

CONTENTS

ACTIVATION AND CHECKOUT	1
S3 Activation	3
S3/S4 Activation Flowchart	53
 PRIMARY POWER	
1.3.450 SAW XX SABB Initial Unlatch	55
1.3.452 SAW XX Deploy	81
3.190 SAW XX Failure to Unlatch SABB Remotely	129
3.191 SAW XX Failure to Extend Mast Remotely	151
3.192 SAW XX Failure to Retract Mast Remotely	171
3.193 SAW XX Failure to Latch (Tension) SABB Remotely	191
3.194 SAW XX Blanket Panel Stiction During Deploy	211
4.118 P6 SAW 2B Retract (P6 on Z1 Truss)	214a
SARJ Initial Activation and Checkout	214bu
 OGS	
OGS H2/N2 Vent Assembly Final Installation and Leak Check	214dy
 ASSEMBLY	215
 PAS OPS	
PAS Heater Checkout	217
 SSAS OPS	
S1S3 SSAS Prep For Mate	223
S1S3 SSAS Nominal Mate	253
S1S3 SSAS Manual Mate	277
S1S3 SSAS Capture Latch Deployment - Post Mate	305
 NOMINAL	327
 APCU	
APCU Activation	329
APCU Deactivation	331
 DEORBIT PREP	
Payload Deactivation	333
Payload Entry Switch List/Verification	335
Payload Reactivation	337

MALFUNCTION	339
APCU	
APCU Amps (up arrow).....	341
APCU Temp (down arrow/up arrow)	343
APCU Trip	345
APCU Volts (up arrow/down arrow)	351
COMM	
Comm Malfunction Points	357
OIU Fail To Command	359
OIU Temp High Malfunction	363
PL/DPS Reconfiguration	365
S212 OIU AD 1 NOLK/Loss of ISS or SSOR Telemetry	367
S62 PDI Decom Fail.....	371
CRITICAL EQUIPMENT LOST	
Orbiter Electrical Bus Loss Matrix	373
Orbiter MDM Loss Impacts.....	375
REFERENCE	377
DISPLAYS	
SPEC 200 APCU Status	379
SPEC 205 ISS MCS Moding	383
SPEC 211 ISS C&W	391
SPEC 212 OIU	393
STANDARD SWITCH PANELS	
Standard Switch Panel 1	403
Standard Switch Panel 2	407

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 1 of 72 pages

OBJECTIVE:

This procedure will unlatch and latch the Solar Array Blanket Boxes (SABBs) and retract the 2B solar array on the P6 truss. This procedure is applicable only to P6 when it is attached to the Z1 truss.

NOTE

1. Crew will be primary for performing steps 19.2, 19.3, 19.5, 19.7, 19.8 and visual portions of steps 22.2, 23.5, 23.7, and 23.8. **MCC-H** will be primary for performing all remaining steps, as S-Band and Ku-Band availability permits. The crew may be asked to perform additional steps if video to the ground is unavailable.

Overview of SAW Retraction

1. Unlatch Left Blanket Box (LBB) and Right Blanket Box (RBB).
 2. Retract ~1/2 Bay of Mast, then stop retract (13 seconds).
 3. Latch LBB and RBB for EVA access.
 4. Perform a visual inspection of blanket.
 5. Retract Mast 1 Bay.
 6. Perform Beta Gimbal Assembly (BGA) Wiggle Technique (IVA) or EVA assist to align blankets (relatch SABBs if EVA assist required).
 7. Repeat numbers 4 to 6 until only one Mast Bay is visible, stop retract.
 8. Unlatch LBB and RBB when only one Bay visible.
 9. Perform visual inspection of blanket containment by rotating the BGA for IVA or perform containment inspection by EVA.
 10. Retract Mast 100 %.
 11. Perform visual inspection of blanket containment by rotating the BGA for IVA or perform containment inspection by EVA.
 12. Latch LBB and RBB.
2. Due to the anomalies experienced during the retraction of the 4B solar array, direct view is required when the mast is in motion and for visual verification items in steps 14.6, 14.8, 19.5, 19.7, 19.8, 22.2, 23.5, and 23.7. It is highly desirable, but not required, to have video downlink of all remaining SAW retraction operations.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 2 of 72 pages

CAUTION

Steps that involve mechanical motion (e.g., Latch, Unlatch, Deploy, Retract) of the SAW hardware, must

1. Be performed during insolation to support crew visual cues.
2. Be performed with ISS and orbiter thrusters inhibited.

1. VERIFYING PRE-RETRACTION INSPECTIONS COMPLETE **MCC-H**

NOTE

Both front and back of the SAW 2B will be inspected at approximately L-5 weeks. The array will be inspected again at approximately L-3 days prior to mission when the solar array will be retracted.

Confirm SAW 2B pre-retract visual inspections are complete and nominal.

Confirm {4.124 SAW XX PRE-RETRACT MDA CHECKOUT} (SODF: EPS: CORRECTIVE: PRIMARY POWER SYSTEM) for SAW 2B, is complete and nominal.

MCC-H ↑ ISS, Orbiter, "We have a GO to start SAW 2B retract operations."

2. VERIFYING ECU 2B CONFIGURED FOR SAW RETRACT

NOTE

Before retracting the solar array, the ECU 2B primary power feed (RPCM 2B A RPC 1) will be swapped to the redundant power feed (RPCM 4B A RPC 2) from the opposite channel on the IEA. This configuration provides a power source to ECU 2B, independent of the array being retracted.

Confirm {1.3.403 ECU XX CONFIG FROM PRIME TO REDUNDANT POWER} (SODF: EPS: ACTIVATION AND CHECKOUT: CHANNEL ACTIVATION) has been completed for ECU 2B.

3. VERIFYING COMM WITH BGA CONTROLLER

PCS

P6: EPS: BGA 2B

BGA 2B

'ECU 2B'

Verify ECU/BGA Integ Cnt – incrementing

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN)

Page 3 of 72 pages

4. VERIFYING COMM WITH SAW CONTROLLER

P6: EPS: SAW 2B

SAW 2B

'ECU 2B'

Verify ECU/SAW Integ Cnt – incrementing

5. REDUCING LOAD ON DDCU 4B PRIOR TO SAW RETRACT (MCC-H)

NOTE

Power is supplied to ECU 2B from the opposite channel through DDCU 4B and RPCM 4B A RPC 2 for the solar array retraction operations. Therefore, it may be necessary to reduce loads on DDCU 4B to support a peak power load of 580 watts during array retraction.

Verify enough margin exist on DDCU 4B to support a potential peak power load of 580 watts during retract operations. Reduce load as necessary to meet this requirement.

6. VERIFYING ECU POWER SUPPLY TEMPERATURES AND VOLTAGE STATUS

SAW 2B

'ECU 2B'

Verify SAW PS Temp, deg C: -33 to 51

Verify SAW PS Voltage, V: 115 to 125

Verify BGA PS Temp, deg C: -33 to 51

Verify BGA PS Voltage, V: 115 to 125

7. CONFIGURING BGA 2B FOR SAW RETRACT

NOTE

The BGA must be locked prior to retracting the SAW during EVA to prevent BGA rotation when the crew is working on the SAW. The BGA will not be locked during IVA retraction of the SAW; therefore, the BGA Wiggle Technique may be used. During the retraction, visual confirmation of SAW mechanisms will be performed by viewing the back side of the array.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 4 of 72 pages

If SAW 2B is to be retracted by IVA

Position BGA 2B to 227.8125 degrees.

Perform {2.102 PVM CONFIGURE BGA XX TO DIRECTED POSITION MODE} (SODF: EPS: NOMINAL: PRIMARY POWER SYSTEM), inhibit velocity limit safing to support BGA Wiggle Technique, then:

If SAW 2B is to be retracted with EVA assistance

Position BGA 2B to 227.8125 degrees and latch BGA on Latch 2.

Perform {2.101 PVM BGA XX ENGAGE ANTIROTATION LATCH}, all (SODF: EPS: NOMINAL: PRIMARY POWER SYSTEM), then:

8. VERIFYING SAW STATUS

8.1 Configuring for DBCL Dump of SAW Data

MCC-H

Confirm with ODIN that SAW 2B/4B DBCL is loaded in P6 PVCUs. This DBCL corresponds to PPL 71 Version 801.

Configure for continuous data dump of SAW 2B. To build dump command, perform {1.230 CCS BUILD DATA DUMP COMMAND}, all (SODF: GND AVIONICS: C&DH: NOMINAL). For start location addresses, use 255D2C and for number of words use 86. Verify initial SAW C&W flags and MDA data on SAW 2B DBCL MSK displays.

8.2 Verifying SAW Operational Ranges and Limit Switch Status

NOTE

Disconnects are present in the MDA Over Temp Trip FDIR. The software implements an MDA Over Temp Trip at 77.8° C. The ECU firmware implements an MDA Over Temp Trip at 140° C. These FDIR responses remove power to the MDA. Potential damage to hardware occurs at 120° C. MDA upper limit temperatures indicated in this step are conservative. At a minimum, a 30° C Mast MDA temperature increase should be protected during Mast retraction.

SAW 2B

'LBB'

NOTE

SABB limit switches are sensitive to thermal conditions and may indicate inaccurate values during eclipse and the first 15 minutes of insolation.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 5 of 72 pages

Verify SW01,02 Pin Released – Yes
Verify SW01,02 Latched – Yes
Verify SW01,02 Unlatched – No
Verify MDA Slow Alert – Nominal
Verify MDA Voltage: 000.0 (± 2.8)
Verify MDA Temp, deg C: -54 to 48
Verify MDA Over Temp Trip – blank

'MAST'

NOTE

SAW 2B SW 02 Deployed limit switch failed prior to the 4A mission. No is always indicated.

Verify SW01,02 Retracted – No, No
Verify SW01,02 Deployed – Yes, No
Verify MDA Slow Alert – Nominal
Verify MDA Voltage: 000.0 (± 2.8)
Verify MDA Temp, deg C: -54 to 48
Verify MDA Over Temp Trip – blank

'RBB'

NOTE

SABB limit switches are sensitive to thermal conditions and may indicate inaccurate values during eclipse and the first 15 minutes of insolation.

Verify SW 01,02 Pin Released – Yes
Verify SW 01,02 Latched – Yes
Verify SW 01,02 Unlatched – No
Verify MDA Slow Alert – Nominal
Verify MDA Voltage: 000.0 (± 2.8)
Verify MDA Temp, deg C: -54 to 48
Verify MDA Over Temp Trip – blank

'ECU 2B'

Verify MDA Current, A: 0.00 (± 0.4)
Verify MDA Over Current Trip – blank

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 6 of 72 pages

```
*****
* If any MDA temperature is out of range, notify MCC-H before
* | proceeding.
* |
* | 

|                                                    |
|----------------------------------------------------|
| <b>NOTE</b>                                        |
| PVCU software implements an MDA Over Temp Trip     |
| at 77.8° C which will remove power from the motor. |


* |
* | If MCC-H unavailable and MDA temperature is greater than 48° C,
* | | inhibit MDA Over Temp Safing.
* | | 'ECU 2B'
* | |
* | | sel SAW Software Inhibits
* | |
* | | 

|                          |
|--------------------------|
| SAW 2B Software Inhibits |
|--------------------------|


* | |
* | | sel SAW 2B Temp Safing
* | |
* | | 

|                    |
|--------------------|
| SAW 2B Temp Safing |
|--------------------|


* | | 'LBB (RBB)(Mast) Over Temp Safing'
* | | 'Primary PVCU'
* | |
* | | cmd Inhibit – Arm
* | | cmd Inhibit – Inhibit
* | |
* | | √Over Temp Safing, Primary PVCU – Inh
* | |
* | | 'Backup PVCU'
* | |
* | | cmd Inhibit – Arm
* | | cmd Inhibit – Inhibit
* | |
* | | √Over Temp Safing, Backup PVCU – Inh
* | |
*****
```

9. VERIFYING SAW FDIR STATUS

9.1 Verifying SABB Limit Switch Override

NOTE
These steps must be performed nominally if the Mast will be deployed or retracted while an SABB is in an undetermined state. These steps also override a failed Latched, Unlatched, or Pin Released limit switch.

P6: EPS: SAW 2B

SAW 2B

'ECU 2B'

sel SAW Software Inhibits

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 7 of 72 pages

SAW 2B Software Inhibits

'Deploy Reject'

cmd Inhibit – Arm

cmd Inhibit – Inhibit

√Deploy Reject – Inh (Allows deploy or retract commands when SABB state is undetermined.)

9.2 Verifying Mast Limit Switch Override

NOTE

These steps must be performed nominally if the SABBs will be latched or unlatched or if the BGA will be moved while the Mast is in an undetermined (partially deployed) state. These steps will also be performed to override a failed limit switch (e.g., SAW 2B SW 02 Deployed limit switch).

SAW 2B Software Inhibits

'Latch Reject'

cmd Inhibit – Arm

cmd Inhibit – Inhibit

√Latch Reject – Inh (Allows SABB unlatch or latch commands when Mast state is undetermined.)

9.3 Verifying BGA Software Configuration

P6: EPS: BGA 2B

BGA 2B

sel BGA Software Inhibits

BGA 2B Software Inhibits

'SAW Deployment'

'Primary PVCU'

√SAW Deployment, Primary PVCU – Ena (Allows BGA to be operated when SAW Mast is in an undetermined state.)

'Backup PVCU'

√SAW Deployment, Backup PVCU – Ena

10. VERIFYING MDA HI TEMP REJECT FUNCTION INHIBITED

P6: EPS: SAW 2B

SAW 2B

sel SAW Software Inhibits

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 8 of 72 pages

SAW 2B Software Inhibits

sel SAW 2B Temp Safing

SAW 2B Temp Safing

'Hi Temp Reject'

cmd Inhibit – Arm

cmd Inhibit – Inhibit

√Hi Temp Reject – Inh (Allows unlatch or latch and deploy or retract commands when MDA temperature is >30° C.)

11. VERIFYING MDA SAFING CONFIGURATION

sel SAW Software Inhibits

SAW 2B Software Inhibits

√Limit Sw Turnoff Function – Ena (Stops motor upon limit switch contact but does not turn motor off.)

NOTE

The Config Complete MDA Off Safing must be inhibited to prevent an inadvertent ECU trip during retraction operations. Due to an incorrect current limit value in PPL 69, when enabled, the Config Complete MDA Off Safing functional inhibit removes power from the MDA and ECU, if the SAW is in a fully deployed configuration.

'Config Complete MDA Off Safing'

'Primary PVCU'

cmd Inhibit – Arm

cmd Inhibit – Inhibit

√Config Complete MDA Off Safing, Primary PVCU – Inh (When enabled, this FI turns the motor off upon limit switch contact, if MDA current above limit.)

'Config Complete MDA Off Safing'

'Backup PVCU'

cmd Inhibit – Arm

cmd Inhibit – Inhibit

√Config Complete MDA Off Safing, Backup PVCU – Inh

sel SAW 2B Motor Stall Safing

SAW 2B Motor Stall Safing

- √Motor Stall Safing, Primary PVCU – Ena
- √Motor Stall Safing, Backup PVCU – Ena (Turns motor off if Slow is indicated when between limit switches and if MDA current above limit.)

12. UNLATCHING (DETENSIONING) LEFT BLANKET BOX (LBB)

12.1 Verifying Temperatures are Within Nominal Ranges Prior to Unlatch

P6: EPS: SAW 2B

SAW 2B

'ECU 2B'

Verify SAW PS Temp, deg C: -33 to 51

Verify BGA PS Temp, deg C: -33 to 51

'LBB'

Verify MDA Temp, deg C: -54 to 48

12.2 Powering On LBB Motor Drive Assembly (MDA)

NOTE

MDA Slow alert will be Nominal until MDA power is applied. Once this is done, the indication is Slow.

SAW 2B

'LBB'

sel LBB Commands

SAW 2B LBB Commands

'MDA'

'Power'

cmd On – Arm

cmd On – On

√MDA Voltage: 120 to 125

12.3 Performing Visual Verification Via Cameras

Perform a visual verification prior to, during, and at the completion of each blanket box unlatch (detension) operation. There are eight latches to be unlatched (detensioned) for each blanket box prior to SAW retract. Only four of eight latches are visible at a time.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 10 of 72 pages

Verify camera configuration correct for solar array retraction before proceeding.

Verify latch position (four of eight) latched (tensioned).

Crew

If orbiter is performing mated attitude control, proceed to step 12.5.

Otherwise, proceed to step 12.6 and wait for **MCC-H GO** for left blanket box unlatch.

12.4 Verifying Initial SAW Left Blanket Box Configuration

SAW 2B LBB Commands

Verify parameters in LATCHED column in step 12.7 before executing unlatch command.

12.5 Preventing Thruster Firings

CAUTION

To minimize the potential for structural damage to hardware while the solar array mechanisms are in motion, nonpropulsive CMG control or Free Drift will be maintained. Anytime the latches are not in motion, thrusters may be enabled.

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)

MCS: MCS Configuration: Manual CMG Desat

Manual CMG Desat

√Desat Request – Inh

MCC-H ↑ ISS, Orbiter, “Desats are Inhibited.”

Go to step 12.6.

