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EOS

SUNSHIELD ASSEMBLY
FM TEST PROCEDURE

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1. SCOPE

This document details the test plan and requirement to verify the HIRDLS Sun Shield Assembly Flight Model at unit level.

2. APPLICABLE DOCUMENTS

2.1 Documents

a) Sun Shield Requirement Specification SP-HIR-50.
b) STM, SSH and SVA Design Development and Test Plan TP-MMS-248.
c) Manual for SSH & SVA Test equipment (EGSE) TC-MMS-400

2.2 Drawings

a) Sunshield / HDA Assembly - HRIL100
b) Vibration Fixture - TAA 2124.
c) Thermal Vacuum and Assembly Fixture - TAA2128.

3. TEST PLAN

3.1 Model Philosophy

The SSH model philosophy is defined in the STH, SSH and SVA DD&T plan, AD2.1 (b). The FM will be subjected to the acceptance level tests described herein.

3.2 Test Specimen

The test specimen is the FM unit SSH assembly - HRIL100.

3.3 Test Sequence

The test sequence for the FM SSH assembly is as follows:-

- Preliminary characterisation tests.
- Baseline functional test.
- Vibration test (at unit level).
- Post Vibration functional test.
- Thermal vacuum test.
- Vibration test (at STH level).
- Post Vibration functional test.

4. TEST REQUIREMENT

4.1 Preliminary Characterisation Tests

Set up SSH assembly (HRIL100) in assembly fixture (TAA2128). Clamp side cleats with door in the open position to ensure aperture plate is not distorted by seal loads.
Note, before clamping the HDA plate to fixture:-

- Release door by operating the HDRM manual override with torque wrench set at 1.8 Nm.
- Open door manually by back driving hinge motor gearhead 90°
- Torque tighten M4 fasteners.
- Close door manually.
- Relatch door, by operating HDRM manual override with torque wrench set at 1.8 Nm to offload torque on the latch open spring, pull spring outwards from HDRM to allow the mechanism to return to the locked position, under the control of the torque wrench.

4.1.1 Determine HDRM Latch Bearing Friction

- Disengage both latch torsion springs.
- Determine torque to rotate latch using torque clock.
- Determine torque with lockout hairspring in contact with micro-switch striker lever.
- Determine operating torque required to lock door and apply preload.
- Refit torsion spring and verify latch can operate with 1 spring.
- Determine spring torque in the following positions:-
  - Fully open
  - Fully closed

4.1.2 Determine Hinge Friction Torque

- Set up SSH Assembly fixture with hinge axis vertical.
- Ensure motor drive shaft is disconnected.
- Determine torque to rotate door away from latch, then back towards latch.
  Note: *This torque will include the friction torque of both hinges, the potentiometer and the grounding spring.*
- Push door with Correx gauge to determine torque at hinge.
- Determine the detent torque of the motor gearhead.
- Reconnect the motor gearhead drive to the hinge. Measure the hinge torque with Correx gauge.
- Determine hinge drive backlash
- Refit second torsion spring to HDRM
- Determine spring torsion in both positions:-
  - Fully open
  - Fully closed.
- Verify latch preload. Determine deflection away from the door of the roller lever with a force of 30N applied at the roller. Measure deflection with dial indicator at this point. Set shim at latch to provide this additional deflection of the roller lever in the locked position.
- Determine force required at latch to compress door seal by applying dead loads at latch position on door until door contacts ‘Vee’ locator.

4.1.3 Preliminary Electrical Tests

- Verify motor resistance of each phase of the hinge stepper motor (prime and redundant): 115Ω ± 10% (x 2 for star)
- Determine potentiometer resistance.
  - Door open position.
  - Door closed position.

