

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ATMOSPHERIC REVIT. FMEA NO 06-1C -0203 -2 REV: 01/06/88

ASSEMBLY : ATMOS VENTING CONTROL CRIT. FUNC: 1R
P/N RI : MC250-0002-0090 CRIT. HDW: 2
P/N VENDOR: 2874-0001-3 CARLETON VEHICLE 102 103 104
QUANTITY : 1 EFFECTIVITY: X X X
: TWO BUTTERFLY VALVES PHASE(S): PL X LO X OO X DO X LS
: IN ONE HOUSING

PREPARED BY:	DES M. PRICE <i>W.P.</i>	APPROVED BY:	DES <i>Michael J. ...</i>	REDUNDANCY SCREEN:	A-PASS	B-FAIL	C-FAIL
REL N. L. STEISSLINGER <i>N.L.S.</i>	REL <i>N.L.S.</i>	REL <i>...</i>	REL <i>...</i>	SSM	APPROVED BY (NASA) <i>...</i>		
QE W. J. SMITH	QE <i>W.J.S.</i>	QE <i>...</i>	QE <i>...</i>	REL <i>...</i>	REL <i>...</i>		

ITEM:
BLEED VALVE - CABIN PRESSURE, MOTOR OPERATED

FUNCTION:
PROVIDES FOR VENTING THE CREW COMPARTMENT THROUGH THE AFT BULKHEAD FOLLOWING A 2 PSID PRELAUNCH PRESSURE TEST. THESE TWO VALVES (CABIN VEN AND VENT ISOLATION) WORK IN SERIES TO ALLOW 16-20 LB/MIN OF AIR TO FLOW OUT OF THE CABIN.

FAILURE MODE:
INTERNAL LEAKAGE

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

EFFECT(S) ON:
(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE
(A) LOSS OF REDUNDANCY - ONLY ONE VALVE WOULD PREVENT CABIN AIR FROM VENTING OVERBOARD.
(B) NO EFFECT.
(C) PRELAUNCH FAILURE RESULTS IN LAUNCH SCRUB. POSSIBLE EARLY MISSION TERMINATION BASED ON MAGNITUDE OF LEAK.
(D) NO EFFECT.
(E) FUNCTIONAL CRITICALITY EFFECT - SECOND VALVE FAILURE MAY RESULT IN LOSS OF CREW/VEHICLE (LOSS OF CABIN ATMOSPHERE). SCREEN B FAILS BECAUSE SHUTOFF VALVES ARE IN SERIES AND FAILURE OF EITHER REDUNDANT VALVE IS NO DETECTABLE. SCREEN C FAILS BECAUSE A SOURCE OF CONTAMINATION COULD AFFECT BOTH VALVES.

DISPOSITION & RATIONALE:
(A) DESIGN (B) TEST (C) INSPECTION (D) FAILURE HISTORY (E) OPERATIONAL USE
(A) DESIGN
SILASTIC 675 SILICONE RUBBER IS MOLDED IN PLACE ON THE METAL FLAPPER,

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ASSURING A CONTINUOUS GAS SEAL ACROSS THE EDGE OF THE FLAPPER. SILAST 675 SILICONE RUBBER HAS GOOD RESISTANCE TO ENVIRONMENTAL EXPOSURE, FLEXING, AND FATIGUE. IT ALSO HAS LOW FLAMMABILITY AND OUTGASSING. THE OZONE RESISTANCE OF SILICONE RUBBER IS EXCELLENT. ECCENTRIC ACTUATED VALVE POSITION INDICATOR PROVIDES POSITIVE VALVE POSITION INDICATION. THE BORE AREA IS TEFLON IMPREGNATED HARD ANODIZED TO MINIMIZE FRICTION AND PROVIDE CORROSION RESISTANCE. VALVE STEM THRUST BEARINGS ELIMINATE LONGITUDINAL RUNOUT INSURING THAT THE CENTERLINE OF THE VALVE STEM RUNS THROUGH THE CENTERLINE OF THE BORE. TWO VALVES (CABIN VENT AND VENT ISOLATION) PROVIDE REDUNDANCY. INLET AND OUTLET (6 MESH/INCH) SCREENS PROVIDE DEBRIS SCREENING.

(B) TEST

ACCEPTANCE TEST - PROOF PRESSURE 24 PSIG, LEAKAGE (INTERNAL AND EXTERNAL) 1 SCCM MAX AT 16.7 PSIG.