* If ISS is performing attitude control and ISS is not in TEA (**MCC-H**)

* Perform {2.404 **MODING CMG TA TO FREE DRIFT**} (SODF:

* MCS: NOMINAL: GNC MODING), then:

*

* **MCC-H** ↑ ISS, Orbiter, “ISS is in Free Drift.”

*

* Go to step 12.6.

C3(A6)

* If orbiter is performing mated attitude control

* DAP: FREE

*

* Orbiter ⇒ ISS, **MCC-H**, “Orbiter is in Free Drift.”

*

* Go to step 12.6.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 11 of 72 pages

12.6 Unlatching (Detension) SAW Left Blanket Box

CAUTION

Confirm no crew exercise or maximum EVA loads before proceeding.

NOTE

Upon successful unlatch command, the MDA current will increase (0.2 to 3.0 amps) and the Slow alert will go to Nominal during transition, then return to Slow. Once power is removed from the MDA, the Slow alert will indicate Nominal.

If crew is performing the LBB unlatch

MCC-H ↑ ISS, Orbiter, "Crew is GO to unlatch the left blanket box"

If ground is performing the LBB unlatch

MCC-H ↑ ISS, Orbiter, "We are ready to unlatch the left blanket box, please monitor cameras."

PCS

P6: EPS: SAW 2B

SAW 2B

'LBB'

sel LBB Commands

SAW 2B LBB Commands

'LBB'

cmd Unlatch – Arm

cmd Unlatch – Unlatch

12.7 Monitoring LBB Latch Parameters During Unlatch (Detension) (Approximately 14 Seconds)

Refer to Table 1.

NOTE

SABB limit switches are sensitive to thermal conditions and may indicate inaccurate values during eclipse and the first 15 minutes of insolation.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

Table 1. LBB Parameters

PARAMETER	LATCHED→	TRANSITION→ Approximately 14 Seconds	UNLATCHED
LBB SW01,02 Pin Released	Yes	Yes	Yes
LBB SW01,02 Latched	Yes	No	No
LBB SW01,02 Unlatched	No	No	Yes
MDA Slow Alert	Slow	Nominal	Slow
MDA Voltage, V	120 to 125	120 to 125	120 to 125
MDA Temp, deg C	-54 to 48	-54 to 48	-54 to 48
MDA Over Temp Trip	blank	blank	blank
MDA Current, A	~0.10 (±0.4)	0.20 to 2.00 (±0.4)	~0.10 (±0.4)
MDA Over Current Trip	blank	blank	blank

Crew

If orbiter is performing mated attitude control, proceed to step 12.8.
Otherwise, proceed to step 12.9.

- *****
- * If one Latched, Unlatched, or Pin Released limit switch fails
 - * | Confirm configuration visually and notify **MCC-H** before
 - * | proceeding.
 - * |
 - * | SABB limit switch status that would restrict Mast commanding
 - * | has already been overridden in step 9.1.
 - * |
 - * If two Latched, Unlatched, or Pin Released limit switches fail
 - * | Perform steps 12.8 and 12.9; then, notify **MCC-H** before
 - * | proceeding.
- *****

12.8 Configuring for Nominal Attitude Control

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)
Go to step 12.9.

- *****
- * If ISS is performing attitude control and ISS is not in TEA (**MCC-H**)
 - * | Perform {2.405 **MODING FREE DRIFT TO CMG TA**} (SODF:
 - * | MCS: NOMINAL: GNC MODING), then:
 - * |
 - * | **MCC-H** ↑ ISS, Orbiter, "ISS is in Attitude Control."
 - * |
 - * | Go to step 12.9.
- *****

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 13 of 72 pages

C3(A6)

- * If orbiter is performing mated attitude control
- * | Perform rate damping DOCKED CONFIGURATION DAP
- * | REFERENCE (FDF: ORB OPS, REBOOST/DAP), then:
- * |
- * | Go to step 12.9.

12.9 Performing Visual Verification Via Cameras

Verify latch position (four of eight) unlatched (detensioned).

ISS ↓ **MCC-H**, "We confirm the left blanket box is unlatched."

MCC-H ↑ ISS, "We confirm nominal unlatch."

Crew

Proceed to step 13.3.

- * If unlatch sequence is not successful, notify **MCC-H** before proceeding.
- * |
- * |

- * If **MCC-H** unavailable, perform {3.190 SAW XX FAILURE
- * | TO UNLATCH SABB REMOTELY}, all (SODF: EPS:
- * | MALFUNCTION: PRIMARY POWER SYSTEM), then:

PCS

12.10 Power Off Left Blanket Box MDA

P6: EPS: SAW 2B

SAW 2B

'LBB'

sel LBB Commands

SAW 2B LBB Commands

'MDA'

'Power'

cmd Off – Off

√MDA Voltage <10 (±2.8)

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 14 of 72 pages

13. UNLATCHING (DETENSIONING) RIGHT BLANKET BOX (RBB)

13.1 Verifying Temperatures are Within Nominal Ranges Prior to Unlatch

P6: EPS: SAW 2B

SAW 2B

'ECU 2B'

Verify SAW PS Temp, deg C: -33 to 51

Verify BGA PS Temp, deg C: -33 to 51

'RBB'

Verify MDA Temp, deg C: -54 to 48

13.2 Powering On RBB Motor Drive Assembly (MDA)

NOTE

MDA Slow alert will be Nominal until MDA power is applied. Once this is done, the indication is Slow.

SAW 2B

'RBB'

sel RBB Commands

SAW 2B RBB Commands

'MDA'

'Power'

cmd On – On Arm

cmd On – On

√MDA Voltage, V: 120 to 125

13.3 Performing Visual Verification Via Cameras

Perform a visual verification prior to, during, and at the completion of each blanket box unlatch (detension) operation. There are eight latches to be unlatched (detensioned) for each blanket box prior to SAW retract. Only four of eight latches are visible at a time.

Verify camera configuration correct for solar array retraction before proceeding.

Verify Latch Position (four of eight) – latched (tensioned)

Crew

If orbiter is performing mated attitude control, proceed to step 13.5.

Otherwise, proceed to step 13.6, and wait for **MCC-H GO** for right blanket box unlatch.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 15 of 72 pages

13.4 Verifying Initial SAW Right Blanket Box Configuration

SAW 2B RBB Commands

Verify parameters in LATCHED column in step 13.7 before executing unlatch command.

13.5 Preventing Thruster Firings

CAUTION

To minimize the potential for structural damage to hardware while the solar array mechanisms are in motion, nonpropulsive CMG control or Free Drift will be maintained. Anytime the latches are not in motion, thrusters may be enabled.

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)

MCS: MCS Configuration: Manual CMG Desat

Manual CMG Desat

√Desat Request – Inh

MCC-H ↑ ISS, Orbiter, “Desats are Inhibited.”

Go to step 13.6.

* If ISS is performing attitude control and ISS is not in TEA (**MCC-H**)

* Perform {2.404 MODING CMG TA TO FREE DRIFT} (SODF:

* MCS: NOMINAL: GNC MODING), then:

*

* **MCC-H** ↑ ISS, Orbiter, “ISS is in Free Drift.”

*

* Go to step 13.6.

C3(A6)

* If orbiter is performing mated attitude control

* DAP: FREE

*

* Orbiter ⇒ ISS, **MCC-H**, “Orbiter is in Free Drift.”

*

* Go to step 13.6.

13.6 Unlatching (Detension) SAW Right Blanket Box

CAUTION

Confirm no crew exercise or maximum EVA loads before proceeding.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 16 of 72 pages

NOTE

Upon successful unlatch commanding, the MDA current will increase (0.2 to 3.0 amps) and the Slow alert will go to Nominal during transition, then return to Slow. Once power is removed from the MDA, the Slow alert will indicate Nominal.

If crew is performing the RBB unlatch

MCC-H ↑ ISS, Orbiter, "Crew is GO to unlatch the right blanket box."

If ground is performing the RBB unlatch

MCC-H ↑ ISS, Orbiter, "We are ready to unlatch the right blanket box, please monitor cameras."

PCS

P6: EPS: SAW 2B

SAW 2B

'RBB'

sel RBB Commands

SAW 2B RBB Commands

'RBB'

cmd Unlatch – Arm

cmd Unlatch – Unlatch

13.7 Monitoring RBB Latch Parameters During Unlatch (Detension) (Approximately 14 Seconds)

Refer to Table 2.

NOTE

SABB limit switches are sensitive to thermal conditions and may indicate inaccurate values during eclipse and the first 15 minutes of insolation.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

Table 2. RBB Parameters

PARAMETER	LATCHED→	TRANSITION→ Approximately 14 Seconds	UNLATCHED
RBB SW01,02 Pin Released	Yes	Yes	Yes
RBB SW01,02 Latched	Yes	No	No
RBB SW01,02 Unlatched	No	No	Yes
MDA Slow Alert	Slow	Nominal	Slow
MDA Voltage, V	120 to 125	120 to 125	120 to 125
MDA Temp, deg C	-54 to 48	-54 to 48	-54 to 48
MDA Over Temp Trip	blank	blank	blank
MDA Current, A	~0.10 (±0.4)	0.20 to 2.00 (±0.4)	~0.10 (±0.4)
MDA Over Current Trip	blank	blank	blank

Crew

If orbiter is performing mated attitude control, proceed to step 13.8.
Otherwise, proceed to 13.9.

- * If one Latched, Unlatched, or Pin Released limit switch fails
- * | Confirm configuration visually and notify **MCC-H** before
- * | proceeding.
- * |
- * | SABB limit switch status that would restrict Mast
- * | commanding has already been overridden in step 9.1.
- * |
- * If two Latched, Unlatched, or Pin Released limit switches fail
- * | Perform steps 13.8 and 13.9; then, notify **MCC-H** before
- * | proceeding.

13.8 Enabling Thrusters (or Configuring for Attitude Control)

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)
Go to step 13.9.

- * If ISS is performing attitude control and ISS is not in TEA (**MCC-H**)
- * | Perform {2.405 **MODING FREE DRIFT TO CMG TA**} (SODF:
- * | MCS: NOMINAL: GNC MODING), then:
- * |
- * | **MCC-H** ↑ ISS, Orbiter, "ISS is in Attitude Control."
- * |
- * | Go to step 13.9.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 18 of 72 pages

C3(A6)

```
*****
* If orbiter is performing mated attitude control
* | Perform rate damping DOCKED CONFIGURATION DAP
* | REFERENCE (FDF: ORB OPS, REBOOST/DAP), then:
* |
* | Go to step 13.9.
*****
```

13.9 Performing Visual Verification Via Cameras

Verify latch position (four of eight) unlatched (detensioned).

ISS ↓ **MCC-H**, “We confirm the right blanket box is unlatched.”

MCC-H ↑ ISS, “We confirm nominal unlatch.”

Crew

Proceed to step 14.2 and provide camera support as necessary.

```
*****
* If unlatch sequence is not successful, notify MCC-H before
* | proceeding.
* |
* | If MCC-H unavailable, perform {3.190 SAW XX FAILURE
* | TO UNLATCH SABB REMOTELY}, all (SODF: EPS:
* | MALFUNCTION: PRIMARY POWER SYSTEM), then:
*****
```

PCS

13.10 Powering Off Right Blanket Box MDA

P6: EPS: SAW 2B

SAW 2B

‘RBB’

sel RBB Commands

SAW 2B RBB Commands

‘MDA’

‘Power’

cmd Off – Off

√MDA Voltage <10 (±2.8)

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 19 of 72 pages

14. RETRACTING FIRST 1/2 BAY OF SOLAR ARRAY MAST

NOTE

The array will be retracted with the SABB latches in the unlatched position for the first 1/2 Bay to reduce tension in the blanket from 75 lbs to 12 lbs and reduce the risk of backward folding blanket panels. After the first 1/2 Bay is retracted and the tension bar is resting on the sill of the SABB, the blankets are no longer under tension. The SABBs will be relatched prior to EVA assisted solar array retraction operations to minimize snag hazard and provide EVA access to blanket panels.

14.1 Verifying Temperatures are Within Nominal Ranges Prior to SAW

Retract

P6: EPS: SAW 2B

SAW 2B

'ECU 2B'

Verify SAW PS Temp, deg C: -33 to 51

Verify BGA PS Temp, deg C: -33 to 51

'Mast'

Verify MDA Temp, deg C: -54 to 48

14.2 Powering On Mast Motor Drive Assembly (MDA)

NOTE

MDA Slow alert will be Nominal until MDA power is applied. Once this is done, the indication is Slow.

SAW 2B

'Mast'

sel Mast Commands

SAW 2B Mast Commands

'MDA'

'Power'

cmd On – Arm

cmd On – On

√MDA Voltage, V: 120 to 125

√MDA Current, A: ~0.10 (±0.4)

√MDA Slow Alert: Slow

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 20 of 72 pages

14.3 Verifying Camera Configuration

Perform a visual verification prior to, during, and at the completion of the Mast retract operation to minimize the risk of potential collision hazards and monitor for any anomalies. Total number of visible Mast Bays is 31.5, 1 Bay is rigid batten to rigid batten.

Verify camera configuration correct for solar array retraction before proceeding.

Crew

If orbiter is performing mated attitude control, proceed to step 14.5.

Otherwise, proceed to step 14.6 and wait for **MCC-H GO** for retraction of first 1/2 Bay.

14.4 Verifying Initial SAW Mast Configuration

SAW 2B Mast Commands

'Mast'

NOTE

SAW 2B SW 02 Deployed limit switch failed prior to the 4A mission, No is always indicated.

√SW01,SW02 Retracted – No

√SW01,SW02 Deployed – Yes

14.5 Preventing Thruster Firings

CAUTION

To minimize the potential for structural damage to hardware while the solar array mechanisms are in motion, nonpropulsive CMG control or Free Drift will be maintained. Anytime the array retraction is stopped or aborted, thrusters may be enabled.

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)

MCS: MCS Configuration: Manual CMG Desat

Manual CMG Desat

√Desat Request – Inh

MCC-H ↑ ISS, Orbiter, "Desats are Inhibited."

Go to step 14.6.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 21 of 72 pages

```
*****
* If ISS is performing attitude control and ISS is not in TEA (MCC-H)
*   Perform {2.404 MODING CMG TA TO FREE DRIFT} (SODF:
*   MCS: NOMINAL: GNC MODING), then:
*
*   MCC-H ↑ ISS, Orbiter, "ISS is in Free Drift."
*
*   Go to step 14.6.
*****
```

C3(A6)

```
*****
* If orbiter is performing mated attitude control
*   DAP: FREE
*
*   Orbiter ⇒ ISS, MCC-H, "Orbiter is in Free Drift."
*
*   Go to step 14.6.
*****
```

14.6 Retracting First 1/2 Bay of SAW Mast (**MCC-H**)

WARNING

If retracting a solar array during EVA operations, confirm EV crew clear of solar array mechanisms and mast interface.

CAUTION

Confirm no crew exercise or maximum EVA loads before proceeding.

NOTE

1. During the retraction of the first half Bay, the tension mechanisms will rotate (approximately two turns) and the tension bar will lower to the blanket box sill.
2. Upon successful retract command, the Slow alert will go to Nominal during transition and the MDA current will peak briefly at ~2 amps and then oscillate between 0.3 and 1.3 amps (± 0.4) as Bays retract. Once power is removed from the MDA, the Slow alert will indicate Nominal.

MCC-H ↑ ISS, Orbiter, "We are ready to retract the first 1/2 bay, please monitor cameras."

PCS

P6: EPS: SAW 2B

SAW 2B

'Mast'

sel Mast Commands

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 22 of 72 pages

SAW 2B Mast Commands

'Mast'

NOTE

To reduce the risk of a backward folding panel, the following three commands should be built and executed as time tagged commands. The Abort command is issued when the tension bar reaches the sill of the SABB. This equates to 13 seconds from when the Retract command is issued and when the Abort command is issued.

cmd Retract – Arm

cmd Retract – Retract

Wait 13 seconds (~1/2 Bay).

cmd Abort – Abort

NOTE

The Mast – Abort command removes power from the MDA.

'MDA'

√Voltage <10 (±2.8) (MDA – Off)

'Mast'

√SW01,SW02 Retracted – No

√SW01,SW02 Deployed – No

Crew

If orbiter is performing mated attitude control, proceed to step 14.7.
Otherwise, proceed to step 14.8.

14.7 Configuring for Nominal Attitude Control

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)

Go to step 14.8.

```

*****
* If ISS is performing attitude control and ISS is not in TEA (MCC-H)
* | Perform {2.405 MODING FREE DRIFT TO CMG TA} (SODF:
* | MCS: NOMINAL: GNC MODING), then:
* |
* | MCC-H ↑ ISS, Orbiter, "ISS is in Attitude Control."
* |
* | Go to step 14.8.
*****

```


4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 23 of 72 pages

C3(A6)

- * If orbiter is performing mated attitude control
- * | Perform rate damping DOCKED CONFIGURATION DAP
- * | REFERENCE (FDF: ORB OPS, REBOOST/DAP), then:
- * |
- * | Go to step 14.8.

14.8 Performing Visual Verification Via Cameras

Live downlink of video for **MCC-H** evaluation is highly desired for this step.

Verify tension bar correctly seated in Y brackets.
Verify initial panel folding (no blanket panels folding backwards.)
Verify guide wires along back of blankets have no slack.

ISS ↓ **MCC-H**, “We confirm first 1/2 Bay retracted.”