Note: *Reset position of potentiometer if dead band is entered.*

- Verify micro-switch closure status against position
- Verify resistance of HOP heaters 78Ω ± 10%
  - Prime resistance.
  - Redundant resistance.
- Verify resistance of thermistors at 20°C ≅ 2.8KΩ and drive is positive.
- Determine resistance of grounding between :
  - Door and aperture panel grounding terminals.
  - Hinge clevis plate to aperture panel terminal
  - Latch plate to aperture panel terminal
- Verify Sun Sensor (3 off) circuit

4.2 Baseline Functional Test

4.2.1 HDRM

- Set lockout spring back with MGSE to prevent HDRM locking in the open position.
- Set up SSH assembly with the door latched.
- Switch on HOP prime heater circuit (28V) (Connector J211P pin 1 & 11) until latch lever is in the fully open position and micro-switch operates, switch off power after 15 sec and allow latch lever to retract to the fully closed position.
  - Monitor and record the following parameters to characterise HDRM function:.
  - Deployment and Retract time.
  - Micro-switch operation at limits.
  - Thermistor output temperature / time
  - Repeat above operation for redundant circuit.

CAUTION: *The redundant circuit (Conn J211P pin 2 & 6) is **NOT** protected from overheating and must be switched off immediately after micro-switch operates.*

Repeat the above sequence to a total of 5 operations

4.2.2 Hinge Drive

- Set up SSH Assembly with hinge axis vertical.
- Set HDRM with latch locked open.
- Manually rotate door 20° out of latch.
- Connect up EGSE as shown in operating manual TC-MMS-400 and set up Labview screen to the following settings:
  - Voltage - 28V
  - Current limit - 0.5A
  - Stepper motor rate - 20Hz
  - Prime motor winding
- Command door to rotate 10° (100 steps) at nominal 28V on prime winding of hinge drive.
  - Verify direction of operation.

  - Confirm angular displacement of door.
- Repeat operation for redundant winding.
- Determine torque to overcome powered motor detent.
- On Labview screen select 'calibration' . This command records potentiometer voltage at each step position over full operating range of door . Plot results to characterise stepper motor count to potentiometer output voltage errors.
- Determine hinge drive torque margin:

  Connect 3 in-line resistors in stepper motor harness to limit current
  Increase in-line resistor values until hinge drive motor is close to stall.
  Calculate torque margin:

$$\frac{\text{Motor Resistance + (2x In-line resistance)}}{\text{Motor Resistance}}$$

4.3 Door Operations

- Command door to fully closed position
- Verify operation of fully closed micro-switch
- Command door to fully open position
- Verify operation of fully open micro-switch

Repeat the above sequence to a total of 10 operations

4.4 Vibration Test

The FM unit shall undergo a random vibration workmanship test. The full test sequence for each axis shall be as follows:-

Jig survey	(See Section 4.3.1)
Sine survey	(See Section 4.3.1)
Random	(See Section 4.3.2)
Sine survey	(See Section 4.3.1)

The purpose of the sine surveys is to verify the structural integrity of the equipment after the workmanship test and to confirm that the unit meets it's stiffness requirements.

The vibration axes and accelerometer positions are defined in Figure 4.3-1. The SSH will be mounted to the vibration fixture TAA2128 in accordance with the drawing requirements. Note, the sequence for clamping the HDA plate to the vibration fixture is as follows:-

- Release door by operating HDRM manual override with torque wrench set at 1.8 Nm.
- Open door manually by back-driving hinge motor gearhead 90°.
- Shim gaps between unit cleats and vibration fixture.
- Torque fasteners as follows:-
  M4 Stainless steel screws (UNBRAKO) - 4,0 Nm
  M4 nuts onto Stainless steel threads - 2,4 Nm
- Fillet lock all fixings except on CFRP.
- Close door manually.
- Re-latch door, by operating HDRM manual override with torque wrench set at 1.8 Nm to offload torque on the latch open spring, pull spring outwards from HDRM to allow the mechanism to return to the locked position, under the control of the torque wrench.

