

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : LIFE SUPPORT FMEA NO 06-2C -0302 -2 REV:09/28/87

ASSEMBLY : WASTE LIQUID STORAGE CRIT. FUNC: 2R
 P/N RI : MC282-0069 CRIT. HDW: 3
 P/N VENDOR: 47A232884P2 VEHICLE 102 103 104
 QUANTITY : 4 EFFECTIVITY: X X X
 : TWO PER LOOP PHASE(S): PL LO OO X DO LS

REDUNDANCY SCREEN: A-PASS B-FAIL C-PAS.
 PREPARED BY: APPROVED BY: APPROVED BY (NASA):
 DES D. SANDERSFELD DES *[Signature]* SSM *[Signature]*
 REL L. SCHASCHL REL *[Signature]* REL *[Signature]*
 QE M. SAVALA QE *[Signature]* CE *[Signature]*

ITEM:
 DUAL CHECK VALVE, LIQUID RELIEF

FUNCTION:
 PREVENTS BACK FLOW OF WASTE WATER FROM THE WASTE STORAGE TANKS INTO THE FAN/SEPARATORS. CREATES BACK PRESSURE ON PITOT PUMP DISCHARGE LINE TO DECREASE AIR ENTRAINMENT IN PUMP DISCHARGE. PREVENTS LIQUID BACKFLOW FROM DISABLING THE FAN/SEPARATORS.

FAILURE MODE:
 INABILITY TO CLOSE, INTERNAL LEAKAGE

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

EFFECT(S) ON:
 (A)SUBSYSTEM (B)INTERFACES (C)MISSION (D)CREW/VEHICLE
 (A) LOSS OF REDUNDANCY - ONE CHECK VALVE COULD NOT BE USED TO PREVENT LIQUID BACK FLOW.
 (B, C) NO EFFECT FOR FIRST FAILURE.
 (D) NO EFFECT.
 (E) FUNCTIONAL CRITICALITY EFFECT - FAILURE OF BOTH CHECK VALVES WOULD ALLOW WASTE TANK CONTENTS TO BACKFLOW INTO THE WCS, FLOODING BOTH FAN/SEPARATORS. POSSIBLE FREE WASTE WATER IN CABIN. LOSS OF WASTE COLLECTION CAPABILITY MAY RESULT IN EARLY MISSION TERMINATION. REDUNDANCY SCREEN B FAILS BECAUSE ONE FAILED CHECK VALVE IS NOT DETECTABLE DURING FLIGHT.

DISPOSITION & RATIONALE:
 (A)DESIGN (B)TEST (C)INSPECTION (D)FAILURE HISTORY (E)OPERATIONAL USE
 (A) DESIGN
 TWO CHECK VALVES IN SERIES. TEST PORT BETWEEN VALVES TO VERIFY REDUNDANCY. 17-4 PH CRES HOUSING, TEFLON POPPET, SILICONE VALVE SEAT, 17-7 PH CRES SPRING, INTERNAL PARTS OF 304 OR 316 CRES, SILASTIC 675

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O-RING. DYNATUBE FITTING AT BOTH ENDS AND TEST PORT ARE TORQUED TO SPECIFIED VALUES AND LOCKWIRED. ALL MATERIALS ARE COMPATIBLE WITH WORKING FLUIDS (URINE, EMU DRAIN WATER, AND DISINFECTANT).

(B) TEST

QUALIFICATION TESTS FOR 100 MISSION LIFE - RANDOM VIBRATION, 48 MINUTES PER AXIS AT A RATE OF PLUS 6 dB/OCTAVE FROM 20 TO 150 HZ; CONSTANT AT 0.03 G SQ/HZ FROM 150 TO 1000 HZ; DECREASING AT THE RATE OF MINUS 6 dB/OCTAVE FROM 1000 TO 2000 HZ. SINUSOIDAL VIBRATION SWEEPS 5 TO 35 HZ AT 1 OCTAVE/MINUTE AT 0.25 G PEAK. SHOCK TEST OF 20 G SAWTOOTH SHOCK IMPULSE - 11 MILLISECOND DURATION. FUNCTIONAL TEST - 210 MAN DAYS WITH NO CORROSION OR MATERIAL INCOMPATIBILITY PROBLEMS.

ACCEPTANCE TEST - SOURCE ACCEPTANCE AT VENDOR'S FACILITY. INCLUDES LEAK CHECK BETWEEN VALVES.

OMRSD: VERIFIES NO INTERNAL LEAKAGE OF EITHER VALVE AND FUNCTIONAL OPERATION BEFORE EACH FLIGHT.

(C) INSPECTION

RECEIVING INSPECTION

CERTIFICATION OF RAW MATERIALS AND PROCESSES IS VERIFIED.

CONTAMINATION CONTROL

THE VALVE IS VERIFIED TO PASS CLEANLINESS REQUIREMENTS.

ASSEMBLY/INSTALLATION

VISUAL INSPECTION FOR DAMAGE DURING INSTALLATION IS VERIFIED. CORROSION PROTECTION PROVISIONS VERIFIED BY INSPECTION.

TESTING

FUNCTIONAL INTEGRITY IS WITNESSED AND VERIFIED DURING ATP.

HANDLING/PACKAGING

PARTS PROTECTION, HANDLING AND PACKAGING REQUIREMENTS ARE VERIFIED.

(D) FAILURE HISTORY

NO FLIGHT FAILURES. ONE INCIDENT OCCURRED DURING TURNAROUND WHERE THE REDUNDANT CHECK VALVE DID NOT MAINTAIN PRESSURIZATION AND FAILED LEAK TEST. CORRECTIVE ACTION - IMPLEMENTATION OF A DESIGN CHANGE TO ELIMINATE SPRING OFFSET AND MAXIMIZE THE APPLIED FORCE BY THE SPRING ON THE POPPET. (CAR #AC8466)

(E) OPERATIONAL USE

FAILURE OF ONLY ONE VALVE IS NOT DETECTABLE; FAILURE OF TWO IN SERIES IS NEEDED FOR DETECTION BY TANK QUANTITY MEASUREMENT. AFTER SECOND FAILURE (SECOND CHECK VALVE FAILS) CREW WILL PERFORM THE WASTE WATER LEAK ISOLATION PROCEDURE. ISOLATE THE WASTE WATER SYSTEM FROM THE WCS, REMOVE THE FRONT COVER OF THE WCS AND DISCONNECT QD FROM URINE LINE. CREW WILL USE CONTINGENCY URINE COLLECTION DEVICE (BAGS).