MCC-H ↑ ISS, “We confirm nominal Mast retraction.”

Crew

If orbiter is performing mated attitude control, proceed to step 15.3.
| Otherwise, proceed to step 15.4, and wait for **MCC-H GO** for left
| blanket box latch.

- * If retract sequence is not successful, notify **MCC-H** before proceeding.
- * |
- * |

- * If **MCC-H** unavailable, perform {3.192 SAW XX FAILURE
- * | TO RETRACT MAST REMOTELY}, all (SODF: EPS:
- * | MALFUNCTION: PRIMARY POWER SYSTEM), then:

15. LATCHING LEFT BLANKET BOX (LBB)

NOTE

After the first 1/2 Bay is retracted and the tension bar is resting on the sill of the SABB, the blankets are no longer under tension. The SABBs will be relatched prior to EVA assisted solar array retraction operations to minimize snag hazard and provide EVA access to blanket panels.

15.1 Powering On LBB Motor Drive Assembly (MDA)

NOTE

MDA Slow alert will be Nominal until MDA power is applied. Once this is done, the indication is Slow.

P6: EPS: SAW 2B

SAW 2B

'LBB'

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 24 of 72 pages

sel LBB Commands

SAW 2B LBB Commands

'MDA'

'Power'

cmd On – Arm

cmd On – On

√MDA Voltage, V: 120 to 125

15.2 Verifying SAW Left Blanket Box Configuration

Verify parameters in UNLATCHED column in step 15.5 before executing latch command.

15.3 Preventing Thruster Firings

CAUTION

To minimize the potential for structural damage to hardware while the solar array mechanisms are in motion, nonpropulsive CMG control or Free Drift will be maintained. Anytime the latches are not in motion, thrusters may be enabled.

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)

MCS: MCS Configuration: Manual CMG Desat

Manual CMG Desat

√Desat Request – Inh

MCC-H ↑ ISS, Orbiter, “Desats are Inhibited.”

Go to step 15.4.

* If ISS is performing attitude control and ISS is not in TEA (**MCC-H**)

* Perform {2.404 MODING CMG TA TO FREE DRIFT} (SODF:
* MCS: NOMINAL: GNC MODING), then:

* **MCC-H** ↑ ISS, Orbiter, “ISS is in Free Drift.”

* Go to step 15.4.

C3(A6)

* If orbiter is performing mated attitude control

* DAP: FREE

* Orbiter ⇒ ISS, **MCC-H**, “Orbiter is in Free Drift.”

* Go to step 15.4.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 25 of 72 pages

15.4 Latching SAW Left Blanket Box

CAUTION

Confirm no crew exercise or maximum EVA loads before proceeding.

NOTE

Upon successful latch command, the Slow alert will go to Nominal during transition, then return to Slow. Once power is removed from the MDA, the Slow alert will indicate Nominal.

If crew is performing the LBB Latch

MCC-H ↑ ISS, Orbiter, "Crew is GO to latch the left blanket box."

If ground is performing the LBB Latch

MCC-H ↑ ISS, Orbiter, "We are ready to latch the left blanket box, please monitor cameras."

PCS

P6: EPS: SAW 2B

SAW 2B

'LBB'

sel LBB Commands

SAW 2B LBB Commands

'LBB'

cmd Latch – Arm

cmd Latch – Latch

15.5 Monitor LBB Latch Parameters During Latch (Approximately 14 Seconds)

Refer to Table 3.

Perform a visual verification prior to, during, and at the completion of each blanket box latching to monitor for any anomalies and to verify blanket box latching operation.

NOTE

SABB limit switches are sensitive to thermal conditions and may indicate inaccurate values during eclipse and the first 15 minutes of insolation.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

Table 3. LBB Parameters

PARAMETER	UNLATCHED→	TRANSITION→ Approximately 14 Seconds	LATCHED
LBB SW01,02 Pin Released	Yes	Yes	Yes
LBB SW01,02 Latched	No	No	Yes
LBB SW01,02 Unlatched	Yes	No	No
MDA Slow Alert	Slow	Nominal	Slow
MDA Voltage, V	120 to 125	120 to 125	120 to 125
MDA Temp, deg C	-54 to 48	-54 to 48	-54 to 48
MDA Over Temp Trip	blank	blank	blank
MDA Current, A	~0.10 (±0.4)	0.20 to 2.00 (±0.4)	~0.10 (±0.4)
MDA Over Current Trip	blank	blank	blank

Crew

If orbiter is performing mated attitude control, proceed to step 15.6.
Otherwise, proceed to step 15.7.

- * If one Latched or Unlatched limit switch fails
 - * Confirm configuration visually and notify **MCC-H** before proceeding.
 - *
 - * SABB limit switch status that would restrict Mast commanding has already been overridden in step 9.3.
 - *
- * If two Latched or Unlatched limit switches fail
 - * Perform steps 15.6 and 15.7; then, notify **MCC-H** before proceeding.
 - *

15.6 Configuring for Nominal Attitude Control

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)
Go to step 15.7.

- * If ISS is performing attitude control and ISS is not in TEA (**MCC-H**)
 - * Perform {2.405 **MODING FREE DRIFT TO CMG TA**} (SODF: MCS: NOMINAL: GNC MODING), then:
 - *
 - * **MCC-H** ↑ ISS, Orbiter, "ISS is in Attitude Control."
 - *
 - * Go to step 15.7.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 27 of 72 pages

C3(A6)

```
*****
* If orbiter is performing mated attitude control
* | Perform rate damping DOCKED CONFIGURATION DAP
* | REFERENCE (FDF: ORB OPS, REBOOST/DAP), then:
* |
* | Go to step 15.7.
*****
```

15.7 Performing Visual Verification Via Cameras

Verify latch position (four of eight) latched (hooks engaged with pins).

Verify blanket fully contained within blanket box.

ISS ↓ **MCC-H**, “We confirm the left blanket box is latched.”

MCC-H ↑ ISS, “We confirm nominal latch.”

Crew

If orbiter is performing mated attitude control, proceed to step 16.3.

| Otherwise, proceed to step 16.4 and wait for **MCC-H GO** for right blanket box latch.

```
*****
* If latch sequence is not successful, notify MCC-H before
* | proceeding.
* |
* | If MCC-H unavailable, perform {3.193 SAW XX FAILURE
* | TO LATCH (TENSION) SABB REMOTELY}, all (SODF:
* | EPS: MALFUNCTION: PRIMARY POWER SYSTEM),
* | then:
*****
```

PCS

15.8 Powering Off Left Blanket Box MDA

P6: EPS: SAW 2B

SAW 2B

‘LBB’

sel LBB Commands

SAW 2B LBB Commands

‘MDA’

‘Power’

cmd Off – Off

√MDA Voltage <10 (±2.8)

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 28 of 72 pages

16. LATCHING RIGHT BLANKET BOX (RBB)

16.1 Powering On RBB Motor Drive Assembly (MDA)

NOTE

MDA Slow alert will be Nominal until MDA power is applied. Once this is done, the indication is Slow.

P6: EPS: SAW 2B

SAW 2B

'RBB'

sel RBB Commands

SAW 2B RBB Commands

'MDA'

'Power'

cmd On – Arm

cmd On – On

√MDA Voltage, V: 120 to 125

16.2 Verifying SAW Right Blanket Box Configuration

Verify parameters in UNLATCHED column in step 16.5 before executing latch command.

16.3 Preventing Thruster Firings

CAUTION

To minimize the potential for structural damage to hardware while the solar array mechanisms are in motion, nonpropulsive CMG control or Free Drift will be maintained. Anytime the latches are not in motion, thrusters may be enabled.

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)

MCS: MCS Configuration: Manual CMG Desat

Manual CMG Desat

√Desat Request – Inh

MCC-H ↑ ISS, Orbiter, "Desats are Inhibited."

Go to step 16.4.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 29 of 72 pages

```
*****
* If ISS is performing attitude control and ISS is not in TEA (MCC-H)
* | Perform {2.404 MODING CMG TA TO FREE DRIFT} (SODF:
* | MCS: NOMINAL: GNC MODING), then:
* |
* | MCC-H ↑ ISS, Orbiter, "ISS is in Free Drift."
* |
* | Go to step 16.4.
*****
```

C3(A6)

```
*****
* If orbiter is performing mated attitude control
* | DAP: FREE
* |
* | Orbiter ⇒ ISS, MCC-H, "Orbiter is in Free Drift."
* |
* | Go to step 16.4.
*****
```

16.4 Latching SAW Right Blanket Box

CAUTION
Confirm no crew exercise or maximum EVA loads before proceeding.

<u>NOTE</u>
Upon successful latch command, the Slow alert will go to Nominal during transition, then return to Slow. Once power is removed from the MDA, the Slow alert will indicate Nominal.

If crew is performing the RBB Latch
| **MCC-H** ↑ ISS, Orbiter, "Crew is GO to latch the right blanket box."

If ground is performing the RBB Latch
| **MCC-H** ↑ ISS, Orbiter, "We are ready to latch the right blanket box, please monitor cameras."

PCS

P6: EPS: SAW 2B

SAW 2B

'RBB'

sel RBB Commands

SAW 2B RBB Commands

'RBB'

cmd Latch – Arm
cmd Latch – Latch

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

16.5 Monitoring RBB Latch Parameters During Latch (Approximately 14 Seconds)

Refer to Table 4.

Perform a visual verification prior to, during, and at the completion of each blanket box latching to monitor for any anomalies and to verify blanket box latching operation.

NOTE

SABB limit switches are sensitive to thermal conditions and may indicate inaccurate values during eclipse and the first 15 minutes of insolation.

Table 4. RBB Parameters

PARAMETER	UNLATCHED→	TRANSITION→ Approximately 14 Seconds	LATCHED
RBB SW 01,02 Pin Released	Yes	Yes	Yes
RBB SW 01,02 Latched	No	No	Yes
RBB SW 01,02 Unlatched	Yes	No	No
MDA Slow Alert	Slow	Nominal	Slow
MDA Voltage, V	120 to 125	120 to 125	120 to 125
MDA Temp, deg C	-54 to 48	-54 to 48	-54 to 48
MDA Over Temp Trip	blank	blank	blank
MDA Current, A	~0.10 (±0.4)	0.20 to 2.00 (±0.4)	~0.10 (±0.4)
MDA Over Current Trip	blank	blank	blank

Crew

If orbiter is performing mated attitude control, proceed to step 16.6.
Otherwise, proceed to step 16.7.

```

*****
* If one Latched or Unlatched limit switch fails
* | Confirm configuration visually and notify MCC-H before
* | proceeding.
* |
* | SABB limit switch status that would restrict Mast
* | commanding has already been overridden in step 9.1.
* |
* If two Latched or Unlatched limit switches fail
* | Perform steps 16.6 and 16.7; then, notify MCC-H before
* | proceeding.
*****
    
```


4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 31 of 72 pages

MCC-H 16.6 Configuring for Nominal Attitude Control
If ISS is performing attitude control and ISS is in TEA (**MCC-H**)
Go to step 16.7.

```
*****
* If ISS is performing attitude control and ISS is not in TEA (MCC-H)
* | Perform {2.405 MODING FREE DRIFT TO CMG TA} (SODF:
* | MCS: NOMINAL: GNC MODING), then:
* |
* | MCC-H ↑ ISS, Orbiter, "ISS is in Attitude Control."
* |
* | Go to step 16.7.
*****
```

C3(A6) * If orbiter is performing mated attitude control
* | Perform rate damping DOCKED CONFIGURATION DAP
* | REFERENCE (FDF: ORB OPS, REBOOST/DAP), then:
* |
* | Go to step 16.7.

16.7 Performing Visual Verification Via Cameras
Verify latch position (four of eight) latched (hooks engaged with pins).
Verify blanket fully contained within blanket box.

ISS ↓ **MCC-H**, "We confirm the right blanket box is latched."

MCC-H ↑ ISS, "We confirm nominal latch."

Crew proceed to step 19.2 and confirm correct camera and RWS configuration for retraction of the 2B solar array.

```
*****
* If latch sequence is not successful, notify MCC-H before
* | proceeding.
* |
* |
* | If MCC-H unavailable, perform {3.193 SAW XX FAILURE
* | TO LATCH (TENSION) SABB REMOTELY}, all (SODF:
* | EPS: MALFUNCTION: PRIMARY POWER SYSTEM),
* | then:
*****
```

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 32 of 72 pages

PCS 16.8 Powering Off Right Blanket Box MDA
P6: EPS: SAW 2B
SAW 2B
'RBB'

sel RBB Commands

SAW 2B RBB Commands
'MDA'
'Power'

cmd Off – Off

$\sqrt{\text{MDA Voltage}} < 10 (\pm 2.8)$

17. VERIFYING BGA 2B CONFIGURATION FOR SAW RETRACT

NOTE

The BGA must be locked prior to retracting the SAW during EVA to prevent BGA rotation when the crew is working on the SAW. The BGA will not be locked during IVA retraction of the SAW; therefore, the BGA Wiggle Technique may be used. During the retraction, visual confirmation of SAW mechanisms will be performed by viewing the back side of the array.

If SAW 2B is to be retracted by IVA

Verify BGA 2B position is 227.8125 degrees and the BGA is unlatched.

* If BGA 2B not positioned at 227.8125 degrees
* | Perform {2.102 PVM CONFIGURE BGA XX TO DIRECTED
* | POSITION MODE} (SODF: EPS: NOMINAL: PRIMARY
* | POWER SYSTEM), inhibit velocity limit safing to support BGA
* | Wiggle Technique, then:

If SAW 2B is to be retracted with EVA assistance

Verify BGA 2B position is 227.8125 degrees and Latch 2 is latched.

* If BGA 2B is unlatched and not positioned at 227.8125 degrees
* | Perform {2.101 PVM BGA XX ENGAGE ANTIROTATION
* | LATCH}, all (SODF: EPS: NOMINAL: PRIMARY POWER
* | SYSTEM), then:

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN)

Page 33 of 72 pages

NOTE

Following step 18, no power will be supplied to Ch 2B from SAW 2B.

18. VERIFYING CHANNEL 2B LOADS SUPPORTED FROM ANOTHER SOURCE

18.1 Confirming Seamless Power Channel Handover (SPCH) Complete

NOTE

At the end of the SPCH, all DCSU 2B RBIs are closed and SSU 2B is shunted. No power is supplied to channel 2B loads from SAW 2B.

Confirm {2.134 SEAMLESS POWER CHANNEL HANDOVER (SPCH)} (SODF: EPS: NOMINAL: PRIMARY POWER SYSTEM) has been completed.

18.2 Shunting SSU 2B

P6: EPS: SSU 2B

SSU 2B

sel PVCE

SSU 2B PVCE

cmd All PVCE Off – Off (single-step command – arm not required)

√PVCE 1 Error Voltage: <5 Volts

√PVCE 2 Error Voltage: <5 Volts

√PVCE 3 Error Voltage: <5 Volts

MCC-H ↑ ISS: “Steps 1 to 18 of solar array retract procedure have been completed.”

19. RETRACTING 2B SOLAR ARRAY 1 BAY AT A TIME

19.1 Verifying Temperatures are Within Nominal Ranges Prior to SAW

Retract

P6: EPS: SAW 2B

SAW 2B

'ECU 2B'

Verify SAW PS Temp, deg C: -33 to 51

Verify BGA PS Temp, deg C: -33 to 51

'Mast'

Verify MDA Temp, deg C: -54 to 48

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN)

Page 34 of 72 pages

19.2 Verifying Camera Configuration

Perform a visual verification prior to, during, and at the completion of the Mast retraction operation to minimize the risk of potential collision hazards, monitor for any anomalies, and to verify solar array retraction. Total number of visible Mast Bays is 31.5, 1 Bay is rigid batten to rigid batten.

Observe

- a. Smooth Mast operation, Mast visually straight (no bending or twisting).
- b. Broken or missing Mast members.
- c. No bending or twisting of SABB cover and base.
- d. Correct panel folding (no backward folding) and uniform stacking of blanket panels inside SABB skirts (outboard FCC STE loops stack inside SABB base goal posts).
- e. Smooth retraction of guide wires (three per SABB) (no loose cable).

Verify camera configuration correct for solar array retraction before proceeding.

19.3 Powering On Mast Motor Drive Assembly (MDA)

WARNING

If retracting a solar array during EVA operations, confirm EV crew clear of solar array mechanisms and Mast interface prior to MDA activation.

NOTE

MDA Slow alert will be Nominal until MDA power is applied. Once this is done, the indication is Slow.

SAW 2B

'Mast'

sel Mast Commands

SAW 2B Mast Commands

'MDA'

'Power'

cmd On – Arm

cmd On – On

√MDA Voltage, V: 120 to 125

√MDA Current, A: ~0.10 (±0.4)

√MDA Slow Alert – Slow

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 35 of 72 pages

Crew

If orbiter is performing mated attitude control, proceed to step 19.4.

Otherwise, proceed to step 19.5 and wait for **MCC-H GO** for Mast retraction of one Bay.

19.4 Preventing Thruster Firings

CAUTION

To minimize the potential for structural damage to hardware while the solar array mechanisms are in motion, nonpropulsive CMG control or Free Drift will be maintained. At any time the array retraction is stopped or aborted, thrusters may be enabled to clean up the attitude.

