

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :ORBITAL MANEUVER FMEA NO 03-3 -4508 -2 REV:11/14/87

ASSEMBLY :ENGINE SUBSYSTEM ABORT: CRIT. FUNC: 3  
P/N RI :MC621-0009 TAL, ATO CRIT. HDW: 3  
P/N VENDOR:1186770 VEHICLE 102 103 104  
QUANTITY :4 EFFECTIVITY: X X X  
:SP-31 SP-32 PHASE(S): PL X LO X CO X DO X LS X  
:SERIES VALVE-EACH ENGINE

REDUNDANCY SCREEN: A- B- C-  
PREPARED BY: APPROVED BY: APPROVED BY (NASA):  
DES V F ROZDOS DES *[Signature]* SSM *[Signature]*  
REL C M AKERS REL *[Signature]* REL *[Signature]*  
QE W J SMITH QE *[Signature]* QE *[Signature]*

ITEM:  
VALVE ASSEMBLY, ENGINE PURGE, GN1, SOLENOID, N.C., SPRING LOADED.

FUNCTION:  
SERIES VALVES ARE USED FOR POSTFIRE PURGE OF PROPELLANT FROM THE REGENERATIVE COOLING CHANNELS, INJECTOR AND COMBUSTION CHAMBER TO PREVENT FREEZING, POTENTIAL CHANGE IN PROPELLANT LEAD CHARACTERISTICS OR HARD STARTS RESULTING FROM RESIDUAL PROPELLANT. A SINGLE SOLENOID IS USED TO OPEN EACH VALVE AND IS SPRING LOADED CLOSED. ITEM INCLUDES ORIFICE, CHECK VALVE AND TEST PORT.

FAILURE MODE:  
FAILS CLOSED, RESTRICTED FLOW, FAILS TO REMAIN OPEN.

CAUSE(S):  
ELECTRICAL FAILURE, FAILED CLOSED CHECK VALVE, POPPET BINDING OR JAMMING, SPRING BREAKS, PLUGGED ORIFICE OR SCREEN, CONTAMINATION, SHOCK, VIBRATION.

EFFECT(S) ON:  
(A)SUBSYSTEM (B)INTERFACES (C)MISSION (D)CREW/VEHICLE  
(A) LOSS OF FUNCTION - MUST WAIT 10 MINUTES BEFORE RESTARTING ENGINE WITHOUT POSTFIRE PURGE. NO EFFECT ON NORMAL MISSION.  
(B,C) NO EFFECT.  
(D) NO EFFECT FOR NORMAL MISSION - CRIT 1 FOR ABORTS REQUIRING POST-MECO OMS PROPELLANT DUMP. IF ENGINE RESTARTED WITH NO PURGE, HARD START COULD DAMAGE ENGINE AND VEHICLE (INABILITY TO RESTART ENGINE COULD RESULT IN EXCESSIVE PROPELLANT REMAINING, LANDING WT., C.G. ISSUES).

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DISPOSITION & RATIONALE:

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

(A) DESIGN

THE PURGE SYSTEM IS REQUIRED FOR REPETITIVE FIRINGS (WITH SHORT COAST PERIODS BETWEEN FIRINGS). IF NO PURGE IS AVAILABLE THE ENGINE CAN STILL BE SAFELY FIRED BY ALLOWING AT LEAST 10 MINUTES BETWEEN FIRINGS. AN 18-MICRON FILTER IS PROVIDED TO LIMIT THE POSSIBILITY OF CONTAMINATE CAUSING LEAKAGE, JAMMING OF MOVING PARTS, OR PLUGGING OF ORIFICES. THE DESIGN FACTOR OF SAFETY IS 2.4. REDUNDANT ENGINES ARE PROVIDED EITHER OF WHICH IS ADEQUATE FOR DEORBIT.

(B) TEST

QUALIFICATION TESTS

THERMAL CYCLE (-23 TO +150 DEG F), ENDURANCE (2440 CYCLES), HANDLING SHOCK, BURST (1080 PSI - ACTUAL 5500 BY TEST). ALSO QUALIFIED AS PART OF ENGINE ASSEMBLY - 138 HOT-FIRE TESTS DURING ENGINE QUAL, 498 TESTS AT SYSTEM LEVEL AT WSTF. VIBRATION TEST AT ENGINE LEVEL.

ACCEPTANCE TESTS

EACH UNIT - VISUAL INSPECTION, PROOF PRESSURE, ELECTRICAL CHECKS, PULL-IN AND DROP-OUT VOLTAGE, LEAKAGE, FLOW CALIBRATION, CLEANLINESS.

GROUND TURNAROUND

V43CBO.197 PERFORMS PURGE VALVE LEAK AND FUNCTIONAL TESTS FOR FIRST FLIGHT AND ON 5 FLIGHT INTERVALS.

V43CAO.050 PERFORMS ENGINE PNEUMATIC ELECTRICAL VERIFICATION FOR POD FIRST FLIGHT.

V43CAO.070 PERFORMS REDUNDANT CIRCUIT VERIFICATION ORBITER/POD EVERY 5TH FLIGHT.

V43CAO.075 PERFORMS ELECTRICAL INTERFACE VERIFICATION ORBITER/POD ON A CONTINGENCY BASIS.

V43CEO.055 PERFORMS PNEUMATIC SYSTEM VENT EVERY FLIGHT. PURGE VALVE FUNCTION AFTER EACH BURN IS VERIFIED BY GN2 TANK PRESSURE DROP.

(C) INSPECTION

RECEIVING INSPECTION

MATERIALS AND PROCESSES CERTIFICATIONS ARE VERIFIED BY INSPECTION.

CONTAMINATION CONTROL

CLEANLINESS TO LEVEL 200 AND CORROSION PROTECTION PROVISIONS ARE VERIFIED BY INSPECTION.

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**ASSEMBLY/INSTALLATION**

MANUFACTURING, ASSEMBLY AND INSTALLATION PROCEDURES ARE VERIFIED BY INSPECTION. CRITICAL DIMENSIONS AND SURFACE FINISHES ARE VERIFIED BY INSPECTION. VISUAL AND DIMENSIONAL INSPECTION OF VALVE BODY AND COMPONENTS DURING FABRICATION IS VERIFIED BY INSPECTION.

**NONDESTRUCTIVE EVALUATION**

PENETRANT AND RADIOGRAPHIC INSPECTION OF WELDS ARE VERIFIED BY INSPECTION.

**CRITICAL PROCESSES**

THE WELDING PROCESS AND VERIFICATION THAT WELDS MEET SPECIFICATION REQUIREMENTS ARE VERIFIED BY INSPECTION.

**TESTING**

TEST EQUIPMENT AND TOOL CALIBRATION ARE VERIFIED BY INSPECTION. ACCEPTANCE TEST IS VERIFIED BY INSPECTION.

**HANDLING/PACKAGING**

HANDLING, PACKAGING, STORAGE AND SHIPPING REQUIREMENTS ARE VERIFIED BY INSPECTION.

**(D) FAILURE HISTORY**

NONE.

**(E) OPERATIONAL USE**

ALLOW 10 MINUTES BETWEEN BURNS. FOR POST-MECO RESTARTS, RISK OF HARD START IS CONSIDERED LESS THAN RISK OF UNCONTROLLABLE VEHICLE C.G. FOR SOME ABORT DUMPS. FOR THESE CASES, PERFORM DUMP AS PLANNED.