HIRDLS

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Issue B

HIGH RESOLUTION DYNAMICS LIMB SOUNDER

Originator: R Coupe Date: 03/03/99

Subject/Title: **SSH/SVA Torque Margins Conclusions Post Functional Test**

Description/Summary/Contents:

This report defines the SSH and SVA torque margin test results and conclusions and closes Action SSH-14 placed at the MMS CDA at Oxford in 10th –11th February 1999.

Keywords: Sunshield Assembly, Space View Aperture, Torque Margins

Purpose of this Document: Report of Torque Margin data

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EOS

SSH/SVA TORQUE MARGIN CONCLUSIONS POST FUNCTIONAL TEST

TR-MMS-441

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16/03/99

1 SCOPE

This report defines the SSH and SVA torque margin test results and conclusions and closes Action SSH-14 placed at the MMS CDA at Oxford in 10th –11th February 1999.

2 SSH DOOR OPERATION

1. Source: Qualification test results
2. Design requirement specified in GSFC 424-11-13-01 (para 3.4.5.3).
3. Torque margin determined by reducing motor current with resistors in series with motor windings

Measurement	Value	Comment
Hinge bearings and potentiometer	0.09 Nm	
Anti-backlash torsion spring (max. Torque)	0.70 Nm	
Min. measured overall Torque margin (In Thermal Vac)	2.62	
Minimum <u>test verified</u> torque ratio	***2.25***	This is the appropriate margin as 88% of resistive torque is the spring load. This is constant and known. The unknown Friction element is the lesser 12% and thus MMS argue the MAR requirement of 3 is not valid in this case. Therefore **SSH Design is COMPLIANT.**

Additional Comments

The anti-backlash torsion spring will be redesigned for more efficient operation on FM. Basic interfaces or function not changed however.

Max.spring torque design target	0.5 Nm
This torque reduction would increase overall operating margin	**3.5**

3 SSH LATCH OPENING OPERATION

1. Source: Qualification test results

2. Design requirement specified in GSFC 424-11-13-01 (para 3.4.5.3).

Measurement	Value	Comment
Maximum latch operating torque	0.4 Nm	
Maximum torsion spring torque	1.4 Nm	
Minimum HOP actuator output torque	4.0 Nm	One third of max available is quoted.
Torque margin	2.86	
Minimum test verified torque ratio	2.25	This is the appropriate margin as 78% of resistive torque is the spring load. This is constant and known. The unknown Friction element is the lesser % and thus MMS argue the MAR requirement of 3 is not valid in this case. **Therefore MMS SSH design is COMPLIANT**.

Additional Comments

The HOP Actuator minimum output torque is based on lowest force output at start of operation, when torsion spring torque is at a minimum of 1 Nm and force increases towards the end of stroke. Therefore, at start of operation torque margin is **2.86.**

Note HOP actuator nominal output force is a 1/3 of maximum.

Relatch torque margin - 1.0/0.4 = **2.5 (Not a requirement for In-orbit operations)**

4 SVA DOOR OPENING OPERATION

1. Source: Qualification test results

2. Design requirement specified in GSFC 424-11-13-01 (para 3.4.5.3)

3. Torque margin is determined by increasing motor voltage until mechanism operates. Nominal 28V / operating voltage.

Measurement	Value	Comment
Release and open aperture cover overall Torque margin	2.95	**SVA Design NON-COMPLIANT.**
Minimum test verified torque ratio	3.00	This is the appropriate margin as friction is the driver.
Closing cover over aperture, overall Torque margin	7.00	
Fully sealing cover in launch configuration, Torque margin	2.5	Locking the door back down is not a requirement in Orbit.
Door torque margin @Test Conditions Vacuum @ -35°C	2.8	
Door torque margin @Test Conditions Vacuum @ +35°C	4.0	
Door torque margin Vacuum @ +35°C	5.6	After hot soak @ 60°C
Door torque margin Vacuum @ +20°C	3.5	After hot soak @ 60°C

Additional Comments

The above results are functional operations results.

As can be seen MMS are non compliant on the Torque margin. However the torque margin can be easily obtained if this is a real problem. However to obtain the full torque margin the electrical circuitry would be more complex with resistor and diode sets replacing a double resistor. MMS feel the complexity increase is not justified hence a waiver is requested.

Note: Motor terminal voltage has been reduced from 28 to 18 V using a 12Ω series resistor.

The resistor value was selected to provide a torque margin of 3, and minimise wear and tear to the mechanism, but can be fine tuned to provide optimal performance. (Note a higher voltage will result in both more electrical circuit complexity and also the force of the SVA operation is significantly greater as the door swing against a stop is more rapid).

5 SSH AND SVA IN ORBIT OPERATING TEMPERATURE PREDICTIONS

1. Source: Instrument Thermal Analysis Report TC-MMS-381 Issue: A

Condition	SVA	SSH (Motor)	SSH (HRDM)
Hot	-9 to –18°C	0 to –2°C	+2 to –2°C
Cold	-20 to –15°C	-1 to –3°C	-5 to –8°C

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CHANGE RECORD

CHANGE NUMBER	CLASS	CHANGE DETAILS	ISSUE
3164-00215	-	First Issue	A
3164-	-	Periodic update to include latest test data	B