# SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :AFT - REACTION CONTROL FMEA NO 03-2A -201060 -1 REV:04/10/89

ASSEMBLY :PRESSURIZATION SUBSYSTEM
P/N RI :MC284-0421-0011, -0012
P/N VENDOR:5760009-111, -112
QUANTITY :4
:2 PER POD
:1 PER PROPELLANT

CRIT. FUNC: 1
CRIT. HDW: 1

| VEHICLE EFFECTIVITY: | 102 | 103 | 104 |
|---|---|---|---|
| | X | X | X |

PHASE(S): PL LO X OO X DO X LS

REDUNDANCY SCREEN: A- B- C-

| PREPARED BY: | | APPROVED BY: | APPROVED BY (NASA): |
|---|---|---|---|
| DES | R GONZALEZ | DES | SSM |
| REL | R P DIEHL | REL | REL |
| QE | W J SMITH | QE | QE |

ITEM:
VALVE,RELIEF, PRESSURE, BURST DISC & POPPET.

FUNCTION:
PROVIDES PRESSURE RELIEF IN EVENT REGULATOR FAILS OPEN. THE S.S. BURST DISC RELIEF PRESSURE IS 324 TO 340 PSI. THE MAIN POPPET MINIMUM CRACKING PRESSURE IS 315 PSI AND THE MINIMUM RESEAT PRESSURE IS 310 PSI. AMBIENT PRESSURE SENSING (EXTERNAL) IS PROVIDED SINCE THE VALVE OUTLET IS SUBJECTED TO BACK-PRESSURE. STAINLESS STEEL BURST DISK ASSEMBLY CONTROLLED BY INLET PRESSURE ACTING ON BELLEVILLE SPRING PROTECTS RELIEF VALVE FROM PROPELLANT EXPOSURE.

FAILURE MODE:
EXTERNAL LEAK, LEAK THROUGH BELLEVILLE ASS'Y BELLOWS & ORIFICE. LEAK IS SINGLE POINT FAILURE.

CAUSES(S)
WELD POROSITY, BELLOWS FRACTURES OR CORROSION AND PIN HOLE LEAKAGE, MATERIAL DEFECT.

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

(A) LOSS OF PRESSURANT. FLOW AREA FROM THE END CAP BACK OF THE BELLOWS/BURST DISC AREA IS GREATER THAN THAT OF AN OPEN REGULATOR OR RELIEF VALVE. (40 ORIFICES 0.096 DIAMETER AND 4 ORIFICES 0.062 DIAMETER ARE DRILLED THROUGH THE END CAP.)

(B) DEGRADATION OF INTERFACE SUBSYSTEM. OVERPRESSURIZATION OF POD. PROPELLANT VAPORS MAY ENTER POD.

(C) ABORT DECISION TO BE MADE.

(D) POSSIBLE INABILITY TO PERFORM ET SEP AND ENTRY DUE TO INABILITY TO UTILIZE/DEPLETE PROPELLANT IF MOST OF PRESSURANT IS DEPLETED THROUGH RELIEF VALVE.

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

(A) DESIGN
TWO PLY BELLOWS USED. SHOULD FRACTURE OF BELLOWS OCCUR LEAKAGE WOULD BE RESTRICTED BY THE STACKED BELLEVILLE ASSY. THE FACTOR OF SAFETY IS 1.5 FOR PROOF AND 2.0 FOR BURST. MATERIALS ARE CHOSEN FOR COMPATIBILITY WITH PROPELLANTS AND PROPELLANT VAPORS (INCONEL 625). BELLOWS EB WELDED.

(B) TEST
THE QUALIFICATION TESTING PROGRAM INCLUDED RANDOM VIBRATION, SHOCK (PER MIL-STD 810 20g PEAK), THERMAL CYCLES -20 TO +150 DEG F), ENDURANCE (80 CYCLES RELIEF VALVE AND 36,500 CYCLES FOR THE BURST DISK), AND PROPELLANT COMPATIBILITY.

THE UNIT WAS ALSO QUALIFIED AS PART OF THE POD ASSEMBLY DURING THE VIBRO-ACOUSTIC TESTING AT JSC (131 EQUIVALENT MISSIONS). THE HOT FIRE TEST PROGRAM AT WSTF SUBJECTED THE UNIT TO 24 EQUIVALENT MISSION DUTY CYCLES AND APPROX SEVEN YEARS OF PROPELLANT EXPOSURE.

