

CRITICAL ITEMS LIST

ASSY NOMENCLATURE: ANTI-EXPOSURE GARMENT

SYSTEM: CREW ESCAPE SYSTEM

REVISION

ASSY P/N: 40014G-01

SUBSYSTEM: LAUNCH ENTRY SUIT

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FMEA		NAME, QTY & DRAWING REF DESIGNATION	QTY	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RATIONALE FOR ACCEPTANCE
REF	REV					
3.15.1		ANTI-EXPOSURE GARMENT (1), 189516-02	1/1	<p>3.15.1 Mode: Tear in material</p> <p>Cause: • defective material • overstress</p>	Unable to maintain thermal capabilities	<p>1. DESIGN FEATURES TO MINIMIZE FAILURE MODE</p> <p>a. The garment is protected by the coverall assembly</p> <p>b. The material is gortex and polyurethane</p> <p>2. TEST OR ANALYSIS TO DETECT FAILURE MODE</p> <p>a. <u>Acceptance Testing.</u></p> <p>(1) Leak tested at 3.0 ± 0.2 psig for 15 minutes, 130 0 scc/minute maximum allowable leak rate.</p> <p>(2) Structural test at 5.6 ± 0.2 psig for 15 minutes</p> <p>b. <u>Certification Test.</u></p> <p>(1) Naval Air Development Center cold water testing at 40°F water temperature</p> <p>(2) Live water jumps at Naval Weapons Center, four water jumps.</p> <p>c. <u>Turnaround Test.</u> (In accordance with PIA 23033)</p> <p>(1) Leak tested at 3.0 ± 0.2 psig for 15 minutes, 130 0 scc/minute maximum allowable leak rate</p> <p>(2) The material is gortex and polyurethane.</p> <p>3. INSPECTION</p> <p>a. One hundred percent verification of all cementing and stitching operations</p> <p>b. One hundred percent visual inspection for leakage</p>

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CRITICAL ITEMS LIST

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SYSTEM: CREW ESCAPE SYSTEM

REVISION:

ASSY P/N: 40014G-01

SUBSYSTEM: LAUNCH ENTRY SUIT

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FMEA		NAME, QTY & DRAWING REF DESIGNATION	CRITY	FAILURE MODE AND CAUSE	FAILURE EFFECTION END ITEM	RATIONALE FOR ACCEPTANCE
REF	REV					
3.15.1	1	ANTI-EXPOSURE GARMENT (11, 18951G-02)	1/1	<p>3.15.1 Mode: Tear in material</p> <p>Cause: • defective material • overstress</p>	Unable to maintain thermal capabilities	<p>c. One hundred percent inspection during assembly.</p> <p>d. Inspection of material for defects.</p> <p><u>Turnaround Inspection</u> (In accordance with PIA 23033)</p> <p>a. One hundred percent visual inspection for leakage.</p> <p>b. Inspection of material for defects.</p> <p>4. FAILURE HISTORY</p> <p>Note: This anti-exposure garment is used by the Air Force in high altitude suits for high performance aircraft and Dryden Flight Research Center.</p> <p>5. OPERATIONAL USE</p> <p>a. Operational Effect of Failure - Possible loss of crewmember.</p> <p>b. Crew Action - None.</p> <p>c. Crew Training - Crew is trained in the proper use of all survival gear.</p> <p>d. Mission Constraints - None. Mission would be terminated prior to use of this equipment.</p> <p>e. In-Flight Checkout - None. Crew could not repair or replace a defective garment.</p>

PREPARED BY: R. L. ALLISON

SUPERSEDING DATE:

APPROVED BY: J. O. SCHLOSSER

DATE:

CEE/KES-46

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CRITICAL ITEMS LIST

1. 49005 8/97

REFERENCE DESIGNATOR:
 NAME/QUANTITY: Battery Pack
 DRAWING REFERENCE: 3P0434

PROJECT: Orbiter
 LRU NAME/QUANTITY: Radio/Beacon (AN/PRC-112)
 LRU PART NUMBER: SED39121945