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)

MCS: MCS Configuration: Manual CMG Desat

Manual CMG Desat

√Desat Request – Inh

MCC-H ↑ ISS, Orbiter, “Desats are Inhibited.”

Go to step 19.5.

* If ISS is performing attitude control and ISS is not in TEA (**MCC-H**)

* Perform {2.404 MODING CMG TA TO FREE DRIFT} (SODF: MCS: NOMINAL: GNC MODING), then:

* **MCC-H** ↑ ISS, Orbiter, “ISS is in Free Drift.”

* Go to step 19.5.

C3(A6)

* If orbiter is performing mated attitude control

* DAP: FREE

* Orbiter ⇒ ISS, **MCC-H**, “Orbiter is in Free Drift.”

* Go to step 19.5.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 36 of 72 pages

19.5 Retracting 1 Mast Bay at a Time

WARNING

If retracting a solar array during EVA operations, confirm EV crew clear of solar array mechanisms and mast interface.

CAUTION

Confirm no crew exercise or maximum EVA loads before proceeding.

NOTE

Upon successful retract command, the Slow alert will go to Nominal during transition and the MDA current will peak briefly at ~2 amps and then oscillate between 0.3 and 1.3 amps (± 0.4) as Bays retract. Once power is removed from the MDA, the Slow alert will indicate Nominal.

If crew is performing the Mast retraction

MCC-H ↑ ISS, Orbiter, "Crew is GO to retract one Bay."

If ground is performing the Mast retraction

MCC-H ↑ ISS, Orbiter, "We are ready to retract one Bay, please monitor cameras."

PCS

P6: EPS: SAW 2B

SAW 2B

'Mast'

sel Mast Commands

SAW 2B Mast Commands

'Mast'

NOTE

If ground performing Mast retraction, the following three commands should be built and executed as time tagged commands. The Abort command is already onboard in the event of LOS. This equates to 20 seconds from when the Retract command is issued and when the Abort command is issued.

cmd Retract – Arm

cmd Retract – Retract

Wait approximately 20 seconds (~one Bay).

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 37 of 72 pages

CAUTION
If Mast begins to twist or bend, guide wires become slack, panels fold the wrong direction, or if the solar array does not appear to be retracting as expected. Immediately send the Mast – Abort command.

cmd Abort – Abort

<u>NOTE</u>
The Mast – Abort command removes power from the MDA.

'MDA'

√Voltage <10 (±2.8) (MDA – Off)

'Mast'

√SW01,SW02 Retracted – No

√SW01,SW02 Deployed – No

Crew

If orbiter is performing mated attitude control, proceed to step 19.6.
Otherwise, proceed to step 19.7.

19.6 Configuring Nominal for Attitude Control

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)
Go to step 19.7.

```
*****
* If ISS is performing attitude control and ISS is not in TEA (MCC-H)
* | Perform {2.405 MODING FREE DRIFT TO CMG TA} (SODF:
* | MCS: NOMINAL: GNC MODING), then:
* |
* | MCC-H ↑ ISS, Orbiter, "ISS is in Attitude Control."
* |
* | Go to step 19.7.
*****
```

C3(A6)

```
*****
* If orbiter is performing mated attitude control
* | Perform rate damping DOCKED CONFIGURATION DAP
* | REFERENCE (FDF: ORB OPS, REBOOST/DAP), then:
* |
* | Go to step 19.7.
*****
```

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 38 of 72 pages

19.7 Performing Visual Verification Via Cameras

Live downlink of video for **MCC-H** evaluation is highly desired for this step.

If more than one Bay remains visible

Verify initial panel folding (no blanket panels folding backwards.)
Verify guide wires along back of blankets have no slack.

ISS ↓ **MCC-H**, "We confirm one Mast Bay retracted."

MCC-H ↑ ISS, "We confirm nominal retraction."

If one Bay remains visible

Verify blankets correct panel folding (no overhang outside of the blanket box containment).

Verify blanket box cover and base aligned.

Verify guide wires (three per SABB along back of blankets) retracted.

Verify hinge lines are parallel to one another in the blanket stack.

Verify mast canister tip is parallel to lip of Mast canister.

ISS ↓ **MCC-H**, "We confirm only one Mast Bay remains visible."

MCC-H ↑ ISS, "We confirm nominal retraction."

* If retract sequence is not successful, notify **MCC-H** before proceeding.
*
*

* If **MCC-H** unavailable, perform {3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY}, all (SODF: EPS: MALFUNCTION: PRIMARY POWER SYSTEM), then:
*
*

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 39 of 72 pages

19.8 Distributing Panels to Avoid Hang Up on Grommets

Live downlink of video for **MCC-H** evaluation is highly desired for this step.

If SAW 2B is to be retracted by IVA

Verify that first panel on LBB and RBB have folded correctly.

If the first panels have not folded

Return to step 19.3 and repeat sequence.

If the first panels exhibit signs of backward folding

Notify **MCC-H** before proceeding.

* *****

* If redeployment required to clear backwards folding panel
* condition

* Turn on Mast MDA by performing step 19.3.

CAUTION

If Starboard SARJ is in Autotrack, do not redeploy SAW 2B beyond 17.5 Bays due to collision hazard.

P6: EPS: SAW 2B

SAW 2B

'Mast'

sel Mast Commands

SAW 2B Mast Commands

'Mast'

cmd Deploy – Arm

cmd Deploy – Deploy

If less than 17.5 Bays deployed and the Starboard SARJ is in autotrack, redeploy up to 17.5 Bays.

If more than 17.5 Bays deployed and the Starboard SARJ is not in autotrack, redeploy until condition clears.

cmd Abort – Abort

'MDA'

√Voltage <10 (±2.8) (MDA – Off)

Notify **MCC-H** before proceeding.

* *****

PCS

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN)

Page 40 of 72 pages

If the first panels have folded correctly perform the BGA Wiggle Technique to distribute blanket panels. **(MCC-H Only)**

NOTE

The PCS displays cannot be used to perform the BGA Wiggle technique, it must be executed by MCC-H utilizing a time tagged script.

P6: EPS: BGA 2B

BGA 2B

'BGA 2B'

Monitor Actual Angle, as the BGA sweeps between 220 and 230 deg

If more than 24 bays remain deployed, perform the following sequence:

Command BGA 2B to 220 deg then to 230 deg in 26-second increments for 5 periods. Finish sequence with BGA 2B at 227.8125 deg.

If more than 14 but less than 24 bays remain deployed, perform the following sequence:

Command BGA 2B to 220 deg then to 230 deg in 22-second increments for 6 periods. Finish sequence with BGA 2B at 227.8125 deg

If less than 14 bays remain deployed, perform the following sequence:

Command BGA 2B to 220 deg then to 230 deg in 15-second increments for 8 periods. Finish sequence with BGA 2B at 227.8125 deg.

Crew

If more than one Bay remains visible, return to step 19.3 and repeat retract sequence. If only one Mast Bay remains visible, proceed to step 20.3.

If SAW 2B is to be retracted with EVA assistance

Perform MANUAL SAW RETRACTION (EVA STS 117 FS CHECKLIST), then:

Crew

If more than one Bay remains visible, return to step 19.3 and repeat sequence. If only one Mast Bay remains visible, proceed to step 20.3.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 41 of 72 pages

20. UNLATCHING (DETENSIONING) LEFT BLANKET BOX (LBB)

20.1 Verifying Temperatures are Within Nominal Ranges Prior to Unlatch

P6: EPS: SAW 2B

SAW 2B

'ECU 2B'

Verify SAW PS Temp, deg C: -33 to 51

Verify BGA PS Temp, deg C: -33 to 51

'LBB'

Verify MDA Temp, deg C: -54 to 48

20.2 Powering On LBB Motor Drive Assembly (MDA)

NOTE

MDA Slow alert will be Nominal until MDA power is applied. Once this is done, the indication is Slow.

SAW 2B

'LBB'

sel LBB Commands

SAW 2B LBB Commands

'MDA'

'Power'

cmd On – Arm

cmd On – On

√MDA Voltage: 120 to 125

20.3 Performing Visual Verification Via Cameras

Perform a visual verification prior to, during, and at the completion of each blanket box unlatch (detension) operation. There are eight latches to be unlatched (detensioned) for each blanket box prior to SAW retract. Only four of eight latches are visible at a time.

Verify camera configuration correct for solar array retraction before proceeding.

Verify latch position (four of eight) latched (tensioned).

Crew

If orbiter is performing mated attitude control, proceed to step 20.5.

Otherwise, proceed to step 20.6, and wait for **MCC-H GO** for left blanket box unlatch.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 42 of 72 pages

20.4 Verifying Initial SAW Left Blanket Box Configuration

SAW 2B LBB Commands

Verify parameters in LATCHED column in step 20.7 before executing unlatch command.

20.5 Preventing Thruster Firings

CAUTION

To minimize the potential for structural damage to hardware while the solar array mechanisms are in motion, nonpropulsive CMG control or Free Drift will be maintained. Anytime the latches are not in motion, thrusters may be enabled.

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)

MCS: MCS Configuration: Manual CMG Desat

Manual CMG Desat

√Desat Request – Inh

MCC-H ↑ ISS, Orbiter, “Desats are Inhibited.”

Go to step 20.6.

* If ISS is performing attitude control and ISS is not in TEA (**MCC-H**)

* Perform {2.404 MODING CMG TA TO FREE DRIFT} (SODF:

* MCS: NOMINAL: GNC MODING), then:

*

* **MCC-H** ↑ ISS, Orbiter, “ISS is in Free Drift.”

*

* Go to step 20.6.

C3(A6)

* If orbiter is performing mated attitude control

* DAP: FREE

*

* Orbiter ⇒ ISS, **MCC-H**, “Orbiter is in Free Drift.”

*

* Go to step 20.6.

20.6 Unlatching (Detension) SAW Left Blanket Box

CAUTION

Confirm no crew exercise or maximum EVA loads before proceeding.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 43 of 72 pages

NOTE

Upon successful unlatch command, the MDA current will increase (0.2 to 3.0 amps) and the Slow alert will go to Nominal during transition, then return to Slow. Once power is removed from the MDA, the Slow alert will indicate Nominal.

If crew is performing the LBB unlatch

MCC-H ↑ ISS, Orbiter, "Crew is GO to unlatch the left blanket box."

If ground is performing the LBB unlatch

MCC-H ↑ ISS, Orbiter, "We are ready to unlatch the left blanket box, please monitor cameras."

PCS

P6: EPS: SAW 2B

SAW 2B

'LBB'

sel LBB Commands

SAW 2B LBB Commands

'LBB'

cmd Unlatch – Arm

cmd Unlatch – Unlatch

20.7 Monitoring LBB Latch Parameters During Unlatch (Detension) (Approximately 14 Seconds)

Refer to Table 5.

NOTE

SABB limit switches are sensitive to thermal conditions and may indicate inaccurate values during eclipse and the first 15 minutes of insolation.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 44 of 72 pages

Table 5. LBB Parameters

PARAMETER	LATCHED→	TRANSITION→ Approximately 14 Seconds	UNLATCHED
LBB SW01,02 Pin Released	Yes	Yes	Yes
LBB SW01,02 Latched	Yes	No	No
LBB SW01,02 Unlatched	No	No	Yes
MDA Slow Alert	Slow	Nominal	Slow
MDA Voltage, V	120 to 125	120 to 125	120 to 125
MDA Temp, deg C	-54 to 48	-54 to 48	-54 to 48
MDA Over Temp Trip	blank	blank	blank
MDA Current, A	~0.10 (± 0.4)	0.20 to 2.00 (± 0.4)	~0.10 (± 0.4)
MDA Over Current Trip	blank	blank	blank

Crew

If orbiter is performing mated attitude control, proceed to step 20.8.
Otherwise, proceed to step 20.9.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 45 of 72 pages

```
*****
* If one Latched, Unlatched, or Pin Released limit switch fails
* | Confirm configuration visually and notify MCC-H before
* | proceeding.
* |
* | SABB limit switch status that would restrict Mast commanding
* | has already been overridden in step 9.1.
* |
* If two Latched, Unlatched, or Pin Released limit switches fail
* | Perform steps 20.8 and 20.9; then, notify MCC-H before
* | proceeding.
*****
```

MCC-H 20.8 Configuring for Nominal Attitude Control
If ISS is performing attitude control and ISS is in TEA (**MCC-H**)
Go to step 20.9.

```
*****
* If ISS is performing attitude control and ISS is not in TEA (MCC-H)
* | Perform {2.405 MODING FREE DRIFT TO CMG TA} (SODF:
* | MCS: NOMINAL: GNC MODING), then:
* |
* | MCC-H ↑ ISS, Orbiter, "ISS is in Attitude Control."
* |
* | Go to step 20.9.
*****
```

C3(A6) *****
* If orbiter is performing mated attitude control
* | Perform rate damping **DOCKED CONFIGURATION DAP**
* | **REFERENCE** (FDF: ORB OPS, REBOOST/DAP), then:
* |
* | Go to step 20.9.

20.9 Performing Visual Verification Via Cameras
Verify latch position (four of eight) unlatched (detensioned).

ISS ↓ **MCC-H**, "We confirm the left blanket box is unlatched."

MCC-H ↑ ISS, "We confirm nominal unlatch."

Crew
Proceed to step 21.3.

```
*****
* If unlatch sequence is not successful, notify MCC-H before
* | proceeding.
* |
* If MCC-H unavailable, perform {3.190 SAW XX FAILURE
* | TO UNLATCH SABB REMOTELY}, all (SODF: EPS:
* | MALFUNCTION: PRIMARY POWER SYSTEM), then:
*****
```

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 46 of 72 pages

PCS 20.10 Powering Off Left Blanket Box MDA
P6: EPS: SAW 2B
SAW 2B
'LBB'

sel LBB Commands

SAW 2B LBB Commands
'MDA'
'Power'

cmd Off – Off

$\sqrt{\text{MDA Voltage}} < 10 (\pm 2.8)$

21. UNLATCHING (DETENSIONING) RIGHT BLANKET BOX (RBB)

21.1 Verifying Temperatures are Within Nominal Ranges Prior to Unlatch
P6: EPS: SAW 2B
SAW 2B
'ECU 2B'

Verify SAW PS Temp, deg C: -33 to 51
Verify BGA PS Temp, deg C: -33 to 51

'RBB'

Verify MDA Temp, deg C: -54 to 48

21.2 Powering On RBB Motor Drive Assembly (MDA)

NOTE
MDA Slow alert will be Nominal until MDA power is applied. Once this is done, the indication is Slow.

SAW 2B
'RBB'

sel RBB Commands

SAW 2B RBB Commands
'MDA'
'Power'

cmd On – On Arm

cmd On – On

$\sqrt{\text{MDA Voltage, V: 120 to 125}}$

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 47 of 72 pages

21.3 Performing Visual Verification Via Cameras

Perform a visual verification prior to, during, and at the completion of each blanket box unlatch (detension) operation. There are eight latches to be unlatched (detensioned) for each blanket box prior to SAW retract. Only four of eight latches are visible at a time.

Verify camera configuration correct for solar array retraction before proceeding.

Verify Latch Position (four of eight) – latched (tensioned)

Crew

If orbiter is performing mated attitude control, proceed to step 21.5.

Otherwise, proceed to step 21.6, and wait for **MCC-H GO** for right blanket box unlatch.

21.4 Verifying Initial SAW Right Blanket Box Configuration

SAW 2B RBB Commands

Verify parameters in LATCHED column in step 21.7 before executing unlatch command.

21.5 Preventing Thruster Firings

CAUTION

To minimize the potential for structural damage to hardware while the solar array mechanisms are in motion, nonpropulsive CMG control or Free Drift will be maintained. Anytime the latches are not in motion, thrusters may be enabled.

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)

MCS: MCS Configuration: Manual CMG Desat

Manual CMG Desat

√Desat Request – Inh

MCC-H ↑ ISS, Orbiter, “Desats are Inhibited.”

Go to step 21.6.

* If ISS is performing attitude control and ISS is not in TEA (**MCC-H**)

* Perform {2.404 MODING CMG TA TO FREE DRIFT} (SODF:

* MCS: NOMINAL: GNC MODING), then:

*

* **MCC-H** ↑ ISS, Orbiter, “ISS is in Free Drift.”

*

* Go to step 21.6.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 48 of 72 pages

C3(A6)

```
*****
* If orbiter is performing mated attitude control
* | DAP: FREE
* |
* | Orbiter => ISS, MCC-H, "Orbiter is in Free Drift."
* |
* | Go to step 21.6.
*****
```

21.6 Unlatching (Detension) SAW Right Blanket Box

CAUTION
Confirm no crew exercise or maximum EVA loads before proceeding.

<u>NOTE</u>
Upon successful unlatch commanding, the MDA current will increase (0.2 to 3.0 amps) and the Slow alert will go to Nominal during transition, then return to Slow. Once power is removed from the MDA, the Slow alert will indicate Nominal.

If crew is performing the RBB unlatch

| **MCC-H** ↑ ISS, Orbiter, "Crew is GO to unlatch the right blanket box."

If ground is performing the RBB unlatch

| **MCC-H** ↑ ISS, Orbiter, "We are ready to unlatch the right blanket box, please monitor cameras."

