

CRITICAL ITEMS LIST

ASSY NOMENCLATURE: PRIMARY POLE ASSEMBLY

SYSTEM: CREW ESCAPE SYSTEM

REVISION:

ASSY P/N: SED27101408

SUBSYSTEM: POLE CREW ESCAPE SYSTEM

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FMEA		NAME, QTY & DRAWING REF DESIGNATION	CRITY	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RATIONALE FOR ACCEPTANCE
REF	REV					
7.2.1		ROLLER BLOCK ASSEMBLY (1), SED27101310	2/1R	<p>7.2.1 Mode: roller block seizes</p> <p>Cause:</p> <ul style="list-style-type: none"> • Contamination • Bearings seize 	Primary pole will not deploy if ratchet assembly fails to deploy primary pole	<p>1. Design Features. The design features which minimize the probability of this failure mode are:</p> <ul style="list-style-type: none"> a. The roller block assembly is fabricated of materials reviewed and approved by the Materials Branch. b. The roller block is designated as a fracture critical item on the design drawings. Fracture control activities were established and implemented in accordance with a formal fracture control plan, LEMSCO document 75076. c. The roller block is machined from AL 7075-T7351 material in accordance with specification QQ-A-250/11. The part is anodized in accordance with MIL-A-8625, class II requirements after machining and liquid dye penetrant inspected; no cracks are permissible. d. The roller block assembly is installed in the PCES housing assembly which protects against the entry of external contamination. The design of the roller block bearings is such that it is unlikely that anything less than a relatively large foreign object such as a loose screw from another assembly could jam the bearings and cause them to seize. The PCES design requires torquing and/or thread locking compounds and self-locking fasteners which minimizes this probability. e. The roller block rollers and bearings are lubricated with Mobil No. 28 (manufactured to MIL-A-72632) during installation. The roller pins are retained with set screws torqued to 70 inch lbs. and secured by locking tabs.

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7.2.1		ROLLER BLOCK ASSEMBLY (1), SED27101310	2/1R	<p>7.2.1 Mode: Roller block seizes</p> <p>Cause:</p> <ul style="list-style-type: none"> Contamination Bearings seize 	<p>Primary pole will not deploy if ratchet assembly fails to deploy primary pole</p>	<p>2. Testing/Analyses.</p> <p>a. <u>Acceptance Tests</u></p> <p>(1) Acceptance vibration test (AVT).</p> <ul style="list-style-type: none"> Duration: 3 minutes/axis Levels: 20 - 80 Hz, increasing 3dB/Octave 80 - 350 Hz at 0.04g²/Hz 350 - 2000 Hz, decreasing 3dB/Octave <p>(2) Functional test (prior to and after AVT).</p> <ul style="list-style-type: none"> Initial process, controlled PCEES deployment and recocking Noncontrolled deployment with equivalent aerodynamic loads on pole tip Manual deployment with ratchet assembly <p>b. <u>Certification Tests</u> (These tests were performed at the system level)</p> <p>(1) Qualification acceptance vibration tests (QAVT)</p> <ul style="list-style-type: none"> 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 <p>(2) Functional test (after QAVT)</p> <ul style="list-style-type: none"> Controlled deployment and recocking of PCEES Noncontrolled deployment with equivalent aerodynamic loads on the pole tip

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FMEA		NAME, QTY & DRAWING REF DESIGNATION	CRIT'Y	FAILURE MODE AND CAUSE	FAILURE EFFECT OR EVIDENCE	RATIONALE FOR ACCEPTANCE															
REF	REV																				
7.2.1		ROLLER BLOCK ASSEMBLY (1), SED27101310	Z/IR	<p>7.2.1 Mode: Roller block seizes</p> <p>Cause:</p> <ul style="list-style-type: none"> • Contamination • Bearings seize 	<p>Primary pole will not deploy if ratchet assembly fails to deploy primary pole</p>	<p>(3) Flight random vibration tests, 48 minutes/axis, in 4 segments as follows.</p> <table border="1"> <thead> <tr> <th>Segment No.</th> <th>No. of Missions</th> <th>Vibration Duration/Axis</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>6</td> <td>171 sec.</td> </tr> <tr> <td>2</td> <td>19</td> <td>548 sec.</td> </tr> <tr> <td>3</td> <td>25</td> <td>720 sec.</td> </tr> <tr> <td>4</td> <td>50</td> <td>1440 sec.</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • 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 <p>(4) Life cycle tests</p> <ul style="list-style-type: none"> • 14 controlled deployments • 6 noncontrolled deployments (which stroke the energy absorbers) <p>(5) Design limit load and ultimate limit load tests</p> <ul style="list-style-type: none"> • With PCES fully deployed, a series of load ramps will be applied to the pole tip 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 tip and verified no failure below 100 percent (1.4 safety factor) of design limit loads <p>(6) Thermal testing (by analyses).</p> <ul style="list-style-type: none"> • 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 	Segment No.	No. of Missions	Vibration Duration/Axis	1	6	171 sec.	2	19	548 sec.	3	25	720 sec.	4	50	1440 sec.
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REF	REV					
7.2.1		ROLLER BLOCK ASSEMBLY (1), SED27101310	2/IR	<p>7.2.1 Mode: Roller block seizes</p> <p>Cause: • Contamination • Bearings seize</p>	Primary pole will not deploy if ratchet assembly fails to deploy primary pole	<p>(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)</p> <p>(8) Humidity (by analysis). • The PCES materials list was analyzed to certify compliance with MF0004-014, paragraph 3.1.1.e</p> <p>(9) Salt spray (by analysis). • The PCES materials list was analyzed to certify compliance with MF0004-014, paragraph 3.3.3.7</p> <p>(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 0.000039 to 0.001 inches - suspended dust 3.7 to 0.1 lb/cu ft - wind speed 33 ft/sec - hardness 7 to 8 Moh scale</p> <p>(11) Additional certification test/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)</p>

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7.2.1		ROLLER BLOCK ASSEMBLY (1), SED27101310	2/1R	<p>7.2.1 Mode: Roller block seizes</p> <p>Cause:</p> <ul style="list-style-type: none"> • Contamination • Bearings seize 	Primary pole will not deploy if ratchet assembly fails to deploy primary pole	<p>c. <u>Turnaround Testing</u>: Each PCEs is subjected to a controlled functional deployment test, in per DMRSD requirements, every 10 missions or every 2 years, whichever occurs first.</p> <p>3. <u>Inspection/QA/Manufacturing</u>.</p> <p>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.</p> <p>b. Receiving inspection verified that the rollers, bearings, and other materials provided by suppliers were as identified on the design drawings and procurement documents, and that data was provided attesting to their traceability and acceptability.</p> <p>c. All roller block components were fabricated of aerospace approved materials and assembled by trained technicians. QA inspections performed during the fabrication, assembly, testing, and acceptance process verified</p> <ol style="list-style-type: none"> (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 roller block in accordance with MIL-STD 8836 after machining, with no cracks permissible

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