

SRB CRITICAL ITEMS LIST

SUBSYSTEM: SEPARATION

ITEM NAME: CDF Assembly

PART NO.: 10314-0001-105 through -109
10314-0001-110 or 10314-0001-145 (alternate)
10314-0001-111 through -122

FM CODE: A02

ITEM CODE: 30-01-04, 30-02-04

REVISION: Basic

CRITICALITY CATEGORY: 1R

REACTION TIME: Immediate

NO. REQUIRED: 9 Forward and 9 Aft

DATE: March 1, 2001

DCN 042

CRITICAL PHASES: Separation

SUPERCEDES: March 31, 2000

DCN 042

FMEA PAGE NO.: B-12, B-31

ANALYST: K.C. Finch/S. Parvathaneni

DCN 042

SHEET 1 OF 4

APPROVED: S. Parvathaneni

FAILURE MODE AND CAUSES: Fails to operate (four CDF Assemblies leading to two BSMs) caused by:

- o Insensitive explosive degraded by moisture, contamination or chemical decomposition .
- o Voids or cracks in the explosive cord
- o Improper gap at external interface
- o Contamination or excessive gap at internal interfaces
- o Overheating of charge
- o Vibration/Shock

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 USA SRBE 10SPC-0035
 - Contamination Control per paragraphs 3.1.2 (Insensitive Explosive)

- No autoignition below 275°F, paragraph 3.3.7
- o Predicted temperature will not exceed 134°F (Fwd) and 110°F (Aft) per SRB Thermal Design Data Book SE-019-068-2H, Table 4.9.1.1. (Overheating of Charge)
- o P/N 10314-0002 explosive material (PETN) certified to MIL-H-387C (Contamination)
- o P/N 10315-0002 (Ensign Bickford) explosive material (PETN) TIP certified to MIL-H-387C and (HMX) cord certified to MIL-H-4544B or P/N 10315-0001 (Teledyne McCormick Selph) explosive material (PETN) TIP certified to MIL-H-387C and (HNS) cord certified to WS5003F or P/N 10315-0003 (OEA Aerospace) explosive material (PETN) tip certified to MIL-H-387C and (HNS) cord certified to WS5003F. (Contamination)
- o Sealed device prevents the entry of contamination following manufacturing. (Insensitive Explosive)
- o Qualification
 - Proven design qualified for Saturn V per North American Aviation Qualification Test Summary 67MS1149.
 - Delta Qualification for SRB
 - o Operating High temperature (250°F for 30 minutes) (Overheating of Charge)
 - o 8 and 40 foot drop (Vibration/Shock)
 - o Vibration
 - o Pyroshock
 - Delta qualification per Ensign Bickford Test Reports 5860A, for the (PETN)-Cord CDF assembly and EB Test Report 86-08-03, 87-1435: DEN for the (HMX)-Cord CDF assembly or Teledyne McCormick Selph(TMCS) Test Report QTR-7786-324A for the (HNS)-Cord CDF assembly or OEA Aerospace test report 11914 (01) qtr. Rev. A for (HNS-Cord) CDF Assembly.

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B. TESTING

- o Lot acceptance test per Ensign Bickford Procedure ATP 0030/2 (PETN- Cord) or ATP 0030/5 (HMX-Cord) or Teledyne McCormick Selph ATP 817296 (HNS-Cord) or OEA Aerospace ATP 11914 (01) (HNS-Cord).
 - Radiographic examination of entire lot. (Voids, Cracks, Improper Gap)
 - Vibration tests of all destructive lot samples.
 - Temperature-Humidity-Altitude test of all destructive LAT samples. (Insensitive explosive due to contamination)
 - Low Temperature (-150°F) function 5 percent of the lot. (All Failure Causes)
 - High temperature (+250°F) function test of 5% of the lot. (All Failure Causes)
- o Pyro (lot) preflight verification test, which includes CDF assembly Pyro Lot Verification Testing (PVT) is performed per OMRSD File V, Volume I, requirement number B000FL.003. (All Failure Causes)

- Performed as late as possible prior to flight and repeated annually until the lot is expended.

C. INSPECTION

The following inspections are performed.

