PFR-020 Title: SPB Sphere Keyreel Axle Modification

Assembly : SPB Assy THM-SPB-MEC-001	**SubAssembly : Sphere Keyreel**
Component : Keyreel Spring Axle	
Originator: Gregory Dalton	**Organization: UCB/SSL THEMIS EFI**
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Failure Occurred During (Check one √)

■ Functional test □ Qualification test □ S/C Integration □ Launch operations □ Other (Flight Assy)

Environment when failure occurred:

□ Ambient □ Vibration □ Shock □ Acoustic
□ Thermal □ Vacuum ■ Thermal-Vacuum □ EMI/EMC

Problem Description

(In this section it is important to document the specific symptoms which exhibited the problem. In the event we see it happen again, we would like to know as much as possible.)

After performing initial thermal-vacuum tests on *SPB Sphere* subassembly to determine spring force/deflection characteristics, the keyreel was found to not fully retract the fine wire into a stowed position. Bench tests had previously provided satisfactory results: the fine wire retracted onto the sphere keyreel as expected. An indication of keyreel failure was noted visually using vacuum chamber video cameras and observing a sudden drop in force on data acquisition equipment during retraction of fine wire.

Analyses Performed to Determine Cause

(How do we know how the failure happened? Was it a bad part, bad handling, what?)

The sphere in question was disassembled and all parts checked for excessive or abnormal wear, tolerances per part drawings, material failures, and assembly inconsistencies. Excessive wear was noted in the mating area of the *Keyreel* and *Keyreel Cover* with the *Keyreel Spring* Axle (fig. 1). Plating was rubbed off, and some plating and aluminum material was embedded in the PEEK *Keyreel Spring Axle*. This created friction between moving and stationary parts, exacerbated by CTE mismatches in materials during thermal-vacuum testing. After analyzing the subassembly CAD model and fabrication drawings, it was noted that moving parts did not have sufficient clearance. In addition, dry lubricant was not applied between moving components. After analyzing other tested subassemblies that did not exhibit binding, it was determined that the machined parts were at LMC per original shop drawings, allowing sufficient clearance to avoid failure.

Corrective Action/ Resolution

(How do we fix the unit? And how do we make sure it doesn't happen again?)

For this unit:

Part drawing dimensions and tolerances were changed. The *Keyreel Spring Axle* was removed and re-machined to create more clearance between the moving *Keyreel* and *Keyreel Cover*. DAG-154 was applied to the *Keyreel Spring Axle* before installation to provide lubricant to the moving parts.

Future Units:

1. All *Keyreel Spring Axles* will be removed and machined per THM-SPB-MEC-204 Rev G to allow for more clearance with other moving parts of the keyreel.
2. Permaslik RMAC will be applied to the *Keyreel Spring Axle* before installation to provide sufficient lubrication between moving parts.
3. Bench test force/deflection data will be analyzed carefully prior to thermal-vacuum testing. This will identify any future problems prior to environmental testing.

Acceptance:

MAM: Ron Jackson_____; MSE: Ellen Taylor_____

PM: Peter Harvey_____; Co-Eng: Greg Dalton_____

Date of Closure_____

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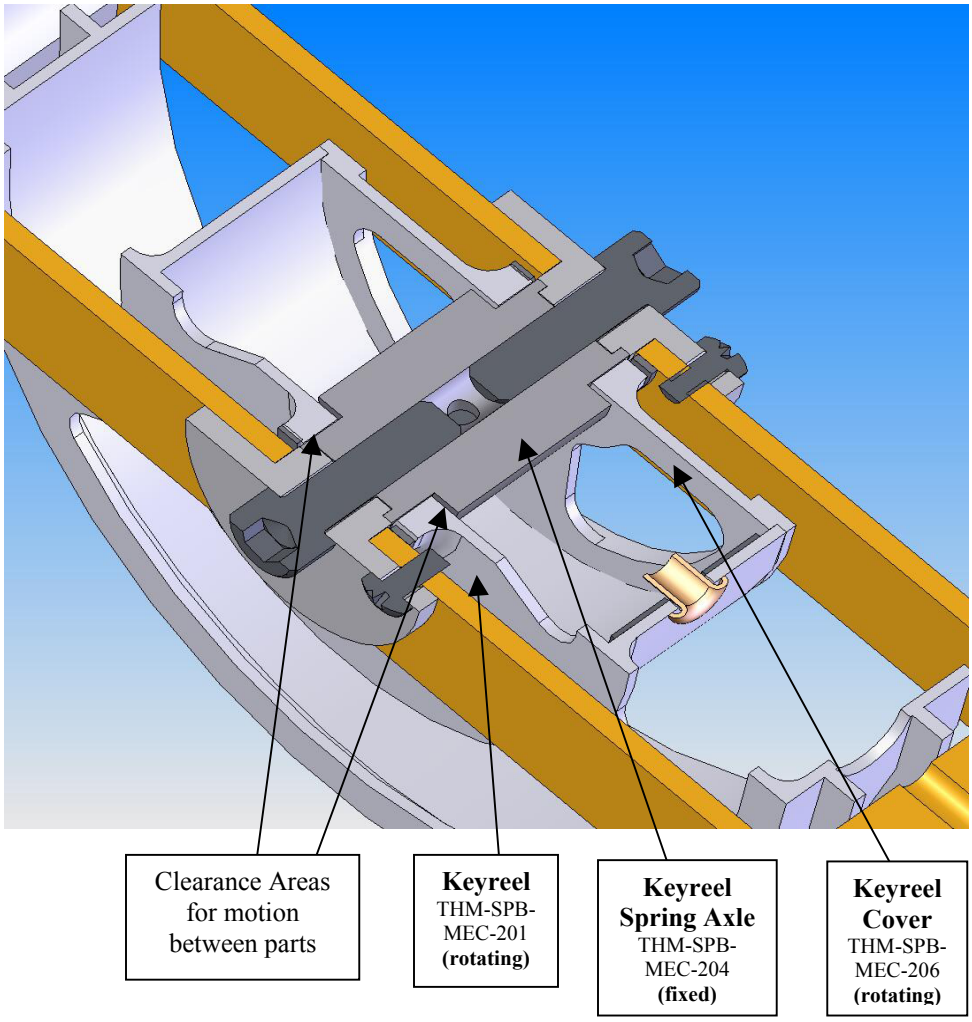

Figure 1. SPB Sphere Keyreel Assembly Section Diagram - THM-SPB-MEC-200