SUBSYSTEM: CEE
 EFFECTIVITY: All Orbiters

FAILURE MODE NUMBER PRC-2.1.3	CRITICALITY 1/3	FAILURE EFFECT	RETENTION RATIONALE
FUNCTION Provides power to AN/PRC-112		END ITEM Radio/Beacon does not function.	<p>1. DESIGN FEATURES TO MINIMIZE FAILURE MODE</p> <p>a. The battery consists of 3 Li/BCR C-Cells which use lithium (Li) as the anode and thionyl chloride (SOCl₂) with 16 percent bromine chloride (BrCl) as the catholyte reacting on an inert carbon cathode to produce an open circuit voltage of 3.9 volts. The normal operating temperature range for the Li/BCR cells is -40 F to 160 F.</p> <p>b. A fiberglass separator material between the positive and negative electrodes is designed to provide ion conduction while insulating against internal shorts.</p> <p>c. The cell contents are contained in a approximately 0.019 inch thick 304L stainless steel case with a 0.093 inch TIG welded lid.</p> <p>2. TEST OR ANALYSIS TO DETECT FAILURE MODE</p> <p><u>Acceptance:</u></p> <p>a. Vendor cell lot certification (acceptance) tests (Boeing FEPC Spec PS2/A FP-DBDD1). A certified lot is defined as a set of cells which has been consecutively made within 4 consecutive calendar days using a single batch of electrolyte mix. Additionally, the cells are made from one batch of anode, cathode, and separator material. To certify a lot, a sample (20 percent minimum) of a lot is subjected to the following test performed by the vendor:</p> <p>(1) <u>Capacity Discharge</u> - one sample (6 percent) of cells is discharged through a 25 ohm load at 70°F until reaching a cutoff voltage of 2 volts. <u>Pass/Fail Criterion</u> - average capacity must be greater than 6.5 ampere-hours. <u>Fuse Check</u> - 4 ampere fuse must blow within 15 seconds at 6 amperes. <u>Over discharge Tolerance</u> - 3 weeks after the discharge test, the cells are over discharged at low current for 16 hours at 160°F with bypass diodes. <u>Pass/Fail Criterion</u> - no venting or rupture of cell material.</p> <p>(2) <u>High Temperature Exposure</u> - a second sample (6 percent) is placed in an oven 200°F for 2 hours. <u>Pass/Fail Criterion</u> - no venting or leakage.</p>
FAILURE MODE AND CAUSE Failure Mode: <u>Internal short resulting venting/explosion.</u> Cause: <ol style="list-style-type: none"> 1. Excessive shock or vibration. 2. Defective separator membrane (manufacturing defect) 		MISSION N/A	
REUNDANCY SCREENS A - N/A B - N/A C - N/A		CREW/VEHICLE Possible loss of crew due to toxic venting/explosion.	
REMAINING PATHS 0 N/A		INTERFACE N/A	
MISSION PHASE ALL	TIME TO EFFECT IMMEDIATE	TIME TO CORRECT N/A	

PREPARED BY: G. Wright

REVISION:

SUPERSEDING DATE:

DATE: 9/91

CRITICAL ITEMS LIST

UNCLASSIFIED

REFERENCE DESIGNATOR:
 NAME/QUANTITY: Battery Pack
 DRAWING REFERENCE: 3DP434

PROJECT: Orbitec
 IRII NAME/QUANTITY: Radio/Beacon (AN/PRC-112)
 LRU PART NUMBER: 5E039127945