VENDOR RELATED INSPECTION

- o Receiving Inspection. All explosive material certifications and test reports are verified one hundred percent.
 - USA SRBE Quality Assurance
USA SRBE Source Inspection Plan 1149 for (PETN)-Cord, (HNS)-Cord or (HMX)-Cord
 - Contractor Quality Assurance
Ensign Bickford Inspection Procedure QA 461/2 for the (PETN)-Cord CDF Assembly
Ensign Bickford Inspection Procedure QA 461/3 for the (HMX)-Cord CDF Assembly
TMcS Assembly and Inspection Procedure 817296 for the (HNS)-Cord CDF Assembly
OEA Aerospace Receiving Inspection Plan 11914(01) RIP for the (HNS-Cord) CDF Assembly
- o Assembly Operation. Moisture content determination and explosive loading are verified one hundred percent by Contractor Quality Assurance and USA SRBE Quality Assurance. Mass ratio determination for 10315-0001 and fill density determination for 10314/10315-002 are verified by Contractor Quality Assurance and USA SRBE Quality Assurance. For OEA Aerospace CDF assemblies only, the flexibility test is witnessed one hundred percent by Contractor and USA SRBE Quality Assurance. (Contamination)
 - USA SRBE Quality Assurance
USA SRBE Source Inspection Plan 1149 for (PETN)-Cord, (HNS)-Cord or (HMX)-Cord
 - Contractor Quality Assurance
Ensign Bickford Inspection Procedure QA 461/2 for the (PETN)-Cord CDF Assembly
Ensign Bickford Inspection Procedure QA 461/3 for the (HMX)-Cord CDF Assembly
TMcS Assembly and Inspection Procedure 817296 for the (HNS)-Cord CDF Assembly
OEA Aerospace Procedures 11914(01) MP (Booster Cup) or 11914(02) MP (HNS-Cord)
- o Lot Acceptance Test. N-ray and X-ray films are examined by certified vendor personnel and verified by USA SRBE personnel. Vibration test is monitored and high temperature function test is witnessed one hundred percent. For OEA Aerospace CDF assemblies only, Helium leak test is witnessed one hundred percent by contractor and USA SRBE Quality Assurance. (All Failure Causes)

- USA SRBE Quality Assurance
USA SRBE Source Inspection Plan 1149 for (PETN)-Cord, (HNS) - Cord or (HMX)-Cord
- Contractor Quality Assurance
Ensign Bickford Acceptance Test Procedure ATP 0030/2 (PETN-Cord) or ATP 0030/5 (HMX-Cord).
Teledyne McCormick Selph (TMcS) ATP 817296 (HNS-Cord)
OEA Aerospace ATP 11914(01) ATP (HNS-Cord)
- o Lot review and certification per USA SRBE 10PLN-0035.
- o Critical Processes/Inspections: The following critical processes and inspections are used to verify that explosive charge is properly assembled/sealed. (Voids or Gaps, Improper Gap or Excessive Gap at Internal Interface)
 - X-ray per EB ATP 0030/2 (PETN-Cord) or ATP 0030/5 (HMX-Cord) or TMcS ATP 817296 (HNS-Cord) or OEA Aerospace ATP 11914 (01) (HNS-Cord).
 - N-ray per EB ATP 0030/2 (PETN-Cord) or ATP 0030/5 (HMX-Cord) or TMcS ATP 817296 (HNS-Cord) or OEA Aerospace ATP 11914 (01) (HNS-Cord).
 - Adhesive application per EB Inspection Procedure QA 461/2 (PETN-Cord) or QA 461/3 (HMX-Cord) or TMcS Assembly and Inspection Procedure 817296 (HNS-Cord) or OEA Aerospace manufacturing procedure 11914(01) MP.

KSC RELATED INSPECTION

- o Receiving Inspection
 - Ordnance device shelf life is verified one hundred percent by Shuttle Processing Contractor Quality Assurance per OMRSD File II, Vol. 3 Table C00CA0.040-000. (Contamination)
 - Each nonelectric pyrotechnic device is visually inspected for evidence of damage, degradation, corrosion, misalignment or moisture per Shuttle Processing Contractor OMRSD File V, Volume I, requirement number B000FL.005. (Contamination)
 - Verify that CDF Assemblies have been flight certified by MSFC as required by NSTS 08060 per Shuttle Processing Contractor OMRSD File V, Volume 1, requirement no. B000FL.002. (All Failure Causes)
- o Installation Inspection
 - Verify proper installation of the CDF assemblies to the CDF manifolds per 10REQ-0021, para. 1.1.4.1 (forward) and 2.1.1.1 (aft).

D. FAILURE HISTORY

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

E. OPERATIONAL USE

- o Not applicable to this failure mode.