PCS

P6: EPS: SAW 2B

SAW 2B

'RBB'

sel RBB Commands

SAW 2B RBB Commands

'RBB'

cmd Unlatch – Arm

cmd Unlatch – Unlatch

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

21.7 Monitoring RBB Latch Parameters During Unlatch (Detension)
(Approximately 14 Seconds)

Refer to Table 6.

NOTE

SABB limit switches are sensitive to thermal conditions and may indicate inaccurate values during eclipse and the first 15 minutes of insolation.

Table 6. RBB Parameters

PARAMETER	LATCHED→	TRANSITION→ Approximately 14 Seconds	UNLATCHED
RBB SW01,02 Pin Released	Yes	Yes	Yes
RBB SW01,02 Latched	Yes	No	No
RBB SW01,02 Unlatched	No	No	Yes
MDA Slow Alert	Slow	Nominal	Slow
MDA Voltage, V	120 to 125	120 to 125	120 to 125
MDA Temp, deg C	-54 to 48	-54 to 48	-54 to 48
MDA Over Temp Trip	blank	blank	blank
MDA Current, A	~0.10 (±0.4)	0.20 to 2.00 (±0.4)	~0.10 (±0.4)
MDA Over Current Trip	blank	blank	blank

Crew

If orbiter is performing mated attitude control, proceed to step 21.8.
 Otherwise, proceed to 21.9.

```

*****
* If one Latched, Unlatched, or Pin Released limit switch fails
* | Confirm configuration visually and notify MCC-H before
* | proceeding.
* |
* | SABB limit switch status that would restrict Mast
* | commanding has already been overridden in step 9.1.
* |
* If two Latched, Unlatched, or Pin Released limit switches fail
* | Perform steps 21.8 and 21.9; then, notify MCC-H before
* | proceeding.
*****
    
```

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 50 of 72 pages

MCC-H 21.8 Enabling Thrusters (or Configuring for Attitude Control)
If ISS is performing attitude control and ISS is in TEA (**MCC-H**)
Go to step 21.9.

```
*****
* If ISS is performing attitude control and ISS is not in TEA (MCC-H)
* | Perform {2.405 MODING FREE DRIFT TO CMG TA} (SODF:
* | MCS: NOMINAL: GNC MODING), then:
* |
* | MCC-H ↑ ISS, Orbiter, "ISS is in Attitude Control."
* |
* | Go to step 21.9.
*****
```

C3(A6)

```
*****
* If orbiter is performing mated attitude control
* | Perform rate damping DOCKED CONFIGURATION DAP
* | REFERENCE (FDF: ORB OPS, REBOOST/DAP), then:
* |
* | Go to step 21.9.
*****
```

21.9 Performing Visual Verification Via Cameras
Verify latch position (four of eight) unlatched (detensioned).

ISS ↓ **MCC-H**, "We confirm the right blanket box is unlatched."

MCC-H ↑ ISS, "We confirm nominal unlatch."

Crew

Proceed to step 22.2 and provide camera support as necessary during containment inspection.

```
*****
* If unlatch sequence is not successful, notify MCC-H before
* | proceeding.
* |
* | If MCC-H unavailable, perform {3.190 SAW XX FAILURE
* | TO UNLATCH SABB REMOTELY}, all (SODF: EPS:
* | MALFUNCTION: PRIMARY POWER SYSTEM), then:
*****
```

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 51 of 72 pages

PCS 21.10 Powering Off Right Blanket Box MDA
P6: EPS: SAW 2B
SAW 2B
'RBB'

sel RBB Commands

SAW 2B RBB Commands
'MDA'
'Power'

cmd Off – Off

$\sqrt{\text{MDA Voltage}} < 10 (\pm 2.8)$

22. COMPLETING VISUAL CONTAINMENT INSPECTION

If EV crew is performing the containment inspection

Wait for EVA containment confirmation then proceed to step 23.

NOTE

For EVA, BGA 2B will be at 227.8125 degrees with Latch 2 engaged.

If ground or IVA is performing the containment inspection

Proceed to step 22.1.

22.1 Unlatching BGA

Perform {2.110 PVM BGA XX UNLATCH ANTIROTATION LATCH}, all (SODF: EPS: NOMINAL: PRIMARY POWER SYSTEM), then:

Perform {2.102 PVM CONFIGURE BGA XX TO DIRECTED POSITION MODE}, (SODF: EPS: NOMINAL: PRIMARY POWER SYSTEM), then:

22.2 Positioning BGA for Containment Inspections

Refer to Figures 1, 2, and 3 for containment inspections and Table 7 for containment inspection positions.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN)

Page 52 of 72 pages

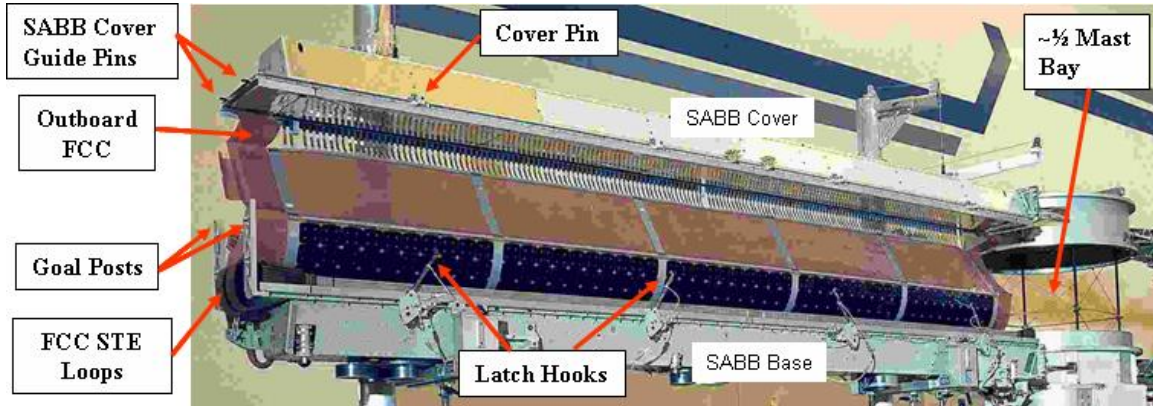


Figure 1.- Mast Half to One Bay Deployed.

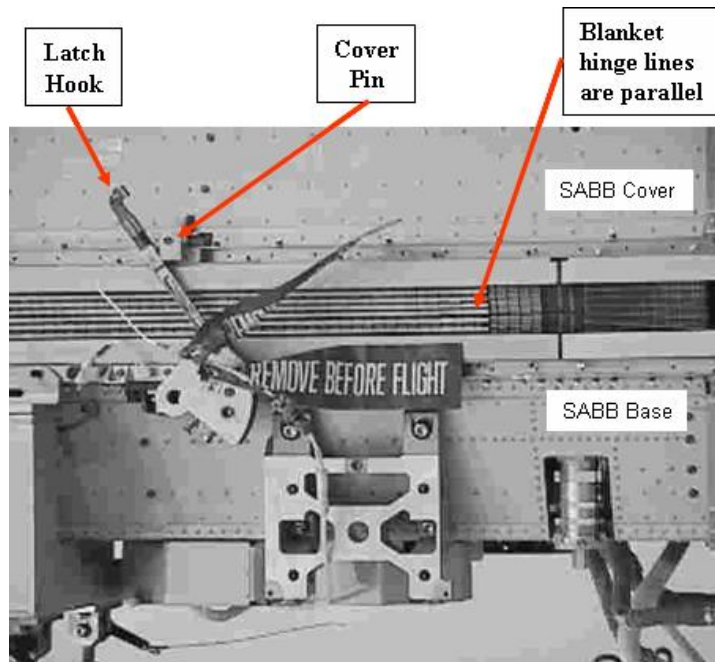


Figure 2.- Full Retract Blanket Containment Side View.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

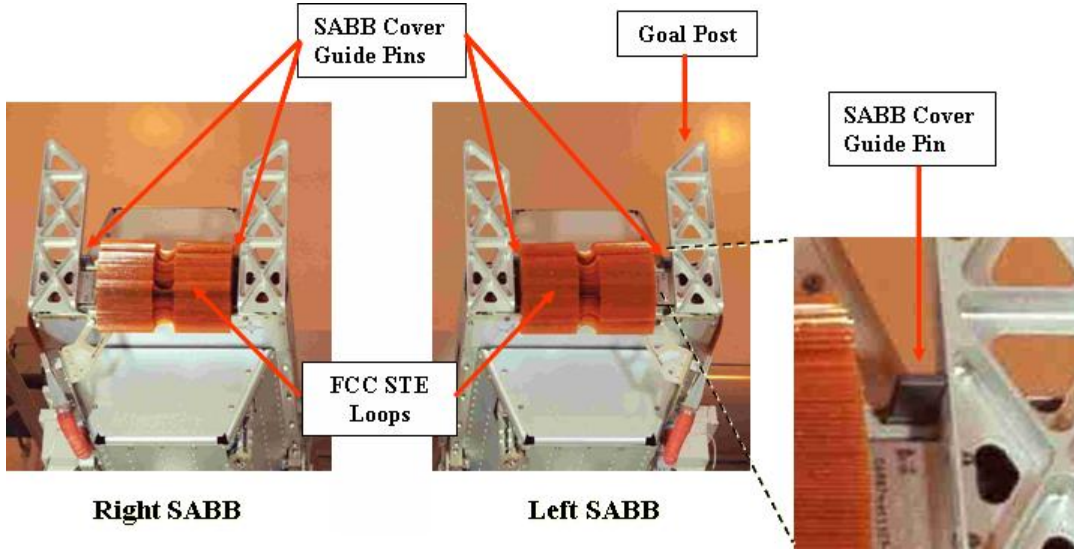


Figure 3.- Full Retract Blanket Containment Tip View.

NOTE
 BGA positions for IVA containment assume crew is viewing array from the orbiter windows or SM window 13.

Table 7. Solar Array Containment
 Inspection Positions

POSITION [P]	BGA 2B (Ground)	BGA 2B (IVA) Orbiter	BGA 2B (IVA) SM 13
1 (Inactive Side of LBB/RBB)	227.8125	227.8125	65
2 (LBB Tip)	341	341	195
3 (Active Side of LBB/RBB)	45	45	245
4 (RBB Tip)	158	158	20

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 54 of 72 pages

Perform for BGA 2B, where [P] =

Position BGA for containment inspection at Position P.

NOTE

BGA rotation is not required for containment inspection at Position 1, since the first inspection is at the original safe/lock position.

P6: EPS: BGA 2B

sel Channel Targeted Modes

'Column = Non-Solar Tracking, Row = Directed Position'

input Cmded Angle, deg: _____ (refer to Table 7)

cmd Set

Verify Ch 2B Mode – Non-Solar Tracking

Verify BGA Mode – Directed Position

Verify Cmded Angle: _____ (refer to Table 7)

Verify Actual Angle: _____ (refer to Table 7)

NOTE

1. The following steps require direct view of the mechanisms for evaluation.
2. It can take 10 minutes to rotate the BGA to the next inspection position.
3. Planned inspection time at each position will be 5 minutes. For Ku-Band LOS periods video will be recorded via VTR. The BGA may be repositioned to the next inspection points; however, the recorded video must be downlinked and reviewed or crew assessment performed before final GO is given for that position. For Ku-Band AOS periods, the downlink video will be recorded by **MCC-H**.

Perform visual containment inspection.

Verify blanket fully contained within blanket box.

Verify hinge lines are parallel to one another in the blanket stack.

Verify outboard FCC STE loops neatly stacked within SABB goal posts.

Verify SABB cover guide pins aligned with base goal posts.

Verify guide wires (three per SABB) retracted.

Repeat

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 55 of 72 pages

If 1 Bay, 1/2 Bay, and 1/4 Bay inspections indicate nominal
containment
Crew
Proceed to step 23.2.

If inspections at full retraction indicate nominal containment
Crew
If orbiter is performing mated attitude control, proceed to step 24.3.
Otherwise, proceed to step 24.4 and wait for **MCC-H GO** for
left blanket box latch.

22.3 Positioning BGA for Mast Retraction (or SABB Latch)

P6: EPS: BGA 2B

BGA 2B

sel Channel Targeted Modes

BGA 2B Ch Targeted Modes

'Column = Non-Solar Tracking, Row = Directed Position'

input Cmded Angle, deg: 2 2 7 . 8 1 2 5

cmd Set

Verify Ch 2B Mode – Non-Solar Tracking

Verify BGA Mode – Directed Position

Verify Cmded Angle: 227.8125

Verify Actual Angle: 227.8125

23. COMPLETING SOLAR ARRAY RETRACTION

23.1 Verifying Temperatures are Within Nominal Ranges Prior to SAW

Retract

P6: EPS: SAW 2B

SAW 2B

'ECU 2B'

Verify SAW PS Temp, deg C: -33 to 51

Verify BGA PS Temp, deg C: -33 to 51

'Mast'

Verify MDA Temp, deg C: -54 to 48

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 56 of 72 pages

23.2 Verifying Camera Configuration

NOTE

Perform a visual verification prior to, during, and at the completion of the Mast retract operation to minimize the risk of potential collision hazards, monitor for any anomalies, and to verify solar array retraction. Total number of visible Mast Bays is 31.5, 1 Bay is rigid batten to rigid batten.

Verify camera configuration correct for solar array retraction before proceeding.

23.3 Powering On Mast Motor Drive Assembly (MDA)

WARNING

If retracting a solar array during EVA operations, confirm EV crew clear of solar array mechanisms and mast interface prior to MDA activation.

NOTE

MDA Slow alert will be Nominal until MDA power is applied. Once this is done, the indication is Slow.

SAW 2B

'Mast'

sel Mast Commands

SAW 2B Mast Commands

'MDA'

'Power'

cmd On – Arm

cmd On – On

√MDA Voltage, V: 120 to 125

√MDA Current, A: ~0.10 (±0.4)

√MDA Slow Alert – Slow

Crew

If orbiter is performing mated attitude control, proceed to step 23.4.

Otherwise, proceed to step 23.5 and wait for **MCC-H GO** for retraction.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 57 of 72 pages

23.4 Preventing Thruster Firings

CAUTION

To minimize the potential for structural damage to hardware while the solar array mechanisms are in motion, nonpropulsive CMG control or Free Drift will be maintained. Anytime the array retraction is stopped or aborted, thrusters may be enabled.

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)

MCS: MCS Configuration: Manual CMG Desat

Manual CMG Desat

√Desat Request – Inh

MCC-H ↑ ISS, Orbiter, “Desats are Inhibited.”

Go to step 23.5.

* If ISS is performing attitude control and ISS is not in TEA (**MCC-H**)

* Perform {2.404 MODING CMG TA TO FREE DRIFT} (SODF:

* MCS: NOMINAL: GNC MODING), then:

*

* **MCC-H** ↑ ISS, Orbiter, “ISS is in Free Drift.”

*

* Go to step 23.5.

C3(A6)

* If orbiter is performing mated attitude control

* DAP: FREE

*

* Orbiter ⇒ ISS, **MCC-H**, “Orbiter is in Free Drift.”

*

* Go to step 23.5.

23.5 Retracting 100 % of SAW

WARNING

If retracting a solar array during EVA operations, confirm EV crew clear of solar array mechanisms and mast interface.

CAUTION

Confirm no crew exercise or maximum EVA loads before proceeding.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN)

Page 58 of 72 pages

NOTE

Upon successful retract command, the Slow alert will go to Nominal during transition and the MDA current will peak briefly at ~2 amps and then oscillate between 0.3 and 1.3 amps (± 0.4) as Bays retract. Once power is removed from the MDA, the Slow alert will indicate Nominal.

PCS

P6: EPS: SAW 2B

SAW 2B

'Mast'

sel Mast Commands

SAW 2B Mast Commands

'Mast'

If one Mast Bay is visible

NOTE

To reduce the risk of guide-wire slack, the following three commands will be built and executed as time tagged commands. When the Abort command is issued, only 1/2 of the last Bay remains visible. This equates to 10 seconds between the Retract command and the Abort command.

cmd Retract – Arm

cmd Retract – Retract

Wait approximately 10 seconds until 1/2 of the last Bay remains visible.

cmd Abort – Abort

NOTE

The Mast – Abort command removes power from the MDA.

'MDA'

$\sqrt{\text{Voltage}} < 10 (\pm 2.8)$ (MDA – Off)

IVA or EVA Crew

Visually verify guide-wires are not slack and are not pinched between panels.

Crew

If orbiter is performing mated attitude control, proceed to step 23.6. Otherwise, proceed to step 23.7.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 59 of 72 pages

If 1/2 of last Mast Bay is visible

NOTE

To reduce the risk of guide-wire slack, the following three commands will be built and executed as time tagged commands. When the Abort command is issued, only 1/4 of the last Bay remains visible. This equates to 5 seconds between the Retract command and the Abort command.

cmd Retract – Arm

cmd Retract – Retract

Wait approximately 5 seconds until 1/4 of the last Bay remains visible.

cmd Abort – Abort

NOTE

The Mast – Abort command removes power from the MDA.

'MDA'

√Voltage <10 (±2.8) (MDA – Off)

I/A or E/A Crew

Visually verify guide-wires are not slack and are not pinched between panels.

Crew

If orbiter is performing mated attitude control, proceed to step 23.6.
Otherwise, proceed to step 23.7.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 60 of 72 pages

If 1/4 of last Mast Bay is visible

cmd Retract – Arm
cmd Retract – Retract

Wait approximately 5 seconds until 100 % retracted.

