

SRB CRITICAL ITEMS LIST

SUBSYSTEM: RANGE SAFETY COMMAND DESTRUCT

ITEM NAME: Range Safety Battery & Recovery Battery (BST)

PART NO.: 10406-0259-851 Range Safety

FM CODE: A02

10400-0966-851 Recovery

ITEM CODE: 70-11A

REVISION: BASIC

CRITICALITY CATEGORY: 1R

REACTION TIME: Seconds

NO. REQUIRED: 1 and 1

DATE: March 31, 1997

CRITICAL PHASES: Boost

SUPERSEDES: January 16, 1995

FMEA PAGE NO.: F-39E

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SHEET 1 OF 5

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DCN032

DCN032

FAILURE MODE AND CAUSES: Loss of output voltage from Range Safety Battery and recovery battery (requires two failures) caused by:

DCN032

- o Open cells or cells
- o Open connector contacts
- o Shorted cell or cells
- o Contaminated electrolyte
- o Open or short internal to case

FAILURE EFFECT SUMMARY: Loss of destruct capability of one SRB, leading to loss of life or injury to the public. Inability to safe the S&A device during a launch scrub results in a hazard to the flight and ground crews until the S&A device can be accessed and mechanically safed. One success path remains after the first failure. Operation is not affected until both paths are lost.

REDUNDANCY SCREENS AND MEASUREMENTS

1. Pass - Output checked and monitored during SIT, Ordnance Installation and final countdown utilizing voltage and current measurements B55V1625C, B55C1051C, B76V1602C and B76C1050C.
2. Pass - Monitored during flight until SRB separation by voltage and current measurements, B55V1625C, B55C1051C, B76V1602C and B76C1050C.
3. Pass- No known credible causes.

RATIONALE FOR RETENTION:

A. DESIGN

RANGE SAFETY/RECOVERY BATTERY

- o The Range Safety Battery is the power source for the SRB Range Safety Command Destruct System A and is a Silver-Oxide Zinc (AgO-Zn) electrochemical couple design that utilizes 42% Potassium Hydroxide (KOH) for electrolyte.
- o The Recovery Battery is the power source for the SRB Range Safety Command Destruct System B and is a Silver-Oxide Zinc (AgO-Zn) electrochemical couple design that utilizes 42% Potassium Hydroxide (KOH) for electrolyte.
- o The RSS Battery and Recovery Battery were designed and Qualified to the performance and environmental requirements defined in USBI Specification 10SPC-0225 (RSS) and 10SPC-0226 (Recovery). Qualification of the RSS Battery is documented in BST QTP-TBD (COQ TBD) and qualification of the Recovery Battery is documented in BST QTP-TBD (COQ TBD).
- o The RSS Battery is a 14 ampere-hour battery that weights approximately 14 pounds and consists of 22 series connected cells housed in a glass filled nylon case.
- o The Recovery Battery is a 50 ampere-hour battery that weights approximately 45 pounds and consists of 20 series connected cells housed in a glass filled nylon case.
- o Both the RSS and Recovery Batteries are sealed units that have redundant pressure relief capability. Each battery has a pressure relief valve that opens within a range of 7 to 10 psig and reseats by 4 psig minimum. The batteries also have a case to cover o-ring seal that helps maintain sealability and also provides a second escape path for internal pressure. Development tests have shown the battery case to cover o-ring seal will vent internal battery pressure at approximately 25 psig. Each battery is equipped with a MS28889-2 pressurizing valve that allows pressure testing of the battery case and functional testing of the case relief valve.
- o Each battery cell housing is made of polysulfone and contains an Electrode Pack Assembly (positive/negative electrodes, separator and interseparator). Each electrode has redundant leads, which are looped for stress relief.
- o Each cell is a redundantly sealed device that also has pressure relief capability. Redundant seals include a primary and secondary cover to case seal and an o-ring at the cell terminals and pressure relief valve interfaces. The cell pressure relief valve opens within a range of 15 to 20 psig and reseats by a minimum pressure of 2 psig.
- o Each battery manufactured will have a minimum of one lot sample cell electrically load tested and 100% discharged as a part of ATP prior to battery acceptance for shipment.
- o Each battery is manually activated, monitored and tested prior to vehicle installation.

B. TESTING

VENDOR RELATED TESTING
RANGE SAFETY BATTERY (10406-0259-851)
RECOVERY BATTERY (10400-0966-851)

- o Four RSS batteries and four Recovery batteries were qualification tested per BST QTP-0031 and experienced vibration and shock for launch and water impact. A high level of confidence is provided by these tests and periodic audits of manufacturing quality.
- o Perform pull test on cell lead to plate hot forge bond samples per BST WIP-SB-005 and BST WIP-SB-115.
- o Each RSS battery is acceptance tested per ATP TP-0030 and each Recovery battery is acceptance tested per ATP TP-0029.

