

SRB CRITICAL ITEMS LIST

SUBSYSTEM: RECOVERY

ITEM NAME: Nose Cap Thruster

PART NO.: 10304-0001-801

FM CODE: A02

ITEM CODE: 40-01-08

REVISION: Basic

CRITICALITY CATEGORY: 1

REACTION TIME: Immediate

NO. REQUIRED: 3

DATE: March 31, 1999

CRITICAL PHASES: Boost, Separation

SUPERCEDES: March 31, 1998

FMEA PAGE NO.: C-18

ANALYST: D. Wilson/ V. Patel

SHEET 1 OF 3

APPROVED: P. Kalia

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FAILURE MODE AND CAUSES: Premature operation due to structural failure caused by:

- o Broken or corroded shear flange
- o Thread damage on release nut and piston rod

FAILURE EFFECT SUMMARY: Premature operation of one Nose Cap Thruster during boost or separation causes ascent loads to fail the remaining thrusters which in turn allows the nose cap to separate from the SRB. Impact with the ET and Orbiter is possible leading to loss of mission, vehicle and crew. During boost and separation, abnormal aerodynamic forces on the vehicle or impact of the nose cap with the vehicle will cause loss of mission, vehicle and crew.

RATIONALE FOR RETENTION:

A. DESIGN

- o Design specification USBI 10SPC-0028
 - Materials are selected in accordance with JSC SE-R-0006 and MSFC-SPEC-522A per paragraphs 3.1.1 and 3.1.1.6. (Broken or Corroded Shear Flange)
 - The thruster shall be capable of withstanding a limit static tension load of 10,000 pounds applied along the longitudinal axis of the thruster per paragraph 3.3.1. (Broken Shear Flange)
 - The thruster shall meet an overall minimum safety factor of 1.1 on yield strength and 1.4 on ultimate strength per paragraph 3.3.1. (Broken Shear Flange)
- o Shear flange (17-4 PH Stainless Steel per AMS 5643, heat treated to H1025) sized to give shear strength of 15,600-16,200 pounds per drawings 9362792 (Hi-Shear), 51-4908 (Unidynamics) and 12545100 (OEA Aerospace) and flange thickness determination procedures 9362-1021 (Hi-Shear) and 51-4903-MCD-01 (Unidynamics). (Broken Shear Flange)

- o Qualification:
 - Demonstrated resistance to: salt fog, vibration, thermal shock. (Broken or Corroded Shear Flange)
 - Tension load test thrusters to failure: demonstrated conformance to specification load requirement (10,000 pounds plus 1.4 ultimate safety factor). (Broken or Corroded Shear Flange)
- o Qualification test results are documented in Hi-Shear Reports QTR 9362786-1490 and QTR 9362786-1429, in Unidynamics Report 51-4903-QTR-10 and in OEA Aerospace Report 12545.

B. TESTING

- o Lot acceptance testing is conducted per Acceptance Test Procedure ATP 9362786-1034 (Hi-Shear) or 51-4903-ATP-08 (Unidynamics) or 7-12545100 (OEA Aerospace). (All Failure Causes)
 - X-ray all thrusters
 - Vibration test all samples
 - Tension load test
 - Shear flange is proof loaded to 4,000 pounds during assembly per Assembly Operation Sheets 9362786-1 (Hi-Shear) or PC-4903-01 (Unidynamics) or 40-12545100 (OEA Aerospace).

C. INSPECTION

The following inspections are performed.

VENDOR RELATED INSPECTION

- o Receiving Inspection. Raw material certifications, test reports and heat treatment data are verified one hundred percent. (Broken or Corroded Shear Flange)
 - USBI Quality Assurance
USBI Source Inspection Plan (SIP) 1368
 - Contractor Quality Assurance
Hi-Shear Corporation Inspection Check Sheets 9362786-1099
Unidynamics Receiving Inspection Operations Sheets 51-4903-CP-07.
OEA Aerospace Acceptance Test Procedure ATP 7-12545100
- o Thruster dimensions and threads are inspected by Contractor Quality Assurance and verified by USBI Quality Assurance per: (Thread Damage on Release Nut and Piston Rod)
 - USBI Quality Assurance
USBI SIP 1368
 - Contractor Quality Assurance
Hi-Shear Corporation Inspection Check Sheets 9362786-1099
Unidynamics Receiving Inspection Operations Sheets 51-4903-QCP-07.
OEA Aerospace Acceptance Test Procedure ATP 7-12545100

- o Lot Acceptance Test. Radiographic examination (X-ray) is performed by certified vendor personnel and verified by USBI personnel. Tension load testing is witnessed one hundred percent. (All Failure Causes)
 - USBI Quality Assurance
USBI SIP 1368
 - Contractor Quality Assurance
Hi-Shear Corporation Acceptance Test Procedure 9362786-1034
Unidynamics Acceptance Test Procedure 51-4903-ATP-08.
OEA Aerospace Acceptance Test Procedure ATP 7-12545100
- o Lot review and certification per USBI Plan 10PLN-0028.
- o Critical Processes/Inspections. The following critical processes and inspections are used to assure structural integrity of the Nose Cap Thruster. (All Failure Causes)
 - X-ray per HSC QTP 9362786-4429 or Unidynamics 51-4903-ATP-01 or OEA Aerospace 25-12545100.
 - Shear Flange thickness determination per HSC procedure 9362786-1021 or Unidynamics Procedure 51-4903-MCD-01 or OEA Aerospace procedure 40-12545100. CN 035
 - Shear Flange fluorescent penetrant inspection per HSC drawing 9362792 or Unidynamics drawing 51-4908 or OEA Aerospace 12545100.
 - The thruster body, piston, piston rod, release nut, and cap made from 4340 material magnetic particle inspection per ASTM-E-1444 in accordance with HSC drawings.
 - The thruster body, piston, piston rod, release nut, and cap made from PH13-8Mo material fluorescent penetrant inspection per MIL-STD-6866 in accordance with OEA drawings.
 - Shear Flange acceptance load test per HSC Assembly Operation Sheets 9362786-1 or OEA Aerospace Drawing 12545100. CN 035
 - Tension load test per HSC Acceptance Test Procedure 9362786-1034 or Unidynamics procedure 51-4903-ATP-08 or OEA Aerospace procedure 7-12545100.

KSC RELATED INSPECTION

- o Receiving Inspection

Visual inspection of pyrotechnic device for evidence of damage, degradation, corrosion, misalignment or moisture is performed per OMRSD File V, Vol. 1, requirement number B000FL.005. (All Failure Causes)
(This device is treated the same as a pyro by SPC)

Verify that the Nose Cap Thruster 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 Inspection

Installation of each Nose Cap Thruster is witnessed by USBI. (All Failure Causes)

D. FAILURE HISTORY

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

E. OPERATIONAL USE

- o Not applicable to this failure mode.