SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 06-1C3-1512-X

SUBSYSTEM NAME: ARS - ARPCS

REVISION : 2 02/07/90

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU :	VALVE, O2 SUPPLY CARLETON TECHNOLOGIES	MC250-0004-0006 1-4-00-51-27

QUANTITY OF LIKE ITEMS: 1

FUNCTION:
SHUTOFF VALVE, DIRECT OXYGEN

PROVIDES ON-OFF CONTROL OF 900 PSI OXYGEN TO DIRECT O2 RESTRICTOR. USED DURING 8.0 PSI CONTINGENCY OPERATIONS TO MAINTAIN AN O2/N2 MIXTURE WHILE 8 PSI REGULATOR FLOWS N2.

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 06-1C3-1512-02

REVISION# 2 02/07/90

SUBSYSTEM: ARS - ARPCS
LRU :VALVE, O2 SUPPLY
ITEM NAME: VALVE, O2 SUPPLY

CRITICALITY OF THIS FAILURE MODE:1/1

■ FAILURE MODE:
EXTERNAL LEAKAGE (GROSS)

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, CORROSION, CONTAMINATION, SEAL MATERIAL DEGRADATION, MATERIAL DEFECT

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN A) N/A
B) N/A
C) N/A

PASS/FAIL RATIONALE:
A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
UNCONTROLLED O2 FLOW INTO CABIN.

(B) INTERFACING SUBSYSTEM(S):
POSSIBLE HIGH PPO2 UNTIL CORRECTING ACTION (C/A) TAKES EFFECT.
POSSIBLE FLAMMABILITY LIMIT VIOLATION.

(C) MISSION:
ABORT DECISION. CREW ALTITUDE PROTECTION SYSTEM (LES)/AIRLOCK O2 SUPPORT HAS BEEN LOST IF LEAKAGE IS SIGNIFICANT. CABIN O2 MAKE-UP CAPABILITY IS STILL AVAILABLE.

(D) CREW, VEHICLE, AND ELEMENT(S):
GROSS EXTERNAL LEAKAGE RESULTS IN INADEQUATE O2 SUPPLY TO LES STATIONS. THE LOSS OF LES SUPPORT CAPABILITY MAY RESULT IN LOSS OF CREW IF LEAK RATE PROHIBITS LES SYSTEM PRESSURIZATION AND LES IS REQUIRED. NOTE - IN AN 8.0 PSIA HOLE IN CABIN CONTINGENCY MODE, AN EXTERNAL LEAK ALLOWING FLOW INTO THE CABIN MAY NOT BE CATASTROPHIC SINCE THERE IS A POSSIBILITY OF SAFELY BREATHING THE CABIN AIR, INTO WHICH THE O2 IS LEAKING, BY RAISING LES VISORS. THE WORST CASE FAILURE WOULD BE IN THE CASE OF A CONTAMINATED CABIN ATMOSPHERE, WHEN LEAKAGE PREVENTS ADEQUATE FLOW TO LES STATIONS AND CABIN AIR MAY NOT BE SAFE FOR BREATHING.

(E) FUNCTIONAL CRITICALITY EFFECTS:

- DISPOSITION RATIONALE -

(A) DESIGN:
VALVE BODY IS MADE OF 6061-T6 ALUMINUM ANODIZED FOR CORROSION RESISTANCE. FITTINGS ARE MADE OF 17-4 PH CONDITION A CRES, WHICH IS PRECIPITATION HARDENED CORROSION RESISTANT STEEL WHICH HAS A HIGH STRENGTH TO WEIGHT RATIO. STATIC SEALS ARE MADE OF SILASTIC 675 SILICONE RUBBER. POPPET IS PRESSURE COMPENSATED THROUGH THE USE OF DYNAMIC SEALS AT EACH END, WHICH SLIDE ON THE VALVE STEM. VALVE STEM IS HIGHLY POLISHED FOR EASE OF OPERATION (REDUCED FRICTION PROTECTS SEALS). DYNAMIC SEALS ARE ALSO SILASTIC 675 SILICONE AND ARE LUBRICATED WITH BRAYCO LUBE. SILASTIC 675 SILICONE RUBBER HAS GOOD RESISTANCE TO ENVIRONMENTAL EXPOSURE, FLEXING AND FATIGUE. IT ALSO HAS LOW FLAMMABILITY AND OUTGASSING. THE OZONE RESISTANCE OF SILICONE RUBBER IS EXCELLENT. BRAYCO LUBE IS COMPATIBLE WITH LOW AND HIGH PRESSURE GO2. EXTERNAL LEAKAGE REQUIREMENT IS 0.2 SCCM MAX. INLET/OUTLET PORTS ARE FILTER PROTECTED TO 25 MICRONS. POPPET IS PRESSURE COMPENSATED THROUGH THE USE OF DYNAMIC SEALS AT EACH END OF POPPET. CONSTANT SEAT FORCES DUE TO BELLEVILLE CLOSING SPRING ELIMINATE EXCESS SEAL AND SEAT WEAR. OPERATING FORCE IS 4.5 POUNDS MAXIMUM AND IS INDEPENDENT OF PRESSURE LOADS. THE MOST PROBABLE LEAK (TWO CUT O-RINGS WORST CASE) IS ESTIMATED AT 100 SCCM (0.0175 LB/HR).

