

## FAILURE MODE EFFECTS ANALYSIS/CRITICAL ITEMS LIST

FMEA NUMBER: EC-PORT3-02

ORIGINATOR: JSC

PROJECT: EDFT-03

PART NAME: SEGMENT LATCH  
 PART NUMBER: SED39126412-301  
 LSC CONTROL NO: N/A  
 ZONE/LOCATION: PORT 3 & 4

LRU/ORU PART NUMBER: SED39126409-301  
 LRU/ORU PART NAME: RIG UMB ASSY  
 DRAWING/REF DESIGNATOR: SEE P/N  
 EFFECTIVITY/AFFECT STAGE: STS-72

QUANTITY: 2.1  
 SYSTEM: GFE  
 SUBSYSTEM: EVA

### CRITICALITY:

CRITICAL ITEM: Yes  
 CRITICALITY CATEGORY: 1R/2

SUCCESS PATHS: 2  
 SUCCESS PATH REMAINING: 1

END ITEM NAME: N/A  
 END ITEM FUNCTIONAL: N/A  
 END ITEM CAPABILITY: N/A  
 END ITEM FAILURE TOLERANCE: N/A

### REDUNDANCY SCREENS:

- A/1. C/O PRELAUNCH: Pass
2. C/O ON ORBIT: N/A for NSTS
- B/3. DETECTION FLIGHT CREW: Pass
4. DETECTION GROUND CREW: N/A
- C/5. LOSS OF REDUNDANCY FROM SINGLE CAUSE: Pass

FUNCTION: The RU Segment Latch and Handrail Latch are used to secure the RU in the folded position. The latches consists of a captured EVA bolt, two hinge locks (which prevent the bolt from backing out), and a ball detent riding on notches around the bolt (preventing rotation of the bolts until a overriding torque is applied to bolt). The hinge locks are freed when a socket is inserted on the bolt.

FAILURE MODE CODE: N/A for NSTS

FAILURE MODE: 1) Unable to fully close a segment latch 2) Hinge lock open.

CAUSE: galling, contamination.

REMAINING PATHS: 1  
 Other latches on RU/ FSE and jettison.

EFFECT/ MISSION PHASE: EVA

CORRECTIVE ACTION: jettison RU

### -FAILURE EFFECTS-

END ITEM/LRU/ORU/ASSEMBLY: Unable to secure RU following EVA operations.

SUBSYSTEM/NEXT ASSEMBLY/INTERFACE: N/A

SYSTEM/END ITEM/MISSION: None.

CREW/VEHICLE: Loads on the remaining RU segment latches may be overloaded if one of the latches is open. RU may become free in PLB and damage vehicle.

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PART NAME: SEGMENT LATCH	LRU/ORU PART NUMBER: SED39126409-301	QUANTITY: 2,1
PART NUMBER: SED39126412-301	LRU/ORU PART NAME: RIG UMB ASSY	SYSTEM: GFE
LSC CONTROL NO: N/A	DRAWING/REF DESIGNATOR: SEE P/N	SUBSYSTEM: EVA
ZONE/LOCATION: PORT 3 & 4	EFFECTIVITY/AFFECT STAGE: STS-72	

## HAZARD INFORMATION:

HAZARD: N/A

HAZARD ORGANIZATION CODE: N/A

HAZARD NUMBER: N/A

TIME TO EFFECT: Hours

TIME TO DETECT: Seconds

TIME TO CORRECT: Minutes

FAILURE DETECTION/FLIGHT    Visual hinge lock will not be closed

## REMARKS:

## -RATIONALE FOR ACCEPTABILITY-

(A) DESIGN: Segment latches and Handrail latch design incorporates two hinge locks either one of which can prevent the EVA captive bolt from backing out and a ball detent preventing bolt rotation.

(B) TEST:

Acceptance: Functional (performed at predelivery acceptance, preinstallation acceptance, pre/post environmental test, and demonstrated during the Thermal Vacuum test).