SUBSYSTEM: CEE
 EFFECTIVITY: AN/Orbiters

FAILURE MODE NUMBER PRC-2.1.3	CRITICALITY 1/1	FAILURE EFFECT	RETENTION RATIONALE								
FUNCTION Provides power to AN/PRC-112.		END ITEM Radio/Beacon does not function.	(3) <u>Short Circuit tolerance</u> - a third sample (4 percent) is electrically shorted through a load equal to 500 milliohms. <u>Pass/Fail Criterion</u> - no venting or leakage. (4) AQ sample of four cells per lot is subjected to random vibration for 15 minutes/axis prior to being discharged for capacity information. The random vibration testing is identical to that for NASA acceptance in "5" below (5) <u>Visual and open circuit voltage (OCV) tests</u> is performed on 100 percent of delivered cells. (6) Four cells from each lot of the cells is tested to the following spectrum by the vendor are delivered to NASA who subjects them to acceptance vibration test for 15 minutes in each of three mutually perpendicular axes, according to the following spectrum, before being discharged for capacity information <table style="width: 100%; border: none;"> <tr> <td style="text-align: left;">FREQUENCY (Hz)</td> <td style="text-align: left;">LEVEL</td> </tr> <tr> <td>20 to 80</td> <td>+ 3 dB/octave</td> </tr> <tr> <td>80 to 350</td> <td>0 1g/Hz</td> </tr> <tr> <td>350 to 2000</td> <td>-3 dB/octave</td> </tr> </table> The OCV is monitored during testing and a load test is performed after vibration testing is complete.	FREQUENCY (Hz)	LEVEL	20 to 80	+ 3 dB/octave	80 to 350	0 1g/Hz	350 to 2000	-3 dB/octave
FREQUENCY (Hz)	LEVEL										
20 to 80	+ 3 dB/octave										
80 to 350	0 1g/Hz										
350 to 2000	-3 dB/octave										
FAILURE MODE AND CAUSE Failure Mode: Internal short resulting venting/explosion. Cause: <ol style="list-style-type: none"> 1. Excessive shock or vibration. 2. Defective separator membrane (manufacturing defect) 		MISSION N/A*									
REUNDANCY SCREENS A - N/A B - N/A C - N/A		CREW/VEHICLE Possible loss of crew due to toxic venting/explosion.									
REMAINING PATHS - 0 N/A		INTERFACE N/A									
MISSION PHASE ALL	TIME TO EFFECT IMMEDIATE	TIME TO CORRECT N/A									

CERTIFICATION
 During battery certification, the LIBCX cell was evaluated over a variety of performance and off limits test conditions in order to meet the three basic requirements for certification:

- a Capacity performance
- b High Temperature exposure tolerance testing
- c Vibration/shock
- d Altitude (100,000 ft)
- e Offgassing
- f Water proofing (50 ft)

PREPARED BY: G. Wright

REVISION:

SUPERSEDING DATE:

DATE: 9/91

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 ATTACHMENT
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CRITICAL ITEMS LIST

USPSG/STC/17

REFERENCE DESIGNATOR:
NAME/QUANTITY: Battery Pack
DRAWING REFERENCE: 3PD434

PROJECT: Orbiter
LRU NAME/QUANTITY: Radio/Beacon (AM/PRC-112)
LRU PART NUMBER: 56D39823945

SUBSYSTEM: CEE
EFFECTIVITY: All Orbiters

FAILURE MODE NUMBER PRC-2.1.3	CRITICALITY 1/1	FAILURE EFFECT	RETENTION RATIONALE								
FUNCTION Provides power to AM/PRC-112.		END ITEM Radio/Beacon does not function.	<p>The lithium battery cell was subjected to the following vibration tests conducted by EP6/TTA. The battery cells did not experience any failures for the duration of 15 minutes seconds in each 3 axes.</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">FREQUENCY</th> <th style="text-align: left;">LEVEL</th> </tr> </thead> <tbody> <tr> <td>20-150 Hz</td> <td>+ 6 dB/octave</td> </tr> <tr> <td>150-1000 Hz</td> <td>0.1 g²/Hz</td> </tr> <tr> <td>1000-2000 Hz</td> <td>-6 g²/Hz</td> </tr> </tbody> </table> <p>Shock: Testing was according to MIL-STD-810C, Method 516.2, procedure 1, 20g peaks, 11 ms rise, 1 ms decay.</p> <p>TURNAROUND</p> <p>After a battery configuration has been certified, each battery is usable for flight for the length of its shelf life from date of manufacture. This non-rechargeable battery may be reflow as long as it was not activated during flight. Once a battery has had any use (no matter how limited) during a mission, it is removed from inventory and submitted for disposal. Unused batteries are subjected to a visual inspection, DCV, and load test and returned to flight status, provided its shelf life has not expired. The length of its shelf life is to be determined by on-going tests.</p> <p>3. Inspection</p> <p>MANUFACTURING</p> <p>During vendor cell manufacturing/acceptance testing, 100 percent of the cells are manufactured under on-site Defense Contract Administration Services (DCAS) delegation.</p> <ol style="list-style-type: none"> a. Electrode plates and separator material are checked for burrs and misalignment. b. Ohmic resistance across the dry cell terminal is checked. c. Each cell is identified by a serial number. d. After filling the cell with electrolyte and finishing its terminal assembly, each cell is x-rayed in two directions to examine the assembled internal configuration and its terminal assy. which contains a fast blow fuse. 	FREQUENCY	LEVEL	20-150 Hz	+ 6 dB/octave	150-1000 Hz	0.1 g ² /Hz	1000-2000 Hz	-6 g ² /Hz
FREQUENCY	LEVEL										
20-150 Hz	+ 6 dB/octave										
150-1000 Hz	0.1 g ² /Hz										
1000-2000 Hz	-6 g ² /Hz										
FAILURE MODE AND CAUSE Failure Mode: Internal short resulting venting/explosion. Cause: <ol style="list-style-type: none"> 1. Excessive shock or vibration. 2. Defective separator membrane (manufacturing defect) 		MISSION N/A*									
REUNDANCY SCREENS A - N/A B - N/A C - N/A		CREW/VEHICLE Possible loss of crew due to toxic venting/explosion.									
REMAINING PATHS - 0 N/A		INTERFACE N/A									
MISSION PHASE	TIME TO EFFECT	TIME TO CORRECT									
ALL	IMMEDIATE	N/A									

