SRB CRITICAL ITEMS LIST

SUBSYSTEM: SEPARATION

ITEM NAME: NSI Pressure Cartridge

PART NO.: 10303-0001-801

FM CODE: A04, A02

ITEM CODE: 30-03-01, 30-04-01A

REVISION: Basic

CRITICALITY CATEGORY: 1R

REACTION TIME: Immediate

NO. REQUIRED: 2 Forward and 6 Aft

DATE: March 31, 1997

DCN032

CRITICAL PHASES: Separation

SUPERCEDES: March 1, 1995

DCN032

FMEA PAGE NO.: B-44, B-56

ANALYST: S. Parvathaneni

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SHEET 1 OF 5

APPROVED: P. Kalia

FAILURE MODE AND CAUSES: Fails to operate (both of the NSI Pressure Cartridges) 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 forward and/or aft attachment separation would result in damage to the Orbiter/ET leading to loss of mission, vehicle and crew. 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 USBI 10SPC-0027
  - Contamination and moisture control per para. 3.1.2, 3.1.3, 3.2.5 and 3.2.6 (Insensitive Explosive)

- Bridgewire resistance per para. 4.4.2.3. (Short, Low Resistance or Open Circuit)

- Insulation resistance per para. 3.3.5. (Short, Low Resistance Circuit)

o Predicted temperature will not exceed 80°F for Forward NSI Pressure Cartridge and 99°F for Aft NSI Pressure Cartridge per SRB Thermal Design Data Book, SE-019-068-2H, Table 4.9.1.1. (Chemical Decomposition)

o Predicted minimum temperature is +3°F per SRB Thermal Design Data Book, SE-019-068-2H, Table 4.9.1.1.

o Explosive material is certified to the following:

- Hi-Shear specification 700871 or Unidynamics Specification 51-3789-PRS-01 or OEA Aerospace Manufacturing Procedure 40-5607100 DCN032

- Hi-Shear Source Control Drawing 9391576 or Unidynamics Specification 51-3789-PRS-01 or OEA Aerospace drawing 5607100 DCN032

  o Graphite per MIL-G-155
  o Diphenylamine per MIL-D-98
  o Nitrocellulose per MIL-N-244
  o Potassium sulfate per MIL-P-193A
  o Dinitrotoluene per MIL-D-204A

o Hermetically sealed device prevents entry of moisture and contamination following manufacturing. (Insensitive Explosive)

o Qualification
- Temperature - Humidity - Altitude (Contamination)
- Low temperature functional test (-10°F) (Insensitive Explosive)

o Qualification of design is documented in Hi-Shear document 9391360-1262, 9362793-1364 (Forward Bolt) and 9362801-1109 (Aft Bolt) or in Unidynamics Report P45-059/CM-11W-954 and USBI Similarity Report ER-PYR-88-006 or OEA Aerospace Report 10-5607100. DCN032

B. TESTING

o Lot acceptance testing per:

- Hi-Shear ATP 9391360-869 or Unidynamics 51-3789-ATP-02 or OEA Aerospace ATP 7-5607100.
  o Leak test the entire lot. (Contamination) DCN032
  o Radiographic examination (X-ray) the entire lot. (Separated Bridgewire/ Charge)
  o Lot sample firing test 10% of the lot. (All Failure Causes) DCN032
  o Bridgewire Resistance Test. (Short/low resistance)
  o Insulation Resistance Test. (Short/low resistance)

o Five pre-acceptance test samples are fired prior to production loading per Hi-Shear assembly operation sheet, AOS 9391360-1 or Unidynamics NSI Cartridge Assembly Process Card PC51-3789-1. (All Failure Causes) or OEA Aerospace Manufacturing Procedure 40-5607100. DCN032

- o Calorific output determination tests are conducted within 60 days prior to cartridge loading per Hi-Shear assembly operation sheet AOS 9391360-1 or Unidynamics NSI Cartridge Assembly Process Card PC51-3789-1. (Insensitive Explosive) or OEA Aerospace Manufacturing Procedure 40-5607100. DCN032
- o Pyro (lot) preflight verification testing is performed per OMRSD File V, Vol. 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.
- o The following SRB/ET PIC Tests are performed every flight: (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 B75PI0.011.
  - SRB NSI not connected PIC resistance test is performed with neither GO type simulators nor flight NSIs connected per OMRSD File II, Vol. 1, requirement number S00000.411.
  - PIC resistance test verifies NSI connection per OMRSD File II, Vol. 1, requirement number S00000.410.
  - PIC resistance test (GO mode) verifies ordnance connection per OMRSD File II, Vol. 1, requirement number S00FA0.015.

