

SHUTTLE CRITICAL ITEMS LIST - ORBITER

SUBSYSTEM : CREW MODULE SEALS FMEA NO 01-4 -CS20 -1 REV: 03/29/8

ASSEMBLY : AIRLOCK HATCH 'A' & 'B' CRIT. FUNC: J
P/N RI : CRIT. HDW:
P/N VENDOR: HATCH A, M83248/1-349 & -356 VEHICLE: 102 103 104
QUANTITY : 4 EFFECTIVITY: X X X
: ONE EACH PART NUMBER ON PHASE(S): PL LO OO X DO L
: EACH HATCH WINDOW

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ITEM:
SEALS, AIRLOCK HATCH 'A' AND 'B' WINDOWS

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. LOSS OF REDUNDANT SEAL WOULD RESULT IN THE LOSS OF CREW MODULE CONSUMABLES INTO THE AIRLOCK OR INTO THE PAYLOAD BAY IN THE CASE OF LEAKAGE OF HATCH B WINDOWS.

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

(C) FAILURE OF A SINGLE SEAL HAS NO EFFECT. LOSS OF THE REDUNDANT 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 SINGLE SEAL HAS NO EFFECT. LOSS OF THE REDUNDANT SEAL AND AN ADDITIONAL SEAL 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

DUAL O-RING FACE SEALS ARE INSTALLED BETWEEN WINDOW SURFACE AND HATCH BASE WHICH IS A RIGID STRUCTURE. DIFFERENTIAL PRESSURE ACROSS WINDOW INCREASES SEAL COMPRESSION. SEAL MATERIAL IS FLUOROCARBON ELASTOMER (VITON).

(B) TEST

ACCEPTANCE TESTS: STRUCTURAL LEAK TEST OF AIRLOCK TO 14.7 PSID, INTERNAL AND EXTERNAL, IS PERFORMED.

QUALIFICATION TESTS: NO QUALIFICATION TESTS WERE PERFORMED. CERTIFICATION IS BASED ON ACCEPTANCE TESTS AND SEAL MATERIALS DATA. OMRSD: NO TEST IS CAPABLE OF DETECTING SINGLE SEAL FAILURE. CREW MODULE PRESSURE TEST WOULD NOT DETECT DUAL SEAL FAILURE BECAUSE PRESSURE ACROSS HATCH 'A' IS EQUALIZED DURING TEST.

(C) INSPECTION

RECEIVING INSPECTION

RECEIVING INSPECTORS INSPECT FOR DAMAGE AND WORKMANSHIP AND VERIFY THAT IT IS OF SINGLE PIECE MOLDED CONSTRUCTION. RECEIVING INSPECTORS ALSO CHECK IDENTIFICATION AND WALL CROSS-SECTIONAL DIAMETER ON A S-3 SAMPLING BASIS AND THAT SUPPLIER SUBMITTED REQUIRED REPORTS.

CONTAMINATION CONTROL

RECEIVING INSPECTORS VISUALLY INSPECT SEAL FOR CLEANLINESS. INSPECTORS VERIFY, BEFORE INSTALLATION, THAT THE SEALING SURFACE AND VITON SEAL ARE CLEAN.

ASSEMBLY/INSTALLATION

THE SEALS ARE INSTALLED PER MAO106-328. PRIOR TO INSTALLATION AN INSPECTION IS PERFORMED TO VERIFY THAT THE SEALING SURFACE IS NOT DAMAGED.

TESTING

THE AIRLOCK STRUCTURAL LEAK TEST TO 14.7 PSID, BOTH INTERNAL AND EXTERNAL, IS VERIFIED BY INSPECTION.

HANDLING/PACKAGING

THE RECEIVING INSPECTORS VERIFY THAT THE SEAL IS INDIVIDUALLY PACKAGED WITH PART NUMBER, MANUFACTURER NAME, COMPOUND NUMBER AND CURE DATE. RECEIVING INSPECTORS ALSO VERIFY THAT THE SEAL IS PACKAGED IN A WAY THAT WILL PROTECT IT DURING STORAGE.

(D) FAILURE HISTORY

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

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(E) OPERATIONAL USE

IF BOTH SEALS FAIL, AIRLOCK HATCH 'B' COULD BE CLOSED OR INCREASED USE
CREW MODULE CONSUMABLES CAN BE MONITORED AND ASSESSED FOR FEASIBILITY OF
CONTINUING THE MISSION PER CABIN LEAK PROCEDURES AND FLIGHT RULES.