SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :ATMOSPHERIC REVIT. FMEA NO 06-1C -0109 -3 REV:08/10/88

ASSEMBLY :ATMOS MAKEUP CONTROL
P/N RI :MC250-0002-2020
P/N VENDOR:2729-0001-9 CARLETON
QUANTITY :1
:ONE PER SUBSYSTEM
:

CRIT. FUNC: 1R
CRIT. HDW: 2

VEHICLE EFFECTIVITY:	102	103	104
	X	X	X

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

REDUNDANCY SCREEN: A-PASS B-PASS C-PASS

PREPARED BY:
DES M. PRICE
REL N. L. STEISSLINGER
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APPROVED BY:
DES
RBL
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APPROVED BY (NASA):
SSM
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ITEM:
PRESSURE REGULATOR
AUXILIARY OXYGEN STORAGE TANK, TWO STAGE

FUNCTION:
WHEN HIGH PRESSURE AUXILIARY OXYGEN TANK IS INSTALLED, REGULATES AUXILIARY OXYGEN SUPPLY FROM 3300 PSIG TO 285 PSIG IN TWO STAGES AT FLOW RATES FROM ZERO TO 150 LB/HR MINIMUM. THE ROUGHING REGULATOR (FIRST) REDUCES OXYGEN PRESSURE TO 400 PSIG, AND LIMITS FLOW TO 300 LB/HR. THE SECOND REGULATOR MAINTAINS OXYGEN PRESSURE AT 300 PSI. WHEN TANK IS NOT INSTALLED THIS REGULATOR DOES NOT PERFORM ANY DYNAMIC FUNCTION. THE LISTED FAILURE EFFECTS ARE FOR THE CASE WHEN THE AUX. O2 TANK IS NOT INSTALLED. THE FAILURE EFFECTS FOR THE CASE OF THE TANK BEING INSTALLED WILL BE ADDRESSED IN THE MISSION KIT FMEA ON A MISSION BY MISSION BASIS.

FAILURE MODE:
EXTERNAL LEAKAGE
AUX O2 TANK NOT INSTALLED

CAUSE(S):
MECHANICAL SHOCK, VIBRATION, CORROSION, POROSITY

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

(A) NO EFFECT. REGULATOR FUNCTION NOT REQUIRED WHEN O2 AUX TANK IS NOT INSTALLED.

(B,C,D) NO EFFECT.

(E) GROSS LEAKAGE THROUGH THE ISOLATION VALVE SEAT AND THEN THIS LEAK PATH WOULD RESULT IN LOSS OF LES SUPPORT AND O2 SYSTEMS CROSS-TIE CAPABILITY.

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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 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. COMPATIBILITY OF THE PANEL COMPONENTS WITH OXYGEN RELATES TO THE 1.16 VALVE AND 1.26 REGULATOR. THE INTERNAL NON-METALLICS ARE SILASTIC AND POLYIMIDE (VESPEL). VESPEL MEETS BOTH NHB8060.1 AND MSFC-SPEC-106 REQUIREMENTS. SILICONE IS INDICATED TO BE COMPATIBLE WITH OXYGEN PER THE PARKER O-RING HANDBOOK, OR-5700. FURTHER, COMPATIBILITY WAS DEMONSTRATED AT JSC IN THE ARPCS VERIFICATION TESTS PER CSD-SH-140.

(B) TEST
ACCEPTANCE TEST - PROOF PRESSURE OF 1885 PSIG IN WHICH THE PRESSURE IS MAINTAINED FOR 3 MINUTES. EXTERNAL LEAK TESTED FOR 1.0 SCCM MAX LEAKAGE AT 900 PSIG FOR A MINIMUM OF 15 MINUTES. INTERNAL LEAK TESTED FOR 2.5 SCCM MAX LEAKAGE AT 900 PSIG FOR A MINIMUM OF 5 MINUTES. ATP ON N2/O2 SUPPLY PANEL AS AN ASSEMBLY INCLUDES EXAMINATION OF PRODUCT, RADIOGRAPHIC INSPECTION, PROOF PRESSURE AT 4945 +/- 5 PSIG FOR A MINIMUM OF 3 MINUTES, AND EXTERNAL LEAKAGE TEST (DECAY TEST USING GN2) AT 3300 +/- 20 PSIG WITH NITROGEN SYSTEM AT A LOWER PRESSURE - ENTIRE PANEL LEAKAGE IS LIMITED TO 5.8 SCCM MAX.

QUALIFICATION TEST - THE TEST SPECIMEN WAS SUBJECTED TO A BURST PRESSURE LEVEL OF 6650 PSIG INLET AND 2500 PSIG OUTLET FOR 3 MINUTES. LIFE CYCLE TESTING - 2500 CYCLES AT 900 PSIG. BENCH HANDLING SHOCK PER MIL-STD-810 METHOD 516.7, PROCEDURE V. RANDOM VIBRATION 84 MIN/AXIS, INCREASING AT 6 DB/OCTAVE FROM 20 - 80 HZ, CONSTANT AT .023 G**2/HZ FROM 80 - 300 HZ, DECREASING AT -6 DB/OCTAVE FROM 300 TO 2000 HZ. TRANSIENT VIBRATION ONE OCTAVE/MINUTE SWEEP RATE 5 TO 35 HZ AT ACCELERATION AMPLITUDE OF +/- .25G PEAK IN EACH AXIS. ATP TO VERIFY LEAKAGE IS PERFORMED AFTER SHOCK AND VIBRATION TESTING.

IN-VEHICLE TESTING - THE 3300 PSI GO2 MANIFOLD IS OVERPRESSURE (4125-4325 PSIG) AND LEAK (2900 - 3000 PSIG, 1 X 10 EXP -7 SCCS GHE MAX) TESTED.

OMRSD - THE 3300 PSI MANIFOLD IS LEAK TESTED BY PRESSURE DECAY TEST AT 3100 - 3300 PSIG, 10 SCCM GN2 MAX LEAKAGE, AS A CONTINGENCY FOR LRU RETEST.

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(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 PER MAO110-301 AND 100 ML RINSE TESTS VERIFIED. SYSTEM GAS SAMPLES ANALYZED FOR CONTAMINATION.

ASSEMBLY/INSTALLATION
DIAMETER AND THREADS ON LOWER BELLOWS VERIFIED BY INSPECTION. VISUAL, DIMENSIONAL, BELLOWS RATES AND CHECK FOR BELLOWS DAMAGE PERFORMED BY INSPECTION. TORQUES, BELLEVILLE SPRING FORCES, SURFACE, AND SUBSURFACE DEFECTS VERIFIED. 10X VISUAL INSPECTION ON SEAL RING VERIFIED BY INSPECTION.

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

CRITICAL PROCESSES
PARTS PASSIVATION, ANODIZING AND HEAT TREATMENT VERIFIED. LUBRICANT ON SEAL RING VERIFIED BY TECHNICIAN. POTTING APPLICATION AND SOLDER CONNECTIONS ARE VERIFIED BY INSPECTION. NICKEL FINISH ON BELLOWS 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 EXTERNAL LEAKAGE FAILURE MODE. THE REGULATOR HAS SUCCESSFULLY BEEN USED THROUGH THE SHUTTLE PROGRAM CONSIDERING THIS FAILURE MODE.

(E) OPERATIONAL USE
TBS.