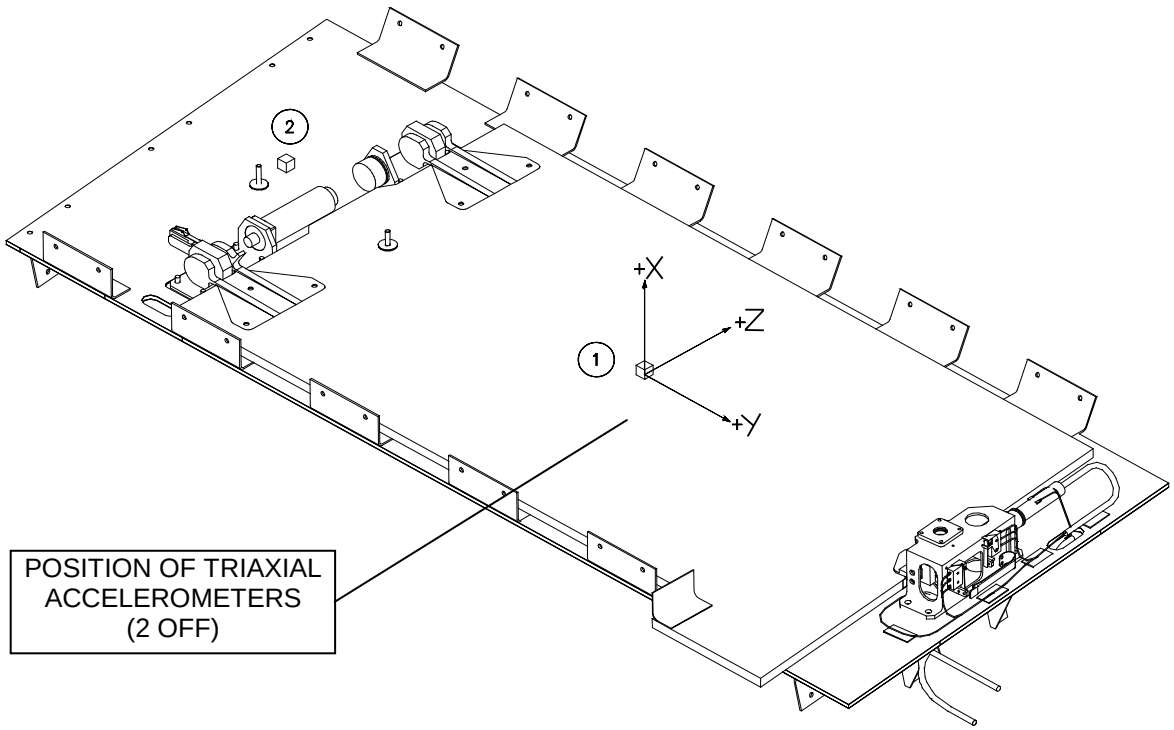

Figure 4.3-1 : SSH Axes for Vibration Test

4.4.1 Sine Survey

Jig and sine survey tests shall be carried out between 5 and 2000 Hz with a sweep rate of 2 octaves/minute at a level of 0.2g.

4.4.2 Random Vibration

The workmanship test level is given in Table 4.3-2. FM tests shall have a duration of 60 seconds per axis.

Axis	Frequency (Hz)	Level (g^2/Hz)	Total Level (grms)
ALL	20	0.01	)
	20-160	+3 dB/oct	)
	160-250	0.08	) 7.4
	250-2000	- 3 dB/oct	)
	2000	0.01	)

Table 4.3-2 : Random Vibration Workmanship Test

4.5 Post-vibration function test

4.5.1 HDRM

- Set lockout spring back with MGSE to prevent HDRM locking in the open position.
- Set up SSH assembly with the door latched.
- Switch on HOP prime heater circuit (28V) (Connector J211P pin 1 & 11) until latch lever is in the fully open position and micro-switch operates, switch off power after 15 sec and allow latch lever to retract to the fully closed position.
  - Monitor and record the following functional parameters:.
  - Micro-switch operation at limits.
  - Verify operation of redundant circuit for 30 sec.

CAUTION: *The redundant circuit (Conn J211P pin 2 & 6) is* ***NOT*** *protected from over-heating and must be switched off immediately after micro-switch operates.*

Repeat the above sequence to a total of 5 operations

4.5.2 Hinge Drive

- Set up SSH Assembly with hinge axis vertical.
- Set HDRM with latch locked open
- Command door to fully open position
- Verify operation of fully open micro-switch.
- Command door to fully closed position
- Verify operation of fully closed micro-switch
- Command door to fully open position
- Verify operation of fully open micro-switch

- Command door to rotate 0.1° towards the closed position, record potentiometer voltage. Repeat sequence until door is closed. Plot results to characterise stepper motor count to potentiometer output voltage.

