

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ATMOSPHERIC REVIT. FMEA NO 06-1C -0141 -1 REV:09/11/98

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  
REL N. L. STEISLINGER  
QE S. MOR

REUNDANCY SCREEN: A-PASS B-N/A C-PASS  
APPROVED BY: DES M. PRICE  
REL N. L. STEISLINGER  
QE S. MOR

APPROVED BY: (NASA)  
SSM  
REL  
QE

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 OPEN, RESTRICTED FLOW

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 - ONE 8 PSI REGULATOR REMAINING TO SUPPORT 8 PSI CABIN DURING ABORT.

(B) NO EFFECT. REDUNDANT REGULATOR AUTOMATICALLY TAKES OVER FUNCTION.

(C) NO EFFECT. ONLY OPERATIONAL DURING 8.0 PSIA CABIN CONTINGENCY.

(D) NO EFFECT.

(E) FUNCTIONAL CRITICALITY EFFECT - FAILURE OF REDUNDANT 8 PSIA REGULATOR CAUSES LOSS OF EMERGENCY PRESSURE REGULATION AND POSSIBLE LOSS OF CREW/VEHICLE. SCREEN B IS N/A BECAUSE BOTH 8 PSIA REGULATORS ARE IN STANDBY UNTIL REQUIRED.

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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 PARALLELED 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 +5/-0 PSIG FOR 15 MINUTES MINIMUM, 0.2 SCCM MAX LEAKAGE. INTERNAL LEAKAGE TEST AT 240 +5/-0 PSIG FOR 15 MINUTES, 7 SCCM MAX LEAKAGE. AT INLET PRESSURES OF 100 OR 200 PSIG IN THE HIGH DEMAND MODE THE FLOW MUST BE GREATER THAN OR EQUAL TO 75 LB/HR.

QUALIFICATION TEST - LIFE CYCLE TESTING - 1000 CYCLES AT 875 +/- 25 PSIG. BURST PRESSURE IS 2500 PSIG. SUBJECTED TO THE FOLLOWING AS PART OF THE H2/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 LOW (0.25 - 0.75 LB/HR) AND HIGH (75 LB/HR MINIMUM) FLOW TESTS ARE PERFORMED.

OMRSD - REGULATOR LOW (0.25 - 0.75 LB/HR) AND HIGH (75 LB/HR MINIMUM) FLOW TESTS ARE PERFORMED 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 OPEN, RESTRICTED FLOW FAILURE MODE. THE REGULATOR HAS SUCCESSFULLY BEEN USED THROUGH THE SHUTTLE PROGRAM CONSIDERING THIS FAILURE MODE.

(E) OPERATIONAL USE

TBS.