SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM :CREW MODULE SEALS FMEA NO 01-4 -CS1 -1 REV:03/29/8

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

P/N RI :V070-331115, V070-331106
:V070-331555, V070-331705

P/N VENDOR:

QUANTITY :16 V070-331115
: 8 V070-331106
: 8 V070-331555
: 8 V070-331705

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-PAS

PREPARED BY:			APPROVED BY:	APPROVED BY (NASA):
DES	W.	HENRY	DES W. A. Henry 7/28/88	SSM [illegible]
REL	D.	MAYNE	REL D.M. Mayne for RH 7/27/88	REL [illegible]
QE	W.	SMITH	QE [illegible] 7/25/88	QE [illegible] 8/10/88

ITEM:
SEALS, WINDOW PANE ASSEMBLY

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. FAILURE OF THE REDUNDANT (SPACER/RETAINER) SEAL WOULD RESULT IN THE LOSS OF CREW MODULE CONSUMABLES.

(B) FAILURE OF SINGLE SEAL HAS NO EFFECT. FAILURE OF THE REDUNDANT (SPACER/RETAINER) SEAL WOULD RESULT IN THE LOSS OF CREW MODULE CONSUMABLES.

(C) FAILURE OF A SINGLE SEAL HAS NO EFFECT. FAILURE OF THE REDUNDANT (SPACER/RETAINER) 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 (SPACER/RETAINER) SEAL AND AN ADDITIONAL SEAL FAILURE WITHIN THE CREW MODULE COULD RESULT IN A LEAK RATE EXCEEDING THE ARPCS MAKEUP CAPABILI 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 PANE ASSEMBLY SEALS ARE REDUNDANT TO THE SPACER/RETAINER SEALS. THESE SEALS PROVIDE INTERFACE SEALING BETWEEN THE PRESSURE PANE, REDUNDANT PANE AND THE WINDOW SPACERS/RETAINERS OF THE WINDOW PANE ASSEMBLY. MULTIPLE SEAL FAILURES ARE NECESSARY BEFORE CREW MODULE ATMOSPHERE LEAKAGE CAN OCCUR, HOWEVER, IF THE SEAL WAS CONSIDERED ABSEN 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 1 MINUTES. SEAL MATERIAL (FLUOROCARBON ELASTOMER [VITON]), CHARACTERISTI ARE NOT ADVERSELY AFFECTED BY HUMIDITY, TEMPERATURE, OR PRESSURE EXTREM EXPERIENCED DURING FLIGHT.

(B) TEST
QUALIFICATION TESTS: THE FORWARD FUSELAGE, WINDOW BARRIERS, RETAINERS A MOUNTING ASSEMBLIES ARE SUBJECTED, AS A FULL ASSEMBLY, TO PRESSURE, THERMAL AND DEFLECTION LOADING TESTS. (NOTE: INFORMATION AVAILABLE ON TEST IS NOT SPECIFICALLY FOR THE OVERHEAD WINDOW SEALS, HOWEVER, VITON MATERIAL TESTED IS IDENTICAL.)

ACCEPTANCE TESTS: THE CREW MODULE HIGH PRESSURE LEAK TEST PERFORMED AT 14.7 PSID. FINAL ACCEPTANCE TEST IS CONDUCTED AT 3.2 PSID AFTER TRANSF 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. INSPECTION VERIFIES, BEFORE INSTALLATION, THAT THE SEALING SURFACE AND VITON SEAL ARE CLEAN, PER MA0106-328 AND VERIFIES CORROSION CONTROL OF METAL PARTS PER MA0106-308.

ASSEMBLY/INSTALLATION
SEALS ARE INSTALLED PER MA0106-328. PRIOR TO INSTALLATION AN INSPECTIO 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. ON THE FORWARD WINDOWS, INSPECTION VERIFIES THAT NAS1581C3T17 BOLTS (CLASS 2) ARE INSTALLED PER MA0101-301 AND THAT PROPER TORQUE IS APPLIED.

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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.

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.