Repeat the above sequence to a total of 10 operations

- On Labview screen select 'calibration' . This command records potentiometer voltage at each step position over full operating range of door . Plot results to characterise stepper motor count to potentiometer output voltage errors.
- Determine hinge drive torque margin:
  Connect 3 in-line resistors in stepper motor harness to limit current
  Increase in-line resistor values until hinge drive motor is close to stall.
  Calculate torque margin:

$$\frac{\text{Motor Resistance + (2x In-line resistance)}}{\text{Motor Resistance}}$$

4.5.3 Test Results

Compare these results with the baseline functional test results (Para 4.2)

4.6 Thermal Vacuum Test

The FM unit shall be tested in vacuum (<10^{-5} Torr) at its upper and lower acceptance temperature limits whist operational and when driven by representative electronics. The thermal vacuum test profile is shown in Figure 4.5-1. The SSH shall be mounted so that the hinge axis is vertical. The test shall be controlled by the reference thermocouple which shall be attached to the aperture plate.

The time duration spent at each upper or lower limit shall be a minimum of 4 hours (see Figure 4.5-1). The rate of change between limits shall not exceed 5°C/min.

Acceptance temperature limits are given in Table 4.5-1.

Operating	
Min	**Max**
-25	25

Table 4.5-1 : Acceptance Temperature Limits (°C)

The time duration (minimum) spent at each limit and the maximum rate of change between limits, shall be 4 hours and 5°C/min respectively (see Figure 4.5-1).
The unit will be tested through 4 complete thermal cycles.

