(A) DESIGN  
THE VALVE IS DESIGNED FOR A MAXIMUM LEAK RATE OF 5 SCCH. AMMONIA SAMPLING PRIOR TO LOADING. FILTRATION AT VEHICLE INTERFACE. SPRING IS DESIGNED TO MAINTAIN CONSTANT PRESSURE ON POPPET SEAT. VALVE HAS A 22 MICRON ABSOLUTE FILTER AT INLET TO PROTECT AGAINST CONTAMINATION. MATERIALS USED ARE CRES STAINLESS STEEL, INCONEL, AND TEFLON WHICH ARE CORROSION RESISTANT AND COMPATIBLE WITH AMMONIA.

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(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 +/- 2  
G/AXIS.

ACCEPTANCE TEST - SEALING SURFACES ARE EXAMINED FOR DEFECTS DURING  
ASSEMBLY. LEAKAGE IS CHECKED IN ATP USING A MASS SPECTROMETER.

OMRSD - PRE- AND POST-FLIGHT LEAK CHECK USING VEHICLE INSTRUMENTATION.  
AMMONIA SAMPLE VERIFIED TO MEET SE-S-0073 REQUIREMENTS PRIOR TO LOADING.

(C) INSPECTION

RECEIVING INSPECTION

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

CONTAMINATION CONTROL

CONTAMINATION CONTROL PROCESSES, CONTAMINATION CONTROL PLAN, AND  
CORROSION PROTECTION PROVISIONS ARE VERIFIED BY INSPECTION. SYSTEM FLUID  
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.

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. SEALS INSPECTED AT 3X TO 7X MAGNIFICATION FOR DAMAGE.

TESTING

PROOF PRESSURE, INTERNAL LEAKAGE AND FUNCTIONAL TESTING PERFORMED DURING  
ATP ARE VERIFIED BY INSPECTION.

HANDLING/PACKAGING

HANDLING AND STORAGE ENVIRONMENTS ARE VERIFIED BY INSPECTION.

(D) FAILURE HISTORY

(CAR 30F025) DURING STS-3 POSTLANDING OPERATIONS, ISOLATION VALVE B  
FAILED TO CLOSE WHEN AMMONIA SYSTEM WAS DEACTIVATED. THE CAUSE WAS FOUND  
TO BE AMMONIUM CHLORIDE, CALCIUM CARBONATE AND SOME RUST PARTICLES  
LODGED IN THE VALVE. VALVE HANDLING PROCEDURES AT THE SUPPLIER AND  
AMMONIA FLUID REQUIREMENTS WERE CHANGED TO CONTROL FORMATION OF  
CONTAMINANTS.

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(E) OPERATIONAL USE

FAULT DETECTION AND ANNUNCIATION, AND CAUTION AND WARNING ALARMS FOR EVAPORATOR OUT TEMPERATURE FOR THIS FAILURE. ACTIVATE BOTH WATER COOLING LOOPS, SWITCH RADIATOR CONTROLLERS TO HIGH SET POINT, OR TURN OFF A FREEZE PUMP TO PREVENT FREEZING OF INTERCHANGER. ASSOCIATED AMMONIA CONTROLLED VALVE CAN BE ACTIVATED TO CONTROL AMMONIA LEAK FLOW UNTIL TANK DEPLETION.