

SRB CRITICAL ITEMS LIST

SUBSYSTEM: SEPARATION

ITEM NAME: CDF Initiator, Forward and Aft BSM

PART NO.: 10308-0003-801

FM CODE: A02

ITEM CODE: 30-01-05, 30-02-05

REVISION: Basic

CRITICALITY CATEGORY: 1R

REACTION TIME: Immediate

NO. REQUIRED: 8 Forward and 8 Aft

DATE: March 31, 1999

CRITICAL PHASES: Separation

SUPERCEDES: March 31, 1997

FMEA PAGE NO.: B-16, B-32

ANALYST: B. Crawford/V. Patel

SHEET 1 OF 5

APPROVED: P. Kalia

CN 035

CN 035

CN 035

FAILURE MODE AND CAUSES: Fails to operate (Four CDF initiators installed in two BSMs) caused by:

- o Insensitive explosive degraded by moisture, contamination or chemical decomposition
- o Voids or cracks in the charge
- o Overheating of charge
- o Separation between bulkhead and PETN charge
- o Thick bulkhead
- o Insufficient charge

FAILURE EFFECT SUMMARY: Loss of mission, vehicle and crew due to loss of ability to fire two 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 Design specification USB1 10SPC-0032
 - Contamination control per paragraphs 3.1.2 and 3.1.3
 - Shock levels per paragraph 3.4.1.4
 - Vibration levels per paragraph 3.4.1.3

- No autoignition at 240°F per paragraph 3.2.5.2
- o Predicted temperature will not exceed +134°F (I^{wd}) and 110°F (A^{ft}) per SRB Thermal Design Data Book SE-019-068-2H, Table 4.9.1.1. (Overheating of Charge)
- o Explosive material (PETN) certified to MIL-P-387. (Insensitive Explosive)
- o Output mix per OEA Aerospace Drawing 5616107 or Pacific Scientific Drawing 2-900108 (Contamination)¹
CN 035
 - Magnesium per MIL-M-382
 - Cupric Oxide reagent grade
- o Hermetically sealed device prevents entry of moisture and contamination following manufacturing
- o Qualification
 - Proven design qualified for Saturn V per North American Aviation Qualification Test Summary 67MS1147.
 - Delta qualification for SRB.
 - o High temperature test (190°F) (All Failure Causes)
 - o Thermal shock test. (Overheating of Charge)
 - o Vibration (Separation between bulkhead and PETN charge)
 - o Pyro Shock (Separation between bulkhead and PETN charge)
 - o 8 foot drop (Separation between bulkhead and PETN charge)
 - Qualification per OEA Aerospace test report 10-5616100 or Pacific Scientific test report 4984 QTR 9803.
CN 035

B. TESTING

- o Lot Acceptance Tests are conducted per OEA Aerospace Acceptance Test Procedure 7-5616100 or Pacific Scientific Acceptance Test Procedure ATP 51-4894.
CN 035
 - X-ray and N-ray entire lot. (Voids or Cracks, Separation)
 - Leakage Test Entire Lot. (Contamination)
 - Vibration test of ten percent of the lot. (Separation between bulkhead and PETN charge)
 - N-ray, ten percent of the lot following vibration. (Voids or cracks, separation)

- Lot Sample Firing Test 10 percent of the lot, (20⁰F) (190⁰F). (All Failure Causes)
- Ignition material function test. (Insensitive Explosive)
- o Perform output mix caloric output test within 120 days of loading per OEA Aerospace Manufacturing Procedure 40-5616100 or Pacific Scientific Manufacturing Procedure MP 51-4894. (Insensitive Explosive) CN 035
- o Pyro (lot) Preflight Verification Test is performed per OMRSD File V, Volume 1, requirement number B000FL.003. (All Failure Causes)
- Performed as late as possible prior to flight use of the lot and repeated annually until the lot is expended.

C. INSPECTION

The following inspections are performed.

VENDOR RELATED INSPECTION

- o Receiving Inspection. Critical body dimensions, explosive material certifications and test reports are verified one hundred percent. (Contamination, Bulkhead Thickness)
 - USBI Quality Assurance
USBI Source Inspection Plan (SIP) 1350
 - Contractor Quality Assurance
OEA Aerospace Manufacturing Procedure 40-5616100 or Pacific Scientific Manufacturing Procedure MP 51-4894. CN 035
- o PETN Verification: Correct type of PETN per MIL-P-387, Class 2 is verified for loading of CDF initiators. (Contamination)
 - USBI Quality Assurance
USBI Source Inspection Plan 1350
 - Contractor Quality Assurance
OEA Aerospace Manufacturing Procedure 40-5616100 or Pacific Scientific Manufacturing Procedure MP 51-4894. CN 035
- o Assembly Operation. Moisture content determination, explosive loading and sealing process are verified one hundred percent by Contractor Quality Assurance and USBI Quality Assurance. (Contamination)
 - USBI Quality Assurance
USBI Source Inspection Plan 1350.
 - Contractor Quality Assurance
OEA Aerospace Manufacturing Procedure 40-5616100 or Pacific Scientific Manufacturing Procedure MP 51-4894. CN 035

- o Lot Acceptance Test. N-ray and X-ray films are examined by certified vendor personnel and verified by USBI personnel. Helium leak test is witnessed one hundred percent. (Voids or Cracks, Separation, Contamination)
 - USBI Quality Assurance
USBI Source Inspection Plan 1350.
 - Contractor Quality Assurance
OEA Aerospace Acceptance Test Procedure 7-5616100 or Pacific Scientific Acceptance Test Procedure ATP 51-4894.
- o Lot review and certification per USBI plan 10PLN-0032.
- o Critical Processes/Inspections. The following critical processes and inspections are used to assure structural integrity of bulkhead and that explosive charge is properly sealed.
 - X-ray per OEA Aerospace ATP 7-5616100 or Pacific Scientific ATP 51-4894.
 - N-ray per OEA Aerospace ATP 7-5616100 or Pacific Scientific ATP 51-4894.
 - Helium Leak Test per OEA Aerospace ATP 7-5616100 or Pacific Scientific ATP 51-4894.

CN 035

CN 035

KSC RELATED INSPECTIONS

- o Receiving Inspections
 - The CDF initiator shelf life is verified by SPC Quality Assurance per OMRSD File II, Vol. 3 Table C00CA0.040-000. (Insensitive Explosive)
 - Nonelectric pyrotechnic devices are inspected for evidence of damage, degradation, corrosion, misalignment or moisture per OMRSD File V, Volume 1, requirement number B000FL.005. (Moisture/Contamination)
 - Verify that CDF initiators have been flight certified by MSFC as required by NSTS 08060 per OMRSD File V, Volume 1, requirement no. B000FL.002. (All Failure Causes)
- o Installation Inspection
 - The CDF initiator are inspected per IDREQ-0021, para. 1.1.4.2 (forward) and para. 2.1.1.3 (aft). (Contamination)

D. FAILURE HISTORY

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

E. OPERATIONAL USE

- o Not applicable to this failure mode.