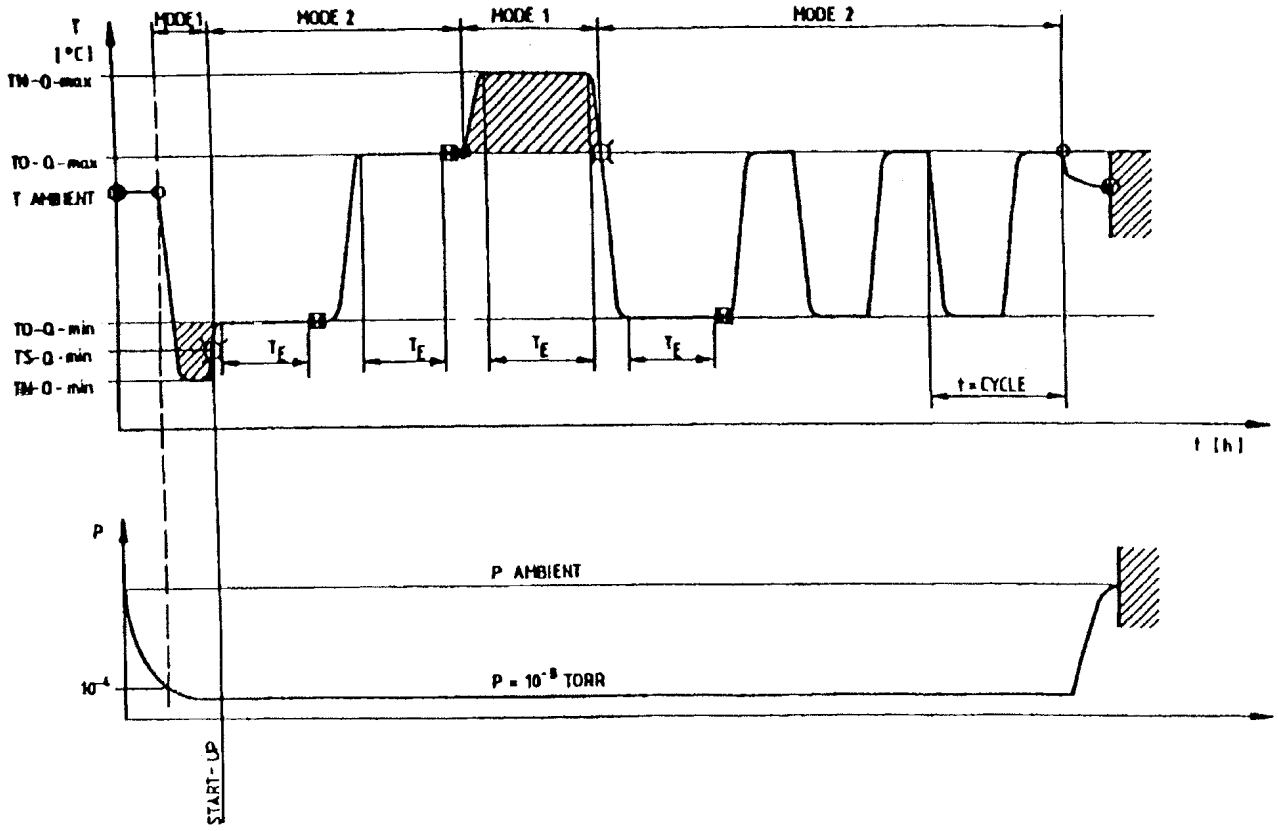

Figure 4.5-1 : SSH Thermal Vacuum Test Profile

4.6.1 SSH Test Configuration

Set up SSH assembly (HR1L100) in assembly fixture (TAA2128). All side cleat fasteners to be replaced with M2 nuts and bolts, with the exception of a single central fastener on 90 degree cleat side.

- Torque tighten this M4 bolt to 2Nm.
- All M2 fasteners to be clamped finger tight on this side.
- Remove packing from between cleats and fixture, fit M2 fasteners finger tight.
- Set lockout spring back with MGSE to prevent HDRM locking in the open position.
- Bolt complete assembly to the vacuum chamber transom plate, with the door hinge axis vertical.
- Connect harness.
- Verify chamber clearance by operating door.

4.6.2 SSH Functional tests

The HDRM and Door Hinge Drive tests detailed below are to be performed prior to closing chamber:-

i. after cold temperature soak at -25°C
ii. after raising temperature to 25°C
iii. at ambient temperature after completion of 8 thermal cycles.

This represents a total of 20 operations (4 HDRM and 16 Door Drive).

4.6.2.1 HDRM

- Switch on HOP prime heater circuit (28V) (Connector J211P pin 1 & 11) until latch lever is in the fully open position and micro-switch operates, switch off power after 15 sec and allow latch lever to retract to the fully closed position.
- Repeat HOP operation at -25°C and 25°C.
- Repeat HOP operation at ambient temperature in vacuum.
- Repeat HOP operation at ambient temperature and pressure.
- Monitor and record the following functional parameters:.
  - Micro-switch operation at limits.
  - HOP actuator temperature as micro-switches operate(both directions).

- Verify operation of redundant circuit for 30 sec.

  CAUTION: *The redundant circuit (Conn J211P pin 2 & 6) is* ***NOT*** *protected from over-heating and must be switched off immediately after micro-switch operates.*

4.6.2.2 Hinge Drive

Prior to pump down;

- Command door to fully open position
- Verify operation of door fully open micro-switch.
- Command door to fully closed position.
- Verify operation of door fully closed micro-switch
- Record potentiometer readings at both the fully open and closed door positions.
- On Labview screen select 'calibration' . This command records potentiometer voltage at each step position over full operating range of door . Plot results to characterise stepper motor count to potentiometer output voltage errors.

- Determine hinge drive torque margin:
  Connect 3 in-line resistors in stepper motor harness to limit current
  Increase in-line resistor values until hinge drive motor is close to stall.
  Calculate torque margin:

$$\frac{\text{Motor Resistance + (2x In-line resistance)}}{\text{Motor Resistance}}$$

- Repeat opening / closing to a total of 4 operations

Repeat the above sequence;
- at -25°C and 25°C
- at ambient temperature

4.6.2.3 Test results

- Open chamber to inspect SSH assembly.
- Compare these results with the baseline functional test results (Para 4.2)

4.7 STH Level Vibration Test

The FM unit shall be installed on the HIRDLS structure during STH level vibration testing (refer to Doc. No. TP-MMS-448 for details of this testing).