THE VALVE ACCEPTANCE TESTING INCLUDES PROOF PRESSURE, EXTERNAL LEAKAGE, INTERNAL LEAKAGE, CRACKING AND RESEAT PRESSURE, FLOW CAPACITY, CLEANLINESS AND DRYING, PROOF AND LEAK TESTING OF WELDED JOINTS OF THE BELLOWS, AND CHECKING OF PROPER SET POINT OF THE BURST DISK ACTUATOR.

OMRSD PERFORMS THE FOLLOWING: FIRST FLIGHT EXTERNAL LEAK CHECKS AND ALSO WHEN COMPONENTS ARE REMOVED AND REPLACED. HELIUM SYSTEM ACTIVATION EVERY MISSION. A PRESSURE DECAY CHECK ON THE LOW PRESSURE HELIUM SYSTEM EVERY MISSION. HELIUM SERVICING TO FLIGHT LOAD FOR EVERY MISSION.

(C) INSPECTION

RECEIVING INSPECTION
TEST REPORTS AND RAW MATERIAL CERTIFICATIONS CERTIFYING MATERIALS AND PHYSICAL PROPERTIES ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL
CLEANLINESS OF THE RELIEF VALVE INTERNAL FLOW CAVITY TO LEVEL 100 FOR THE MC284-0421-0011 AND LEVEL 100A FOR THE MC284-0421-0012 AND CORROSION PROTECTION ARE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
DIMENSIONAL AND VISUAL INSPECTION IS VERIFIED BY INSPECTION. MANUFACTURING PROCESSES, INSTALLATION, AND ASSEMBLY OPERATIONS ARE VERIFIED BY INSPECTION. TEFLON GUIDE RING INSTALLATION IS VERIFIED BY INSPECTION. CRITICAL DIMENSIONS AND SURFACE FINISHES ARE VERIFIED BY INSPECTION. SEAT IS VERIFIED BY INSPECTION TO BE FREE OF SURFACE DEFECT AND CRACKS PRIOR TO ASSEMBLY.

NONDESTRUCTIVE EVALUATION
RADIOGRAPHIC INSPECTION OF WELD NUMBER W8 (PER EPS5760009) PER MIL-STD-453 IS VERIFIED BY INSPECTION. PENETRANT INSPECTION PER MIL-I-6866 TYPE 1, METHOD A OR C, OF WELD NUMBER W3, W5, W8, W9, AND W11 (PER EPS5760009) IS VERIFIED BY INSPECTION.

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CRITICAL PROCESSES
WELDING PER EPS5760009 IS VERIFIED BY INSPECTION. VISUAL OR 10X MAGNIFICATION INSPECTION OF ALL WELDS PER EPS5760009 IS VERIFIED BY INSPECTION. PROOF PRESSURE TEST AND LEAK TEST OF CERTAIN WELDS IS VERIFIED BY INSPECTION.

TESTING
ATP IS WITNESSED AND VERIFIED BY INSPECTION.

HANDLING/PACKAGING
PACKAGING OF THE FINAL ASSEMBLY FOR SHIPMENT PER 1EPS5760009 IS VERIFIED BY INSPECTION. HANDLING AND STORAGE REQUIREMENTS ARE VERIFIED BY INSPECTION. RETURNED AND ACCEPTED GOODS ARE KEPT IN BONDED AREAS AND VERIFIED BY INSPECTION.

(D) FAILURE HISTORY
NO FAILURE HISTORY.

(E) OPERATIONAL USE
IF FAILURE OCCURS PRIOR TO ET SEP USE CROSSFEED. FOR NOTICEABLE LEAK RATES ON-ORBIT DUMP ONBOARD PROPELLANT. USE CROSSFEED FOR ENTRY. THIS MAY NOT BE SUFFICIENT PROPELLANT FOR NOMINAL ENTRY. IF THE LEAK OCCURS DURING ENTRY USE FAILED SYS DOWN TO ZERO PVT. SWITCH TO CROSSFEED FOR THE REMAINDER OF ENTRY.