SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 06-1C2-0127-X

SUBSYSTEM NAME: ARS - ARPCS

REVISION : 2 01/09/90

		PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU	:	N2/02 CONTROL PANEL CARLETON TECHNOLOGIES	MC250-0002-1001 2720-0001
SRU	:	VALVE, RELIEF & REG, 02	1-4-00-58-13

QUANTITY OF LIKE ITEMS: 2
ONE PER LOOP
TWO PER SUBSYSTEM

FUNCTION:
RELIEF VALVE,
OXYGEN SUPPLY PRESSURE

RELIEVES OXYGEN SYSTEM OVERPRESSURES DOWNSTREAM OF OXYGEN SUPPLY REGULATOR AT 245 PSIG MAXIMUM IN CASE OF REGULATOR MALFUNCTION SO THAT EXCESSIVE PRESSURE IS NOT SENT INTO DOWNSTREAM COMPONENTS. THE RELIEF VALVE IS INTEGRAL TO THE ON/OFF VALVE AND REGULATOR ASSEMBLY.

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 06-1C1-0127-02

REVISION# 2 01/09/90

SUBSYSTEM: ARS - ARPCS
LRU :M2/02 CONTROL PANEL CRITICALITY OF THIS
ITEM NAME: VALVE, RELIEF & REG, 02 FAILURE MODE:1R2

FAILURE MODE:
INABILITY TO CLOSE, INCLUDING INTERNAL OR EXTERNAL LEAKAGE

MISSION PHASE:
PL PRELAUNCH
LO LIFT-OFF
OO ON-ORBIT
DO DE-ORBIT
LS LANDING SAFING

■ VEHICLE/PAYLOAD/KIT EFFECTIVITY: 102 COLUMBIA
: 103 DISCOVERY
: 104 ATLANTIS
: 105 ENDEAVOUR

CAUSE:
MECHANICAL SHOCK, VIBRATION, CONTAMINATION, CORROSION

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN A) PASS
B) PASS
C) PASS

PASS/FAIL RATIONALE:
A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LEAKAGE OF OXYGEN INTO CABIN UNTIL ASSOCIATED REG INLET VALVE IS CLOSED.
LOSS OF ONE REDUNDANT 100 PSI 02 SYSTEM TO CABIN REGULATORS.

(B) INTERFACING SUBSYSTEM(S):
INCREASED CABIN PPO2 UNTIL REG INLET VALVE IS CLOSED.

(C) MISSION:
POSSIBLE LOSS OF MISSION; ONLY REG INLET VALVE REMAINS TO ISOLATE LEAKAGE IN ORDER TO PRECLUDE LOSS OF EMERGENCY SYSTEM (LES).

(D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT.

(E) FUNCTIONAL CRITICALITY EFFECTS:
GROSS LEAKAGE OF RELIEF VALVE, COMBINED WITH INLET VALVE INTERNAL LEAKAGE, CAUSES LOSS OF LES SYSTEM AND POSSIBLE LOSS OF CREW/VEHICLE.

- DISPOSITION RATIONALE -

(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.

(B) TEST:
ACCEPTANCE TEST - PROOF TEST AT 1875 +/- 25 PSIG FOR A MINIMUM OF 3 MINUTES. LEAK TESTED AT INLET PRESSURE 885 +/- 25 PSIG AND OUTLET PRESSURE 125 PSIG; 0.3 SCCM MAX LEAKAGE. INTERNAL LEAKAGE TEST PERFORMED AT THE SAME PRESSURE; 0.2 SCCM MAX LEAKAGE. RELIEF VALVE OPERATIONAL TEST AT A CRACKING PRESSURE OF 245 PSIG MAX AND A RESEAT PRESSURE OF 215 PSIG MINIMUM.

QUALIFICATION TEST - LIFE CYCLE TESTING - 1000 CYCLES AT 875 -/- 25 PSIG. BURST PRESSURE IS 2500 PSIG. SUBJECTED TO THE FOLLOWING AS PART OF THE EMERGENCY O2 CONTROL PANEL. DESIGN SHOCK - THE UNIT WAS SUBJECTED TO 3 SHOCKS OF A 20 G PEAK ACCELERATION PULSE APPROXIMATELY A SAWTOOTH AND HAVING A TOTAL DURATION OF 11 MILLISECONDS. THIS PULSE WAS APPLIED IN BOTH DIRECTIONS OF THE THREE PRINCIPLE AXES FOR A TOTAL OF 18 SHOCKS. RANDOM VIBRATION SPECTRUM ENVELOPE - 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. ATP TO VERIFY LEAKAGE IS PERFORMED AFTER SHOCK AND VIBRATION TESTING.

IN-VEHICLE TESTING - OVERPRESSURE AND LEAK TESTED. RELIEF VALVE CRACK, RESEAT, AND RESEAT LEAKAGE TESTS PERFORMED.

OMRSD - RELIEF VALVE CRACK AND RESEAT TEST IS PERFORMED AT INTERVALS OF FIVE FLIGHTS; CRACK PRESSURE 210 - 250 PSIG, RESEAT PRESSURE 205 PSIG MIN AND RESEAT LEAKAGE 10 SCCM MAX. EXTERNAL LEAK TEST IS PERFORMED AT THE SAME INTERVAL AT 900 - 950 PSIG, 70 SCCM MAX SYSTEM LEAKAGE. INFLIGHT CHECKOUT DURING EACH MISSION VERIFIES NO GROSS EXTERNAL LEAKAGE.

(C) INSPECTION:
RECEIVING INSPECTION
RAW MATERIAL VERIFIED BY INSPECTION FOR MATERIAL AND PROCESS CERTIFICATION.

CONTAMINATION CONTROL
CORROSION PROTECTION PROVISIONS AND CONTAMINATION CONTROL PLAN ARE VERIFIED BY INSPECTION. CLEANLINESS LEVEL 200A PER MAOIIG-301 VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
BELLEVILLE SPRING FORCES AND TORQUES ARE VERIFIED. DIMENSIONAL CHECKS ARE PERFORMED BY INSPECTION. MIPS FOR CONCENTRICITY AND PERPENDICULARITY. VISUAL INSPECTION USING 10X MAGNIFICATION ON SEAL RING VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
BRAZING, WELDING, X-RAYS AND PENETRANT INSPECTIONS ARE VERIFIED BY INSPECTION.

CRITICAL PROCESSES
HEAT TREAT AND PARTS PASSIVATION AND ANODIZING ARE VERIFIED BY INSPECTION. LUBRICANT APPLICATION ON SEAL RING VERIFIED BY INSPECTION. POTTING VISUALLY VERIFIED BY INSPECTION. SOLDERING VERIFIED BY INSPECTION.

TESTING
ATP VERIFIED BY INSPECTION.

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

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 06-1C1-0127-02

(D) FAILURE HISTORY:
AB8553-010, PRIOR TO STS-1, INTERNAL LEAKAGE WAS CAUSED BY THE POPPET BEING HELD OPEN BY CONTAMINANT PARTICLE.

(E) OPERATIONAL USE:
TBS.

- APPROVALS -

RELIABILITY ENGINEERING: O. R. RISING DLR :
DESIGN ENGINEERING : K. KELLY KK :
QUALITY ENGINEERING : M. SAVALA MS :
NASA RELIABILITY :
NASA SUBSYSTEM MANAGER :
NASA QUALITY ASSURANCE :