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: 06-1C3-1512-01

REVISION# 2 02/07/90

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

CRITICALITY OF THIS FAILURE MODE:1R2

■ FAILURE MODE:
INABILITY TO OPEN, RESTRICTED FLOW

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/JAMMING

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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

PASS/FAIL RATIONALE:
A)

B)
SCREEN B IS N/A BECAUSE SHUTOFF VALVE IS IN STANDBY UNTIL REQUIRED.

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LOSS OF ABILITY TO FLOW 10 LB/HR INTO CABIN.

(B) INTERFACING SUBSYSTEM(S):
DECREASED PERCENTAGE OF OXYGEN IN CABIN AIR MIXTURE DURING 8.0 PSIA

CONTINGENCY.

(C) MISSION:
NO EFFECT - ABORT ALREADY IN PROGRESS.

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

(E) FUNCTIONAL CRITICALITY EFFECTS:
SECOND ASSOCIATED FAILURE, IN LES O2 SUPPLY, WHICH REQUIRES A CREWMEMBER TO BREATHE CABIN AIR, RESULTS IN LOSS OF CREW AND POSSIBLY VEHICLE.

- DISPOSITION RATIONALE -

(A) DESIGN:
VALVE BODY IS MADE OF 6C61-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. 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. DELTA P 1.0 PSID MAX AT 7.0 LB/HR FLOW AND 100 PSIA.

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 - OBSTRUCTION FLOW TEST IS PERFORMED AT 850 - 900 PSIG, 75 LB/HR MINIMUM FLOW.

OMRSD - FLOW TEST IS PERFORMED BEFORE THE FIRST REFLIGHT OF EACH ORBITER AND AT INTERVALS OF EVERY FIVE FLIGHTS AT 900-950 PSIG (VERIFICATION OF FLOW ONLY).

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

CONTAMINATION CONTROL
CORROSION PROTECTION PROVISIONS AND CONTAMINATION CONTROL PLAN VERIFIED BY INSPECTION. CLEAN LEVEL 200A PER MA0110-301 AND 100 ML RINSE VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
PARTS PROTECTION FROM DAMAGE AND CONTAMINATION VERIFIED. DIMENSIONAL CHECKS PERFORMED BY INSPECTION. SEAL RING IS VISUALLY INSPECTED BY 10X MAGNIFICATION.

CRITICAL PROCESSES
HEAT TREAT, PASSIVATED PARTS AND ANODIZING ARE VERIFIED BY INSPECTION. APPLICATION OF LUBRICATION ON SEAL RING VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
BRAZING AND WELDING X-RAY VERIFIED BY INSPECTION.

TESTING
ATP VERIFIED BY INSPECTION.

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

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(D) FAILURE HISTORY:
NO FAILURE HISTORY APPLICABLE TO INABILITY TO OPEN/RESTRICTED FAILURE MODE. THE SHUTOFF VALVE HAS SUCCESSFULLY BEEN USED THROUGH THE SHUTTLE PROGRAM CONSIDERING THIS FAILURE MODE.

(E) OPERATIONAL USE:
TBS.

- APPROVALS -

RELIABILITY ENGINEERING	D. R. RISING	:	
DESIGN ENGINEERING	K. KELLY	:	
QUALITY ENGINEERING	M. SAVALA	:	
NASA RELIABILITY		:	
NASA SUBSYSTEM MANAGER		:	
NASA QUALITY ASSURANCE		:	