

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : LIFE SUPPORT FMEA NO 06-2C -0443 -2 REV:09/28/87  
 ASSEMBLY : URINE COLLECTION EQUIPMENT CRIT. FUNC: :  
 P/N RI : MC282-0069, MC276-0020-1101/-3104 CRIT. HDW: :  
 P/N VENDOR: 47C265889 VEHICLE 102 103 104  
 QUANTITY : 1 EFFECTIVITY: X X X  
 : PHASE(S): PL LO OO X DO LS  
 : ONE PER SUBSYSTEM

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

ITEM:  
 LINES, FITTINGS AND QUICK DISCONNECT (QD), SECOND CHECK VALVES TO  
 WCS/WASTE TANK SYSTEM QD

FUNCTION:  
 PROVIDES FLOW PATH FROM SECOND CHECK VALVES TO WCS/WASTE SYSTEM  
 INTERFACE QD SO THAT WASTE WATER CAN BE TRANSFERRED TO WASTE TANK.

FAILURE MODE  
 EXTERNAL LEAKAGE

CAUSE(S):  
 VIBRATION, MECHANICAL SHOCK, CORROSION

- EFFECT(S) ON:  
 (A)SUBSYSTEM (B)INTERFACES (C)MISSION (D)CREW/VEHICLE
- (A) LOSS OF URINE COLLECTION CAPABILITY.
  - (B) STORED URINE WOULD LEAK INTO CABIN AIR.
  - (C) INABILITY TO TRANSFER WASTE WATER TO WASTE TANK OR CONTINGENCY WATER CONTAINER (CWC), OR DUMP OVERBOARD. LOSS OF WASTE WATER STORAGE CAPABILITY MAY LIMIT MISSION DURATION.
  - (D) NO EFFECT.

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

(A) DESIGN  
 HOSE ASSEMBLY IS A RESISTOFLEX FLEX HOSE CONSTRUCTED OF TEFLON TUBING WITH AN OUTER PROTECTIVE CRES BRAID WELDED TO CRES TUBING WITH A DYNATUBE FITTING ON ONE END. QD IS ALL STAINLESS STEEL CONSTRUCTION WITH AN ETHYLENE PROPYLENE (EPR) O-RING SEAL AND A TEFLON BACKUP RING SEAL. POPPET IS SPRING-LOADED CLOSED. 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 O-RING. DYNATUBE FITTING AT BOTH ENDS AND TEST PORT CAP ARE TORQUED TO SPECIFIED VALUES AND LOCKWIRED. ALL MATERIALS ARE COMPATIBLE WITH WORKING FLUIDS (URINE, EMU DRAIN WATER, AND DISINFECTANT).

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(B) TEST

QUALIFICATION TESTS FOR 100 MISSION LIFE - QD WAS SHOCK TESTED AT 20 G. OPERATION TEST OF 5 CYCLES AT 0 PSIG AND AT 55 PSIG. BURST TESTED AT 180 PSIG FOR 5 MINUTES (MAX OPERATION PRESSURE OF 22 PSIG). RANDOM VIBRATION - 0.2 G SQ/HZ AT 10 PSIG FOR FIRST 24 MINUTES/AXIS FOLLOWED A 90 PSIG FOR 24 MINUTES/AXIS. 5% SALT/85% RH FOR 50 HOURS. THERMAL TEST AT 250 F FOR 15 MINUTES AND AT -65 F FOR 3 HRS. LINES, FITTINGS AND CHECK VALVES SUBJECTED TO 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.

SYSTEM FUNCTIONAL TEST - 210 MAN DAYS WITH NO CORROSION OR MATERIAL INCOMPATIBILITY PROBLEMS.

ACCEPTANCE TEST - QD LEAKAGE AND PROOF PRESSURE - PRESSURIZED AT 10, 55 AND 90 PSIG IN THE MATED, DEMATED, AND CAPPED CONFIGURATIONS. LEAKAGE WILL NOT EXCEED 0.0001 SCCS He. HOSE ASSEMBLY IS PRESSURE TESTED AT 45 PSI MINIMUM. SOURCE ACCEPTANCE FOR CHECK VALVES AT VENDOR'S FACILITY. INCLUDES LEAK CHECK BETWEEN CHECK VALVES. VISUAL INSPECTION FOR NO LEAKAGE IN THE LINES, FITTINGS AND CHECK VALVES IS VERIFIED DURING FLOW TEST.

OMRSD: NO EXTERNAL LEAKAGE IN LINES, FITTINGS, AND QD IS VERIFIED BEFORE EACH FLIGHT. NO EXTERNAL LEAKAGE OF EITHER CHECK VALVE AND FUNCTIONAL OPERATION IS VERIFIED BEFORE EACH FLIGHT DURING VENDOR TURNAROUND.

(C) INSPECTION

RECEIVING INSPECTION

CERTIFICATION OF RAW MATERIALS AND PROCESSES VERIFIED.

CONTAMINATION CONTROL

CONTAMINATION CONTROL AND DIMENSIONS VERIFIED BY INSPECTION. THE CHECK VALVES ARE VERIFIED TO PASS CLEANLINESS REQUIREMENTS.

ASSEMBLY/INSTALLATION

CORROSION PROTECTION IS VERIFIED BY INSPECTION PRIOR TO INSTALLATION. VISUAL INSPECTION FOR DAMAGE DURING INSTALLATION AND ACCEPTANCE TEST PROCEDURE.

CRITICAL PROCESSES

WELDING CERTIFICATION AND HEAT TREATMENT VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

RADIOGRAPHIC INSPECTION IS VERIFIED BY SUPPLIER.

TESTING

FUNCTIONAL INTEGRITY IS WITNESSED AND VERIFIED DURING ATP.

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HANDLING/PACKAGING

PARTS PROTECTION, HANDLING AND PACKAGING REQUIREMENTS ARE VERIFIED.

(D) FAILURE HISTORY

NO EXTERNAL LEAKAGE FAILURES OF THESE LINES, FITTINGS, COMPONENTS, AND MATED QD. DURING NORMAL OPERATIONS, QD IS MATED.

DEMATED QD POPPET FAILED OPEN ON WCS CAUSED BY BUILDUP OF URINE SOLIDS; URINE LINE IS NOW FLUSHED WITH A DISINFECTANT SOLUTION PRIOR TO WCS REMOVAL TO CONTROL SOLIDS BUILDUP. (CAR #ACS096)

TWO INSTANCES WHERE DEMATED QD'S LEAKED DUE TO SCRATCH ON POPPET; PERSONNEL CAUTIONED TO USE APPROVED TOOLS DURING QD INSTALLATION. (CAR #AC2552, #AB2840)

TWO INSTANCES OF A METAL SLIVER LODGED BETWEEN POPPET AND SEAL; IMPROVED ASSEMBLY PROCEDURES (CLEANING, WORKMANSHIP). (CAR #AB5643, #AB5921)

(E) OPERATIONAL USE

CREW SHOULD USE CONTINGENCY URINE BAGS. CREW CAN REMOVE FRONT PANEL OF WCS TO DEMATE WCS WASTE SYSTEM INTERFACE QD TO REGAIN THE USE OF THE WASTE WATER SYSTEM TO STORE CONDENSATE.