

CRITICAL ITEMS LIST

ASSY NOMENCLATURE: TRIGGER ASSEMBLY

SYSTEM: CREW ESCAPE SYSTEM

REVISION:

ASSY P/N: SED27101362

SUBSYSTEM: POLE CREW ESCAPE SYSTEM

PAGE 25 OF 70

FMEA		NAME, QTY & DRAWING REF DESIGNATION	CRITY	FAILURE MODE AND CAUSE	FAILURE EFFECT OR END ITEM	RATIONALE FOR ACCEPTANCE
REF	REV					
3.1.1		TRIGGER ASSEMBLY (1), SED27101362	1/1	<p>3.1.3 Mode: Premature release of trigger jams arming pin</p> <p>Cause: • Stress corrosion • Vibration</p>	Unable to deploy pole if arming pin cannot be removed	<p>1. Design Features. The design features which minimize the probability of this failure mode are:</p> <p>a. The PCES arming pin also serves as a safing pin and is designed for insertion through matched holes drilled in the housing assembly and the primary extension poles. The 5/16 inch steel pin is retained by a spring steel hitch pin installed in the trigger assembly. Because the PCES kick spring force is restrained by the trigger assembly, jamming of the arming pin is unlikely unless the trigger assembly should fail.</p> <p>b. The only loads expected on the arming pin during normal operations are the friction loads of the pin surfaces against the hole surfaces in the housing assembly and the primary and extension poles.</p> <p>c. The arming pin and insertion holes are toleranced on the design drawings with sufficient margin to permit easy removal of the hitch pin prior to planned PCES deployments.</p> <p>d. The arming pin and hitch pin are fabricated of corrosion resistant materials approved by the JSC Materials Branch.</p> <p>e. The trigger assembly is designed to a safety factor of 1.4.</p>

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ASSY P/N: SED/710136Z

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PAGE 26 OF 70

FMEA		NAME, QTY & DRAWING REF DESIGNATION	CRITY	FAILURE MODE AND CAUSE	FAILURE EFFECT OR END ITEM	RATIONALE FOR ACCEPTANCE
REF	REV					
3.1.3		TRIGGER ASSEMBLY (1), SED2710136Z	7/1	<p>3.1.3 Mode: Premature release of trigger jams arming pin</p> <p>Cause:</p> <ul style="list-style-type: none"> • Stress corrosion • Vibration 	Unable to deploy pole if arming pin cannot be removed	<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 0.04g/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 PCES deployment and recocking • Noncontrolled deployment with equivalent aerodynamic loads on pole tip • Manual deployment with catchet 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 0.067g/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 PCES • Noncontrolled deployment with equivalent aerodynamic loads on the pole tip

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S40210D
 ATTACHMENT -
 Page 71 of 11

CRITICAL ITEMS LIST

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PAGE 27 OF 70

FMEA		NAME, QTY & DRAWING REF DESIGNATION	CRIT'Y	FAILURE MODE AND CAUSE	FAILURE EFFECT ON END-ITEM	RATIONALE FOR ACCEPTANCE															
REF	REV																				
313		TRIGGER ASSEMBLY (1), SED27101362	1/1	<p>3.0.3 Mode: Premature release of trigger jams arming pin</p> <p>Cause: • Stress corrosion • Vibration</p>	Unable to deploy pole if arming pin cannot be removed	<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"> • 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) Thermal testing (by analyses)</p> <ul style="list-style-type: none"> • Ground operations: 35 to 120°F • Normal operations: 45 to 90°F • Ascen/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 <p>(6) Fungus (by analysis).</p> <ul style="list-style-type: none"> • 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>(7) Humidity (by analysis)</p> <ul style="list-style-type: none"> • The PCES materials list was analyzed to certify compliance with MF0004-014, paragraph 3.1.1.e. 	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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PAGE 28 OF 70

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REF	REV							
313		TRIGGER ASSEMBLY (1), SED27101362	1/1	<p>3.1.3 Mode: Premature release of trigger jams arming pin</p> <p>Cause:</p> <ul style="list-style-type: none"> • Stress corrosion • Vibration 	Unable to deploy pole if arming pin cannot be removed	<p>(8) Salt spray (by analysis).</p> <ul style="list-style-type: none"> • The PCES materials list was analyzed to certify compliance with MF0004-014, paragraph 3.3.7 <p>(9) Sand/dust (by analysis).</p> <table border="0"> <tr> <td> <ul style="list-style-type: none"> • 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 </td> <td> <ul style="list-style-type: none"> • Dust - diameter 0.000039 to 0.003 inches - suspended dust 3.7 to 0.1 lb/cu. ft. - wind speed 33 ft/sec - hardness 7 to 8 Moh scale </td> </tr> </table> <p>(10) Additional certification tests/analyses</p> <ul style="list-style-type: none"> • 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>C. Turnaround Testing: Each PCES is subjected to a controlled functional deployment test, per OMRSD requirements, every 10 missions or every 2 years, whichever occurs first.</p>	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Dust - diameter 0.000039 to 0.003 inches - suspended dust 3.7 to 0.1 lb/cu. ft. - wind speed 33 ft/sec - hardness 7 to 8 Moh scale
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PCES - 28

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 ATTACHMENT -
 PAGE 73 OF 115

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PAGE 29 OF 70

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REF	REV					
313		TRIGGER ASSEMBLY (1), SED27101362	7/1	<p>3.1.3 Mode: Premature release of trigger jams arming pin</p> <p>Cause: • Stress corrosion • Vibration</p>	Unable to deploy pole if arming pin cannot be removed	<p>3. Inspection/QA/Manufacturing.</p> <p>a. All PCEES fabrication, assembly, and test activities were performed under the jurisdiction of the NASA JSC Quality Assurance (QA) Division in accordance with ISCM 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 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 of the trigger assembly components were fabricated of aerospace approved materials 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) Cleaning of parts and assemblies in accordance with ISCM Manual 5322, paragraph 7.1.3 to level GC (3) Inspection of surfaces assuring proper surface preparation prior to application of special surface coating processes (4) Anodizing of aluminum surfaces as specified on engineering drawings; passivating of inconnel and steel components, as defined by drawings. (5) Proper installation and handling of components and controlled application of lubricant and thread compounds in accordance with drawing requirements <p>(b) Trigger assembly functional performance in accordance with TPS instructions, visual inspection for and proper packaging for transport</p>

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SH021GD
 ATTACHMENT
 Page 74 of

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PAGE 30 OF 70

FMEA		NAME, QTY & DRAWING REF DESIGNATION	QNTY	FAILURE MODE AND CAUSE	FAILURE EFFECT ON	RATIONALE FOR ACCEPTANCE
REF	REV				END ITEM	
3.1.3		TRIGGER ASSEMBLY (1), SED27101362	1/1	<p>3.1.3 Mode: Premature release of trigger jams arming pin</p> <p>Cause: • Stress corrosion • Vibration</p>	Unable to deploy pole if arming pin cannot be removed	<p>d. <u>Turnaround</u>. The PCES end item is removed after each flight and the trigger is visually inspected, per OMRSD 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 deployment tests, and recocking.</p> <p>4. <u>Failure History</u>. The trigger 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>. Probable loss of crew.</p> <p>b. <u>Crew Action</u>. None</p> <p>c. <u>Crew Training</u>. Crew is trained in the proper use of the equipment</p> <p>d. <u>Mission Constraints</u>. None. Mission would be terminated prior to use of this equipment</p> <p>e. <u>In-Flight Checkout</u>. None</p>

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PCES - 36

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 ATTACHMENT 1
 Page 75 of 115