1) Torque required to tighten or loosen the segment latch and handrail latch bolts is between 50 and 120 in-lb.

2) Hinge locks verified to remain in position during all environmental tests and verified to swing away at the time of bolt insertion or removal.

Acceptance vibration test performed on the flight RU was performed to the following levels for a duration of 1 minute per axis:

X,Y,Z AXIS

20 Hz	.01g <sup>2</sup> /Hz
20 - 80Hz	+3 db/oct
80 - 350 Hz	.040g <sup>2</sup> /Hz
350 - 2000 Hz	-3db/oct
2000 Hz	.007g <sup>2</sup> /Hz
6.1 grms	

Acceptance: Thermal/Vacuum test performed at a temperature of -100°F and pressure of  $1 \times 10^{-5}$  torr at Human thermal/vacuum test.

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QUANTITY: 2,1

PART NUMBER: SED39126412-301

LRU/ORU PART NAME: RIG UMB ASSY

SYSTEM: GFE

LSC CONTROL NO: N/A

DRAWING/REF DESIGNATOR: SEE P/N

SUBSYSTEM: EVA

ZONE/LOCATION: PORT 3 &amp; 4

EFFECTIVITY/AFFECT STAGE: STS-72

**Qualification:**

Qualification for Acceptance Vibration was performed to the following levels for a duration of 2 minutes per axis:

20 Hz	.017g <sup>2</sup> /Hz
20 - 80Hz	+3 db/oct
80 - 350 Hz	.0670g <sup>2</sup> /Hz
350 - 2000 Hz	-3db/oct
2000 Hz	.012g <sup>2</sup> /Hz
7.87 grms	

**Qualification Vibration :** A vibration test was performed to the following levels for a duration of 1 minute in each axis: Each redundant path was verified on the track angle assy. latch during x-axis vibration test (x axis was the only axis where anomalies from an earlier test occurred on earlier design of the latch.)

X AXIS		Y AXIS		Z AXIS	
20 - 32 Hz	.003g <sup>2</sup> /Hz	20 - 45 Hz	+10 db/oct	20 - 45Hz	.009g <sup>2</sup> /Hz
20 - 32 Hz	+3 db/oct	45 - 600 Hz	.060g <sup>2</sup> /Hz	45 - 70 Hz	+12 db/oct
80 - 350 Hz	.040g <sup>2</sup> /Hz	600 - 2000	-10db/oct	70 - 600 Hz	.050 g <sup>2</sup> /Hz
350 - 2000 Hz	-3cb/oct			600 - 2000Hz	-6 db/oct
6.1 grms		7.7 grms		7.0 grms	

**(C) INSPECTION:**

**Fabrication -** All latch components are verified to generally clean individually. The RU and RU FSE is verified to be visually clean at predelivery acceptance.

**Test -** Quality Assurance surveillance is required at all test and inspections. Discrepancy reports are written on all noncompliances.

**(D) FAILURE HISTORY:** None for this failure mode, the bolt did back out during x axis vibration testing on a earlier version of the track angle latch. Hinge locks were modified and a ball detent added on all of the RU and track angle latches to correct this anomaly. Modified design passed 2nd series of vibration tests.

**(E) OPERATIONAL USE:**

1) Operational Effect - Segment latch may not close (bolt not torqued completely). Hinge locks not in correct position. Release of the RU is possible during deorbit/landing if double failure occurs. Loose equipment could impact the vehicle.

2) Crew Action - If one segment latch cannot be closed, remove RU from FSE and jettison.

3) Crew Training - Crew trained in proper operation of segment latch.

4) Mission constraint - None.

5) In Flight Checkout - Proper stowage verified during EVA operations. Bolt turns are counted and the hinge locks visually verified to be in position.

**(F) MAINTAINABILITY: N/A**

PREPARED BY: G. Wright

REVISION:

DATE: 8/10/95

WAIVER NUMBER: