

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ATMOSPHERIC REVIT. FMEA NO 06-1C -0141 -2A REV: 08/10/88

ASSEMBLY : ATMOS MAKEUP CONTROL CRIT. FUNC: 1R  
P/N RI : MC250-0002-1001 CRIT. HDW: 2  
P/N VENDOR: 2144-0001-33 CARLETON VEHICLE 102 103 104  
QUANTITY : 2 EFFECTIVITY: X X X  
: ONE PER LOOP PHASE(S): PL LO X OO X DO X LS  
: TWO PER SUBSYSTEM

PREPARED BY: DES M. PRICE *MP* APPROVED BY: DES *[Signature]* REDUNDANCY SCREEN: A-PASS B-PASS C-PASS  
REL N. L. STEISSINGER *NLS* REL *[Signature]* APPROVED BY: NBSA: *[Signature]*  
QE S. MOR *SM* QE *[Signature]* ESM *[Signature]*  
REL *[Signature]* REL *[Signature]* REL *[Signature]*  
QE *[Signature]* QE *[Signature]* QE *[Signature]*

ITEM:  
PRESSURE REGULATOR, CABIN (8 PSIA)

FUNCTION:  
MAINTAINS CABIN PRESSURE AT 8 PSIA WITH OXYGEN PARTIAL PRESSURE AT 2.2 PSIA WHEN EMERGENCY PRESSURIZATION OF CABIN IS REQUIRED. ONE REGULATOR FLOW RATE IS ADEQUATE TO MAINTAIN AN 8 PSIA CABIN PRESSURE FOR 165 MINUTES WITH 0.45 INCH DIAMETER LEAK PATH.

FAILURE MODE:  
INABILITY TO CLOSE, LEAKAGE (NORMAL MISSION)

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

- EFFECT(S) ON:  
(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE
- (A) LOSS OF REDUNDANCY - ONLY ONE 8 PSIA REGULATOR CAN BE USED IN A CONTINGENCY.
  - (B) INCREASE IN N2 OR O2 PRESSURE IN CABIN UNTIL CORRECTING ACTION IS IMPLEMENTED.
  - (C) POSSIBLE EARLY MISSION TERMINATION DUE TO UNRESTRICTED O2 FLOW INTO CABIN.
  - (D) NO EFFECT.
  - (E) FUNCTIONAL CRITICALITY EFFECT - ONE 8 PSIA REGULATOR REMAINING. FAILURE OF REDUNDANT 8 PSIA REGULATOR CAUSES LOSS OF EMERGENCY PRESSURE REGULATION AND POSSIBLE LOSS OF CREW/VEHICLE.

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DISPOSITION & RATIONALE:

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

(A) DESIGN

THE VALVE BODY IS MADE OF ALUMINUM ALLOY 6061. THE DUAL-FLOW REGULATOR IS MADE UP OF PARALLEL LOW AND HIGH FLOW REGULATORS WHICH PROVIDE ACCURATE PRESSURE REGULATION WITH FLOWS UP TO 75 POUNDS PER HOUR. THE REGULATOR IS AN INLET PRESSURE COMPENSATED, SPRING-REFERENCED TYPE EMPLOYING A 17-7 PH CONDITION C CRES DIAPHRAGM AS A SENSING ELEMENT AND DYNAMIC SEAL. 17-7 PH IS PRECIPITATION HARDENED CORROSION RESISTANT STEEL WHICH HAS A HIGH STRENGTH TO WEIGHT RATIO. THE DIAPHRAGM SEALS WHICH ARE MADE OF SILASTIC 675 SILICONE RUBBER HAVE EXCELLENT RESISTANCE TO OXYGEN, OUTGASSING, AND FATIGUE. THEY ELIMINATE THE FRICTION AND WEAR ASSOCIATED WITH PISTON TYPE SEALS. THE HELICAL/BELLEVILLE SPRING COMBINATION WHICH IS MADE OF 17-7 PH CRES PROVIDES REGULATION AND ASSURES A CLOSE TOLERANCE OPERATION OVER A WIDE FLOW RANGE. THE POPPET WHICH IS ALSO MADE OF 17-7 PH CRES WORKS AGAINST A POLYIMIDE VESPEL SP-1 SEAT WHICH ASSURES A LEAK FREE OPERATION. THE INLET AND OUTLET PORTS ARE FILTER PROTECTED TO 25 MICRONS.

