

PAGE: 1

PRINT DATE: 10/18/94

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CRITICAL HARDWARE
NUMBER: 02-5E-MK04-X**

SUBSYSTEM NAME: P/L RETENTION & DEPLOY - LATCHES

REVISION: 3 10/18/94

	PART NAME VENDOR NAME	PART NUMBER VENDOR NUMBER
ASSEMBLY :	MIDDLEWEIGHT KEEL LATCH	V073-544430
LRU :	LATCH/TRUNNION & BRIDGE INTRFC	

PART DATA

**EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
LATCH/TRUNNION AND BRIDGE INTERFACES**

QUANTITY OF LIKE ITEMS: 5

1 PER LATCH

5 MAX PER VEHICLE

FUNCTION:

THE KEEL LATCH CAN BE MOUNTED IN A PRIMARY (FIXED) CONFIGURATION OR A SECONDARY CONFIGURATION WHERE IT IS FREE TO SLIDE (WITHIN LIMITS) ALONG THE BRIDGE TO ALLOW DYNAMIC REACTION OF PAYLOAD/ORBITER STRUCTURE DURING LAUNCH AND ENTRY. DESIGN ALSO INCLUDES SPHERICAL BEARINGS WITHIN THE LATCH TO ALLOW LIMITED ROTATION AND SLIDING OF THE PAYLOAD TRUNNION IN THE LATCH TO FURTHER RELIEVE LAUNCH AND ENTRY LOADS.

**FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CRITICAL FAILURE MODE
NUMBER: 02-5E-MK04-01**

REVISION# 3 10/18/94

SUBSYSTEM NAME: P/L RETENTION & DEPLOY - LATCHES

LRU: MIDDLEWEIGHT KEEL LATCH

CRITICALITY OF THIS
FAILURE MODE: 1/1

ITEM NAME: LATCH/TRUNNION AND BRIDGE INTERFACES

FAILURE MODE:

PHYSICAL BINDING/JAMMING

MISSION PHASE:

LO LIFT-OFF
OO ON-ORBIT
DO DE-ORBIT

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

CAUSE:

ADVERSE TOLERANCES/WEAR, CONTAMINATION/FOREIGN OBJECT/DEBRIS, LOSS OF LUBRICANT

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

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

PASS/FAIL RATIONALE:

A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:

FAILURE WILL RESULT IN LOSS OF ABILITY FOR PAYLOAD/ORBITER TO FLEX AND RELIEVE LAUNCH AND ENTRY LOADS.

(B) INTERFACING SUBSYSTEM(S):

FAILURE WILL CAUSE PAYLOAD/ORBITER TO BE SUBJECTED TO EXCESSIVE LOADS DURING ASCENT AND ENTRY.

(C) MISSION:

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CRITICAL FAILURE MODE
NUMBER: 02-5E-MK04- 01**

FAILURE OF LATCH TO SLIDE ON BRIDGE MAY PRECLUDE BERTHING OF PAYLOAD OR CLOSING OF LATCH AND RESULT IN LOSS OF MISSION.

(D) CREW, VEHICLE, AND ELEMENT(S):

FAILURE MAY CAUSE LOSS OF CREW/VEHICLE FROM EXCESSIVE LOADS DURING ASCENT OR ENTRY.

(E) FUNCTIONAL CRITICALITY EFFECTS:

NONE

-DISPOSITION RATIONALE-

(A) DESIGN:

THE KEEL FRAME, GEARBOX, AND HOUSING ARE FABRICATED OF TITANIUM. THE PAYLOAD SUPPORT POINTS ARE SELECTED TO MINIMIZE POINT TORSIONAL, BENDING AND RADIAL LOAD IMPARTED TO THE PAYLOADS. TRUNNION FRICTION LOADS ARE MINIMIZED TO $CF = 0.10$ TO 0.25 , BRIDGE FRICTION $CF = 0.10$ TO 0.12 DEPENDING UPON ENVIRONMENT AND LOAD. MATERIAL, FINISHES AND LUBRICANT ARE SELECTED TO PROVIDE MINIMUM COEFFICIENT OF FRICTION. TRUNNION INTERFACE USE SPHERICAL BEARING AND FIBRILOID LINER. BRIDGE INTERFACE USES DRY LUBE FINISH.

(B) TEST:

ACCEPTANCE TESTS: THE FOLLOWING TESTS ARE PERFORMED FOR ALL FLIGHT ARTICLES AND WERE PERFORMED FOR EACH QUALIFICATION TEST ARTICLE: VIBRATION - RANGE 20 TO 2,000 HZ MAXIMUM LEVEL OF $0.04 G^2/HZ$ FROM 80 TO 350 HZ, ALL AXES. THERMAL - STABILIZED RANGE FROM -180 DEG F TO $+255$ DEG F. FUNCTIONAL TESTS CONDUCTED AT -80 DEG F, AMBIENT AND $+255$ DEG F. LOADS/ALIGNMENT - VERIFY RETENTION OF LATCHED POSITION AT 80% LIMIT LOAD, AS WELL AS SPHERICAL BEARING TORQUE RESISTANCE AND TRAVEL LIMITS. ELECTRICAL - VERIFY (WITHIN DESIGN LIMITS) CONTINUITY, DIELECTRIC STRENGTH, INSULATION RESISTANCE, AND SWITCH OPERATION.

QUALIFICATION TESTS: QUALIFICATION IS BY SIMILARITY TO LIGHTWEIGHT KEEL LATCH (V073-544300). FIRST UNIT TESTED TO 100% LIMIT LOAD.

OMRSD: ANY TURNAROUND CHECKOUT TESTING IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

(C) INSPECTION:

RECEIVING INSPECTION
MATERIAL AND PROCESS CERTIFICATIONS VERIFIED BY INSPECTION.

CONTAMINATION CONTROL
CLEANLINESS REQUIREMENTS VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
MACHINING AND DIMENSIONS VERIFIED BY INSPECTION.

NONDESTRUCTIVE EVALUATION
PENETRANT INSPECTION OF DETAIL PARTS VERIFIED BY INSPECTION.

**FAILURE MODES EFFECTS ANALYSIS (FMEA) - CRITICAL FAILURE MODE
NUMBER: 02-5E-MK04-01**

CRITICAL PROCESSES

CHROME PLATING AND ADHESIVE BONDING OF FIBRILOID LINER TO TRUNNION INTERLACED VERIFIED BY INSPECTION. APPLICATION OF LBO140-005 DRY FILM LUBRICANT TO BRIDGE INTERFACE VERIFIED BY INSPECTION. HEAT TREATMENT VERIFIED BY INSPECTION.

TESTING

ATP IS VERIFIED PER PROCEDURE.

HANDLING/PACKAGING

PARTS PACKAGED AND PROTECTED PER APPLICABLE PACKAGING SPECIFICATIONS VERIFIED BY INSPECTION.

(D) FAILURE HISTORY:

FAILURE HISTORY IS TRACKED IN THE PRACA SYSTEM.

(E) OPERATIONAL USE:

NONE

- APPROVALS -

EDITORIALLY APPROVED
EDITORIALLY APPROVED
TECHNICAL APPROVAL

: RI
: JSC
: VIA CR

: *[Signature]*
: *Melanie C. Jaker* 10-25-94
: S502/DAP