

# CRITICAL ITEMS LIST

ASSY NOMENCLATURE: RATCHET ASSEMBLY

SYSTEM: CREW ESCAPE SYSTEM

REVISION:

ASSY P/N: 5ED27101316

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					
4.1.1		RATCHET ASSEMBLY (1), 5ED27101316	1/1	<p>4.1.1 Mode: Inhibits pole deployment</p> <p>Cause:</p> <ul style="list-style-type: none"> <li>■ Contamination</li> <li>■ Cant plate jams on pole</li> </ul>	Unable to deploy pole if cant plate jams on pole	<p>1. Design Features. The design features which minimize the probability of this failure mode are</p> <ul style="list-style-type: none"> <li>a. The ratchet handle, bracket handle, cover, and mandrel are fabricated of 7075-T73 aluminum alloy in accordance with specification QQ-A-250-12; the springs from CRES 302 in accordance with specification A313-43, the pin from 15-5h stainless steel in accordance with AMS 5659, and the ratchet lever and cant plates from CRES material in accordance with AMS 5862. The aluminum components are anodized and the steel components are passivated after fabrication.</li> <li>b. The ratchet lever and ratchet handle are assembled with MAS close tolerance bolts and self-locking nuts selected in accordance with MIL-HBK-5 requirements and in accordance with a minimum 1.4 factor of safety.</li> <li>c. Everlube lubricant is applied to the ratchet lever slot and cant plates during assembly to minimize friction, wear, and binding.</li> <li>d. The ratchet has a minimum 5.5:1 ratio of applied force.</li> <li>e. A NOMEX material protective boot is installed at the ratchet assembly/housing assembly interface to prevent entry of contaminants into the PCES.</li> </ul>

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4.1.1		RATCHET ASSEMBLY (1), SED27101316	1/1	<p>4.1.1 Mode: Inhibits pole deployment</p> <p>Cause:</p> <ul style="list-style-type: none"> <li>• Contamination</li> <li>• Cant plate jams on pole</li> </ul>	Unable to deploy pole if cant plate jams on pole	<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>173 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"> <li>• Duration: Segment dependent (48 minutes/axis)</li> <li>• Levels: 20 - 150 Hz, increasing 6dB/Octave 150 - 1000 Hz, at 0.03g/Hz 1000 - 2000 Hz, decreasing 6dB/Octave</li> </ul> <p>(4) Life cycle tests</p> <ul style="list-style-type: none"> <li>• 14 controlled deployments</li> <li>• 6 noncontrolled Deployments (which stroke the energy absorbers)</li> </ul> <p>(5) Thermal testing (by analysis)</p> <ul style="list-style-type: none"> <li>• Ground operations: 35 to 120°F</li> <li>• Normal operations: 65 to 90°F</li> <li>• Ascent/entry transients: 95° maximum peak</li> <li>• Ferry flight: Not applicable; PCES will be removed from Orbiter</li> <li>• Launch/landing emergency escapes via PCES: 12 to 75°F</li> <li>• Temperature (structure): 120°F maximum</li> </ul> <p>(6) Fungus (by analysis)</p> <ul style="list-style-type: none"> <li>• Non-nutrient to fungi in accordance with MIL-STD-810D, method 508.3 or materials adequately (refer to MFD004-014C, paragraph 3.1.1 c)</li> </ul>	Segment No	No. of Missions	Vibration Duration/Axis	1	6	173 sec	2	19	548 sec	3	25	720 sec	4	50	1440 sec.
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4.1.1		RATCHET ASSEMBLY (1), SED27101316	1/1	<p>4.1.1 Mode: Inhibits pole deployment</p> <p>Cause:</p> <ul style="list-style-type: none"> <li>• Contamination</li> <li>• Cant plate jams on pole</li> </ul>	<p>Unable to deploy pole if cant plate jams on pole</p>	<p>(7) Humidity (by analysis).</p> <ul style="list-style-type: none"> <li>• The PCES materials list was analyzed to certify compliance with MF0004-014, paragraph 3.1.1 e</li> </ul> <p>(8) Salt spray (by analysis)</p> <ul style="list-style-type: none"> <li>• The PCES materials list was analyzed to certify compliance with MF0004-014, paragraph 3.3.7</li> </ul> <p>(9) Sand/dust (by analysis).</p> <ul style="list-style-type: none"> <li>• Sand                             <ul style="list-style-type: none"> <li>- diameter 0.0031 to 0.039 inches</li> <li>- suspended sand 1.2 lbs per cubic ft.</li> <li>- wind speed 33 f/sec</li> <li>- hardness 7 to 8 Moh scale</li> </ul> </li> <li>• Dust                             <ul style="list-style-type: none"> <li>- diameter 0.000039 to 0.003 inches</li> <li>- suspended dust 3.7 to 8<sup>2</sup> lb/cu. ft.</li> <li>- wind speed 33 f/sec.</li> <li>- hardness 7 to 8 Moh scale</li> </ul> </li> </ul> <p>(10) Additional certification tests/analyses.</p> <ul style="list-style-type: none"> <li>• Transportation - packaging, shock, and vibration: Packaging designed and protective procedures developed in accordance with FED-STD-101</li> <li>• On/off cycle life test (by testing): PCES deployed 20 times, refer to (4) above</li> <li>• Transient vibration (by analysis)</li> <li>• Structural fatigue (by analysis)</li> <li>• Corrosion: (by analysis)</li> <li>• Handling shock, crash shock, and landing shock (by analyses)</li> <li>• Acceleration and cabin atmosphere (by analysis)</li> <li>• Full life and limited life certification (by analysis)</li> </ul> <p>• Turnaround Testing: Each PCES is subjected to a controlled functional deployment test, per OMRSO requirements, every 10 missions or every 7 years, whichever occurs first, and the ratchet assembly is exercised during deployment test</p>