Applicable tests include:

- Cell acceptance testing (minimum of 1 cell lot sample per battery)
- transient load profile testing
- 100% discharge (capacity verification)

- Battery acceptance testing
- circuit continuity
- circuit isolation

KSC RELATED TESTING

- o The batteries are tested prior to installation per Drawing 10406-0259 and 10400-0966.
- o Battery activation and soak is performed per Drawing 10406-0259 and 10400-0966.
- o Battery power is monitored during SIT, Pad Validation and Ordnance Installation, per OMRSD File V, Vol. I, requirement B55PRO.012 for voltage and current measurements. (All Failure Causes)
- o Battery power is monitored during countdown per OMRSD File II Vol. I, requirement S00FH0.031. (All Failure Causes)
- o Battery D.C. power input circuit resistance is verified per OMRSD File V, Vol. I, requirement B55PRO.030.
- o Battery isolation test is performed prior to installation per Drawing 10406-0259 and 10400-0966. (Shorted Cell or Cells, Short Internal to Case)
- o Battery continuity test is performed prior to installation per Drawing 10406-0259 and 10400-0966. (Open Cell or Cells, Open Connector Contacts)
- o Activate and verify range safety system (closed loop) per OMRSD File II, Vol. I, requirement S00FH0.031, within one hour prior to launch.

- o RSS status check is performed prior to cryo loading with SRB power on per OMRSD File II, Vol. 1, requirement S00FA0.510

The above referenced OMRSD testing is performed every flight.

C. INSPECTION

VENDOR RELATED INSPECTIONS RANGE SAFETY BATTERY/RECOVERY BATTERY

- o Vendor QA inspects lead looping and grooming per WIP-SB-148 and WIP-SB-149. USBI QAR inspects per SIP-1495.
- o Vendor QA inspects all Plate Forge Bonds per WIP-SB-005 and WIP-SB-115. USBI QAR verifies per SIP-1495.
- o Vendor QA inspects for debris at final cell inspection per QS-SB-001. USBI QA verifies per SIP-1495.
- o Vendor QA inspects plates for burrs or sharp edges per WIP-SB-129 and WIP-SB-130. USBI QAR verifies per SIP-1495.
- o Vendor QA inspects terminal soldering per WIP-SB-127 and WIP-SB-143. USBI QAR inspects per SIP-1495.
- o Vendor QA verifies cell weight per WIP-SB-129 and WIP-SB-130. USBI QAR verifies per SIP-1495.
- o Vendor QA inspects soldering of Power Connector per WIP-SB-135. USBI QAR inspects per SIP-1495.
- o Vendor QA inspects for debris at open battery inspection per IIP-001443 and IIP-001444. USBI QAR inspects per SIP-1495.
- o Vendor QA inspects intercell connections and cell orientation per Drawing 001443 and Drawing 001444. USBI QAR inspects per SIP-1495.
- o Vendor QA witnesses torquing of terminal top nuts and battery connectors per MT-1443 and MT-1444. USBI QAR verifies per SIP-1495.
- o Vendor QA witnesses cell pressure test per IP-001408 and IP-001411. USBI QAR verifies per SIP-1495.
- o Vendor QA witnesses continuity and isolation of Power Harness per TP-0030 and TP-0029. USBI QAR witnesses per SIP-1495.
- o Vendor QA inspects material at receiving and verifies material certification. USBI QAR verifies material certification per SIP-1495.

o Critical Processes/Inspections/Operations:

- Hot Forge Bonding per BST WIP-SB-005 and BST WIP-SB-115
- Solder (wires to solder cups) per BST WIP-SB-136
- Hot Solder Timing (wires and component leads) per BST WIP-SB-139
- Solder (cell terminal) per BST WIP-SB-143
- Lead looping per BST WIP-SB-148 and BST WIP-SB-149
- Potting per BST WIP-SB-132 (connectors) and BST WIP-SB-142 (thermistor)
- Crimping per BST WIP-SB-138

KSC RELATED INSPECTIONS

- o SPC performs visual inspection of battery per Drawing 10406-0259 and 10400-0966.
- o Battery strapping configuration is inspected per Drawing 10406-0259 and 10400-0966.

D. FAILURE HISTORY

- o Criticality Category 1R
 - o No SRB failure history for this failure mode.

E. OPERATIONAL USE

- o Not applicable to this failure mode.

F. WAIVER/DAR

- o NONE