(B) TEST

ACCEPTANCE TEST - PROOF PRESSURE AT 443 PSIG MINIMUM FOR 3 MINUTES MINIMUM. EXTERNAL LEAKAGE TEST AT 240 +/-0 PSIG FOR 15 MINUTES MINIMUM, 0.2 SCCM MAX LEAKAGE. INTERNAL LEAKAGE TEST AT 240 +/-0 PSIG FOR 15 MINUTES, 7 SCCM MAX LEAKAGE.

QUALIFICATION TEST - LIFE CYCLE TESTING - 1000 CYCLES AT 875 +/- 25 PSIG. BURST PRESSURE IS 2500 PSIG. SUBJECTED TO THE FOLLOWING AS PART OF THE N2/O2 CONTROL PANEL: RANDOM VIBRATION SPECTRUM - 20 TO 150 HZ INCREASING AT 6 DB/OCTAVE TO 0.03 G\*\*2/HZ AT 150 HZ, CONSTANT AT 0.03 G\*\*2/HZ FROM 150 TO 1000 HZ, DECREASING AT 6 DB/OCTAVE FROM 1000 TO 2000 HZ FOR 48 MINUTES PER AXIS FOR THREE ORTHOGONAL AXES. DESIGN SHOCK - 20 G TERMINAL SAWTOOTH PULSE OF 11 MS DURATION IN EACH DIRECTION OF THREE ORTHOGONAL AXES. ATP TO VERIFY LEAKAGE IS PERFORMED AFTER SHOCK AND VIBRATION TESTING.

IN-VEHICLE TESTING - REGULATOR LOCKUP LEAKAGE TEST IS PERFORMED AT 90-240 PSIA INLET PRESSURE, 8.6 PSIA MAX OUTLET PRESSURE, 10 SCCM MAX LEAKAGE. 200 PSI MANIFOLD SYSTEM LEAK TEST IS PERFORMED AT 190 - 240 PSIG, 10 SCCM MAX LEAKAGE.

OMPSD - REGULATOR LOCKUP LEAKAGE TEST IS PERFORMED AT 90 - 250 PSIA, 10 SCCM MAX LEAKAGE, BEFORE THE FIRST REFLIGHT OF EACH ORBITER AND AT INTERVALS OF FIVE FLIGHTS.

(C) INSPECTION

RECEIVING INSPECTION

RAW MATERIALS, INCLUDING CHEMICAL AND MECHANICAL REQUIREMENTS, ARE VERIFIED BY INSPECTION FOR MATERIAL AND PROCESS CERTIFICATION.

CONTAMINATION CONTROL

CLEANLINESS LEVEL 300 AND 100 ML RINSE TESTS VERIFIED. SYSTEM GAS SAMPLES ANALYZED FOR CONTAMINATION.

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**ASSEMBLY/INSTALLATION**

DIAMETER AND THREADS ON LOWER BELLOWS VERIFIED BY INSPECTION. VISUAL, DIMENSIONAL, BELLOWS RATE AND CHECK FOR BELLOWS DAMAGE PERFORMED BY INSPECTION. TORQUES, BELLEVILLE SPRING FORCES, SURFACE AND SUB-SURFACE DEFECTS VERIFIED. 10X VISUAL INSPECTION ON SEAL RING VERIFIED.

**NONDESTRUCTIVE EVALUATION**

RADIOGRAPHIC AND PENETRANT INSPECTION OF WELDS ARE VERIFIED, INCLUDING 20X MAGNIFICATION VISUAL EXAM.

**CRITICAL PROCESSES**

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

**TESTING**

ATP VERIFIED BY INSPECTION.

**HANDLING/PACKAGING**

PARTS ARE PLACED IN CLEAN BAGS AND HEAT SEALED. PACKAGING FOR SHIPMENT VERIFIED BY INSPECTION.

**(D) FAILURE HISTORY**

NO FAILURE HISTORY APPLICABLE TO INABILITY TO CLOSE/LEAKAGE FAILURE MODE. THE REGULATOR HAS SUCCESSFULLY BEEN USED THROUGH THE SHUTTLE PROGRAM CONSIDERING THIS FAILURE MODE.

**(E) OPERATIONAL USE**

TBS.