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4.1.1		RATCHET ASSEMBLY (1), SED27101316	1/1	<p>4.1.1 Mode: Inhibits pole deployment</p> <p>Cause:</p> <ul style="list-style-type: none"> <li>• Contamination</li> <li>• Cant plate jams on pole</li> </ul>	Unable to deploy pole if if cant plate jams on pole	<p>3. Inspection/QA/Manufacturing.</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&amp;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 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.</p> <p>c. All assembly components were fabricated of aerospace approved materials by trained technicians. QA inspections performed during the fabrication, assembly, testing, and acceptance process prior to delivery verified:</p> <ol style="list-style-type: none"> <li>(1) Use of correct, approved materials</li> <li>(2) Dimensional tolerances specified on design drawings</li> <li>(3) Removal of all burrs and sharp edges</li> <li>(4) Cleaning of parts and assemblies in accordance with JSC Manual 5322, paragraph 7.1.3 to level GC.</li> <li>(5) Inspection of surfaces assuring proper surface preparation prior to application of special surface coatings</li> <li>(6) Anodizing of aluminum surfaces as specified on engineering drawings, passivating of steel components, as defined by drawings.</li> </ol>

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4.1.1		RATCHET ASSEMBLY (1), SED27101316	1/1	<p>4.1.1 Mode: Inhibits pole deployment</p> <p>Cause:</p> <ul style="list-style-type: none"> <li>• Contamination</li> <li>• Cant plate jams on pole</li> </ul>	Unable to deploy pole if cant plate jams on pole	<p>(7) Proper application of over-lube lubricant to the ratchet lever and cant plates, alignment, and fitting of the components in accordance with drawing requirements.</p> <p>(8) Installation of the NOMEX boot at the ratchet assembly interface with the housing assembly (which prevents entry of contamination).</p> <p>(9) Proper ratchet assembly functional performance in accordance with TPS instructions, visual inspection for damage, and proper packaging of the PCES for transport.</p> <p>d. <u>Turnaround</u> The PCES end item is removed after each flight and the ratchet is visually inspected, per DMARS requirements, prior to reinstallation for each mission. The 2 year inspections include visual examination for signs of deterioration or damage and corrosion, and performance of controlled/manual deployment tests</p> <p>4. <u>Failure History</u>. The ratchet assembly is a newly designed hardware item and has no failure history</p> <p>5. <u>Operational Use</u>.</p> <p>a. <u>Operational Effect of Failure</u>. Unable to deploy pole if spring deployment also fails, probable loss of crew</p> <p>b. <u>Crew Action</u> None.</p> <p>c. <u>Crew Training</u>. The crew is trained to deploy the pole with both the spring and the ratchet</p> <p>d. <u>Mission Constraints</u> None</p> <p>e. <u>In-Flight Checkout</u>. None.</p>

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