SUBSYSTEM: SEPARATION

ITEM NAME: Aft Strut Attachment Fitting (SRB End)

PART NO.: 10176-0010, 10176-0134, 10170-0010, 10170-0011

FM CODE: A01

REVISION: Basic

ITEM CODE: 30-04-01D

CRITICALITY CATEGORY: 1

REACTION TIME: Immediate

NO. REQUIRED: 3

DATE: March 1, 2002

CRITICAL PHASES: Final Countdown, Boost

SUPERCEDES: March 31, 1999

FMEA PAGE NO.: B-62

ANALYST: R. Vaughan/S. Parvathannei

SHEET 1 OF 3

APPROVED: S. Parvathannei

CN 044

FAILURE MODE AND CAUSES: Spherical bearing fails to operate caused by:

- o Galling
- o Corrosion
- o Inadequate dry film lubricant on the spherical surfaces
- o Damaged bearing surfaces

FAILURE EFFECT SUMMARY: Structural damage to the ET leading to fire and explosion with loss of mission, vehicle, and crew.

RATIONALE FOR RETENTION:

A. DESIGN: The aft ET attach strut fittings (SRB end) consist of a strut fitting assembly with an integral spherical seat, a spherical bearing, and an energy absorber.

The spherical bearing and the strut fitting are fabricated from Inconel 718 in accordance with AMS 5664 (Alloy Bars, Forgings, and Rings, Corrosion and Heat Resistant) or AMS 5597 (Alloy Steel, Strip, and Plate, Corrosion and Heat Resistant), as applicable.

The spherical surface of the spherical bearing is coated with a dry film lubricant to preclude any galling or seizure.

The materials used in the design were selected in accordance with 10PLN-0150 (Materials Control and Verification Program Management Plan for SS SRB Program) and MSFC-SPEC-522 (Design Criteria for Controlling Stress Corrosion Cracking).

CN 044

The design allowables are in compliance with MIL-HDBK-5 (Metallic Materials and Elements for Aerospace Vehicle Structures) and MSFC-HDBK-505 (Structural Strength Program Requirements).

The heat treatment operations are in compliance with AMS 5664 (Alloy Bars, Forgings, and Rings, Corrosion and Heat Resistant) and/or AMS 5597 (Alloy Steel, Strip and Plate, Corrosion and Heat Resistant).

The Spherical Bearing (10176-0134-003/004) is qualified by analysis and tested as documented in QTR SST-SC-TR-FR03, SRB/ET Aft Attach Strut Structural Test Final Report under Certificate of Qualification A-STR-7116-1 and Test Report for Strut Fitting Assembly (10170-0010/0011-101) under COQ A-STR-7114-1.

Strength tests were performed on the aft strut attachment fittings under the qualification test program outlined in MSFC document 10A00552. Maximum strut loads were applied.

Lubrication tests were performed to determine the coefficient of friction, both static and dynamic, under applied pressures up to 110,000 PSI. (Inadequate Lubricant, Galling)

B. TESTING: None

C. INSPECTION:

VENDOR RELATED INSPECTIONS

- USA SRBE SIP 1453 controls the USA SRBE QAR inspection requirements at the vendor's facilities. (All Failure Causes)
- Vendor QA and USA SRBE QA verify chemical and physical materials certification and data in accordance with SIP 1453. (Galling, Corrosion)
- Vendor QA and USA SRBE QA verify the dimensional conformance in accordance with SIP 1453. (Damaged Bearing Surfaces)
- USA SRBE QAR verifies proper application of dry film lubricant and proper shipping protection in accordance with SIP 1453. (Inadequate Lubricant)
- USA SRBE QAR performs final inspection per drawing requirements in accordance with SIP 1453. (All Failure Causes)
- Vendor QA and USA SRBE QAR verify heat treat data and charts in accordance with SIP 1453. (Galling)
- Vendor QA and USA SRBE QAR verify eddy current tests, dye penetrant tests, and ultrasonic inspection data in accordance with SIP 1453. (Damaged Bearing Surfaces)

The following critical processes and inspections have been identified:

- Heat treatment operations are in accordance with AMS 5664 and/or AMS 5597 as applicable. (Galling)
- Ultrasonic inspected operations are in accordance with MIL-STD-2154. (Damaged Bearing Surfaces)

- Dye penetrant operations are in accordance with MIL-I-6866. (Damaged Bearing Surfaces)

- Eddy current inspection operations are in accordance with ASTM E-426. (Damaged Bearing Surfaces)

- Application of the dry film lubricant is in accordance with the vendors proprietary process or BOOSTERLUBE^{TM} dry film lubricant application is per 10PRC-0647. Alternately, the application of the ceramic-bonded lubricant is per 10PRC-0575. (Inadequate Lubricant)

PRELAUNCH CHECKOUT RELATED INSPECTIONS

Verify by visual inspection and record all discrepancies per OMRSD File V, Volume 1, requirement no. B08SBO.050. (Damaged Bearing Surfaces)

The OMRSD File V, Vol. I, requirement number BO8ARO.020 requires a verification of the condition of the spherical bearing. (All Failure Causes)

OMRSD File V, Vol. I, requirement number BO8ARO.020 inspects the spherical surface of the bearing for scratches, nicks, gouges, grease and foreign material. (All Failure Causes)

The spherical bearing installation includes verification of proper installation per OMRSD File V, Vol. I requirement no. B08SB0.050. (All Failure Causes)

USA SRBE 10SPC-0131 (Refurbishment Engineering Specifications for Space Shuttle Solid Rocket Booster) visually inspects all bearing surfaces for evidence of galling or breakdown of the lubrication system. (Galling, Inadequate Lubrication)

- Verify condition of the dry film lube on SRB mating surfaces per 10REQ-0021, paragraph 4.6.1.

D. FAILURE HISTORY

- Failure Histories may be obtained from the PRACA database.

E. OPERATIONAL USE

  - Not applicable to this failure mode.