

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : ATMOSPHERIC REVIT. FMEA NO 06-1C -0171 -2 REV:08/10/88

ASSEMBLY : ATMOS MAKEUP CONTROL CRIT. FUNC: 1R
P/N RI : MC250-0002-2020 CRIT. HDW: 2
P/N VENDOR: 2666-0001-23 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: *[Signature]* REDUNDANCY SCREEN: A-PASS B-PASS C-PASS
REL N. L. STEISSLINGER *NLS* DES *[Signature]* APPROVED BY (NASA): *[Signature]*
QE S. MOR *SM* REL *[Signature]* SSM *[Signature]*
QE *[Signature]* REL *[Signature]* REL *[Signature]* QE *[Signature]*

ITEM:

LATCHING VALVE, NITROGEN SYSTEM SELECTOR - MOTOR OPERATED

FUNCTION:

PROVIDES CAPABILITY TO SELECT THE UTILIZATION LOOP FOR THE NITROGEN WHICH LEAVES THE SUPPLY TANKS. PREVENTS THE PRESSURIZATION OF NITROGEN REGULATORS WHICH ARE NOT IN USE TO SUPPLY CABIN DEMANDS.

FAILURE MODE:

EXTERNAL LEAKAGE

CAUSE(S):

VIBRATION, MECHANICAL SHOCK, CORROSION

EFFECT(S) ON:

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

(A) ISOLATION OF A LEAK UPSTREAM OF THE POPPET RESULTS IN LOSS OF NORMAL USE OF BOTH N2 LOOPS.

(B) CORRECTING ACTION DEACTIVATES BOTH N2 LOOPS REMOVING N2 PRESSURE FROM THE WATER TANKS, PAYLOAD AND CABIN MAKE-UP SYSTEM, UNTIL REQUIRED.

(C) POSSIBLE EARLY MISSION TERMINATION DEPENDING UPON LEAKAGE RATE.

(D) NO EFFECT.

(E) FUNCTIONAL CRITICALITY EFFECT - SECOND ASSOCIATED FAILURE WHICH RESULTS IN LOSS OF N2 MAKE-UP CAPABILITY RESULTS IN LOSS OF ABILITY TO SUPPORT AN 8.0 PSIA CONTINGENCY AND LOSS OF ABILITY TO PURGE CABIN IN CASE OF A CONTAMINATED CABIN.

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DISPOSITION & RATIONALE:

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

(A) DESIGN

VALVE BODY IS MADE OF 5061-T6 ALUMINUM ANODIZED FOR CORROSION RESISTANCE. FITTINGS ARE MADE OF PH 13-8 CONDITION A CRES, WHICH IS PRECIPITATION HARDENED CORROSION RESISTANT STEEL AND HAS A HIGH STRENGTH TO WEIGHT RATIO. STATIC SEALS ARE MADE OF SILASTIC 675 SILICONE RUBBER. SILASTIC 675 SILICONE RUBBER HAS GOOD RESISTANCE TO ENVIRONMENTAL ESPOSURE, FLEXING AND FATIGUE. IT ALSO HAS LOW FLAMMABILITY AND OUTGASSING. THE OZONE RESISTANCE OF SILICONE RUBBER IS EXCELLENT. THE BELLEVILLE SPRING LATCHING HAS NO SLIDING PARTS, IS HIGHLY RELIABLE, AND HAS A STABLE POSITION HOLDING FORCE. CONSTANT SEAT FORCES DUE TO BELLEVILLE CLOSING SPRING ELIMINATE EXCESS SEAL AND SEAT WEAR. THE LATCHING MECHANISM, COMPRISING A DUAL, TWO POSITION, BELLEVILLE SPRING SET PROVIDES POSITIVE DETENTING BY ASSURING TWO STABLE POSITION-HOLDING FORCES; VALVE OPEN AND VALVE CLOSED. POLYIMIDE VALVE SEAT HAS AN ADEQUATE SEAT FOOTPRINT WHICH HAS AN EFFECTIVE SEAL EVEN IN THE PRESENCE OF FOREIGN MATERIAL IN THE SEAT AREA. THE VALVE STEM IS HIGHLY POLISHED FOR EASE OF OPERATION (REDUCED FRICTION PROTECTS SEALS). THE VALVE STEM HAS REDUNDANT SEALS WHICH GIVE ADDED PROTECTION AGAINST EXTERNAL LEAKAGE. INLET/OUTLET PORTS ARE FILTER PROTECTED TO 25 MICRONS.