4.8 Post-vibration function test

4.8.1 HDRM

- Set lockout spring back with MGSE to prevent HDRM locking in the open position.
- Set up SSH assembly with the door latched.
- Switch on HOP prime heater circuit (28V) (Connector J211P pin 1 & 11) until latch lever is in the fully open position and micro-switch operates, switch off power after 15 sec and allow latch lever to retract to the fully closed position.
  - Monitor and record the following functional parameters:.
  - Micro-switch operation at limits.
  - Verify operation of redundant circuit for 30 sec.

CAUTION: *The redundant circuit (Conn J211P pin 2 & 6) is* ***NOT*** *protected from over-heating and must be switched off immediately after micro-switch operates.*

Repeat the above sequence to a total of 5 operations

4.8.2 Hinge Drive

- Set up SSH Assembly with hinge axis vertical.
- Set HDRM with latch locked open
- Command door to fully open position
- Verify operation of fully open micro-switch.
- Command door to fully closed position
- Verify operation of fully closed micro-switch
- Command door to fully open position
- Verify operation of fully open micro-switch

- Command door to rotate 0.1° towards the closed position, record potentiometer voltage. Repeat sequence until door is closed. Plot results to characterise stepper motor count to potentiometer output voltage.

Repeat the above sequence to a total of 10 operations

- On Labview screen select 'calibration' . This command records potentiometer voltage at each step position over full operating range of door . Plot results to characterise stepper motor count to potentiometer output voltage errors.
- Determine hinge drive torque margin:

  Connect 3 in-line resistors in stepper motor harness to limit current
  Increase in-line resistor values until hinge drive motor is close to stall.
  Calculate torque margin:

$$\frac{\text{Motor Resistance} + (\text{2x In-line resistance})}{\text{Motor Resistance}}$$

APPENDIX A DETAILED TEST INSTRUCTIONS

Para	Activity	Results	Comments
4.1	**Premilinary Tests** Set up SSH in fixture Release door by operating the HDRM manual override with torque wrench set at 1.8Nm Open door manually by backdriving hinge motor gearhead through 90° Torque tighten M4 fasteners and close the door manually Re-latch door by operating HDRM manual override with torque wrench set at 1.8 Nm to offload torque on the latch open spring. Pull spring outwards from HDRM to allow the mechanism to return to the locked position under the control of the torque wrench		
4.1.1	**Determine HDRM Latch Bearing Friction** Disengage both latch torsion springs **Determine torque to rotate latch using torque clock** **Determine torque with lock-out hairspring in contact with micro-switch striker lever** **Determine operating torque required to lock door and apply preload** **Refit torsion spring and verify latch can operate with one spring** Determine spring torque in the fully open position Determine spring torque in the fully closed position		
4.1.2	**Determine Hinge Friction Torque** Set up SSH fixture with hinge axis vertical Ensure motor drive shaft is disconnected **Determine torque to rotate door away from latch and then back towards latch** **Push door with Correx gauge to determine torque at hinge** Determine the detent torque of the motor gearhead **Reconnect the motor gearhead drive to the hinge and measure the hinge torque with the Correx gauge**		

Para	Activity	Results	Comments
4.1.2	**Cont.** **Determine hinge drive backlash** Refit second torsion spring to HDRM **Determine spring torsion in fully open position** **Determine spring torsion in full closed position** **Verify latch preload** **Apply a force of 30N at the roller lever and determine it's deflection away from the door** Set shim at latch **Determine force required at latch to compress door seal**		
4.1.3	**<u>Preliminary Electrical Tests</u>** **Verify motor resistance of each phase of the hinge stepper motor (prime and redundant)** **Determine potentiometer resistance in door open position** **Determine potentiometer resistance in door closed position** **Verify micro-switch closure status against position** **Verify prime resistance of HOP heater** **Verify redundant resistance of HOP heater** **Verify resistance of thermistors at 20°C** **Determine resistance of grounding between :-** Door and aperture plate grounding terminals Hinge clevis plate to aperture plate panel terminal Latch plate to aperture plate grounding terminal **Verify Sun Sensor circuits**		
4.2 **4.2.1**	**<u>Baseline Functional Test</u>** **<u>HDRM</u>** Set lock-out spring back with MGSE to prevent HDRM locking in open position Set up SSH with the door latched		

