FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL HARDWARE
NUMBER: 02-3A-A8-X

SUBSYSTEM NAME: SEPARATION MECHANISMS - MECHANICAL
REVISION : 0 11/17/92 W

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
LRU :	DEBRIS CONTAINMENT BLADE VALVE	V070-565269

PART DATA

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
ORBITER/ET AFT ATTACH DEBRIS CONTAINMENT SYSTEM BLADE VALVE INSTALLATIC

QUANTITY OF LIKE ITEMS: 2
TWO (ONE PER DEBRIS CONTAINER)

FUNCTION:
PREVENTS ESCAPE OF ET AFT ATTACH FRANGIBLE NUT, BOOSTER, DETONATOR OR PYRO CONNECTOR FRAGMENTS THROUGH THE HOLE IN THE BASE OF THE DEBRIS CONTAINER. SIX SPRING-LOADED BLADES IN BASE PLATE RECESS, OUTSIDE OF DEBRIS CONTAINER, CLOSE OFF 2.875 IN. DIAMETER BOLT HOLE WHEN ET SEPARATES FROM ORBITER. TIME TO CLOSE BLADES IS APPROXIMATELY 10 MILLISECONDS. GSE IS USED TO HOLD BLADES OPEN DURING ORBITER/ET MATE.
NOTE: THE BLADE VALVE SYSTEM WILL REPLACE THE HOLE PLUGGER/COVER ASSEMBLY ANALYZED ON 02-3A-A7-01. VEHICLE AND FLIGHT EFFECTIVITIES FOR THE CHANGEOVER ARE 102/~~17~~ 18, 103/~~18~~ 21, 104/~~14~~ 13 AND 105/~~9~~ 8.

PRINT DATE: 11/17/92

FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
NUMBER: 02-3A-A8-01

REVISION: 0 11/17/92 W

SUBSYSTEM: SEPARATION MECHANISMS - MECHANICAL
LRU DEBRIS CONTAINMENT BLADE VALVE
ITEM NAME: DEBRIS CONTAINMENT BLADE VALVE

CRITICALITY OF THIS FAILURE MODE: 1/1

FAILURE MODE:
FAILS TO RETAIN DEBRIS

MISSION PHASE:
LO LIFT-OFF

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

CAUSE:
DEFECTIVE PART/MATERIAL OR MANUFACTURING DEFECT, PHYSICAL BINDING/ JAMMING, CONTAMINATION/FOREIGN OBJECT, ICE/FROST, BROKEN/DISPLACED SPRING, BLADE BENT/DAMAGED, IMPROPER INSTALLATION/ASSEMBLY, GSE NOT REMOVED

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN A) N/A
B) N/A
C) N/A

PASS/FAIL RATIONALE:
A)
N/A

B)
N/A

C)
N/A

- FAILURE EFFECTS -

(A) SUBSYSTEM:
NONE

(B) INTERFACING SUBSYSTEM(S):
POSSIBLE INABILITY TO FULLY CLOSE THE ORBITER/ET DOOR, DUE TO ESCAPING

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PYRO SEPARATION DEBRIS INTERFERING WITH DOOR CLOSING AND/OR LATCHING, IF THE DEBRIS CANNOT BE DISLODGED BY CYCLING THE DOORS OPEN/CLOSED. POSSIBLE LOSS OF CREW/VEHICLE, DUE TO AFT STRUCTURAL DAMAGE CAUSED BY EXCESSIVE HEAT ENTERING THE JAMMED OPEN ORBITER/ET DOOR, UPON RE-ENTRY.

(C) MISSION:
SAME AS (B)

(D) CREW, VEHICLE, AND ELEMENT(S):
SAME AS (B)

(E) FUNCTIONAL CRITICALITY EFFECTS:
N/A

- DISPOSITION RATIONALE -

(A) DESIGN:
SIX SPRING-LOADED BLADES CLOSE OFF THE BOLT HOLE WHEN EACH AFT ATTACH BOLT ACCELERATES AWAY FROM THE ORBITER AFTER FRANGIBLE NUT SEPARATION. THE BLADES ARE HOUSED IN A RECESS IN THE BASE, OUTSIDE THE BLAST AREA. THE BLADES ARE MACHINED FROM INCONEL 718 BAR AND THE SIX TORSION SPRINGS ARE ELGILOY WIRE. AS EACH OF THE THREE LOWER BLADES ROTATES, IT ENGAGES THE UPPER BLADE TO COMPLETELY CLOSE OFF THE HOLE. BLADES ARE A SIMPLE LIGHTWEIGHT MECHANISM WITH FEW PARTS AND SMALL ANGULAR MOVEMENT. EACH PAIR OF BLADES OPERATES INDEPENDENTLY AND CLOSES OFF ONE THIRD OF THE HOLE. A FLANGE IN EACH UPPER AND LOWER BLADE ENSURES SPRING RETENTION. POTENTIAL FOR JAMMING IS MINIMIZED. CLOSING TIME FOR ALL SIX BLADES IS 10 TO 12 MILLISECONDS. TEMPERATURE RANGE FOR THE MECHANISM AT ET SEPARATION IS 32 DEG. F TO 350 DEG. F. POSITIVE MARGINS OF SAFETY ARE MAINTAINED ON ALL COMPONENTS. THIS SECOND REDESIGN IS IN ACCORDANCE WITH MCR 16876.

(B) TEST:
PLANNED QUALIFICATION TESTS INCLUDE THREE SEPARATION TESTS TO VERIFY PERFORMANCE IN ACTUAL ENVIRONMENT AND 400 CYCLE TESTS TO VERIFY MISSION LIFE.

OMRSD: VISUALLY INSPECT AFTER EACH FLIGHT FOR EVIDENCE OF DEFECTS. MANUALLY OPERATE EACH BLADE SET AFTER EACH FLIGHT TO VERIFY FREEDOM OF MOTION.

(C) INSPECTION:
RECEIVING INSPECTION
INCONEL CERTIFICATION VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
MACHINE TOLERANCES ARE PER DRAWING AND ANSI Y14.5 AND ARE VERIFIED BY INSPECTION.

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NONDESTRUCTIVE EVALUATION
PENETRANT INSPECTION IS REQUIRED AND VERIFIED BY INSPECTION.

HANDLING/PACKAGING
PACKAGED AND PROTECTED PER APPLICABLE SPECIFICATION AND VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:
NONE (NEW DESIGN).

(E) OPERATIONAL USE:
NONE

- APPROVALS -

PAE MANAGER	: T. J. EAVENSON	: K.L. Pate for 12/4/92
PRODUCT ASSURANCE ENGR.	: D. M. MAYNE	: D.M. Mayne
DESIGN ENGINEERING	: E. STAUFFER	: E.J. Stauffer
NASA RELIABILITY	:	: [illegible] 11/27/92
NASA SUBSYSTEM MANAGER	:	: [illegible] 11/27/92
NASA QUALITY ASSURANCE	:	: [illegible] 12/15/92