(B) TEST

ACCEPTANCE TEST - PROOF PRESSURE AT 5000 PSIG FOR A MINIMUM OF 3 MINUTES. EXTERNAL LEAKAGE TEST AT 3350 PSIG FOR 15 MINUTES MINIMUM, 0.4 SCCM MAX LEAKAGE. INTERNAL LEAKAGE TEST AT 3350 PSIG FOR 15 MINUTES, 2.5 SCCM MAX LEAKAGE.

QUALIFICATION TEST - LIFE CYCLE TESTING - 1000 CYCLES AT 3300 +/-20 PSIG. BURST PRESSURE IS 6600 PSIG. SUBJECTED TO THE FOLLOWING AS PART OF THE N2/AUX O2 SUPPLY PANEL: RANDOM VIBRATION SPECTRUM - 20 TO 150 HZ INCREASING AT 6 DB/OCTAVE TO 0.03 G**2/HZ AT 150 HZ, CONSTANT AT 0.01 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 - LINES ARE OVERPRESSURE TESTED WITH COMPONENTS INSTALLED AT 4125 - 4325 PSIG. JOINTS ARE LEAK TESTED AT 2900 - 3000 PSIG, 1 X 10 EXP -7 SCCS GHE MAX LEAKAGE.

OMRSD - LONG TERM SYSTEM LEAK TEST (PRESSURE DECAY) IS PERFORMED AFTER SYSTEM SERVICING, EACH TURNAROUND, AT FLIGHT LOAD PRESSURE. A THREE DAY MINIMUM DECAY TEST IS PERFORMED, WITH 5 PSI/DAY MAX LEAKAGE.

(C) INSPECTION

RECEIVING INSPECTION

RAW MATERIAL VERIFIED BY INSPECTION FOR MATERIAL AND PROCESS CERTIFICATION.

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CONTAMINATION CONTROL
CLEANLINESS LEVEL 300A PER MA0110-301 AND 100 ML RINSE TESTS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
DIMENSIONAL CHECKS PERFORMED BY INSPECTION. MIPS FOR CONCENTRICITY AND PERPENDICULARITY. BELLEVILLE SPRING FORCES VERIFIED BY INSPECTION. DIAMETER AND THREADS ON LOWER BELLOWS VERIFIED BY INSPECTION. VISUAL DIMENSIONAL, BELLOWS RATES AND CHECK FOR BELLOWS DAMAGE PERFORMED BY INSPECTION. NICKEL FINISH ON BELLOWS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
RADIOGRAPHIC AND PENETRANT INSPECTION OF WELDS VERIFIED BY INSPECTION.

CRITICAL PROCESSES
PARTS PASSIVATION AND ANODIZING VERIFIED BY INSPECTION. HEAT TREATMENT VERIFIED BY INSPECTION. SOLDER CONNECTIONS VERIFIED BY INSPECTION. TIG WELD SCHEDULE VERIFIED BY INSPECTION. APPLICATION OF LUBRICANT ON SEAL RING VERIFIED BY INSPECTION.

TESTING
ATP VERIFIED BY INSPECTION.

HANDLING/PACKAGING
HANDLING, PACKAGING, STORAGE AND SHIPPING PROCEDURES ARE VERIFIED.

(D) FAILURE HISTORY

ONE FAILURE HAS OCCURRED:
AC0739-010, 8/20/82. DURING TEMPERATURE CYCLE TESTING OF AN N2/AUX O2 SUPPLY PANEL AT THE SUPPLIER TO DETERMINE THE CAUSE OF ANOTHER FAILURE (AN EXTERNAL LEAK ON STS-3, CAR 03F012-010), THE POPPETS OF TWO N2 LATCHING VALVES FAILED TO CLOSE UPON COMMAND DURING A LOW TEMP EXCURSION (-65 F). CAUSE WAS WATER IN THE BELLOWS/POPPET ASSEMBLIES. CORRECTIVE ACTION - ASSEMBLY INSTRUCTION WAS AMENDED TO INCLUDE A VACUUM BAKE AT 180 F FOR ONE HOUR PRIOR TO INSTALLING TEFLON SECONDARY SEALS AND TESTING AT -65 F. SPECIAL WARNING INSTRUCTIONS WERE ISSUED TO CLEANING PERSONNEL TO EXCLUDE WATER FROM THE BELLOWS ASSEMBLY CLEANING PROCEDURE.

(E) OPERATIONAL USE
TRF.