Para	Activity	Results	Comments
4.2.1	**Cont.** Switch on HOP prime heater circuit (connector J211P pin 1 & 11) until latch lever is in the fully open position and micro-switch operates. Switch off power after 15 secs and allow latch lever to retract to the fully closed position **Monitor the following parameters to characterise HDRM function :-** **- Deployment and Retract time** **- Micro-switch operation at limits** **- Thermistor output temperature / time** Repeat above operations for redundant circuit (Conn J211P pin 2 & 6) **Record :-** **- Deployment and Retract time** **- Micro-switch operation at limits** **- Thermistor output temperature / time**		
4.2.2	**<u>Hinge Drive</u>** Set up SSH with hinge axis vertical Set HDRM with latch locked open Manually rotate door 20° out of latch Using Labview set voltage 28V, current limit 0.5A, stepper motor rate 20 Hz Command door to rotate 10° (100 steps) at nominal 28V on prime winding of hinge drive and; **- verify direction of operation** **- confirm angular displacement of door** Repeat operation for redundant winding and; **- verify direction of operation** **- confirm angular displacement of door** **Determine torque to overcome powered motor detent** On Labview screen select calibration **Plot stepper motor count to potentiometer output voltage errors** Connect 3 in-line resistors in stepper motor harness		

Para	Activity	Results	Comments
4.2.2	**Cont.** Increase in-line resistor values until hinge drive motor is close to stall **Calculate torque margin**		
4.2.3	**<u>Door Operations</u>** Command door to fully closed position **Verify operation of fully closed micro-switch** Command door to fully open position **Verify operation of fully open micro-switch**		
4.4	**<u>Post Vibration Function Test</u>**		
4.4.1	**<u>HDRM</u>** Set lock-out spring back with MGSE to prevent HDRM locking in open position Set up SSH with the door latched Switch on HOP prime heater circuit (connector J211P pin 1 & 11) until latch lever is in the fully open position and micro-switch operates. Switch off power after 15 secs and allow latch lever to retract to the fully closed position **Monitor and record micro-switch operation at limits** **Verify operation of redundant circuit for 30 secs**		
4.4.2	**<u>Hinge Drive</u>** Set up SSH with hinge axis vertical Set HDRM with latch locked open Command door to fully open position **Verify operation of fully open micro-switch** Command door to fully closed position **Verify operation of fully closed micro-switch** Command door to fully open position **Verify operation of fully open micro-switch** On Labview screen select calibration		
Para	**Activity**	**Results**	**Comments**

4.4.2	**Cont.** **Plot stepper motor count to potentiometer output voltage errors** Connect 3 in-line resistors in stepper motor harness Increase in-line resistor values until hinge drive motor is close to stall **Calculate torque margin**		
4.5	**<u>Thermal Vacuum Test</u>**		
4.5.2.1	**<u>HDRM</u>**		
(a)	**Prior to pump down** Switch on HOP prime heater circuit (connector J211P pin 1 & 11) until latch lever is in the fully open position and micro-switch operates. Switch off power after 15 secs and allow latch lever to retract to the fully closed position **Monitor :-** **Micro-switch operation at limits** **HOP actuator temperature as micro-switches operate**		
(b)	**After cold temperature soak at -25°C** Switch on HOP prime heater circuit (connector J211P pin 1 & 11) until latch lever is in the fully open position and micro-switch operates. Switch off power after 15 secs and allow latch lever to retract to the fully closed position **Monitor :-** **Micro-switch operation at limits** **HOP actuator temperature as micro-switches operate**		
(c)	**After raising temperature to 25°C** Switch on HOP prime heater circuit (connector J211P pin 1 & 11) until latch lever is in the fully open position and micro-switch operates. Switch off power after 15 secs and allow latch lever to retract to the fully closed position **Monitor :-** **Micro-switch operation at limits**		
Para	**Activity**	**Results**	**Comments**

