

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : CREW MODULE SEALS FMEA NO 01-4 -CS3 -1 REV: 03/29/8

ASSEMBLY : WINDOW ASSEMBLY, SPACER/RETAINERS (FLT DECK OVERHEAD, FLT DECK AFT, FLT DECK FORWARD) CRIT. FUNC: 1
CRIT. HDW:

P/N RI : V070-331107, V070-331116
: V070-331556, V070-331706

P/N VENDOR: QUANTITY : 4 V070-331107 : 8 V070-331116 : 4 V070-331556 : 4 V070-331706
VEHICLE: 102 103 104
EFFECTIVITY: X X X
PHASE(S): PL LO X OO X DO X L

REDUNDANCY SCREEN: A-FAIL B-FAIL C-PASS
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ITEM:
SEALS, WINDOW ASSEMBLY SPACER/RETAINER

FUNCTION:
THESE SEALS PREVENT LEAKAGE OF CREW MODULE ATMOSPHERE.

FAILURE MODE:
LEAKAGE

CAUSE(S):
CRACKS, LOW TEMPERATURE, MATERIAL DEGRADATION

EFFECT(S) ON:
(A) SUBSYSTEM (B) INTERFACES (C) MISSION (D) CREW/VEHICLE

(A) FAILURE OF SINGLE SEAL HAS NO EFFECT. THE REDUNDANT (PANE ASSEMBLY SEAL WOULD PREVENT LOSS OF CREW MODULE CONSUMABLES.

(B) FAILURE OF SINGLE SEAL HAS NO EFFECT. THE REDUNDANT (PANE ASSEMBLY SEAL WOULD PREVENT LOSS OF CREW MODULE CONSUMABLES.

(C) FAILURE OF SINGLE SEAL HAS NO EFFECT. FAILURE OF THE REDUNDANT (PA ASSEMBLY) SEAL WOULD RESULT IN LOSS OF CREW MODULE CONSUMABLES, HOWEVER THIS WOULD NOT EXCEED THE MAKEUP CAPABILITY OF THE ARPCS BUT WOULD POSSIBLY RESULT IN EARLY TERMINATION OF MISSION.

(D) FAILURE OF A SINGLE SEAL HAS NO EFFECT. FAILURE OF THE REDUNDANT (PANE ASSEMBLY) SEAL AND AN ADDITIONAL FAILURE WITHIN THE CREW MODULE COULD RESULT IN A LEAK RATE EXCEEDING THE ARPCS MAKEUP CAPABILITY RESULTING IN LOSS OF CREW/VEHICLE.

REDUNDANCY SCREENS: SEAL FAILS SCREENS "A" AND "B" BECAUSE LEAK TEST OF EACH SEAL INDIVIDUALLY IS NOT FEASIBLE.

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DISPOSITION & RATIONALE:

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

(A) DESIGN

THE SPACER/RETAINER SEALS ARE REDUNDANT TO THE PANE ASSEMBLY SEALS. THESE SEALS PROVIDE INTERFACE SEALING BETWEEN THE SPACERS AND RETAINERS OF THE WINDOW ASSEMBLY. MULTIPLE SEAL FAILURES ARE NECESSARY BEFORE CREW MODULE ATMOSPHERE LEAKAGE CAN OCCUR, HOWEVER, IF THE SEAL WAS CONSIDERED ABSENT THIS WOULD CAUSE AN EQUIVALENT LEAK HOLE SIZE LESS THAN THE .45 INCH DIAMETER HOLE WHICH THE ARPCS IS CAPABLE OF COMPENSATING AT 8 PSI FOR 165 MINUTES. SEAL MATERIAL (FLUOROCARBON ELASTOMER [VITON]), CHARACTERISTICS ARE NOT ADVERSELY AFFECTED BY HUMIDITY, TEMPERATURE, OR PRESSURE EXTREMES EXPERIENCED DURING FLIGHT.

(B) TEST

QUALIFICATION TESTS: THE FORWARD FUSELAGE, WINDOW BARRIERS AND MOUNTING ASSEMBLIES ARE SUBJECTED, AS A FULL ASSEMBLY, TO PRESSURE, THERMAL AND DEFLECTION LOADING TESTS.

ACCEPTANCE TESTS: THE CREW MODULE HIGH PRESSURE LEAK TEST PERFORMED AT 14.7 PSID. FINAL ACCEPTANCE TEST IS CONDUCTED AT 3.2 PSID AFTER TRANSFER TO ASSEMBLY AREA AND INSTALLATION OF AVIONICS EQUIPMENT IS COMPLETE.

OMRSD: GROUND TURNAROUND INCLUDES PRE-LIFTOFF PRESSURIZATION TEST AT 2 PSID; HOWEVER, IT IS UNLIKELY TO DETECT DUAL SEAL LEAKAGE.

(C) INSPECTION

RECEIVING INSPECTION

RECEIVING INSPECTORS CHECK FOR CORRECT IDENTITY AND FOR DAMAGE, VERIFY THAT SUPPLIER SUBMITTED REQUIRED REPORTS, AND VERIFY PARTS ARE PROPERLY PACKAGED TO PREVENT DAMAGE DURING STORAGE.

CONTAMINATION CONTROL

CLEANLINESS IS MAINTAINED PER MA0110-311. WINDOWS ARE VERIFIED TO BE VISIBLY CLEAN PER MA0110-301 JUST PRIOR TO AND JUST SUBSEQUENT TO ASSEMBLY. THE INSPECTOR VERIFIES, BEFORE INSTALLATION, THAT THE SEALING SURFACE AND VITON SEAL ARE CLEAN.

ASSEMBLY/INSTALLATION

SEALS ARE INSTALLED PER MA0106-328. PRIOR TO INSTALLATION AN INSPECTION IS PERFORMED TO VERIFY THAT THE SEALING SURFACE AND THE VITON SEAL ARE UNDAMAGED. IT IS ALSO VERIFIED THROUGH INSPECTION THAT THE VITON SEAL SURFACE IS FREE OF DEFECTS, BLEMISHES AND IRREGULARITIES PER DRAWING REQUIREMENTS BEFORE INSTALLATION.

TESTING

WINDOW ASSEMBLY IS LEAK TESTED. INSPECTORS VERIFY THAT THE MAXIMUM ALLOWED LEAKAGE OF 0.75 SCIM PER PANE AT A 10 MICRON OR LESS VACUUM LEVEL, IS NOT EXCEEDED. THE ACCEPTANCE LEAK TEST IS WITNESSED AND VERIFIED THROUGH INSPECTION.

01-4-36

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HANDLING/PACKAGING

THE SUPPLIER PACKAGES DETAIL SEALS PER MK0116-001 REQUIREMENTS AND IDENTIFIES THEM BY PART NUMBER.

(D) FAILURE HISTORY

SIMILAR SILICONE RUBBER AND VITON SEALS USED IN SPACE AND COMMERCIAL APPLICATIONS HAVE NO HISTORY OF LEAKAGE FAILURES. SIMILAR SEALS EXHIBITED NO FLIGHT FAILURES DURING APOLLO CSM PROGRAM.

(E) OPERATIONAL USE

IF INTERFACE LEAKAGE OCCURS, LOSS OF CREW MODULE CONSUMABLES CAN BE MONITORED AND ASSESSED FOR FEASIBILITY OF CONTINUING THE MISSION PER CABIN LEAK PROCEDURES AND FLIGHT RULES.