CRITICAL ITEMS LIST

ASSY NOMENCLATURE: *MAGAZINE/LANYARD ASSEMBLY* SYSTEM: *CREW ESCAPE SYSTEM* REVISION:

ASSY P/N: *SED27101417* SUBSYSTEM: *POLE CREW ESCAPE SYSTEM*

FMEA REF	FMEA REV	NAME, QTY & DRAWING REF DESIGNATION	CRIT'Y	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RATIONALE FOR ACCEPTANCE
9.1.2		LANYARD ASSEMBLY (1), SED33103504	1/1	9.1.2 Mode: Lanyard fails to stroke within required load range Cause: • Defective material	Damage to or loss of primary pole, remaining crewmembers may be unable to bailout using pole	1. Design Features. The design features which minimize the probability of this failure mode are: a. The lanyards are designed to stroke at loads in a range average between 700 to 1000 pounds. b. The lanyards are fabricated from Kevlar webbing material which is stitched together with break away Nomex thread material. c. The number of stitches and the acceptance criteria for the lanyard seams and stitches are identified on the design drawings. The materials used for fabrication are identified on the design drawings which are approved by the NASA JSC Materials Branch (ES5) 2. Testing/Analyses. a. <u>Acceptance Tests</u>. (1) Acceptance vibration test (AVT) • Duration: 3 minutes/axis • Levels: 20 - 80 Hz, increasing 3dB/Octave 80 - 350 Hz at 0.04 g^2/Hz 350 - 2000 Hz, decreasing 3dB/Octave (2) Lanyard fabrication sample tests • Proof test of lanyard fabrication material to two times limit load (2000 pounds) by pull test prior to stitching. • Stitch and seam sample pull tests performed at a 20 inch per minute rip rate on sample unit at the beginning of each production run to verify process control and certify procedure. Six lanyards are tested to verify 72 flight lanyards.

PREPARED BY: *R. HEISKALA* SUPERSEDING DATE: APPROVED BY: *T. FELISCHEK* DATE

FCE-962

CRITICAL ITEMS LIST

ASSY NOMENCLATURE: *MAGAZINE/LANYARD ASSEMBLY* SYSTEM: *CREW ESCAPE SYSTEM* REVISION:

ASSY P/N: *SE027101417* SUBSYSTEM: *POLE CREW ESCAPE SYSTEM*

FMEA REF	FMEA REV	NAME, QTY & DRAWING REF DESIGNATION	CRIT'Y	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RATIONALE FOR ACCEPTANCE
9.1.2		LANYARD ASSEMBLY (1), SED33103584	1/1	9.1.2 Mode: Lanyard fails to stroke within required load range Cause: • Defective material	Damage to or loss of primary pole, remaining crewmembers may be unable to bailout using pole	b. Certification Tests. (These tests were performed at the system level.) (1) Qualification acceptance vibration tests (QAVT). • Duration: 5 times AVT, 15 minutes/axis • Levels: 20 - 80 Hz, increasing 3dB/Octave 80 - 350 Hz, at 0.067 g^2/Hz 350 - 2000 Hz, decreasing 3dB/Octave (2) Flight random vibration tests, 48 minutes/axis, in 4 segments as follows: • Segment No. / No. of Missions / Vibration Duration/Axis 1 / 6 / 173 sec. 2 / 19 / 548 sec. 3 / 25 / 720 sec. 4 / 50 / 1440 sec. • Duration: Segment dependent (48 minutes/axis) • Levels: 20 - 150 Hz, increasing 6dB/Octave 150 - 1000 Hz, at 0.03 g^2/Hz 1000 - 2000 Hz, decreasing 6dB/Octave (3) Thermal testing (by analyses) • Ground operations: 35 to 120°F • Normal operations: 65 to 90°F • Ascent/entry transients: 95°F maximum peak • Ferry flight: Not applicable; PCES will be removed from Orbiter • Launch/landing emergency escapes via PCES: 12 to 75°F • Temperature (structure): 120°F maximum (4) Fungus (by analysis) • Non-nutrient to fungi in accordance with MIL-STD 810D, method 508.3 or materials adequately treated (refer to MF0004-014C, paragraph 3.1.1.c.)

PREPARED BY: *R. HEISKALA* SUPERSEDING DATE APPROVED BY: *F. FELISCHER* DATE:

ATTACHMENT 1
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CRITICAL ITEMS LIST

ASSY NOMENCLATURE: *MAGAZINE/LANYARD ASSEMBLY* SYSTEM: *CREW ESCAPE SYSTEM* REVISION:

