

SRB CRITICAL ITEMS LIST

SUBSYSTEM: SEPARATION

ITEM NAME: NASA Standard Detonator, NSD, Forward and Aft BSM

PART NO.: SEB 26100094-201 FM CODE: A03

ITEM CODE: 30-01-01, 30-02-01 REVISION: BASIC

CRITICALITY CATEGORY: 1R REACTION TIME: Immediate

NO. REQUIRED: 2 Forward and 2 Aft DATE: March 1, 1994

CRITICAL PHASES: Separation SUPERCEDES: June 18, 1990

FMEA PAGE NO.: B-5, B-29 ANALYST: M. Hurley

SHEET 1 OF 3 APPROVED: R. Henritze

FAILURE MODE AND CAUSES: Fails to operate (both NSDs) caused by:

- o Insensitive explosive degraded by moisture, contamination or chemical decomposition
- o Low output/insufficient charge
- o Short or open circuits
- o High resistance circuit
- o Defective welds
- o Broken header
- o Separated bridge wire/charge

FAILURE EFFECT SUMMARY: Loss of mission, vehicle and crew due to loss of ability to fire the forward and/or aft separation motors at separation. Loss of separation thrust will lead to vehicle damage caused by recontact between the SRB and Orbiter/ET. One success path remains after the first failure. Operation is not affected until both paths are lost.

REDUNDANCY SCREENS AND MEASUREMENTS:

1. N/A
2. N/A
3. Pass

RATIONALE FOR RETENTION:

A. DESIGN:

- o The NSD is GFE supplied by Johnson Space Center (JSC) and consists of a NASA Standard Initiator (NSI) (SEB26100001) with a backup ring welded to the body of the NASA Standard Detonator. The NSI is controlled by specification SKB26100066 and drawing SEB26100001. The NSD design is controlled by drawing SEB26100094 and specification SKB26100097. Two

(redundant) MSDs are designed to output shock wave to CDF manifolds. Material is A286 CRES for corrosion protection. Explosive mix is RDX and lead azide.

o Qualification

Component Qualification Tests: Salt fog, shock, vibration, thermal cycling, high temperature firing at altitude, 8 foot drop test, sand/dust, high/low/ambient and cryogenic (-450°F) firings. Certification requirements (CR) 45-114-0018-0003, CR-45-453-0021-0009; SKB26100097.

Assembly Qualification Tests: 26 fired in conjunction with 3/4 inch nut qualification (-200°F/-400°F/ambient); salt fog, vibration/low temperature, single detonator 120% web margin firing, limit and zero applied loads firings. CR-45-114-0018-0003.

Delta Qualification for SRB: Vibration and shock. CR-45-453-0021-0009.

System Qualification Tests: 8 firings cryogenic temperature with flight preload 55 K-7b (umbilical separation). CR-45-565330.

B. TESTING

VENDOR RELATED TESTING

Acceptance Testing:

- o Helium leak test, N-ray and X-ray (presence and proper orientation of parts), weight records for explosive mix, lot firing test on random samples, insulation resistance, NSI bridgewire resistance test, tensile test coupons for body. CR-45-453-0021-0009, ATP 5044; SKB26100097. (All Failure Causes)
- o Pyro Verification Test: Sample lot firing yearly at KSC until age life expires. (All Failure Causes)

KSC RELATED TESTING

- o The following SRB tests verify PIC resistance: (Short or Open Circuit, High Resistance Circuit)
  - GO PIC SRB PIC resistance test is performed with NSI GO type simulator connected per OMRSD File V, Vol. I, requirement number B75PIO.011.
  - Verify functional operation of PIC resistance circuit with NSI simulators installed. (Short or Open Circuits)

- Verify that all SRB NSDs are not electrically connected by using the PIC resistance test circuits. Neither go-type NSI simulators nor flight NSIs electrically connected per OMRSD File II, Vol. I, requirement number S00000.411. (Short or Open Circuits)
  - Verify connection of NSD using PIC resistance test circuit after flight NSIs are installed per OMRSD File II, Vol. I, requirement number S00000.410. (Short or Open Circuits)
  - PIC resistance test (GO mode verifies ordnance connection at T-24 hours or later per OMRSD File II, Vol. I, requirement number S00FA0.015. (Short or Open Circuits)
- o The above referenced OMRSD testing (except PVT) is performed every flight.

C. INSPECTION

VENDOR RELATED INSPECTION

- o Receiving Inspection  
Raw material is verified by inspection to assure specific shuttle requirements are satisfied. (Contamination)
- o Contamination Control  
Contamination control and corrosion protection processes and storage environments are monitored and verified by inspection. (Contamination)
- o Assembly/Installation  
Selected manufacturing/assembly steps are identified by NASA and Quality Assurance and verified by Government inspection mandatory inspection points (MIPS). (All Failure Causes)
- o Nondestructive Evaluation  
Parts are X-rayed and N-rayed to verify correct assembly and presence of all detail parts and explosives. X-rays and N-rays are reviewed by vendor, DCAS, and NASA Quality and Engineering. (Contamination)
- o Critical Processes  
All manufacturing processes such as welding, plating, heat treating, passivation and anodizing are verified by inspection. (Defective Welds)
- o Storage  
Storage environment verified by inspection. (Contamination/High Temperature)

### KSC RELATED INSPECTION

#### o Receiving Inspections

- Shelf life is verified by SPC Quality Assurance per OMRSD File II, Vol. 3 Table COOCA0.040-000. (Insensitive Explosive)
- Visual inspection for cleanliness and damage to O-rings, pins, threads, connectors, and body per OMRSD File V, Vol. I, requirement number B000FL.001. (Contamination/Moisture)
- Bridgewire resistance test is performed per OMRSD File V, Vol. I, requirement number B000FL.001. (Short, Open, High Resistance Circuit)
- Verify that the NSDs have been flight certified by JSC as required by NSTS 08060 per OMRSD File V, Volume 1, requirement no. B000FL.002. (All Failure Causes)
- Verification that insulation resistance test is acceptable per OMRSD File V, Vol 1, requirement no. B000FL.001. (Insensitive Explosive degraded by moisture, contamination or chemical decomposition)

#### o Installation Inspection

- Inspection of the installation of the NSDs is performed by SPC Quality Assurance:
  - o Torque NSD per OMRSD File V, Vol. I, requirement number B55TQ0.010. (Broken Header)
  - o Lockwire NSD per OMRSD File V, Vol. I, requirement number B55TQ0.020. (Low Output)

#### D. FAILURE HISTORY

##### o Criticality Category 1R:

- o No failure history for this failure mode.

#### E. OPERATIONAL USE

- o Not applicable to this failure mode.