CRITICAL ITEMS LIST

ASSY NOMENCLATURE: *HOUSING ASSEMBLY*

ASSY P/N: *SED27101279*

SYSTEM: *CREW ESCAPE SYSTEM*

SUBSYSTEM: *POLE CREW ESCAPE SYSTEM*

REVISION:

FMEA REF	FMEA REV	NAME, QTY & DRAWING REF DESIGNATION	CRIT'Y	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RATIONALE FOR ACCEPTANCE
8 1 1		BEARING BLOCK (1), SED27101308	2/1R	8.1.1 Mode: Bearing block seizes Cause: • Contamination • Bearings seize • Defective material	Partial deployment of pole, pole will not deploy if ratchet assembly fails	1. Design Features. The design features which minimize the probability of this failure mode are. a. The PCES bearing block assembly was designed to a safety factor equal to or greater than 1.4 for all mission phases. b. The fracture critical components of the bearing block assembly are identified on the design drawings. PCES fracture control activities were established and implemented in accordance with a formal fracture control plan, LEMSCO document 25076. c. The bearing block is machined from 6061-T6 aluminum in accordance with specification QQ-A-250/11. The part is anodized after machining and liquid dye penetrant inspected in accordance with MIL-STD-6866 (with no cracks permissible). d. The bearing block assembly is installed in the PCES housing assembly which is adequately sealed against the entry of contamination. The design of the assembly is such that it is unlikely that anything less than a relatively large object, such as a loose screw, could jam the bearings and rollers. The PCES design requires torquing, thread locking compound, and/or self-locking features on fasteners which minimizes this possibility. e. The roller pins are retained in the assembly by retainer blocks fastened with self-locking screws. f. The bearing block bearings and rollers are lubricated with Mobil No. 28 (manufactured to MIL-A-72832) during assembly.

PREPARED BY: *R. HEISKALA*

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8.1.1		BEARING BLOCK (1), SED27101308	2/1R	8.1.1 Mode: Bearing block seizes Cause: • Contamination • Bearings seize • Defective material	Partial deployment of pole, pole will not deploy if ratchet assembly fails	2. Testing/Analyses. a. Acceptance Tests. (1) Acceptance vibration test (AVT). • Duration. 3 minutes/axis • Levels: 20 - 80 Hz, increasing 3dB/Octave 80 - 350 Hz at 0.04g²/Hz 350 - 2000 Hz, decreasing 3dB/Octave (2) Functional test (prior to and after AVT). • Initial process, controlled PCES deployment and recocking • Noncontrolled deployment with equivalent aerodynamic loads on pole tip • Manual deployment with ratchet assembly 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 0.067g²/Hz 350 - 2000 Hz, decreasing 3dB/Octave (2) Functional test (after QAVT) • Controlled deployment and recocking of PCES • Noncontrolled deployment with equivalent aerodynamic loads on the pole tip

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

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B.1.1		BEARING BLOCK (1), SED27101308	2/1R	B.1.1 Mode: Bearing block seizes Cause: • Contamination • Bearings seize • Defective material	Partial deployment of pole, pole will not deploy if ratchet assembly fails	(3) 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 0.03g²/Hz 1000 - 2000 Hz, decreasing 6dB/Octave (4) Life cycle tests. • 14 controlled deployments • 6 noncontrolled deployments (which stroke the energy absorbers) (5) Design limit load and ultimate limit load tests. • With PCES fully deployed, a series of load ramps will be applied to the pole up and verified no yielding below 100 percent of design limit • With PCES fully deployed, a series of load ramps will be applied to the pole up and verified no failure below 140 percent (1.4 safety factor) of design limit loads (6) 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

PREPARED BY *R. NIEMKALA*

SUPERSEDING DATE:

APPROVED BY *E. PELISCHEK*

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ASSY P/N: *SED27103279*

SYSTEM: *CREW ESCAPE SYSTEM*

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SUBSYSTEM: *POLE CREW ESCAPE SYSTEM*

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8.1.1		BEARING BLOCK (1), SED27101308	2/1R	8.1.1 Mode: Bearing block seizes Cause: • Contamination • Bearings seize • Defective material	Partial deployment of pole, pole will not deploy if ratchet assembly fails	(7) 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.) (8) Humidity (by analysis) • The PCES materials list was analyzed to certify compliance with MF0004-014, paragraph 3.1.1 e (9) Salt spray (by analysis). • The PCES materials list was analyzed to certify compliance with MF0004-014, paragraph 3.1.3.7 (10) 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 0.7 lb /cu. ft - wind speed 33 ft/sec - hardness 7 to 8 Moh scale (11) 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)

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6 1.1		BEARING BLOCK (1), SED27101308	2/1R	B.1.1 Mode: Bearing block seizes Cause: • Contamination • Bearings seize • Defective material	Partial deployment of pole, pole will not deploy if ratchet assembly fails	c. Turnaround Testing. Each PCES is subjected to a controlled functional deployment test, per OMMSD requirements, every 10 missions or every 2 years, whichever occurs first. 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 bearing block 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 verified. (1) Use of correct, approved materials (2) Dimensional tolerances specified on design drawings (3) Removal of all burrs and sharp edges (4) Cleaning of parts and assemblies in accordance with JSC Manual 5322, paragraph 7.1.3 to level GC (5) Inspection of surfaces assuring proper surface preparation prior to the application of special surface coatings (6) Liquid dye penetrant inspection of the bearing block in accordance with Mil. STD 6866 after machining, with no cracks permissible

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8.1.1		BEARING BLOCK (1), SED27101308	2/1R	8.1.1 Mode: Bearing block seizes Cause: • Contamination • Bearings seize • Defective material	Partial deployment of pole, pole will not deploy if ratchet assembly fails	(7) Anodizing of the bearing block as specified on engineering drawings. (8) Proper installation of bearings and rollers, torquing of threaded fasteners, application of lubricant to bearings, controlled application of thread locking compounds, alignment, and fitting of bearings in accordance with drawing requirements. (9) Bearing block functional performance in accordance with TPS instructions, post-test visual inspection for damage, and proper packaging of the PCES for transport d Turnaround. The PCES end item is removed after each flight and visually inspected, per OMRSD requirements, prior to reinstallation for each mission. The 2 year inspections include visual examination for signs of deterioration, damage, corrosion, and/or contamination, and performance of controlled deployment tests, and recocking 4. Failure History. The bearing block is a newly designed hardware item and has no failure history. 5. Operational Use. a. Operational Effect of Failure. Probable loss of crew if manual ratchet fails. b Crew Action Deploy pole using manual ratchet. c Crew Training. Crew is trained to use the manual ratchet. d Mission Constraints. None. Mission would be terminated prior to use of this equipment e In Flight Checkout None.

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SUPERSEDING DATE:

PCES - 004

APPROVED BY *T. PELISCHEK*

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