

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ATMOSPHERIC REVIT. FMEA NO 06-1A -1601 -2 REV: 07/08/88

ASSEMBLY : AIRLOCK				CRIT. FUNC: 1R	
P/N RI : MC250-0004-0012				CRIT. HDW: 2	
P/N VENDOR: 2763-0001-9		VEHICLE	102	103	104
QUANTITY : 2		EFFECTIVITY:	X	X	X
: TWO ON INNER HATCH		PHASE(S):	PL	LO	OO X DO LS

		REDUNDANCY SCREEN:	A-PASS	B-PASS	C-PASS
PREPARED BY:		APPROVED BY:	APPROVED BY (NASA)		
DES S. CASTILLO		DES <i>[Signature]</i>	SSM	<i>[Signature]</i>	
REL D. RISING		REL <i>[Signature]</i>	REL	<i>[Signature]</i>	
QE W. SMITH		QE <i>[Signature]</i>	QE	<i>[Signature]</i>	

ITEM:
EQUALIZATION VALVE CABIN/AIRLOCK HATCH

FUNCTION:
PROVIDES FOR EQUALIZING PRESSURE ACROSS THE INNER HATCH. EACH VALVE OPERATES INDEPENDENTLY WITH POSITIVE DETENTS AT TWO FLOW POSITIONS. VALVE CAN BE ACTUATED FROM EITHER SIDE OF HATCH.

FAILURE MODE:
INABILITY TO CLOSE, INTERNAL LEAKAGE

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

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

(A) EQUALIZATION VALVE CAP WILL LIMIT LEAK RATE INTO AIRLOCK.

(B) EXCESSIVE LOSS OF CABIN AIR THROUGH VALVE WHEN AIRLOCK IS DEPRESSURIZED.

(C) LOSS OF PLANNED EVA OBJECTIVES.

(D) SECOND ASSOCIATED FAILURE (INABILITY TO MATE CAP) CAN CAUSE LOSS OF EMERGENCY EVA CAPABILITY AND CAN RESULT IN LOSS OF CREW/VEHICLE.

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DISPOSITION & RATIONALE:

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

(A) DESIGN

UNIT IS FLANGE MOUNTED WITH A SINGLE SILASTIC-675 SILICONE RUBBER O-RING WHICH COMPENSATES FOR ROUGHNESS OF FLANGE PREVENTING EXTERNAL LEAKAGE. HOUSING IS FABRICATED OF A356.0-T61 ALUMINUM ALLOY AND IS X-RAYED TO DETECT CRACKS. VALVE IS A BUTTERFLY VALVE. THE BUTTERFLY VALVE CONSISTS OF A VALVE DISC (6061-T6 ALUMINUM ALLOY PER QQ-A-200/8, QQ-A-225/8, AND QQ-A-225/8 AND QQ-A-250/11) WITH A SILASTIC 675 SILICONE RUBBER VALVE SEAL PERMANENTLY MOLDED AND INTERLOCKED AROUND THE CIRCUMFERENCE OF THE VALVE DISC. THE VALVE SEAL MATES AGAINST A VALVE SEAL RING WITH AN AVERAGE SURFACE HEIGHT VARIATION OF NO MORE THAN 16 MICRO INCHES.

(B) TEST

QUALIFICATION TEST - FOR 100 MISSION LIFE: ACCELERATION OF 5 G FOR FIVE MINUTES PER AXIS. SINUSOIDAL VIBRATION - 5 TO 35 KHZ AT +/- 0.25 G PEAK PER AXIS. RANDOM VIBRATION - 0.09 G²/HZ FOR 48 MINUTES PER AXIS. DESIGN SHOCK - 20 G PER AXIS. THERMAL VACUUM/THERMAL CYCLE - WITH VALVE CLOSED AND CAP ON, UNIT EXPOSED TO 120 TO 130 F AND VACUUM OF 1×10^{-6} TORR FOR 24 HOURS. LOW/HIGH TEMPERATURE CYCLE - HELD AT -40 TO -50 F FOR 3 HOURS AND AT +120 TO +130 F FOR 3 HOURS. OPERATING LIFE - OPERATED OFF/NORMAL/EMERGENCY POSITIONS WITH 15 PSIG APPLIED FOR 800 CYCLES. LEAKAGE MONITORED DURING OR AFTER THESE TESTS LIMITED TO 5 SCCM MAX.

ACCEPTANCE TEST - PROOF PRESSURE 25 PSIG GN₂, WITH VALVE OPEN AND CLOSED. LEAK CHECK AT 15 PSIG, 5 SCCM MAX - VALVE OPEN AND CLOSED AND REVERSE LEAKAGE.

OMRSD - AIRLOCK VALVES OPENING AND CLOSING TORQUES VERIFIED EVERY 10 FLIGHTS. CONTINGENCY TEST AT 15 PSIG AFTER LRU REPLACEMENT AND CONTINGENCY TEST AT 3.2 PSIG IN VEHICLE. GROSS LEAKAGE TEST AT 2 PSIG BEFORE EACH FLIGHT.

(C) INSPECTION

RECEIVING INSPECTION

MATERIALS VERIFIED AT RECEIVING INSPECTION. ALUMINUM HOUSING CASTINGS ARE HYDROSTATIC PROOF PRESSURE TESTED AT 32 PSID.

CONTAMINATION CONTROL

CORROSION PROTECTION PROVISIONS AND CONTAMINATION CONTROL PLAN VERIFIED BY INSPECTION. CLEANLINESS LEVELS OF 200A AND 100 ML RINSE TESTS VERIFIED.

ASSEMBLY/INSTALLATION

MANUFACTURING PROCESSES, INSTALLATION AND ASSEMBLY VERIFIED BY INSPECTION. TORQUES VERIFIED BY INSPECTION. DIMENSIONAL CHECKS PERFORMED BY INSPECTION. INSPECTION PERFORMS MIPs FOR CONCENTRICITY AND PERPENDICULARITY. O-RINGS VERIFIED BY INSPECTION.

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NONDESTRUCTIVE EVALUATION

ALUMINUM HOUSING CASTINGS ARE X-RAYED AND DYE PENETRANT INSPECTED TO DETECT CRACKS, VERIFIED BY INSPECTION.

CRITICAL PROCESSES

PASSIVATED PARTS AND HEAT TREATMENT VERIFIED BY INSPECTION. MECHANICAL SOLDERING OF DEBRIS SCREEN VERIFIED BY INSPECTION. ANODIZATION OF ALUMINUM PARTS VERIFIED BY INSPECTION.

TESTING

ATP VERIFIED BY INSPECTION.

HANDLING/PACKAGING

PARTS PROTECTION VERIFIED BY INSPECTION.

(D) FAILURE HISTORY

(AC2285) DURING LEAK CHECK AFTER INSTALLATION OF HATCH "B" INTO VEHICLE, SUPER KOROPON CHIPS IN THE VALVE CAUSED LEAKAGE. CHIPS WERE CAUSED BY INITIAL INSTALLATION OF VALVE WITH INCORRECT O-RING. CLEANING OF VALVE CORRECTED LEAKAGE.

(AB4173) LEAKAGE OCCURRED IN ATP BECAUSE THE VALVE SEALING DISC (BUTTERFLY) WAS OFF-CENTER. IT WAS DETERMINED THAT IMPROPER USE OF TOOL DURING ASSEMBLY CAUSED PROBLEM.

(E) OPERATIONAL USE

CREW CAN INSTALL A GAP FROM THE OUTER HATCH.