(B) TEST:
ACCEPTANCE TEST - PROOF PRESSURE 1875 PSIG, EXTERNAL LEAK 0.2 SCCM MAX AT 1250 PSIG. NORMAL OPERATING PRESSURE IS 1250 PSIG.

CERTIFICATION TEST - CERTIFIED BY SIMILARITY TO IDENTICAL VALVES (O2

ISOLATION VALVE AND NITROGEN CROSSOVER VALVE) ON O2/N2 CONTROL PANEL AND TO SIMILAR TYPE VALVES USED ON APOLLO PROGRAM. LIFE CYCLE TESTING - THE VALVES WERE SUBJECTED TO 150 OPEN/CLOSE CYCLES AT A PRESSURE OF 300 PSIG, AND TESTED FOR EXTERNAL LEAKAGE PRE AND POST LIFE CYCLE TESTING. COMPONENT BURST PRESSURE TESTED AT 490 PSIG FOR A MINIMUM OF 5 MINUTES (2 TIMES MAXIMUM OPERATING PRESSURE). O2 ISOLATION VALVE AND N2 CROSSOVER VALVE WERE 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 - 20G TERMINAL SAWTOOTH PULSE OF 11 MS DURATION IN EACH DIRECTION OF THREE ORTHOGONAL AXES. ATP TO VERIFY LEAKAGE PERFORMED AFTER SHOCK AND VIBRATION TESTING, LEAKAGE NOT TO EXCEED 0.2 SCCM AT PRESSURE OF 110 PSIG.

IN-VEHICLE TESTING - OVERPRESSURE TESTED AT 1070-1255 PSIG.

OMRSD - 900, 100 PSI O2 EMERGENCY BREATHING SYSTEM 1 & 2 LEAK TEST IS PERFORMED PRIOR TO FIRST REFLIGHT OF EACH ORBITER AND EVERY FIVE FLIGHTS AT 900 - 950 PSIG, 70 SCCM MAX LEAKAGE. INFLIGHT CHECKOUT DURING EACH MISSION WILL VERIFY THERE IS NO GROSS SYSTEM EXTERNAL LEAKAGE.

(C) INSPECTION:
RECEIVING INSPECTION
RAW MATERIAL VERIFIED BY INSPECTION AT SUPPLIER.

CONTAMINATION CONTROL
CLEANLINESS LEVEL 200A PER MA0110-301 AND 100 ML RINSE TESTS VERIFIED BY INSPECTION.

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

CRITICAL PROCESSES
INLET FILTER WELD VERIFIED BY INSPECTION. PARTS PASSIVATION AND ANODIZING VERIFIED BY INSPECTION. HEAT TREATMENT VERIFIED BY INSPECTION. SOLDER CONNECTIONS VERIFIED BY INSPECTION TO BE PER NHB5300.4(3A). POTTING VISUALLY VERIFIED BY INSPECTION. APPLICATION OF LUBRICANT ON SEAL RING VERIFIED BY TECHNICIAN.

NONDESTRUCTIVE EVALUATION
LEAK TEST IS VERIFIED BY INSPECTION.

TESTING
ATP VERIFIED BY INSPECTION. BUBBLE POINT AND DELTA P TEST OF INLET FILTER VERIFIED BY INSPECTION.

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

(D) FAILURE HISTORY:
CAR A7517-010, 8/5/77. EXTERNAL LEAKAGE FAILURE OCCURRED AT 1800 PSIG WHILE RUNNING SUPPLIER ATP PROOF PRESSURE TEST. THE VALVE BODY BROKE AT THE WEAKEST POINT OF THE THREADS THAT HOLD ON THE END CAP. THE HOUSING AND END FITTINGS HAVE BEEN REDESIGNED WITH A FEMALE THREAD IN THE HOUSING AND A MALE THREAD ON THE FITTING. THIS ALLOWS FOR MUCH GREATER WALL THICKNESS AT ALL STRESSED AREAS, AND ALLOWS THE USE OF A SMALLER SEAL RING WHICH REDUCES THE LOAD ON THE FITTINGS.

(E) OPERATIONAL USE:
1. CREW ACTION
PERFORM LEAK ISOLATION AND HIGH O2 CONCENTRATION TROUBLE SHOOTING.

2. TRAINING
STANDARD ECLSS TRAINING COVERS THE GENERIC HIGH O2 CONCENTRATION.

3. OPERATIONAL CONSIDERATION
A. PRECLUDES USE OF LES UNLESS LEAK IS SMALL ENOUGH TO PERMIT SIMULTANEOUS LES USE PLUS O2 LEAKAGE TO CABIN.
B. HIGH O2 CONCENTRATION HAS FLAMMABILITY CONCERN.

- APPROVALS -

RELIABILITY ENGINEERING:	D. R. RISING	:	
DESIGN ENGINEERING	: K. KELLY	:	3/14/90
QUALITY ENGINEERING	: M. SAVALA	:	3/6/90
NASA RELIABILITY	:	:	5/10/90
NASA SUBSYSTEM MANAGER	:	:	5/11/90
NASA QUALITY ASSURANCE	:	:	4-5-90