

PAGE: 1

PRINT DATE: 01/10/90

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 06-107-1501-X

SUBSYSTEM NAME: ARS - ARPCS

REVISION : 2 01/10/90

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

■ EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:

■ QUANTITY OF LIKE ITEMS: 8
ONE PER DISCONNECT

■ FUNCTION:
MANUAL SHUTOFF VALVE, LES O2 BREATHING STATIONS

PROVIDES FOR ON-OFF CONTROL OF OXYGEN SUPPLY IN THE CREW COMPARTMENTS
FLIGHT DECK AND MID DECK TO EACH ONE OF THE EIGHT LAUNCH/ESCAPE SUITS
(LES) QUICK DISCONNECTS.

PAGE: 6

PRINT DATE: 01/10/90

SHUTTLE CRITICAL ITEMS LIST - ORBITER

NUMBER: 06-1C3-1501-02

REVISION# 2 01/10/90

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

CRITICALITY OF THIS
FAILURE MODE:1R2

- FAILURE MODE:
INABILITY TO CLOSE: INTERNAL 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, CORROSION, CONTAMINATION, PHYSICAL
BINDING/CAMMING, MATERIAL DEFECT, SEAL MATERIAL DEGRADATION

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN A) PASS
B) FAIL
C) PASS

PASS/FAIL RATIONALE:

A)

B)

SCREEN B FAILS BECAUSE INTERNAL LEAKAGE OF THE VALVE CANNOT BE DETECTED
DOWNSTREAM; THERE IS NO PRESSURE SENSOR BETWEEN THE VALVE AND THE OO.

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

UNABLE TO SHUT OFF OXYGEN SUPPLY TO QUICK DISCONNECT.

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 06-103-1501-02

(B) INTERFACING SUBSYSTEM(S):

NO EFFECT; QUICK DISCONNECT PROVIDES BACKUP SEAL TO VALVE.

(C) MISSION:

SAME AS B.

(D) CREW, VEHICLE, AND ELEMENT(S):

SAME AS B.

■ **(E) FUNCTIONAL CRITICALITY EFFECTS:**

SUBSEQUENT FAILURE OF EXTERNAL LEAKAGE IN DOWNSTREAM LINES, FITTINGS OR GO 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 ARE 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.

 - DISPOSITION RATIONALE -

(A) DESIGN:

VALVE BODY IS MADE OF 6061-T6 ALUMINUM ANODIZED FOR CORROSION RESISTANCE. FITTINGS ARE MADE OF 17-4 PH CONDITION 4 CRES, WHICH IS PRECIPITATION HARDENED CORROSION RESISTANT STEEL AND HAS A HIGH STRENGTH TO WEIGHT RATIO. THE VALVE SEAT IS MOLDED OF VESPEL SP-1, WHICH EXHIBITS HIGH MECHANICAL STRENGTH, LOW WEAR RATE, AND SEALING COMPLIANCE WITHOUT PERMANENT DISTORTION. 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 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. INLET/OUTLET PORTS ARE FILTER PROTECTED TO 25 MICRONS. 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.

■ **(B) TEST:**

ACCEPTANCE TEST PER ATP 2930-1. PROOF PRESSURE TESTED AT 1875 PSIG. INTERNAL LEAK TEST REQUIREMENT 5.0 SCCM MAX LEAKAGE AT 1250 PSIG.

SHUTTLE CRITICAL ITEMS LIST - ORBITER

NUMBER: 06-102-1501-02

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 - 20 G TERMINAL SAWTOOTH PULSE OF 11 MS DURATION IN EACH DIRECTION OF THREE ORTHOGONAL AXES. ATP TO VERIFY LEAKAGE PERFORMED AFTER SHOCK AND VIBRATION TESTING, NOT TO EXCEED 0.2 SCCM AT PRESSURE OF 110 PSIG.

OMRSD - LES MANUAL VALVES CHECKOUT VERIFIES OPERATION OF VALVE PRIOR TO FIRST REFLIGHT OF EACH ORBITER AND EVERY FIVE FLIGHTS. INTERNAL LEAK CHECK PERFORMED AT 90 - 150 PSIG, 10 SCCM MAX LEAKAGE PRIOR TO FIRST REFLIGHT AND AS A CONTINGENCY FOR LRU REPLACEMENT.

(C) INSPECTION:

RECEIVING INSPECTION

RAW MATERIAL VERIFIED BY INSPECTION FOR MATERIAL AND PROCESS CERTIFICATION.

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

SHUTTLE CRITICAL ITEMS LIST - ORBITER NUMBER: 06-1C3-1501-02

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:
NO FAILURE HISTORY APPLICABLE TO INABILITY TO CLOSE/INTERNAL LEAKAGE FAILURE MODE. THE MANUAL SHUTOFF VALVE HAS SUCCESSFULLY BEEN USED THROUGH THE SHUTTLE PROGRAM FOR THIS FAILURE MODE.

(E) OPERATIONAL USE:

1. CREW ACTION

NONE ON FIRST FAILURE. HIGH PPO2 AND LEAK ISOLATION TROUBLESHOOTING AFTER SECOND FAILURE.

2. TRAINING

STANDARD ECLSS TRAINING COVERS THE HIGH PPO2 EFFECT OF THIS FAILURE. STANDARD INGRESS/EGRESS TRAINING COVERS USAGE OF LES

3. OPERATIONAL CONSIDERATION

A. REQUIRES A SECOND FAILURE TO HAVE ADVERSE EFFECTS ON CABIN ATMOSPHERE.

B. IF O2 LEAK OCCURS LES COULD BE HOOKED UP AND THE LES USED AS A SHUTOFF VALVE.

- APPROVALS -

RELIABILITY ENGINEERING:	D. R. RISING	DRR	:	<u>[Signature]</u>
DESIGN ENGINEERING	: K. KELLY	KK	:	<u>[Signature]</u>
QUALITY ENGINEERING	: M. SAVALA	MS	:	<u>[Signature]</u> 3/6/90
NASA RELIABILITY	:		:	<u>[Signature]</u> 5/10/90
NASA SUBSYSTEM MANAGER	:		:	<u>[Signature]</u> 5/11/90
NASA QUALITY ASSURANCE	:		:	<u>[Signature]</u> 4/13-90