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 per: (Insensitive Explosive)
  - USBI Quality Assurance
    USBI Source Inspection Plan 1311.
  - Contractor Quality Assurance
    Hi-Shear Corporation Assembly Operation Sheet 9391360-1 or Unidynamics NSI Cartridge Assembly Process Card PC51-3789-1 or OEA Aerospace Receiving Inspection Plan 5607101. DCN032
- o Assembly Operation. Powder calorific validation operation is verified one hundred percent by Contractor Quality Assurance and USBI Quality Assurance. (Contamination)
  - USBI Quality Assurance
    USBI Source Inspection Plan 1311.

- Contractor Quality Assurance
  Hi-Shear Corporation Assembly Operation Sheet 9391360-1 or Unidynamics NSI Cartridge Assembly Process Card PC51-3789-1 or OEA Aerospace Manufacturing Procedure 40-5607100.

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o Powder Weight. Tare weight of powder is verified one hundred percent by contractor Quality Assurance and USBI Quality Assurance per: (Insufficient Charge)

- USBI Quality Assurance
  USBI SIP 1311

- Contractor Quality Assurance
  Hi-Shear Corporation Assembly Operation Sheet 9391360-1 or Unidynamics NSI Cartridge Assembly Process Card PC51-3789-1 or OEA Aerospace Manufacturing Procedure 40-5607100.

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o Lot Acceptance Test. X-ray films are examined by certified vendor personnel and verified by USBI personnel. Bridgewire resistance test, insulation resistance test, and Helium Leak Test are witnessed one hundred percent : (All Failure Causes)

- USBI Quality Assurance
  USBI Source Inspection Plan 1311

- Contractor Quality Assurance
  Hi-Shear Corporation Acceptance Test Procedure 9391360-869 or Unidynamics 51-3789-ATP-02 or OEA Aerospace Acceptance Test Procedure 7-5607100.

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o Lot review and certification plan per USBI plan 10PLN-0042

o Critical Processes/Inspections: The following critical processes and inspections are used to assure propellant charge is properly sealed and free from moisture or contamination. (All Failure Causes)

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- X-ray per HSC ATP 9391360-869 or Unidynamics 51-3789-ATP-02 or OEA Aerospace ATP 7-5607100.
- Helium Leak Test per HSC 9391360-878 or Unidynamics 51-3789-ATP-02 or OEA Aerospace ATP 7-5607100.

KSC RELATED INSPECTION

o Receiving Inspections

- Shelf life is verified for each NSI pressure cartridge in lot by SPC Quality Assurance per OMRSD File II, Vol. 3 Table C00CA0.040.000. (Insensitive Explosive)

- Each NSI pressure cartridge is inspected for cleanliness and damage to o-rings, pins, threads, connectors and body per OMRSD File V, Volume 1, requirement number B000FL.001. (Contamination)

- A bridgewire resistance test and insulation resistance test is performed on each NSI pressure cartridge per OMRSD File V, Volume 1, requirement number B000FL.001. (Short or Open Circuit, High Resistance Circuit)

- Verify that the NSI Pressure Cartridge has 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 Inspections

- Each NSI Pressure Cartridge is inspected for contamination and surface defects prior to installation into Forward Separation Bolt by USBI Quality Assurance per OMRSD File V, Vol. 1 requirement no. B000FL.005. (Contamination)

- Each NSI pressure cartridge and O-ring is inspected for contamination and surface defects prior to installation into Aft separation bolts by USBI Quality Assurance. (Contamination)

- A bridgewire resistance test is performed on each NSI pressure cartridge immediately following installation in the aft separation bolt by SPC Quality Assurance. (Short or Open Circuit, High Resistance Circuit)

D. FAILURE HISTORY

o Failure Histories may be obtained from the PRACA database.

E. OPERATIONAL USE

o Not applicable to this failure mode.