SUBSYSTEM: SEPARATION

ITEM NAME: NSI Pressure Cartridge

PART NO.: 10303-0001-801 FM CODE: A03, A05

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

CRITICALITY CATEGORY: 1R REACTION TIME: Immediate

NO. REQUIRED: 2 Fwd 30-03-01
6 Aft 30-04-01A DATE: March 1, 2002

CRITICAL PHASES: Separation SUPERCEDES: March 31, 1997

FMEA PAGE NO.: B-43, B-58 ANALYST: S. Finnegan

SHEET 1 OF 4 APPROVED: S. Parvathaneni

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FAILURE MODE AND CAUSES: Rupture/blow out of both NSI Pressure Cartridges (on one bolt) caused by:

- o Improper material
- o Flawed material
- o Thread damage

FAILURE EFFECT SUMMARY: Rupture/blowout of both NSI Pressure Cartridges (on one bolt) causes that bolt not to separate which leads to loss of mission, vehicle and crew due to SRB impacting ET leading to fire and explosion. 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-0027
  - Materials are selected in accordance with JSC SE-R-0006 and MSFC-SPEC-522A per paragraphs 3.1.1 and 3.1.1.5. (Improper Material)
  - After firing, the pressure cartridge shall be capable of withstanding a proof pressure test of 40,000 psig without structural failure per paragraph 3.3.4. (Improper, Flawed Material)

- Qualification
  - Function test at high (+120^{O}F) and low (-10^{O}F) temperature. (All Failure Causes)
  - Proof pressure 40,000 psig. (Improper, Flawed Material)
- Qualification of design is documented in Hi-Shear report 9391360-1262 or in Unidynamics Report F45-059/CM-11W-954 or OEA Aerospace Report 10-5607100 and USA SRBE Similarity Report ER-PYR-88-006.

B. TESTING

- Lot acceptance tests are conducted per
  - Hi-Shear ATP 9391360-869 or Unidynamics 51-3789-ATP-02 or OEA Aerospace ATP 7-5607100
    - Radiographic examination (X-ray) the entire lot. (Flawed Material)
    - Function test 10% of the lot. (All Failure Causes)
- Tensile test of a minimum of three heat treated bar test specimens per ASTM-E8. (Improper, Flawed Material)
- Chemical analysis per ASTM-A-751. (Improper Material)

C. INSPECTION

The following inspections are performed by USA SRBE Quality Assurance and contractor Quality Assurance.

VENDOR RELATED INSPECTION

- Receiving Inspection - All material chem/physical certifications are verified one hundred percent per: (Improper, Flawed Material)
  - USA SRBE Quality Assurance
    USA SRBE Source Inspection Plan 1311
  - Contractor Quality Assurance
    Hi-Shear Corporation Inspection Check Sheet 9391360-1100 or Unidynamics Quality Assurance MGMT/INSP Sys Plan 51-3789-MCD-08 or OEA Aerospace Receiving Inspection Plan 5607101.
- Heat treatment certification is verified by: (Flawed Material)
  - USA SRBE Quality Assurance
    USA SRBE 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.

o Threads are inspected and verified per: (Thread Damage)

- USA SRBE Quality Assurance
  USA SRBE 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.

o Penetrant Inspection is witnessed if done in house per: (Flawed Material)

- USA SRBE Quality Assurance
  USA SRBE 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.

o Lot Acceptance Test: X-ray films are examined by certified vendor personnel and verified by USA SRBE personnel. (All Failure Causes)

- USA SRBE Quality Assurance
  USA SRBE 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.

o Lot review and certification per USA SRBE plan 10PLN-0042.

o Critical Processes/Inspections: The following critical inspection is used to assure the cartridge body is not cracked. (Flawed Material)

- X-ray per HSC ATP 9391360-869 or Unidyamics 51-3789-ATP-02 or OEA Aerospace Acceptance Test Procedure 7-5607100.
- Penetrant inspection per MIL-STD-6866.

KSC RELATED INSPECTION

o Receiving Inspection

- Each NSI Pressure Cartridge in the lot is inspected for cleanliness and damage to o-rings, pins, threads, connectors and body per OMRSD File V, Volume 1, requirement number B000FL.001. (Thread Damage)

o Installation Inspection

- Each NSI Pressure Cartridge is inspected for surface defects (prior to installation into the Forward Separation Bolt), proper torque, and lockwire by SPC Quality Assurance per OMRSD File V, Vol. I requirement no. B000FL.005. (Thread damage, flawed material)

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- Each NSI Pressure Cartridge is inspected for surface defects prior to installation into Aft Separation bolts by USA SRBE per 10REQ-0021 para. 4.2.1. (Thread Damage, Flawed Material)

- Torque NSI pressure cartridge into the separation bolt per OMRSD File V, Vol. I, requirement number B55TQ0.010. (Thread Damage)

- Lockwire the NSI pressure cartridge into the separation bolt per OMRSD File V, Vol. 1, requirement no B55TQ0.020. (Thread Damage)

D. FAILURE HISTORY

o Failure Histories may be obtained from the PRACA database.

E. OPERATIONAL USE

o Not applicable to this failure mode.