ASSY P/N: *SED27101417* SUBSYSTEM: *POLE CREW ESCAPE SYSTEM* PAGE 68 OF 78

FMEA REF	FMEA REV	NAME, QTY & DRAWING REF DESIGNATION	CRIT'Y	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RATIONALE FOR ACCEPTANCE
9 1 2		LANYARD ASSEMBLY (1), SED33103504	I/1	9.1.2 Mode: Lanyard fails to stroke within required load range . Cause: • Defective material	Damage to or loss of primary pole, remaining crewmembers may be unable to bailout using pole	(5) Humidity (by analysis) • The PCES materials list was analyzed to certify compliance with MF0004-014, paragraph 3.1.1 e (6) Salt spray (by analysis). • The PCES materials list was analyzed to certify compliance with MF0004-014, paragraph 3.3.3.7. (7) Sand/dust (by analysis). • Sand - diameter 0.0031 to 0.039 inches - suspended sand 1.2 lbs per cubic ft. - wind speed 33 ft/sec - hardness 7 to 8 Moh scale • Dust - diameter 0.0000039 to 0.003 inches - suspended dust 3.7 to 0.[illegible] lb /cu ft - wind speed 33 ft/sec. - hardness 7 to 8 Moh scale (8) Additional certification tests/analyses • Transportation - packaging, shock, and vibration: Packaging designed and protective procedures developed in accordance with FED-STD 101 • On/off cycle life test (by testing): PCES deployed 20 times, refer to (4) above • Transient vibration (by analysis) • Structural fatigue (by analysis) • Corrosion: (by analysis) • Handling shock, crash shock, and landing shock (by analyses) • Acceleration and cabin atmosphere (by analysis) • Full life and limited life certification (by analysis) c <u>Certification Tests at the LRU Level</u> (1) Lanyard lot sample seam pull test. • Proof test of lanyard fabrication material to two times limit load (2000 pounds) by pull test prior to stitching. • Stitch and seam sample pull tests performed at a 20 inch per minute rip rate on sample unit at the beginning of each production run to verify process control and certify procedure. Six lanyards are tested to verify 72 flight lanyards.

PREPARED BY: *R. HEISKALA* SUPERSEDING DATE: APPROVED BY *T. PELISCHEK* DATE

92-25-065

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ATTACHMENT 1
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CRITICAL ITEMS LIST

ASSY NOMENCLATURE: *MAGAZINE/LANYARD ASSEMBLY* SYSTEM: *CREW ESCAPE SYSTEM* REVISION:

ASSY P/N: *SED27101417* SUBSYSTEM: *POLE CREW ESCAPE SYSTEM*

FMEA REF	FMEA REV	NAME, QTY & DRAWING REF DESIGNATION	CRIT'Y	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RATIONALE FOR ACCEPTANCE
9.1.2		LANYARD ASSEMBLY (1), SED33103504	I/1	9.1.2 Mode: Lanyard fails to stroke within required load range Cause: • Defective material	Damage to or loss of primary pole, remaining crewmembers may be unable to bailout using pole	d. Turnaround Test. The PCES end item is removed after each flight and the lanyards are visually inspected, per OMRSD requirements, prior to reinstallation for each mission. The inspections include visual examination for signs of deterioration or damage to thread or fabric, roller bearings seizing and snap hook function. 3. Inspection/QA/Manufacturing. a. All PCES fabrication, assembly, and test activities were performed under the jurisdiction of the NASA JSC Quality Assurance (QA) Division in accordance with JSCM 5312 SR&QA Manual Requirements. QA surveillance was provided for procurement, planning, processing, fabrication, assembly, certification testing, and acceptance testing. Mandatory inspection points were employed at appropriate points in the fabrication, assembly and acceptance process b. Receiving inspection verified that materials provided by suppliers were as identified on the procurement documents, and that data was provided attesting to the traceability and acceptability of materials and components received from suppliers c. All lanyard assembly components were fabricated of aerospace approved materials and are assembled by trained technicians. QA inspections performed during the fabrication, assembly, testing, and acceptance process prior to delivery verified: (1) Use of correct, approved materials (2) Dimensional tolerances specified on design drawings (3) One hundred percent visual inspection for broken thread and fabric after assembly is stitched (4) Cleaning of parts and assemblies in accordance with JSC Manual 5322, paragraph 7.1.3 to level GC (5) Proper application of lubricant to bearings, alignment, and fitting of bearings in accordance with drawing requirements

PREPARED BY: *R. HEISKALA* SUPERSEDING DATE: APPROVED BY: *T. PELISCHEK* DATE: 6/1 of 70

CRITICAL ITEMS LIST

ASSY NOMENCLATURE: *MAGAZINE/LANYARD ASSEMBLY* SYSTEM: *CREW ESCAPE SYSTEM* REVISION:

ASSY P / N: *SED27103417* SUBSYSTEM: *POLE CREW ESCAPE SYSTEM*

FMEA REF	FMEA REV	NAME, QTY & DRAWING REF DESIGNATION	CRIT'Y	FAILURE MODE AND CAUSE	FAILURE EFFECT ON: END ITEM	RATIONALE FOR ACCEPTANCE
9.1.2		LANYARD ASSEMBLY (1), SED33103504	1/1	9.1.2 Mode: Lanyard fails to stroke within required load range Cause: • Defective material	Damage to or loss of primary pole, remaining crewmembers may be unable to bailout using pole	(6) Application of part number identification in accordance with JSC-SPEC-M1. d. Turnaround. The PCES end item is removed after each flight and the lanyards are visually inspected, per OMRSD requirements, prior to reinstallation for each mission. The inspections include visual examination for signs of deterioration or damage to thread or fabric, roller bearings seizing and snap hook function. 4. Failure History. The lanyard is a newly designed hardware item and has no failure history. 5. Operational Use. a. Operational Effect of Failure. Possible structural failure of pole, probable loss of crew. b. Crew Action. None. c. Crew Training. Not applicable. d. Mission Constraints. None. Mission would be terminated prior to use of the lanyards. e. In-Flight Checkout. None.

PREPARED BY: *R. HEISKALA* SUPERSEDING DATE: APPROVED BY *T. PEUSCHEK* DATE

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