

## FAILURE MODE EFFECTS ANALYSIS/CRITICAL ITEMS LIST

FMEA NUMBER: EC-BS-02	ORIGINATOR: JSC	PROJECT: EDFT-05
PART NAME: DEBRIS SLEEVE	LRU/ORU PART NUMBER: SEG33108756-301	QUANTITY: 1
PART NUMBER: SEG33108773-701 DRAWING: SEE P/N	LRU PART NAME: BALL STACK SUBSYSTEM: EVA	SYSTEM: DTO 673 EFFECTIVITY: STS-RO & SUBSEQUENT

CRITICAL ITEM? YES X NO    

CRITICALITY:

SUCCESS PATHS: 2  
SUCCESS PATH REMAINING: 1

CRITICALITY CATEGORY: 1R/2

### REDUNDANCY SCREENS:

- A - 1.) C/O PRELAUNCH: Pass
- B - 2.) DETECTION FLIGHT CREW: Pass
- C - 3.) LOSS OF REDUNDANCY FROM SINGLE CAUSE: Pass

FUNCTION: The debris sleeve fits around the ball stack to prevent debris, fingers, and other foreign objects from lodging in the ball stack. The debris sleeve is a secondary load path and also serves as a restraint device in case of a failure of the ball stack cable allowing the balls to become free.

FAILURE MODE: Outer debris sleeve fails.

CAUSE: Piece part defect.

FAILURE DETECTION: Visual.

REMAINING PATHS: One - Ball stack cable retains ball stack components.

EFFECT/MISSION PHASE: EVA

CORRECTIVE ACTION: Discontinue use of the ball stack.

### -FAILURE EFFECTS-

END ITEM: No effect if debris sleeve fails, however the ball stack should no longer be used.

INTERFACE: None.

MISSION: Partial loss of remaining DTO objectives.

CREW/VEHICLE : None. For a single failure, however, if 2 failures were to occur possible loose ORUs and/or hardware from the ball stack would possibly be free to drift in the payload bay. Loose hardware in the payload bay could either impact the crewmember/vehicle as in the case of translating ORUs, or could prevent the payload bay doors from closing. Also the possibility of loose hardware impacting the vehicle during landing exists.

**FAILURE MODE EFFECTS ANALYSIS/CRITICAL ITEMS LIST**

FMEA NUMBER: EC-B5-02

ORIGINATOR: JSC

PROJECT: EDFT-05

PART NAME: DEBRIS SLEEVE

LRU/ORU PART NUMBER: SEG33108756-301

QUANTITY: 1

PART NUMBER: SEG33108773-701  
DRAWING: SEE P/NLRU PART NAME: BALL STACK  
SUBSYSTEM: EVASYSTEM: D10 673  
EFFECTIVITY: STS-80  
& SUBSEQUENT**HAZARD INFORMATION:**HAZARD: YES  NO 

HAZARD ORGANIZATION CODE: N/A

HAZARD NUMBER: N/A

TIME TO EFFECT: Seconds.

TIME TO DETECT: Minutes.

TIME TO CORRECT: Immediate.

**REMARKS:****-RATIONALE FOR ACCEPTABILITY-**

(A.) DESIGN: The ball stack debris sleeve is designed to withstand a 125 lb tensile load and is attached at both ends using two screws which are threaded into the ball stack assy. Debris sleeve is made of ortho and armlon and sewn together using nomex thread per Fed. Std. 751A and JSC 26626A, "Extravehicular Activity (EVA) Hardware Generic Design Requirements Document".

(B.) TEST: Applicable requirements from JSC 33794, "Certification and Acceptance Requirements Document, Ball Stack".

## Acceptance:

## 1.) Functional:

- Debris sleeve was tested to 125 lbs.
- Visual Inspection for defects pre/post environmental test.

## 2.) Environmental: Acceptance Vibration

The ball stack is subjected to the following vibration in each axis for a duration of 1 minute per TPS.

20 to 80 Hz	+3.0 dB/Octave
80 to 350 Hz	0.04 G <sup>2</sup> /Hz
350 to 2000 Hz	-3.0 dB/Octave
load factor 6.1 G rms	

## 3.) Acceptance Thermal:

Ball stack assembly functionally verified at -100 F.

## Qualification:

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PART NAME: DEBRIS SLEEVE

LRU/ORU PART NUMBER: SEG33108756-301

QUANTITY: 1

PART NUMBER: SEG33108773-701

LRU PART NAME: BALL STACK

SYSTEM: DTO 671

DRAWING: SEE P/N

SUBSYSTEM: EVA

EFFECTIVITY: STS-80  
& SUBSEQUENT

- 1.) Functional: A similar debris sleeve design was load tested to 183 lbs and tether loop was load tested to 30 lbs per TPS.
- 2.) Vibration: N/A
- 3.) Thermal: Functional verification performed at -100 F and +200 F per TPS.

## (C) INSPECTION:

Fabrication - All ball stack components are verified to be built to print and generally clean individually. The ball stack is verified to be visually clean at preinstallation acceptance.  
Test - Quality Assurance surveillance is required at all tests and inspections.

(D) FAILURE HISTORY: The ball stack is similar to the ORU which flew on STS-69 and STS-72 with no history of failures.

## (E) OPERATIONAL USE:

- 1) Operational Effect - For debris sleeve failure there is no effect, unless cable also fails. Possible loose debris in the payload bay.
- 2) Crew Action - Discontinue use of the ball stack and restow.
- 3) Crew Training - Crew trained in proper operation of ball stack at WETF.
- 4) Mission constraint - When fully extended the crew will not continue to pull against the ball stack or placed into a singularity.
- 5) In Flight Checkout - If debris sleeve is torn or damaged, discontinue use of the ball stack.

PREPARED BY: M. D. Garner

REVISION:

DATE: 8/15/96