

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE

NUMBER: M7-3-S1-X

SUBSYSTEM NAME: TUNNEL ADAPTER

REVISION : 1 03/20/91

PART NAME
VENDOR NAMEPART NUMBER
VENDOR NUMBER

■ LRU : TUNNEL ADAPTER INTERFACE SEAL V075-332430

PART DATA

■ EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
PRESSURE SEAL, TUNNEL ADAPTER INTERFACE SEAL■ QUANTITY OF LIKE ITEMS: 2
TWO

■ FUNCTION:

SEALS INTERFACE BETWEEN TUNNEL ADAPTER FORWARD END FLANGE AND BULKHEAD
576 AFT FACE. DUAL SEALS ARE CONCENTRIC O-RINGS IN DOVETAIL GROOVES IN
TUNNEL ADAPTER FORWARD FLANGE. NOTE - SEALS AT AFT FLANGE OF THE
TUNNEL ADAPTER ARE SUPPLIED BY MDAC.

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
NUMBER: M7-3-S1-01

REVISION# 1 03/20/91 R

SUBSYSTEM: TUNNEL ADAPTER
LRU :TUNNEL ADAPTER INTERFACE SEAL
ITEM NAME: TUNNEL ADAPTER INTERFACE SEAL

CRITICALITY OF THIS
FAILURE MODE:1R3

- FAILURE MODE:
LEAKAGE (O-RING SEALS)

MISSION PHASE:
00 ON-ORBIT

- VEHICLE/PAYLOAD/KIT EFFECTIVITY: 102 COLUMBIA
: 103 DISCOVERY
: 104 ATLANTIS
: 105 ENDEAVOUR

- CAUSE:
CRACKS, AGE, MATERIAL DEGRADATION, STRUCTURAL DEFORMATION

- CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

- REDUNDANCY SCREEN A) PASS
- B) FAIL
- C) PASS

PASS/FAIL RATIONALE:

- A)
PASSES REDUNDANCY SCREEN "A" SINCE THE LEAK TEST PORT ON BULKHEAD 576 STRUCTURE PROVIDES THE CAPABILITY FOR VERIFYING THE INTEGRITY OF EACH REDUNDANT SEAL PRIOR TO LAUNCH.
- B)
FAILS REDUNDANCY SCREEN "B" SINCE THE FLIGHT CREW CANNOT VERIFY SEAL INTEGRITY ON ORBIT. LEAK TEST PORT IS ACCESSIBLE BUT PORTABLE TEST KIT C70-0749 IS NOT FLIGHT EQUIPMENT.
- C)
PASSES REDUNDANCY SCREEN "C" SINCE THE FAILURE OF ANY ONE SEAL CANNOT CAUSE THE FAILURE OF THE OTHER REDUNDANT SEAL.

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- FAILURE EFFECTS -

- (A) SUBSYSTEM:
NO EFFECT IF A SINGLE O-RING SEAL FAILS. LOSS OF CONSUMABLES IF BOTH O-RING SEALS FAIL.
- (B) INTERFACING SUBSYSTEM(S):
SAME AS (A).
- (C) MISSION:
NO EFFECT IF ONLY ONE O-RING SEAL FAILS. POSSIBLE EARLY TERMINATION OF THE MISSION IF BOTH SEALS FAIL AND LEAKAGE IS EXCESSIVE.
- (D) CREW, VEHICLE, AND ELEMENT(S):
NO EFFECT IF SINGLE SEAL FAILS. POSSIBLE LOSS OF CREW/VEHICLE IF LEAK RATE FROM DUAL SEAL FAILURE AND AN ADDITIONAL SEAL FAILURE WITHIN CREW MODULE EXCEEDS THE ARPCS MAKEUP CAPABILITIES.
- (E) FUNCTIONAL CRITICALITY EFFECTS:

- DISPOSITION RATIONALE -

- (A) DESIGN:
SEALS ARE CONCENTRIC O-RING FACE SEALS INSTALLED IN DOVETAIL GROOVES IN TUNNEL ADAPTER FLANGE ADJACENT TO STRUCTURAL ATTACH BOLTS, WITH METAL TO METAL CONTACT AT SEALED INTERFACE. SEAL MATERIAL IS SILICONE RUBBER.
- (B) TEST:
ACCEPTANCE TESTS: TUNNEL ADAPTER TO X576 BULKHEAD INTERFACE SEAL VERIFIED IN MANUFACTURING PRESSURE TEST TO 14.7 PSID AND CREW MODULE LEAK TEST TO 3.2 PSID.

QUALIFICATION TESTS: QUALIFICATION TESTS WERE NOT PERFORMED, CERTIFICATION IS BASED ON ACCEPTANCE TESTS AND SEAL MATERIALS DATA.

OMRSD: EACH TIME TUNNEL ADAPTER IS INSTALLED, LEAK TEST OF CREW MODULE/AIRLOCK/TUNNEL ADAPTER IS PERFORMED AT 3.2 PSIG WITH HATCH "A" OPEN AND HATCHES "C" AND "D" CLOSED.

REF. OMRSD V60AB0.015
- (C) INSPECTION:
RECEIVING INSPECTION

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RECEIVING INSPECTORS INSPECT FOR DAMAGE AND WORKMANSHIP AND VERIFY THAT SEAL 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 MA0106-328. PRIOR TO INSTALLATION AN INSPECTION IS PERFORMED TO VERIFY THAT THE SEALING SURFACE IS NOT DAMAGED.

TESTING
THE TUNNEL ADAPTER STRUCTURAL LEAK TEST TO 14.7 PSID 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:
THERE HAVE BEEN NO ACCEPTANCE TEST, QUALIFICATION TEST, FIELD OR FLIGHT FAILURES ASSOCIATED WITH THIS FAILURE MODE.

■ (E) OPERATIONAL USE:
IF 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.

- APPROVALS -

RELIABILITY ENGINEERING: D. M. MAYNE
DESIGN ENGINEERING : E. L. SALLEE
QUALITY ENGINEERING : M. SAVALA

NASA RELIABILITY
NASA SUBSYSTEM MANAGER
NASA QUALITY ASSURANCE

DM Mayne 3/2/91
: *E L Sallee*
: *M Savala* 3/2/91
: *Brenda C. D'Amico* 3/2/91
: *Alan S. Edler* 3/2/91
: *D. L. ...* 4/2/91