PREPARED BY: G. Wright

REVISION:

SUPERSEDING DATE:

DATE: 9/97

CRITICAL ITEMS LIST

1-1988001-1

REFERENCE DESIGNATOR:
 NAME/QUANTITY: Battery Pack
 DRAWING REFERENCE: 3PD034

PROJECT: Orbiter
 LRU NAME/QUANTITY: Radio/Beacon (AN/PRC-112)
 LRU PART NUMBER: 5E029121945

SUBSYSTEM: CEE
 EFFECTIVITY: AN Orbiters

FAILURE MODE NUMBER PRC-2.1.3	CRITICALITY 1/1	FAILURE EFFECT	RETENTION RATIONALE
FUNCTION Provides power to AN/PRC-112.		END ITEM Radio/Beacon does not function.	e After filling all the cells are put in an oven at 160° F for 2 hours followed by : (1) OCV test - must be greater than 3.85 volts. (2) Load test - must be greater than 3.5 volts. (3) Size and weight check to verify no swelling or venting occurred. NOTE: Visual on OCV inspections are done on 100 percent of the delivered cells. All the tests conducted in part 2 and inspections in part 3 serve to prevent the occurrence of internal shorts in flight batteries containing these cells by product quality control during manufacturing and by parametric screening during cell acceptance testing. 4. Failure History None reported. As of May 1991, over 700 LIBEX cells have been flown in the Shuttle Orbiter without a hazardous event occurring. No internal shorts have been detected in more than 4,350 cells tested at JSC. Furthermore, no such failures have been reported in any of over 2 million cells manufactured by the vendor. 5. Operational Use. a <u>Operational Effect of Failure</u> Possible loss of crewmember b <u>Crew Action</u> None identified. c <u>Crew Training</u> The crew will be trained to perform a preuse visual and subjective temperature checkout of the battery when possible. d <u>Mission Constraints</u> None identified. e <u>In-Flight Checkout</u> A preuse visual and subjective temperature checkout of the battery will be performed when possible.
FAILURE MODE AND CAUSE Failure Mode: Internal short resulting venting/explosion. Cause: <ol style="list-style-type: none"> 1. Excessive shock or vibration. 2. Defective separator membrane (manufacturing defect) 		MISSION N/A*	
REDUNDANCY SCREENS A - N/A B - N/A C - N/A		CREW/VEHICLE Possible loss of crew due to toxic venting/explosion.	
REMAINING PARTS - 0 N/A		INTERFACE N/A	
MISSION PHASE	TIME TO EFFECT	TIME TO CORRECT	
ALL	IMMEDIATE	N/A	

PREPARED BY: G. Wright

REVISION:

SUPERSEDING DATE

DATE: 9/91