4.5.2.1	**Cont.** **HOP actuator temperature as micro-switches operate**		
(d)	**At ambient after completion of 4 cycles** Switch on HOP prime heater circuit (connector J211P pin 1 & 11) until latch lever is in the fully open position and micro-switch operates. Switch off power after 15 secs and allow latch lever to retract to the fully closed position **Monitor :-** **Micro-switch operation at limits** **HOP actuator temperature as micro-switches operate** **Verify redundant circuit for 30 secs**		
4.5.2.2	**<u>Hinge Drive</u>**		
(a)	**Prior to pump down** Command door to fully open position **Verify operation of fully open micro-switch** Command door to fully closed position **Verify operation of fully closed micro-switch** **Record potentiometer readings at both the fully open and closed door positions** On Labview screen select calibration **Plot stepper motor count to potentiometer output voltage errors** Connect 3 in-line resistors in stepper motor harness Increase in-line resistor values until hinge drive motor is close to stall **Calculate torque margin**		
(b)	**After cold temperature soak at -25°C** Command door to fully open position **Verify operation of fully open micro-switch** Command door to fully closed position		
Para	**Activity**	**Results**	**Comments**

4.5.2.2	**Cont.** **Verify operation of fully closed micro-switch** **Record potentiometer readings at both the fully open and closed door positions** On Labview screen select calibration **Plot stepper motor count to potentiometer output voltage errors** Connect 3 in-line resistors in stepper motor harness Increase in-line resistor values until hinge drive motor is close to stall **Calculate torque margin**		
(c)	**After raising temperature to 25°C** Command door to fully open position **Verify operation of fully open micro-switch** Command door to fully closed position **Verify operation of fully closed micro-switch** **Record potentiometer readings at both the fully open and closed door positions** On Labview screen select calibration **Plot stepper motor count to potentiometer output voltage errors** Connect 3 in-line resistors in stepper motor harness Increase in-line resistor values until hinge drive motor is close to stall **Calculate torque margin**		
(d)	**At ambient after completion of 4 cycles** Command door to fully open position **Verify operation of fully open micro-switch** Command door to fully closed position **Verify operation of fully closed micro-switch** **Record potentiometer readings at both the fully open and closed door positions**		
Para	**Activity**	**Results**	**Comments**

4.5.2.2	**Cont.** On Labview screen select calibration **Plot stepper motor count to potentiometer output voltage errors** Connect 3 in-line resistors in stepper motor harness Increase in-line resistor values until hinge drive motor is close to stall **Calculate torque margin**		
4.7	**<u>Post Vibration Function Test</u>**		
4.7.1	**<u>HDRM</u>** Set lock-out spring back with MGSE to prevent HDRM locking in open position Set up SSH with the door latched Switch on HOP prime heater circuit (connector J211P pin 1 & 11) until latch lever is in the fully open position and micro-switch operates. Switch off power after 15 secs and allow latch lever to retract to the fully closed position **Monitor and record micro-switch operation at limits** **Verify operation of redundant circuit for 30 secs**		
4.7.2	**<u>Hinge Drive</u>** Set up SSH with hinge axis vertical Set HDRM with latch locked open Command door to fully open position **Verify operation of fully open micro-switch** Command door to fully closed position **Verify operation of fully closed micro-switch** Command door to fully open position **Verify operation of fully open micro-switch** On Labview screen select calibration **Plot stepper motor count to potentiometer output voltage errors** Connect 3 in-line resistors in stepper motor harness Increase in-line resistor values until hinge drive motor is close to stall		
Para	**Activity**	**Results**	**Comments**
	Calculate torque margin		

DISTRIBUTION LIST

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CHANGE NUMBER	CLASS	CHANGE DETAILS	ISSUE
3164-00305	-	FIRST ISSUE	1
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