Verifying Final SAW Mast Configuration

√SW01,SW02 Retracted – Yes

√SW01,SW02 Deployed – No

'MDA'

√Voltage, V: 120 to 125

√Current, A: ~0.10 (±0.4)

√Slow Alert – Slow

- * If one Deployed or Retracted limit switch fails
- * | Confirm configuration visually and notify **MCC-H** before
- * | proceeding.
- * |
- * | Mast limit switch status that would restrict SABB and BGA
- * | commanding has already been overridden in step 9.2.
- * |
- * If two Deployed or Retracted limit switches fail
- * | Perform steps 23.6 and 23.7; then, notify **MCC-H** before
- * | proceeding.

Powering Off Mast MDA

'MDA'

'Power'

cmd Off – Off

√MDA Voltage <10 (±2.8)

IVA or EVA Crew

Visually verify guide-wires are not slack and are not pinched
between panels.

Crew

If orbiter is performing mated attitude control, proceed to step 23.6.
Otherwise, proceed to step 23.7.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 61 of 72 pages

MCC-H 23.6 Configuring for Nominal Attitude Control
If ISS is performing attitude control and ISS is in TEA (**MCC-H**)
Go to step 23.7.

```
*****
* If ISS is performing attitude control and ISS is not in TEA (MCC-H)
* | Perform {2.405 MODING FREE DRIFT TO CMG TA} (SODF:
* | MCS: NOMINAL: GNC MODING), then:
* |
* | MCC-H ↑ ISS, Orbiter, "ISS is in Attitude Control."
* |
* | Go to step 23.7.
*****
```

C3(A6) * If orbiter is performing mated attitude control
* | Perform rate damping DOCKED CONFIGURATION DAP
* | REFERENCE (FDF: ORB OPS, REBOOST/DAP), then:
* |
* | Go to step 23.7.

23.7 Performing Visual Verification Via Cameras

Verify blankets correct panel folding (no overhang outside of the blanket box containment).
Verify blanket panel waviness insignificant folded panel stack height is small enough such that SABB cover is not forced away from base at outboard end [i.e., SABB cover is parallel to base within 1 inch (tbr)].
Verify guide-wires (three per SABB along back of blankets) fully retracted (no excess wire hanging out).
Verify latch hooks aligned with and above cover latch pins.
Verify Mast canister tip fitting resting on Mast canister (no gap).

ISS ↓ **MCC-H**, "We confirm good containment."

MCC-H ↑ ISS, "We confirm nominal retraction and containment."

```
*****
* If retract sequence is not successful, notify MCC-H before
* | proceeding.
* |
* | If MCC-H unavailable, perform {3.192 SAW XX FAILURE
* | TO RETRACT MAST REMOTELY}, all (SODF: EPS:
* | MALFUNCTION: PRIMARY POWER SYSTEM), then:
*****
```

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN)

Page 62 of 72 pages

23.8 Completing Containment Verification

If EV crew is performing the containment inspection and array is not fully retracted

Wait for EVA containment confirmation then return to step 23.3 and repeat steps 23.3 through 23.8.

NOTE

For EVA containment, BGA 2B will be at 227.8125 degrees with Latch 2 engaged.

If ground or IVA is performing the containment inspection and array is not fully retracted

Perform steps 22.2 through 22.3 again as required for containment confirmation then repeat steps 23.3 through 23.8.

If EV crew is performing the containment inspection and array is fully retracted

Wait for containment confirmation from EV crew then proceed to step 24 and have EV crew visually monitor SABB latch operations.

If ground or IVA is performing the containment inspection and array is fully retracted

Perform steps 22.2 through 22.3 again as required for containment confirmation then proceed to step 24.

24. LATCHING LEFT BLANKET BOX (LBB)

24.1 Powering On LBB Motor Drive Assembly (MDA)

NOTE

MDA Slow alert will be Nominal until MDA power is applied. Once this is done, the indication is Slow.

P6: EPS: SAW 2B

SAW 2B

'LBB'

sel LBB Commands

SAW 2B LBB Commands

'MDA'

'Power'

cmd On – Arm

cmd On – On

√MDA Voltage, V: 120 to 125

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 63 of 72 pages

24.2 Verifying SAW Left Blanket Box Configuration

Verify parameters in UNLATCHED column in step 24.5 before executing latch command.

24.3 Preventing Thruster Firings

CAUTION

To minimize the potential for structural damage to hardware while the solar array mechanisms are in motion, nonpropulsive CMG control or Free Drift will be maintained. Anytime the latches are not in motion, thrusters may be enabled.

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)

MCS: MCS Configuration: Manual CMG Desat

Manual CMG Desat

√Desat Request – Inh

MCC-H ↑ ISS, Orbiter, “Desats are Inhibited.”

Go to step 24.4.

* If ISS is performing attitude control and ISS is not in TEA (**MCC-H**)

* Perform {2.404 MODING CMG TA TO FREE DRIFT} (SODF:
* MCS: NOMINAL: GNC MODING), then:

* **MCC-H** ↑ ISS, Orbiter, “ISS is in Free Drift.”

* Go to step 24.4.

C3(A6)

* If orbiter is performing mated attitude control

* DAP: FREE

* Orbiter ⇒ ISS, **MCC-H**, “Orbiter is in Free Drift.”

* Go to step 24.4.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 64 of 72 pages

24.4 Latching SAW Left Blanket Box

CAUTION

Confirm no crew exercise or maximum EVA loads before proceeding.

NOTE

Upon successful latch command, the Slow alert will go to Nominal during transition, then return to Slow. Once power is removed from the MDA, the Slow alert will indicate Nominal.

If crew is performing the LBB Latch

MCC-H ↑ ISS, Orbiter, "Crew is GO to latch the left blanket box."

If ground is performing the LBB Latch

MCC-H ↑ ISS, Orbiter, "We are ready to latch the left blanket box, please monitor cameras."

PCS

P6: EPS: SAW 2B

SAW 2B

'LBB'

sel LBB Commands

SAW 2B LBB Commands

'LBB'

cmd Latch – Arm

cmd Latch – Latch

24.5 Monitoring LBB Latch Parameters During Latch (Approximately 14 Seconds)

Refer to Table 8.

Perform a visual verification prior to, during, and at the completion of each blanket box latching to monitor for any anomalies and to verify blanket box latching operation.

NOTE

SABB limit switches are sensitive to thermal conditions and may indicate inaccurate values during eclipse and the first 15 minutes of insolation.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

Table 8. LBB Parameters

PARAMETER	UNLATCHED→	TRANSITION→ Approximately 14 Seconds	LATCHED
LBB SW01,02 Pin Released	Yes	Yes	Yes
LBB SW01,02 Latched	No	No	Yes
LBB SW01,02 Unlatched	Yes	No	No
MDA Slow Alert	Slow	Nominal	Slow
MDA Voltage, V	120 to 125	120 to 125	120 to 125
MDA Temp, deg C	-54 to 48	-54 to 48	-54 to 48
MDA Over Temp Trip	blank	blank	blank
MDA Current, A	~0.10 (±0.4)	0.20 to 2.00 (±0.4)	~0.10 (±0.4)
MDA Over Current Trip	blank	blank	blank

Crew

If orbiter is performing mated attitude control, proceed to step 24.6.
Otherwise, proceed to step 24.7.

- * If one Latched or Unlatched limit switch fails
 - * Confirm configuration visually and notify **MCC-H** before proceeding.
 - *
 - *
 - *
 - * SABB limit switch status that would restrict Mast commanding has already been overridden in step 9.3.
 - *
- * If two Latched or Unlatched limit switches fail
 - * Perform steps 24.6 and 24.7; then, notify **MCC-H** before proceeding.
 - *

24.6 Configuring for Nominal Attitude Control

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)
Go to step 24.7.

- * If ISS is performing attitude control and ISS is not in TEA (**MCC-H**)
 - * Perform {2.405 **MODING FREE DRIFT TO CMG TA**} (SODF: MCS: NOMINAL: GNC MODING), then:
 - *
 - * **MCC-H** ↑ ISS, Orbiter, "ISS is in Attitude Control."
 - *
 - * Go to step 24.7.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 66 of 72 pages

C3(A6)

```
*****
* If orbiter is performing mated attitude control
* | Perform rate damping DOCKED CONFIGURATION DAP
* | REFERENCE (FDF: ORB OPS, REBOOST/DAP), then:
* |
* | Go to step 24.7.
*****
```

24.7 Performing Visual Verification Via Cameras

Verify latch position (four of eight) latched (hooks engaged with pins).

Verify blanket fully contained within blanket box.

ISS ↓ **MCC-H**, “We confirm the left blanket box is latched.”

MCC-H ↑ ISS, “We confirm nominal latch.”

Crew

If orbiter is performing mated attitude control, proceed to step 25.3.

| Otherwise, proceed to step 25.4 and wait for **MCC-H GO** for right blanket box latch.

```
*****
* If latch sequence is not successful, notify MCC-H before
* | proceeding.
* |
* | If MCC-H unavailable, perform {3.193 SAW XX FAILURE
* | TO LATCH (TENSION) SABB REMOTELY}, all (SODF:
* | EPS: MALFUNCTION: PRIMARY POWER SYSTEM),
* | then:
*****
```

PCS

24.8 Powering Off Left Blanket Box MDA

P6: EPS: SAW 2B

SAW 2B

‘LBB’

sel LBB Commands

SAW 2B LBB Commands

‘MDA’

‘Power’

cmd Off – Off

√MDA Voltage <10 (±2.8)

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 67 of 72 pages

25. LATCHING RIGHT BLANKET BOX (RBB)

25.1 Powering On RBB Motor Drive Assembly (MDA)

NOTE

MDA Slow alert will be Nominal until MDA power is applied. Once this is done, the indication is Slow.

P6: EPS: SAW 2B

SAW 2B

'RBB'

sel RBB Commands

SAW 2B RBB Commands

'MDA'

'Power'

cmd On – Arm

cmd On – On

√MDA Voltage, V: 120 to 125

25.2 Verifying SAW Right Blanket Box Configuration

Verify parameters in UNLATCHED column in step 25.5 before executing latch command.

25.3 Preventing Thruster Firings

CAUTION

To minimize the potential for structural damage to hardware while the solar array mechanisms are in motion, nonpropulsive CMG control or Free Drift will be maintained. Anytime the latches are not in motion, thrusters may be enabled.

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)

MCS: MCS Configuration: Manual CMG Desat

Manual CMG Desat

√Desat Request – Inh

MCC-H ↑ ISS, Orbiter, “Desats are Inhibited.”

Go to step 25.4.

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 68 of 72 pages

```
*****
* If ISS is performing attitude control and ISS is not in TEA (MCC-H)
* | Perform {2.404 MODING CMG TA TO FREE DRIFT} (SODF:
* | MCS: NOMINAL: GNC MODING), then:
* |
* | MCC-H ↑ ISS, Orbiter, "ISS is in Free Drift."
* |
* | Go to step 25.4.
*****
```

C3(A6)

```
*****
* If orbiter is performing mated attitude control
* | DAP: FREE
* |
* | Orbiter ⇒ ISS, MCC-H, "Orbiter is in Free Drift."
* |
* | Go to step 25.4.
*****
```

25.4 Latching SAW Right Blanket Box

CAUTION
Confirm no crew exercise or maximum EVA loads before proceeding.

<u>NOTE</u>
Upon successful latch command, the Slow alert will go to Nominal during transition, then return to Slow. Once power is removed from the MDA, the Slow alert will indicate Nominal.

If crew is performing the RBB Latch
| **MCC-H** ↑ ISS, Orbiter, "Crew is GO to latch the right blanket box."

If ground is performing the RBB Latch
| **MCC-H** ↑ ISS, Orbiter, "We are ready to latch the right blanket box, please monitor cameras."

PCS

P6: EPS: SAW 2B

SAW 2B

'RBB'

sel RBB Commands

SAW 2B RBB Commands

'RBB'

cmd Latch – Arm

cmd Latch – Latch

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

25.5 Monitoring RBB Latch Parameters During Latch (Approximately 14 Seconds)
Refer to Table 9.

Perform a visual verification prior to, during, and at the completion of each blanket box latching to monitor for any anomalies and to verify blanket box latching operation.

NOTE

SABB limit switches are sensitive to thermal conditions and may indicate inaccurate values during eclipse and the first 15 minutes of insolation.

Table 9. RBB Parameters

PARAMETER	UNLATCHED→	TRANSITION→ Approximately 14 Seconds	LATCHED
RBB SW 01,02 Pin Released	Yes	Yes	Yes
RBB SW 01,02 Latched	No	No	Yes
RBB SW 01,02 Unlatched	Yes	No	No
MDA Slow Alert	Slow	Nominal	Slow
MDA Voltage, V	120 to 125	120 to 125	120 to 125
MDA Temp, deg C	-54 to 48	-54 to 48	-54 to 48
MDA Over Temp Trip	blank	blank	blank
MDA Current, A	~0.10 (±0.4)	0.20 to 2.00 (±0.4)	~0.10 (±0.4)
MDA Over Current Trip	blank	blank	blank

Crew

If orbiter is performing mated attitude control, proceed to step 25.6.
Otherwise, proceed to step 25.7.

```

*****
* If one Latched or Unlatched limit switch fails
* | Confirm configuration visually and notify MCC-H before
* | proceeding.
* |
* | SABB limit switch status that would restrict Mast
* | commanding has already been overridden in step 9.1.
* |
* If two Latched or Unlatched limit switches fail
* | Perform steps 25.6 and 25.7; then, notify MCC-H before
* | proceeding.
*****
    
```

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN) Page 70 of 72 pages

MCC-H 25.6 Configuring for Nominal Attitude Control
If ISS is performing attitude control and ISS is in TEA (**MCC-H**)
Go to step 25.7.

```
*****
* If ISS is performing attitude control and ISS is not in TEA (MCC-H)
* | Perform {2.405 MODING FREE DRIFT TO CMG TA} (SODF:
* | MCS: NOMINAL: GNC MODING), then:
* |
* | MCC-H ↑ ISS, Orbiter, "ISS is in Attitude Control."
* |
* | Go to step 25.7.
*****
```

C3(A6) * If orbiter is performing mated attitude control
* | Perform rate damping DOCKED CONFIGURATION DAP
* | REFERENCE (FDF: ORB OPS, REBOOST/DAP), then:
* |
* | Go to step 25.7.

25.7 Performing Visual Verification Via Cameras

Verify latch position (four of eight) latched (hooks engaged with pins).
Verify blanket fully contained within blanket box.

ISS ↓ **MCC-H**, "We confirm the right blanket box is latched."

MCC-H ↑ ISS, "We confirm nominal latch."

Crew

Exit procedure. Ground will require cameras until procedure is completed.

```
*****
* If latch sequence is not successful, notify MCC-H before
* | proceeding.
* |
* | If MCC-H unavailable, perform {3.193 SAW XX FAILURE
* | TO LATCH (TENSION) SABB REMOTELY}, all (SODF:
* | EPS: MALFUNCTION: PRIMARY POWER SYSTEM),
* | then:
*****
```


4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN)

Page 71 of 72 pages

PCS 25.8 Powering Off Right Blanket Box MDA
P6: EPS: SAW 2B
SAW 2B
'RBB'

sel RBB Commands

SAW 2B RBB Commands

'MDA'

'Power'

cmd Off – Of

$\sqrt{\text{MDA Voltage}} < 10 (\pm 2.8)$

26. INHIBITING BGA VELOCITY LIMIT SAFING

NOTE

1. SCR 19659 - If the array is parked at 0 deg, motor velocity safing may be triggered due to angle oscillations between 0 and 359. Software interprets this as a large angle movement in a short time period. Inhibit motor velocity safing to prevent the RPCs supplying the ECU from being opened.
2. SCR 28128 - The following Caution messages may also be triggered if the array is commanded to 0.
'BGA 2B Observed vs Last Commanded State Discrepancy - PVM'
'BGA 2B Pointing Control Command Response Failed - PVM'

BGA 2B will be taken to 0.0 (± 0.5) degrees.

P6: EPS: BGA 2B

BGA 2B

sel Motor

BGA 2B Motor

'Velocity Limit Safing, Primary PVCU'

cmd Inhibit – Arm

cmd Inhibit – Inhibit

Verify Primary PVCU – Inh

'Velocity Limit Safing, Backup PVCU'

cmd Inhibit – Arm

cmd Inhibit – Inhibit

Verify Backup PVCU – Inh

4.118 P6 SAW 2B RETRACT (P6 ON Z1 TRUSS)

(EPS/13A - ALL/FIN 3/HC/SPN)

Page 72 of 72 pages

27. CONFIGURING BGA 2B FOR DORMANCY

NOTE

The BGA motor must remain on to maintain thermal requirements. This is done by powering the BGA and leaving it in Open Loop mode (performed in a different procedure). Prior to relocating P6, both BGAs will be repositioned and locked at 90 degrees to support thermal constraints, dynamic loads, and clearances during the P6 relocation.

If BGA 2B is unlatched

Position BGA 2B to 0 degree.

For BGA 2B, perform {2.102 PVM CONFIGURE BGA XX TO DIRECTED POSITION MODE} (SODF: EPS: NOMINAL: PRIMARY POWER SYSTEM), then:

For BGA 2B, go to {2.108 PVM BGA XX OPEN LOOP CONTROL}, steps 1 to 8 and 10 (SODF: EPS: NOMINAL: PRIMARY POWER SYSTEM).

