

## FAILURE MODE EFFECTS ANALYSIS/CRITICAL ITEMS LIST

FMEA NUMBER: EDFT-05-STBD7-1	ORIGINATOR: ISC	PROJECT: DTO 671
PART NAME: LATCH BOLT ASSEMBLY	LRU PART NUMBER: SED39128554-401	QUANTITY: 2
PART NUMBER: 683-55271-1	LRU PART NAME: BAY 7 STBD INSTALLATION	SYSTEM: EDFT-05
DRAWING: SEE P/N	SUBSYSTEM: N/A	EFFECTIVITY: STS-80

### CRITICALITY:

CRITICAL ITEM? YES X NO     

CRITICALITY CATEGORY: 1R/2

### REDUNDANCY SCREENS:

A - Pass  
B - N/A  
C - Pass

FUNCTION: Two latch bolt assemblies are used to secure the CHIA subcarrier assembly to the DCC FSE for launch and landing. Each assembly has an anti-backdrive device to prevent the bolt from losing preload and backing out after the torquing device has been removed.

FAILURE MODE: Inadvertent release of latch bolt

CAUSE: Vibration, piece part failure

FAILURE DETECTION: None

REMAINING PATHS: Launch : One - bolt preload after failure of anti-backdrive device.  
(worse case)

Landing: Two - Bolt preload and anti-backdrive device of other latch bolt.

EFFECT/MISSION PHASE: Launch/landing

CORRECTIVE ACTION: None

### -FAILURE EFFECTS-

END ITEM: One failure - no effect

INTERFACE: N/A

MISSION: None for single failure

CREW/VEHICLE: If one bolt releases (2 failures), remaining bolt may not sustain loads. Possible vehicle damage because of loose equipment (600 lbs) in PLB.

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## HAZARD INFORMATION:

HAZARD: YES \_\_\_\_\_ NO X

HAZARD ORGANIZATION CODE:

HAZARD NUMBER: N/A

TIME TO EFFECT: Seconds

TIME TO DETECT: N/A

TIME TO CORRECT: Immediate

REMARKS:

## -RETENTION RATIONALE-

A) DESIGN: Each CHIA Subcarrier latch bolt assembly consists of a bolt actuated by a 7/16" hex drive shaft with an anti-backdrive device to prevent inadvertent back off of torque (preload) during launch and landing. The passive half of the bolt assembly attaches to the carrier C-guides while the active half attaches to the subcarrier. Shear loads are taken by the passive half boss and the active half body. The latch bolts (with visual soft dock and hard latch indications) are in clear view of the EYA crew member. The bolts and anti-backdrive mechanism are designed to minimum risk to the requirements specified in JSC-33481, "Certification and Acceptance Requirements, Orbital Replacement Unit Simulator and Carrier Assembly for the Detailed Test Objective 671 Program". The active bolt, nut and load washer are fracture critical. The bolt material is MP35N, and the nut and load washer are fabricated from CRES, Custom 455, Condition SA.

Deorbit and landing loads were analyzed and results obtained (in all possible combinations and using a factor of safety of 1.0) indicate that, although not recommended, safe landing could be accomplished with one latch bolt engaged. Analysis will show that the anti-backlash device is capable of withstanding 50 ft-lbs of torque applied to the bolt. Factors of Safety and Margins of Safety will be reviewed to show sufficient margin exists.

B) TEST:

Applicable requirements per JSC-33481.

Acceptance: Functional performed at predelivery acceptance, preinstallation acceptance, and pre/post environmental test.

- 1) Torque required to actuate each latch bolt verified to be between 45 and 50 ft-lbs.
- 2) Engagement of anti-backdrive device verified

Thermal Vacuum Qual Test: Performed as specified in the Certification and Acceptance Requirements Document. Insertion/extraction of latch bolt components functionally verified at thermal points (low end limit at vacuum (-100 degrees F), and room temperature following exposure to vacuum. Upper thermal limit will be certified by analysis.

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Protoflight Vibration Test: Performed to the following levels for a duration of 1 minute in each axis:

X AXIS	Y AXIS	Z AXIS
20 - 80 Hz +3.0 db/oct	20 - 45 Hz +10 db/oct	20 - 45 Hz 0.009 g2/Hz
80 - 350 Hz 0.04 g2/Hz	45 - 600 Hz 0.06 g2/Hz	45 - 70 Hz +12 db/oct
350-2000 Hz - 3db/oct	600 - 2000Hz - 6db/oct	70 - 600 Hz 0.05 g2/Hz
6.1 Grms overall	7.7 Grms overall	600-2000Hz -6db/oct
		7.0 Grms overall

A random vibration test to be performed on a latch bolt assembly with the anti-backdrive device disengaged. Torque will be checked before and after the test using a calibrated torque wrench.

A test will be performed to verify the anti-backdrive device will prevent the latch bolt from inadvertent relief of preload.

Proper equipment installation in the PLB verified to the requirements in SED 39128554 and by JSC TPS.

(C) INSPECTION: All latch Bolt components are individually verified to generally clean, individually. The CHIA subcarrier assembly is to be visually clean at predelivery acceptance and pre-installation acceptance.

- Fracture critical hardware is dye penetrant inspected per MIL-STD-6866, Type I, any method. Sensitivity Level 3, no allowable indications and performed after heat treat and bakeout.
- Test and Quality Assurance surveillance is required at all tests and inspections
- Discrepancy reports are required to be written on all non-compliances.

(D) FAILURE HISTORY: None

(E) OPERATIONAL USE:

- 1) Operational Effect: Both latch bolts are required to be torqued down during launch but only one is required for landing.
- 2) Crew Action - Crew must verify CHIA Subcarrier Assembly is secured by both latch bolts following EVA operations.
- 3) Crew Training - Crew trained in the proper operation of securing/releasing CHIA latch bolts and torquing bolts to 45 - 50 ft-lb with power tool. They also train in determining when locking device is engaged and in checking with torque wrench during WETF training.
- 4) Mission constraint - none
- 5) In-flight checkout - None for launch. Crew verifies proper release and securing of CHIA subcarrier assembly during EVA operations.

PREPARED BY: Murray Epstein

REVISION:

DATE: 4/15/96