

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ATMOSPHERIC REVIT. FMEA NO 06-1C -0206 -2 REV: 08/10/E
ASSEMBLY : ATMOS VENTING CONTROL CRIT. FUNC: 1R
P/N RI : MC250-0002-0075 CRIT. HOW: 2
P/N VENDOR: 2725-0001-3 CARLETON VEHICLE 102 103 104
QUANTITY : 2 EFFECTIVITY: X X X
: TWO PER SUBSYSTEM PHASE(S): PL LO OO DO X LS
:

PREPARED BY: DES M. PRICE *M. Price* APPROVED BY: *Michael Price* REDUNDANCY SCREEN: A-PASS B-N/A C-PASS
REL N. L. STEISSLINGER *N. L. SteiSSLinger* REL *N. L. SteiSSLinger* APPROVED BY (NASA): *N. L. SteiSSLinger* 9/27/88
QE S. MOR *S. Mor* QE *S. Mor* SSM *S. Mor* REL *S. Mor* 9/27/88
QE *S. Mor* QE *S. Mor* QE *S. Mor* 9/27/88

ITEM:

RELIEF VALVE - CABIN NEGATIVE PRESSURE

FUNCTION:

TWO VALVES MOUNTED FOR PARALLEL FLOW, EACH OF WHICH ALLOWS SUFFICIENT FLOW INTO CABIN TO MAINTAIN THE CABIN CRUSHING PRESSURE AT LESS THAN 1.0 PSID DURING DEPRESSURIZED CABIN RE-ENTRY CONDITIONS. BEGINS TO FLOW AT MAXIMUM NEGATIVE PRESSURE DIFFERENTIAL OF 0.25 PSID AND MAXIMUM FULL OPEN IS AT 0.5 PSID. THE RELIEF VALVE CONTAINS A SEALING CAP INTEGRAL TO ITS ASSEMBLY. VALVES ARE MOUNTED ON THE LEFT HAND SIDE OF THE ORBITER, BELOW THE CREW HATCH, WITH A SINGLE O-RING SEAL (REF. FMEA 01-4-CS45-1).

FAILURE MODE:

INABILITY TO CLOSE, INTERNAL LEAKAGE

CAUSE(S):

MECHANICAL SHOCK, VIBRATION, CORROSION, CONTAMINATION, PHYSICAL BINDING/JAMMING

EFFECT(S) ON:

(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE

(A) LOSS OF REDUNDANCY - RELIEF VALVE CAP REMAINS TO SEAL AGAINST LOSS OF CABIN ATMOSPHERE.

(B,C,D) NO EFFECT.

(E) FUNCTIONAL CRITICALITY EFFECT - SECOND ASSOCIATED FAILURE, RELIEF VALVE CAP LEAKAGE, RESULTS IN EXCESSIVE LOSS OF CABIN ATMOSPHERE AND POSSIBLE LOSS OF CREW/VEHICLE. SCREEN B IS N/A BECAUSE VALVES ARE IN STANDBY UNTIL REQUIRED.

DISPOSITION & RATIONALE:

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

(A) DESIGN

THE VALVE BODY IS MADE OF 6061-T6 ALUMINUM ALLOY, ANODIZED FOR CORROSION. THE RELIEF VALVE IS OF PRIMARY POPPET CONSTRUCTION AND INCORPORATES A CAPTIVE REDUNDANT VALVE COVER WHICH PROVIDES ASSURANCE AGAINST CABIN OUTFLOW RESULTING FROM A PRIMARY POPPET FAILURE. THE PRIMARY POPPET

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COMPRISES A CIRCULAR VALVE HEAD WITH A SILASTIC 675 SILICONE RUBBER SEAL AND INTEGRAL POLISHED VALVE SHAFT WHICH RIDES IN A TUBULAR BORE OF THE VALVE HOUSING. SILASTIC 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. THE PRIMARY POPPET SHAFT AND VALVE BODY BORE ARE BOTH TEFLON IMPREGNATED HARD ANODIZED TO REDUCE FRICTION. DEBRIS SCREEN PROTECTS AGAINST DEBRIS INJECTION AND RESULTANT-LEAKAGE-PROBLEMS.

(B) TEST

ACCEPTANCE TEST - PER ATP 2725-3. PROBE PRESSURE TEST - PERFORMED WITH COVER OFF/POPPET CLOSED AND WITH COVER ON/POPPET OPEN; PRESSURE 25 PSIG. LEAKAGE TEST - WITH COVER ON/POPPET OPEN AND WITH COVER OFF/POPPET CLOSED; PRESSURE 15 PSIG, MAX LEAKAGE 15 SCCM.

QUALIFICATION TEST - PER QTP 2725-3. BURST PRESSURE - 32 PSID ACROSS THE VALVE POPPET AND ACROSS THE COVER (POPPET HELD OPEN). DESIGN SHOCK - 20 G TERMINAL SAWTOOTH PULSE OF 11 MS DURATION IN EACH DIRECTION OF THREE ORTHOGONAL AXES. RANDOM VIBRATION SPECTRUM - 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 3000 HZ FOR 48 MINUTES PER AXIS. AT THE END OF 17 MINUTES VIBRATION, THE VALVE WAS PRESSURIZED TO 2 PSIG AND LEAKAGE WAS MONITORED FOR 17 MINUTES. AT THE LAST 17 MINUTES, PRESSURE WAS INCREASED TO 14 PSIG AND LEAKAGE WAS MONITORED FOR THE LAST 14 MINUTES OF VIBRATION. MAX ALLOWABLE LEAKAGE WAS 15 SCCM. SINUSOIDAL VIBRATION - 5 - 35 HZ AT AN ACCELERATION AMPLITUDE OF +/- 0.25 G PEAK IN THREE ORTHOGONAL AXES; DURATION CONTROLLED BY A ONE OCTAVE PER MINUTE SWEEP RATE. THERMAL VACUUM TEST WAS CONDUCTED AT 1 X 10 EXP -6 TORR, WITH TEMPERATURE CYCLED THREE TIMES BETWEEN -65 F AND + 200 F. LIFE CYCLE TEST - 200 CYCLES OF RELIEF VALVE OPEN FULL STROKE/RESET. ATP TO VERIFY LEAKAGE IS PERFORMED AFTER SHOCK AND VIBRATION TESTING.

IN-VEHICLE TESTING - RELIEF VALVE RESET TEST IS PERFORMED AT 0.1 PSID MINIMUM. RESET LEAKAGE TEST AT 12.5 PSID MIN, 25 SCCM MAX LEAKAGE.

OMRSD - RELIEF VALVE RESET TEST IS PERFORMED BEFORE THE FIRST REFLIGHT OF EACH ORBITER AND AT INTERVALS OF FIVE FLIGHTS: 0.1 PSID MINIMUM RESET PRESSURE. RESET LEAKAGE-TEST AT 12.5 PSID MIN, 25 SCCM MAX LEAKAGE.

(C) INSPECTION

RECEIVING INSPECTION

RAW MATERIAL VERIFIED BY INSPECTION FOR MATERIAL AND PROCESS CERTIFICATION.

CONTAMINATION CONTROL

CORROSION PROTECTION PROVISIONS AND CONTAMINATION CONTROL PLAN ARE VERIFIED BY INSPECTION. CLEANLINESS LEVEL 200A PER MA0110-301 AND 100ML RINSE VERIFIED BY INSPECTION.

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ASSEMBLY/INSTALLATION

PARTS PROTECTION FROM DAMAGE AND CONTAMINATION IS VERIFIED. TORQUES ARE VERIFIED. DIMENSIONAL CHECKS ARE PERFORMED BY INSPECTION. VISUAL INSPECTION USING 10X MAGNIFICATION ON SEAL RING VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION

BRAZING AND WELDING CERTIFICATIONS ARE VERIFIED BY INSPECTION.

CRITICAL PROCESSES

HEAT TREAT AND PARTS PASSIVATION ARE VERIFIED BY INSPECTION. LUBRICANT APPLICATION ON SEAL RING VERIFIED BY INSPECTION. SOLDER CONNECTIONS VERIFIED BY INSPECTION.

TESTING

ATF VERIFIED BY INSPECTION.

HANDLING/PACKAGING

HANDLING, PACKAGING, STORAGE AND SHIPPING PROCEDURES ARE VERIFIED.

(D) FAILURE HISTORY

ONE FAILURE HAS OCCURRED:

AD4155-000, 3/14/88 AT KSC. HATCH STRUCTURAL MODIFICATION WORK GENERATED DIRT WHICH KEPT RELIEF VALVE A FROM RESEATING PROPERLY. THE SEAT WAS CLEANED WITH ISOPROPYL ALCOHOL AND RETEST WAS SATISFACTORY. RELIEF VALVE B SEAT WAS ALSO CLEANED AS A PRECAUTIONARY MEASURE.

(E) OPERATIONAL USE

TBS.