If BGA 2B is latched

Unlatch the BGA.

Perform {2.110 PVM BGA XX UNLATCH ANTIROTATION LATCH}, all (SODF: EPS: NOMINAL: PRIMARY POWER SYSTEM), then:

For 227.8125 degrees, perform {2.102 PVM CONFIGURE BGA XX TO DIRECTED POSITION MODE} (SODF: EPS: NOMINAL: PRIMARY POWER SYSTEM), then:

Position BGA 2B to 0 degrees.

For BGA 2B, perform {2.102 PVM CONFIGURE BGA XX TO DIRECTED POSITION MODE} (SODF: EPS: NOMINAL: PRIMARY POWER SYSTEM), then:

For BGA 2B, go to {2.108 PVM BGA XX OPEN LOOP CONTROL}, steps 1 to 8 and 10 (SODF: EPS: NOMINAL: PRIMARY POWER SYSTEM).

OBJECTIVE:

This procedure will perform all steps required to accomplish SARJ initial activation and checkout on 13A.

NOTE

1. This procedure makes the assumption that the nadir tray connections are made first and the S3-2 MDM is active.
2. **'The SARJ String 1(2) RJMC Loss of Comm - S3'**
 Cautions should have annunciated upon S3-1/S3-2 MDM initialization since the RJMC Comm application defaults enabled. When the RJMCs are powered on the cautions will clear.

1. VERIFYING SARJ EXT SOFTWARE ENABLED

CDH: Primary EXT: Applications
Primary EXT Applications

Verify SARJ Mgr S – Ena

```
*****
* If SARJ Mgr S – Inh
* |   cmd Ena Execute
* |
* |   Verify – Ena
* |
* *****
```

Verify SE COMM – Ena

```
*****
* If SE COMM – Inh
* |   cmd Ena Execute
* |
* |   Verify – Ena
* |
* *****
```

2. ACTIVATING STRING 2

NOTE

If activated the SARJ Toothcrash algorithms may attempt to rotate the SARJ, so they will be inhibited until the SARJ Launch Locks and Restraints have been removed.

2.1 Inhibiting SARJ Toothcrash

S3: EPS: Stbd SARJ: Software Inhibits
Stbd SARJ Primary EXT Software Inhibits
 'Tooth Crash'

cmd Engage – Arm (Verify Engage – Arm)
cmd Engage – Inhibit (Verify Engage – Inhibit)
cmd Lock – Arm (Verify Lock – Arm)
cmd Lock – Inhibit (Verify Lock – Inhibit)

2.2 Verifying SARJ S3-2 Control Software Enabled

S3: EPS: Stbd SARJ: SARJ Manager

Verify MDM S3-2 UB SEPS 23 – Enable

cmd MDM S3 2 SARJ Contol Lower Tier Available – Enable

Verify MDM S3 2 SARJ Control – Enable

Verify MDM S3-2 RJMC Comm – Enable

* If RJMC Comm – Inhibit

*

*

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*

NOTE
Expect '**SARJ String 2 RJMC Loss of Comm - S3**' Caution.

cmd Enable

Verify – Enable

2.3 Verifying Lower Tier Available

√MDM S3-2 SARJ Control Lower Tier Available – Yes

2.4 Verifying Initial SARJ Configuration

S3: EPS: Stbd SARJ

Verify Mode – Standby

Verify S3-2 MDM String 2 Mode – Monitor

sel RJMC 2

Verify Drive Motor Temp, deg C: -43 to 72

Verify Engage/Lock Motor Temp, deg C: -43 to 72

sel RJMC 1

Verify Engage/Lock Motor DLA 2 Temp, deg C: -43 to 72

2.5 Powering On RJMC 2

sel RJMC 2

sel RPCM S32B A RPC 4

cmd RPC Position – Close (Verify – Cl)

NOTE
'SARJ String 2 RJMC Loss of Comm - S3'
should clear when the RPC to RJMC 2 is closed.

sel RJMC 2

Verify Power On Flag – X

cmd Reset

Verify Power On Flag – blank

sel Operation

'Motor'

Verify String 2 Motor Select – None

3. COMMANDING SARJ MODE TO CHECKOUT

'SARJ Mode'

cmd SARJ Mode – Check Out

Verify SARJ Mode – Checkout

4. SELECTING SARJ STRING 2

Stbd SARJ Operation

cmd String 2 String Mode – Commanded

Verify String 2 String Mode – Commanded

WARNING

Contact hazard. Verify EVA crewmembers are clear of DLA 2 prior to continuing.

NOTE

1. DLAs are launched in the locked position but are not installed on the SARJ race ring. Prior to EVA install, both DLAs must be rotated to the Neutral position.
2. While the EVA crew is working on a given DLA or DLA MLI cover, movement of that DLA is not allowed. To prevent this, the Engage/Lock motor for the DLA in question should not be selected. Movement of the DLA that the crew is not currently working on is allowed.

5. MOVING DLA 2 TO NEUTRAL FOR DEPLOY

5.1 Turning On DLA 2 Engage/Lock Motor

Stbd SARJ Operation

'Motor'

cmd Select DLA 2 – Engage/Lock

Verify String 2 Motor Select – DLA 2 Engage Lock

5.2 Moving DLA 2 to Neutral

Stbd SARJ Operation

Verify String 2 DLA 2 Position – Locked

```
*****
* If String 2 DLA 2 Position not Locked
* |   Perform {3.180 SARJ DLA UNKNOWN POSITION
* |   RECOVERY}, all (SODF: EPS: MALFUNCTION:
* |   PRIMARY POWER), then:
*****
```

'Position DLA'

cmd Position DLA Neutral – Arm

'Motor'

Verify String 2 Motor Setpoint Engage/Lock: -0.45 to -0.51

'Position DLA'

cmd Position DLA Neutral – Neutral

Verify String 2 Remaining Distance – Decreasing

<u>NOTE</u>
DLA Position will read Prelocked and then In between before reading Neutral.

Verify String 2 DLA 2 Position – Prelocked or In between

Verify String 2 DLA 2 Position – Neutral

* If Neutral Timer Expired – X or Caution '**SARJ DLA to**
* **Neutral Timeout - S3**' received and String 2 DLA 2
* Position not Neutral
* Perform {3.180 SARJ DLA UNKNOWN POSITION
* RECOVERY}, all (SODF: EPS: MALFUNCTION:
* PRIMARY POWER), then:

5.3 Moving DLA 2 to Engage

Stbd SARJ Operation

Verify String 2 DLA 2 Position – Neutral

'Position DLA'

cmd Position DLA Engage – Arm

'Motor'

Verify String 2 Motor Setpoint Engage/Lock: -0.45 to -0.51

'Position DLA'

cmd Position DLA Engage – Engage

Verify String 2 Remaining Distance – Decreasing

<u>NOTE</u>
DLA Position will read In between before reading Engaged.

Verify String 2 DLA 2 Position – In between

Verify String 2 DLA 2 Position – Engaged

* If Engage Timer Expired – X, Caution ‘**SARJ Engage**
* **Toothcrash - S3**’ received, or String 2 DLA 2 Position
* not Engaged
* Perform {3.180 SARJ DLA UNKNOWN POSITION
* RECOVERY}, all (SODF: EPS: MALFUNCTION:
* PRIMARY POWER SYSTEM), then:

5.4 Moving DLA 2 to Neutral

Stbd SARJ Operation

Verify String 2 DLA 2 Position – Engaged

‘Position DLA’

cmd Position DLA Neutral – Arm

‘Motor’

Verify String 2 Motor Setpoint Engage/Lock: +0.45 to +0.51

‘Position DLA’

cmd Position DLA Neutral – Neutral

Verify String 2 Remaining Distance – Decreasing

NOTE
DLA Position will read In between before reading Neutral.

Verify String 2 DLA 2 Position – In between

Verify String 2 DLA 2 Position – Neutral

* If Neutral Timer Expired – X or Caution ‘**SARJ DLA to**
* **Neutral Timeout - S3**’ received and String 2 DLA 2
* Position not Neutral
* Perform {3.180 SARJ DLA UNKNOWN POSITION
* RECOVERY}, all (SODF: EPS: MALFUNCTION:
* PRIMARY POWER), then:

5.5 Deselecting DLA 2 Motor

Stbd SARJ Operation

‘Motor’

cmd Motor Setpoint – Reset

Verify String 2 Motor Setpoint Engage/Lock: 0

cmd Select – None

Verify String 2 Motor Select – None

6. GIVING EVA CREW GO FOR DLA 2 DEPLOY

WARNING

Contact hazard. Verify no DLA motors selected prior to EVA DLA deploy.

On **MCC-H GO**, DLA 2 Deploy.

EV perform DEPLOY SARJ DLA, all (EVA C/L, FS 117), then:

WARNING

Contact hazard. Verify EVA crewmembers are clear of the SARJ and have given “DLA deploy complete, GO for Engage” call prior to continuing.

NOTE

The following steps will take the installed DLA 2 from Neutral to Engaged. These steps should be performed quickly so that the EVA crew can verify Pinion Gear fully meshed with Race Ring.

7. ENGAGING DLA 2 POST DEPLOY

7.1 Turning On DLA 2 Engage/Lock Motor

Stbd SARJ Operation
'Motor'

cmd Select DLA 2 – Engage/Lock

Verify String 2 Motor Select – DLA 2 Engage Lock

7.2 Moving DLA 2 to Engage

Stbd SARJ Operation

Verify String 2 DLA 2 Position – Neutral

* If String 2 DLA 2 Position not Neutral
* | Perform {3.180 SARJ DLA UNKNOWN POSITION
* | RECOVERY}, all (SODF: EPS: MALFUNCTION:
* | PRIMARY POWER), then:

'Position DLA'

cmd Position DLA Engage – Arm

'Motor'

Verify String 2 Motor Setpoint Engage/Lock: -0.45 to -0.51

'Position DLA'

cmd Position DLA Engage – Engage

Verify String 2 Remaining Distance – Decreasing

NOTE DLA Position will read In between before reading Engaged.
--

Verify String 2 DLA 2 Position – In between

Verify String 2 DLA 2 Position – Engaged

* If Engage Timer Expired – X, Caution '**SARJ Engage**
* **Toothcrash - S3**' received, or String 2 DLA 2 Position
* not Engaged
* Perform {3.170 SARJ MANUAL RECOVERY FROM A
* **TOOTHCRASH WHILE ENGAGING**}, all (SODF: EPS:
* MALFUNCTION: PRIMARY POWER SYSTEM), then:

7.3 Deselecting DLA 2 Motor

Stbd SARJ Operation

'Motor'

cmd Motor Setpoint – Reset

Verify String 2 Motor Setpoint Engage/Lock: 0

cmd Select – None

Verify String 2 Motor Select – None

8. GIVING EVA CREW GO FOR DLA 2 INSPECTION

WARNING
Contact hazard. Verify no DLA motors selected prior to EVA DLA inspection and MLI Reinstall.

On MCC-H GO, EVA inspection and MLI reinstall.

EV perform INSPECT DLA, all (EVA C/L, FS 117), then:

9. ACTIVATING STRING 1

9.1 Verifying SARJ S3-1 Control Software Enabled

S3: EPS: Stbd SARJ: SARJ Manager

Stbd SARJ Manager

Verify MDM S3 1 UB SEPS 14 – Enable

cmd MDM S3 1 SARJ Control Lower Tier Available – Enable

Verify MDM S3 1 SARJ Control – Enable

Verify MDM S3 1 RJMC Comm – Enable

* If RJMC Comm – Inhibit

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NOTE
Expect 'SARJ String 1 RJMC
Loss of Comm - S3' Caution.

cmd Enable

Verify – Enable

9.2 Verifying Lower Tier Available

Stbd SARJ Manager

√MDM S3 1 SARJ Control Lower Tier Available – Yes

9.3 Verifying Initial SARJ Configuration

S3: EPS: Stbd SARJ

Stbd SARJ

Verify S3-1 MDM String 1 Mode – Monitor

Verify RJMC 1 Temp, deg C : -32 to 77

sel RJMC 1

Stbd SARJ String 1

Verify Drive Motor Temp, deg C: -43 to 77

Verify Engage/Lock Motor Temp, deg C: -43 to 77

Stbd SARJ

sel RJMC 2

Stbd SARJ String 2

Verify Engage/Lock Motor DLA 1 Temp, deg C: -43 to 77

9.4 Powering On RJMC 1

sel RJMC 1

sel RPCM S31A A RPC 4

cmd RPC Position – Close (Verify – Cl)

NOTE
'SARJ String 1 RJMC Loss of Comm - S3' should clear when the RPC to RJMC 1 is closed.

sel RJMC 1

Verify Power On Flag – X

cmd Reset

Verify Power On Flag – blank

sel Operation

'Motor'

Verify String 1 Motor Select – None

9.5 Powering On Joint Resolver 1

Verify String 2 Joint Resolver – Off

Verify String 1 Joint Resolver – Off

cmd String 1 Joint Resolver – On

Verify String 1 Joint Resolver – On

Record SARJ Position: _____ (expect ~0 deg)

WARNING

Contact hazard. Verify EVA crewmembers are clear of DLA 1 prior to continuing.

NOTE

1. DLAs are launched in the locked position but are not installed on the SARJ race ring. Prior to EVA install, both DLAs must be rotated to the Neutral position.
2. While the EVA crew is working on a given DLA or DLA MLI cover, movement of that DLA is not allowed. To prevent this, the Engage/Lock motor for the DLA in question should not be selected. Movement of the DLA that the crew is not currently working on is allowed.

10. MOVING DLA 1 TO NEUTRAL FOR DEPLOY

10.1 Turning On DLA 1 Engage/Lock Motor

Stbd SARJ Operation
'Motor'

cmd Select DLA 1 – Engage/Lock

Verify String 2 Motor Select DLA 1 – Engage Lock

10.2 Moving DLA 1 to Neutral

Stbd SARJ Operation

Verify String 2 DLA 1 Position – Locked

* If String 2 DLA 1 Position not Locked
* | Perform {3.180 SARJ DLA UNKNOWN POSITION
* | RECOVERY}, all (SODF: EPS: MALFUNCTION:
* | PRIMARY POWER), then:

'Position DLA'

cmd Position DLA Neutral – Arm

'Motor'

Verify String 2 Motor Setpoint Engage/Lock: -0.45 to -0.51

'Position DLA'

cmd Position DLA Neutral – Neutral

Verify String 2 Remaining Distance – Decreasing

NOTE
DLA Position will read Prelocked and then
In between before reading Neutral.

Verify String 2 DLA 1 Position – Prelocked or In between
Verify String 2 DLA 1 Position – Neutral

* If Neutral Timer Expired – X or Caution '**SARJ DLA to**
* **Neutral Timeout - S3**' received and String 2 DLA 1
* Position not Neutral
* Perform {3.180 SARJ DLA UNKNOWN POSITION
* RECOVERY}, all (SODF: EPS: MALFUNCTION:
* PRIMARY POWER), then:

10.3 Moving DLA 1 to Engage

Stbd SARJ Operation

Verify String 2 DLA 1 Position – Neutral

'Position DLA'

cmd Position DLA Engage – Arm

'Motor'

Verify String 2 Motor Setpoint Engage/Lock: -0.45 to -0.51

'Position DLA'

cmd Position DLA Engage – Engage

Verify String 2 Remaining Distance – Decreasing

NOTE
DLA Position will read In between before reading Engaged.

Verify String 2 DLA 1 Position – In between
Verify String 2 DLA 1 Position – Engaged

* If Engage Timer Expired – X, Caution '**SARJ Engage**
* **Toothcrash - S3**' received, or String 2 DLA 1 Position not
* Engaged
* Perform {3.180 SARJ DLA UNKNOWN POSITION
* RECOVERY}, all (SODF: EPS: MALFUNCTION:
* PRIMARY POWER SYSTEM), then:

10.4 Moving DLA 1 to Neutral

Stbd SARJ Operation

Verify String 2 DLA 1 Position – Engaged

'Position DLA'

cmd Position DLA Neutral – Arm

'Motor'

Verify String 2 Motor Setpoint Engage/Lock: +0.45 to +0.51

'Position DLA'

cmd Position DLA Neutral – Neutral

Verify String 2 Remaining Distance – Decreasing

NOTE
DLA Position will read In between before reading Neutral.

Verify String 2 DLA 1 Position – In between

Verify String 2 DLA 1 Position – Neutral

* If Neutral Timer Expired – X or Caution '**SARJ DLA to**
* **Neutral Timeout - S3**' received and String 2
* DLA 1 Position not Neutral
* Perform {3.180 **SARJ DLA UNKNOWN POSITION**
* **RECOVERY**}, all (SODF: EPS: MALFUNCTION:
* PRIMARY POWER), then:

10.5 Deselecting DLA 1 Motor

Stbd SARJ Operation

'Motor'

cmd Motor Setpoint – Reset

Verify String 2 Motor Setpoint Engage/Lock: 0

cmd Select – None

Verify String 2 Motor Select – None

11. GIVING EVA CREW GO FOR DLA 1 DEPLOY

WARNING
Contact hazard. Verify no DLA motors selected prior to EVA DLA deploy.