QUALIFICATION TEST - BLEED VALVE IS IDENTICAL TO THE MOTOR DRIVEN BUTTERFLY VALVE ASSEMBLY OF THE POSITIVE PRESSURE RELIEF VALVE (PPRV). THE PPRV IS IDENTICAL RELATIVE TO INTERNAL LEAKAGE REQUIREMENT, AND HAS BEEN SUBJECTED TO AN OPERATING LIFE CYCLE TEST OF 200 HOURS CONTINUOUS VALVE CYCLES. SUBJECTED TO RANDOM VIBRATION SPECTRUM ENVELOPE OF 20 TO 150 HZ INCREASING AT 6 DB/OCTAVE TO 0.09 G**2/HZ. CONSTANT AT 0.09 G**2/HZ FROM 150 TO 900 HZ, DECREASING AT 9 DB/OCTAVE FROM 900 TO 2000 HZ FOR 48 MINUTES PER AXIS FOR THREE ORTHOGONAL AXES. BURST PRESSURE IS 33.4 +/- 0.15 PSIG FOR THREE MINUTES MINIMUM; LEAKAGE NOT TO EXCEED 100 SCCM. FACTOR OF SAFETY = 2. DESIGN SHOCK - THREE 20 G TERMINAL PEAK, 10 MS DURATION SHOCK PULSES IN THREE ORTHOGONAL AXES. INTERNAL LEAK TEST PERFORMED AFTER VIBRATION AND SHOCK TEST TO VERIFY VALVE IS WITHIN SPEC LEAK RATE.

IN-VEHICLE TESTING - AFTER INSTALLATION BOTH THE VENT AND VENT ISOLATION VALVES ARE TESTED FOR INTERNAL LEAKAGE OF 25 SCCM MAX AT 14-15 PSID.

OMRSD - A 2 PSID CABIN INTEGRITY TEST IS PERFORMED BEFORE LAUNCH WHICH VERIFIES THAT BOTH THE VENT AND VENT ISOLATION VALVES MAINTAIN CABIN PRESSURE (CABIN PRESSURE AND RATE OF CHANGE ARE MONITORED). INTERNAL LEAKAGE TEST IS PERFORMED EVERY FIFTH FLIGHT AT 14.0 - 15.0 PSID, 25 SCCM MAX LEAKAGE IN EACH BUTTERFLY VALVE.

(C) INSPECTION

RECEIVING INSPECTION

RAW MATERIAL VERIFIED BY INSPECTION FOR MATERIAL AND PROCESS CERTIFICATION.

CONTAMINATION CONTROL

CLEANLINESS LEVEL 200A PER MA0110-301 AND 100 ML RINSE TESTS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION

TORQUES VERIFIED. DIMENSIONAL CHECKS PERFORMED BY INSPECTION. 10X VISUAL INSPECTION ON SEAL RING. MIPS ARE INCLUDED IN THE ASSEMBLY PROCEDURE.

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CRITICAL PROCESSES

APPLICATION OF BRAYCOTE LUBRICANT ON SEAL RING VERIFIED BY TECHNICIAN. HEAT TREATMENT, PARTS PASSIVATION AND ANODIZING VERIFIED. POTTING VISUALLY INSPECTED. SOLDER CONNECTIONS VERIFIED BY INSPECTION IN ACCORDANCE WITH NHBS300.4(3A).

NONDESTRUCTIVE EVALUATION

WELDS ARE PENETRANT INSPECTED AND VERIFIED BY INSPECTION.

TESTING

ATP IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING

HANDLING, PACKAGING, STORAGE AND SHIPPING PROCEDURES ARE VERIFIED.

(D) FAILURE HISTORY

A FAILURE OCCURRED ON THE POSITIVE PRESSURE RELIEF VALVE (PPRV); THE PPRV'S MOTOR DRIVEN BUTTERFLY VALVE IS IDENTICAL TO BLEED VALVE'S TWO VALVE ASSEMBLIES. CAR AB5186-010, 10/9/79. PPRV RESEAT PRESSURE FAILED IN TEST AT KSC. IRREGULARITIES WERE FOUND ON THE FLAPPER VALVE'S MOLDED SILICONE RUBBER SEAL. CORRECTIVE ACTION: ASSEMBLY PROCEDURES WERE REVISED TO REQUIRE VISUAL INSPECTION OF MOLDED LIP WITH THE AID OF 15/30 POWER MICROSCOPE IMMEDIATELY PRIOR TO ASSEMBLY INTO VALVE. ATP WAS REVISED TO ELIMINATE THE SUBJECTIVE METHOD OF CHECKING RESEAT PRESSURE BY OBSERVING A STREAM OF BUBBLES IN WATER. FLOW METER IS NOW REQUIRED FOR TESTING RESEAT PRESSURE.

(E) OPERATIONAL USE

1. CREW ACTION

VERIFY THE CORRECT VALVE POSITION AND CONFIRM POWER TO VALVE ACTUATOR (CIRCUIT BREAKER MNA 014 PWR).

2. TRAINING

NONE.

3. OPERATIONAL CONSIDERATION

A. BOTH VALVES ARE CHECKED PRIOR TO EACH FLIGHT IN THE PRE-FLIGHT PHASE BY THE CREW DURING THE CABIN INTEGRITY CHECK.

B. LOSS OF CABIN INTEGRITY REQUIRES SECOND VALVE FAILURE.