

SRB CRITICAL ITEMS LIST

SUBSYSTEM: STRUCTURES AND MISCELLANEOUS ITEMS

ITEM NAME: NASA Standard Detonator, NSD

PART NO.: SEB26100094-201

FM CODE: A03

ITEM CODE: 60-04-01

REVISION: Basic

CRITICALITY CATEGORY: 1R

REACTION TIME: Immediate

NO. REQUIRED: 8

DATE: March 1, 1995

CRITICAL PHASES: Boost

SUPERCEDES: March 1, 1994

FMEA PAGE NO.: E-51

ANALYST: Bob White/S. Glasgow

SHEET 1 OF 3

APPROVED: P. Kalia

FAILURE MODE AND CAUSES: Fails to operate (both NSDs on any one holddown assembly) caused by:

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

FAILURE EFFECT SUMMARY: Loss of mission, vehicle and crew due to vehicle out of control at lift-off. 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 - No credible causes.

RATIONALE FOR RETENTION:

A. DESIGN

NSD:

- 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.

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

Qualification Test: (NSD)

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. (All Failure Causes)

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-lb. (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. (Defective Welds)

O Pyro Verification Test: Sample lot firing yearly at KSC until age life expires. (All Failure)

KSC RELATED TESTING

O The following SRB/ET tests verify RSS 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. 1, requirement number B75PID.011.

- Verify functional operation of PIC resistance circuit with NSI simulators installed per OMRSD File IV, requirement number T55DYN.090.
 - Verify that all SRB and ET 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. 1, requirement number S00000.411.
 - Verify connection of NSD using PIC resistance test circuit after flight NSIs are installed per OMRSD File II, Vol. 1, requirement number S00000.410.
 - PIC resistance test (GO mode) verifies ordnance connection at T-24 hours or later per OMRSD File II, Vol. 1, requirement number S00FA0.015.
- O The above referenced OMRSD testing (except PVT) is performed every flight.

C. INSPECTION

VENDOR RELATED INSPECTION

- O Receiving Inspection:
 - o Raw material is verified by inspection to assure specific shuttle requirements are satisfied. (Contamination)
- O Contamination Control:
 - o Contamination control and corrosion protection processes verified by inspection. (Contamination)
- O Assembly/Installation:
 - o 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:
 - o 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. (Improper Material and Contamination)
- O Critical Processes:
 - o All manufacturing processes such as welding, plating, heat treating, passivation and anodizing are verified by inspection. (Improper Material and Defective Welds)

O Storage:

- o Storage environment verified by inspection. (Contamination/High Temperature)

KSC RELATED INSPECTIONS

O Receiving Inspections

- o Shelf life is verified by SPC Quality Assurance per OMRSD File II, Vol. 3, Table COOCAO 040-000. (Insensitive Explosive)
- o Visual inspection for cleanliness and damage to O-rings, pins, threads, connectors and body per OMRSD File V, Vol. 1, requirement number B000FL.001. (Defective Welds)
- o Bridgewire resistance test is performed per OMRSD File V, Vol. 1, requirement number B000FL.001. (Short, Open, High Resistance Circuit)

O Installation Inspection

- o Inspection of the installation of the NSDs is performed by SPC Quality Assurance in accordance with 10100-0014 (SRB Ordnance Installation). (Improper Installation)
- o Torque NSD per OMRSD File V, Vol. 1, requirement number B55TQO.010. (Broken Header)
- o Lockwire NSD per OMRSD File V, Vol. 1, requirement number B55TQO.020. (Low Output)

D. FAILURE HISTORY:

- O Failure Histories may be obtained from the PRACA database.

E. OPERATIONAL USE

- o Not applicable to this failure mode.