On **MCC- H GO**, DLA 1 Deploy.

EV perform DEPLOY SARJ DLA, all (EVA C/L, FS 117), then:

WARNING

Contact hazard. Verify EVA crewmembers are clear of the SARJ and have given "DLA 1 deploy complete, GO for Engage" call prior to continuing.

NOTE

1. The following steps will take the installed DLA 1 from Neutral to Engaged. These steps should be performed quickly so that the EVA crew can verify Pinion Gear fully meshed with Race Ring.
2. If a toothcrash occurs while engaging, the nominal toothcrash recovery procedure cannot be performed because it would attempt to rotate the SARJ with the Launch Locks/Launch Restraints still installed. Instead the recovery steps are included in the second off-nominal situation block in step 12.2.

12. ENGAGING DLA 1 POST DEPLOY

12.1 Turning On DLA 1 Engage/Lock Motor

Stbd SARJ Operation

'Motor'

cmd Select DLA 1 – Engage/Lock

Verify String 2 Motor Select – DLA 1 Engage Lock

12.2 Moving DLA 1 to Engage

Stbd SARJ Operation

Verify String 2 DLA 1 Position – Neutral

* If String 2 DLA 1 Position not Neutral
* | Perform {3.180 SARJ DLA UNKNOWN POSITION
* | RECOVERY}, all (SODF: EPS: MALFUNCTION:
* | PRIMARY POWER), then:

'Position DLA'

cmd Position DLA Engage – Arm

'Motor'

Verify String 2 Motor Setpoint Engage/Lock: -0.45 to -0.51

'Position DLA'

cmd Position DLA Engage – Engage

Verify String 2 Remaining Distance – Decreasing

NOTE DLA Position will read In between before reading Engaged.
--

Verify String 2 DLA 1 Position – In between

Verify String 2 DLA 1 Position – Engaged

* If Engage Timer Expired – X, Caution '**SARJ Engage**
* **Toothcrash - S3**' received, or String 2 DLA 1 Position
* not Engaged

* **cmd** String 2 CWA – Clear

* Verify String 2 Motor Select – None

* If String 2 Motor Select is not None

* **cmd** Motor Setpoint – Reset

* Verify String 2 Motor Setpoint Engage/Lock – 0

* **cmd** Motor Select – None (Verify None)

* **cmd** String 2 Mode – Monitor

* Verify String 2 Mode – Monitor

* **cmd** String 1 Mode – Commanded

* Verify String 1 Mode – Commanded

* Verify String 1,2 DLA 1 Position – Neutral

* If DLA 1 Position – In between

* **cmd** Motor Select – DLA 1 Engage/Lock

* Verify String 1 Motor Select – DLA 1 Engage Lock

* sel Toothcrash Recovery

*

Starboard SARJ Manual Tooth Crash Recovery
--

* 'Step Rate'

* input Rate – 8 Hz

*

- * Verify String 1 Distance: 3 (may not be seen due to telemetry rates)
 - * Verify String 1 Remaining Distance – Decreasing (may not be seen due to telemetry rates)
 - * **cmd** Motor Select – None (Verify None)
 - * **cmd** String 1 Mode – Monitor
 - * Verify String 1 Mode – Monitor
 - * **cmd** String 2 Mode – Commanded
 - * Verify String 2 Mode – Commanded
 - * Re-perform step 12 from the beginning.
- *****

12.3 Deselecting DLA 1 Motor

Stbd SARJ Operation
'Motor'

cmd Motor Setpoint – Reset

Verify String 2 Motor Setpoint Engage/Lock: 0

cmd Select – None

Verify String 2 Motor Select – None

13. GIVING EVA CREW GO FOR DLA 1 INSPECTION

WARNING

Contact hazard. Verify no DLA motors selected prior to EVA DLA inspection and MLI Reinstall.

On MCC-H GO, EVA inspection and MLI reinstall.

EV perform INSPECT DLA, all (EVA C/L, FS 117), then:

WARNING

Contact hazard. Verify no DLA motors selected prior to EVA removal of Launch Locks and Launch Restraints.

NOTE

Removal of Launch Locks and Launch Restraints is scheduled to occur during EVA 2.

SARJ INITIAL ACTIVATION AND CHECKOUT

(ASSY OPS/13A/FIN X/HC) Page 18 of 55 pages

14. GIVING EVA CREW GO FOR EVA REMOVAL OF LAUNCH LOCKS AND LAUNCH RESTRAINTS

On **MCC-H GO**, EVA removal of Launch Locks and Launch Restraints.

EV perform SARJ PREPARATION, all (EVA C/L, FS 117), then:

WARNING

Contact hazard. Verify EVA crewmembers are clear of the SARJ and have given "All Launch Restraints/Locks removed" call prior to continuing.

NOTE

1. The following steps will take DLA 1 from Engaged to Lock to prevent SARJ motion for the rest of the EVA.
2. The SARJ Toothcrash algorithms were inhibited prior to the SARJ Launch Locks and Restraints being removed so that the algorithms would not inadvertently attempt to rotate the SARJ.

15. LOCKING DLA 1 POST LAUNCH LOCK AND LAUNCH RESTRAINT REMOVAL

15.1 Enabling SARJ Toothcrash

Stbd SARJ

sel Software Inhibits

Stbd SARJ Primary EXT Software Inhibits

'Tooth Crash

cmd Engage – Enable (Verify Engage – Enable)

cmd Lock – Enable (Verify Lock – Enable)

15.2 Turning On DLA 1 Engage/Lock Motor

Stbd SARJ Operation

'Motor'

cmd Select DLA 1 – Engage/Lock

Verify String 2 Motor Select – DLA 1 Engage Lock

15.3 Moving DLA 1 to Neutral

Stbd SARJ Operation

Verify String 2 DLA 1 Position – Engaged

'Position DLA'

cmd Position DLA Neutral – Arm

'Motor'

Verify String 2 Motor Setpoint Engage/Lock: +0.45 to +0.51

'Position DLA'

cmd Position DLA Neutral – Neutral

Verify String 2 Remaining Distance – Decreasing

NOTE DLA Position will read In between before reading Neutral.
--

Verify String 1,2 DLA 1 Position – In between

Verify String 1,2 DLA 1 Position – Neutral

* If Neutral Timer Expired – X or Caution '**SARJ DLA to**
* **Neutral Timeout - S3**' received and String 1,2 DLA 1
* Position not Neutral
* Perform {3.180 SARJ DLA UNKNOWN POSITION
* RECOVERY}, all (SODF: EPS: MALFUNCTION:
* PRIMARY POWER), then:

WARNING
If a toothcrash occurs while locking, the Lock Toothcrash algorithm will attempt to rotate the SARJ approximately 0.33 degree during each recovery attempt. Since the P6 2B array is still deployed, if the SARJ continues to rotate, the S4 arrays could collide with the P6 2B array. If the SARJ rotates in an unexpected manner, the abort command will be sent to stop motion. If the abort command does not work, power will be removed from the control string RJMC.

15.4 Moving DLA 1 to Lock

Stbd SARJ Operation

'Position DLA'

Verify String 1,2 DLA 1 Position – Neutral

cmd Position DLA Lock – Arm

'Motor'

Verify String 2 Motor Setpoint Engage/Lock: +0.45 to +0.51

'Position DLA'

cmd Position DLA Lock – Lock

Verify String 2 Remaining Distance – Decreasing

NOTE
DLA Position will read In between and then Prelocked before reading Locked.

Verify String 1,2 DLA 1 Position – In between

Verify String 1,2 DLA 1 Position – Prelocked

Verify String 1,2 DLA 1 Position – Locked

```
*****
* If a toothcrash occurs while locking and the SARJ moves more
* than ~0.33 degrees per recovery attempt
*   Stbd SARJ Operation
*
*   cmd Abort – Abort
*
*   If SARJ continues to move
*   Stbd SARJ
*
*   sel RPCM S32B A RPC 4
*
*   RPCM S32B A RPC 4
*
*   cmd RPC Position – Op (Verify Op)
*
*   SARJ stepper circuitry or control has failed. >>
*****
```

```
*****
* If Lock Timer Expired – X, Caution ‘SARJ Lock
* Toothcrash - S3’ received, or String 1,2 DLA 1 Position
* not Locked
* Perform {3.171 SARJ MANUAL RECOVERY FROM A
* TOOTHCRASH WHILE LOCKING}, all (SODF: EPS:
* MALFUNCTION: PRIMARY POWER SYSTEM), then:
*****
```

15.5 Deselecting DLA 1 Motor

Stbd SARJ Operation

‘Motor’

cmd Motor Setpoint – Reset

Verify String 2 Motor Setpoint Engage/Lock: 0

cmd Select – None

Verify String 2 Motor Select – None

16. INFORMING EVA CREW OF DLA LOCK

WARNING

Contact hazard. Verify one DLA Locked, all Motor Setpoints set to zero and all motors deselected before continuing.

ON MCC-H GO, continue EVA activities in the proximity of the SARJ.

WARNING

Contact hazard. Verify EVA crewmembers are clear of the SARJ prior to continuing.

NOTE

The following steps will take the SARJ to a fully activated state on both Strings.

SARJ EVA activities complete.

BEGINNING COMPLETE NOMINAL ACTIVATION

NOTE

1. The Restart FDIR is inhibited because the EXT MDM does not contain any code to actually restart the SARJ.
2. The Switchover FDIR is inhibited because this inhibit does not actually enable or inhibit the function. The function is inhibited by inhibiting the String Failure FDIRs.
3. The Blind Ops Time Limit FDIR is inhibited to prevent the SARJ from timing out and transitioning to shutdown mode after operating in blind mode for more than 24 hours.
4. Inadvertent Joint Rotation is inhibited because it has multiple SPNs against it.

17. UPDATING DEFAULT SOFTWARE CONFIGURATION

S3: EPS: Stbd SARJ: Software Inhibits

Stbd SARJ Primary EXT Software Inhibits

17.1 Inhibiting Restart

cmd AutoRestart – Arm

Verify AutoRestart – Arm

cmd AutoRestart – Inhibit

Verify AutoRestart – Inhibit

17.2 Inhibiting Switchover

cmd Switchover – Arm

Verify Switchover – Arm

cmd Switchover – Inhibit

Verify Switchover – Inhibit

17.3 Inhibiting Blind Ops Time Limit

cmd Blind Ops Time Limit – Arm

Verify Blind Ops Time Limit – Arm

cmd Blind Ops Time Limit – Inhibit

Verify Blind Ops Time Limit – Inhibit

17.4 Inhibiting Inadvertent Joint Rotation

cmd Inadvertent Joint Rotation – Arm

Verify Inadvertent Joint Rotation – Arm

cmd Inadvertent Joint Rotation – Inhibit

Verify Inadvertent Joint Rotation – Inhibit

17.5 Updating the Shutdown Angle

sel Operation

input Shutdown Angle – 2 2 5

cmd set

Verify Shutdown Angle: 225

18. VERIFYING INITIAL CONDITIONS

S3: EPS: Stbd SARJ

NOTE

As documented in the SARJ Short Sheet, the RJMC Cold Start limit is -43 deg C, the SARJ can not be rotated until it is within the range of -32/77°C.

SARJ INITIAL ACTIVATION AND CHECKOUT
(ASSY OPS/13A/FIN X/HC) Page 23 of 55 pages

Verify RJMC 1 Temp, deg C: -43 to 77
Verify RJMC 2 Temp, deg C: -43 to 77

√TB 1 – TB 12 – No Attention Symbols
√DLA 1 – No Attention Symbol
√DLA 2 – No Attention Symbol

END OF ACTIVATION CHECKOUT STEPS BEGIN

NOTE

The following step will verify that both Joint Resolvers are reading the same value at this position. Both Joint Resolvers should read ~0 degrees.

19. RECORDING INITIAL JOINT RESOLVER READINGS

S3: EPS: Stbd SARJ

Stbd SARJ

sel Operation

Stbd SARJ Operation

Record SARJ Position: _____

cmd String 1 Joint Resolver – Off

Verify String 1 Joint Resolver – Off

cmd String 2 Joint Resolver – On

Verify String 2 Joint Resolver – On

Record SARJ Position: _____

cmd String 2 Joint Resolver – Off

Verify String 2 Joint Resolver – Off

cmd String 1 Joint Resolver – On

Verify String 1 Joint Resolver – On

20. MOVING DLA 1 FROM LOCKED TO ENGAGED ON STRING 2

20.1 Turning On DLA 1 Engage/Lock Motor

Stbd SARJ Operation

'Motor'

cmd Select DLA 1 – Engage/Lock

Verify String 2 Motor Select – DLA 1 Engage Lock

20.2 Moving DLA 1 to Neutral

Stbd SARJ Operation

Verify String 1,2 DLA 1 Position – Locked

'Position DLA'

cmd Position DLA Neutral – Arm

'Motor'

Verify String 2 Motor Setpoint Engage/Lock: -0.45 to -0.51

'Position DLA'

cmd Position DLA Neutral – Neutral

Verify String 2 Remaining Distance – Decreasing

NOTE

DLA Position will read Prelocked and then In between before reading Neutral.

Verify String 1,2 DLA 1 Position – Prelocked or In between

Verify String 1,2 DLA 1 Position – Neutral

- * If Neutral Timer Expired – X or Caution '**SARJ DLA to**
- * **Neutral Timeout - S3**' received and String 1,2 DLA 1
- * Position not Neutral
- * Perform {3.180 SARJ DLA UNKNOWN POSITION
- * RECOVERY}, all (SODF: EPS: MALFUNCTION:
- * PRIMARY POWER), then:

WARNING

If a toothcrash occurs while engaging, the Engage Toothcrash algorithm will attempt to rotate the SARJ approximately 0.33 degree during each recovery attempt. If the P6 2B array is still deployed beyond 20.8 bays, and if the SARJ continues to rotate, the S4 arrays could collide with the P6 2B array. If the SARJ rotates in an unexpected manner, the abort command will be sent to stop motion. If the abort command does not work, power will be removed from the control string RJMC.

20.3 Moving DLA 1 to Engage

Stbd SARJ Operation

Verify String 1,2 DLA 1 Position – Neutral

'Position DLA'

cmd Position DLA Engage – Arm

'Motor'

Verify String 2 Motor Setpoint Engage/Lock: -0.45 to -0.51

'Position DLA'

cmd Position DLA Engage – Engage

Verify String 2 Remaining Distance – Decreasing

NOTE
DLA Position will read In between before reading Engaged.

Verify String 1,2 DLA 1 Position – In between

Verify String 1,2 DLA 1 Position – Engaged

```
*****
* If a toothcrash occurs while engaging and the SARJ moves
* more than ~0.33 degrees per recovery attempt
*   Stbd SARJ Operation
*
*   cmd Abort – Abort
*
*   If SARJ continues to move
*   Stbd SARJ
*
*   sel RPCM S32B A RPC 4
*
*   RPCM S32B A RPC 4
*
*   cmd RPC Position – Op (Verify Op)
*
*   SARJ stepper circuitry or control has failed. >>
*****
```

* If Engage Timer Expired – X, Caution '**SARJ Engage**
* **Toothcrash - S3**' received, or String 1,2 DLA 1
* Position not Engaged
* Perform {3.170 **SARJ MANUAL RECOVERY FROM A**
* **TOOTHCRASH WHILE ENGAGING**}, all (SODF: EPS:
* MALFUNCTION: PRIMARY POWER SYSTEM), then:

20.4 Deselecting DLA 1 Motor

'Motor'

cmd Motor Setpoint – Reset

Verify String 2 Motor Setpoint Engage/Lock: 0

cmd Select – None

Verify String 2 Motor Select – None

21. CHECKING OUT DLA 2 ON STRING 2

21.1 Turning On DLA 2 Engage/Lock Motor

'Motor'

cmd Select DLA 2 – Engage/Lock

Verify String 2 Motor Select – DLA 2 Engage Lock

21.2 Moving DLA 2 to Neutral

Verify String 1,2 DLA 2 Position – Engaged

'Position DLA'

cmd Position DLA Neutral – Arm

'Motor'

Verify String 2 Motor Setpoint Engage/Lock: 0.45 to 0.51

'Position DLA'

cmd Position DLA Neutral – Neutral

Verify String 2 Remaining Distance – Decreasing

NOTE
DLA Position will read In between before reading Neutral.

Verify String 1,2 DLA 2 Position – In between
Verify String 1,2 DLA 2 Position – Neutral

* If Neutral Timer Expired – X or Caution ‘**SARJ DLA to**
* **Neutral Timeout - S3**’ received and String 1,2 DLA 2
* Position not Neutral
* Perform {3.180 SARJ DLA UNKNOWN POSITION
* RECOVERY}, all (SODF: EPS: MALFUNCTION:
* PRIMARY POWER), then:

NOTE
The locked Toothcrash algorithm does not function for locking the DLA on the commanded string. If a toothcrash occurs, recovery must be done manually.

21.3 Moving DLA 2 to Locked
Verify String 1,2 DLA 2 Position – Neutral

‘Position DLA’

cmd Position DLA Lock – Arm

‘Motor’

Verify String 2 Motor Setpoint Engage/Lock: 0.45 to 0.51

‘Position DLA’

cmd Position DLA Lock – Lock

Verify String 2 Remaining Distance – Decreasing

NOTE
DLA Position will read In between and Prelocked before reading Locked.

Verify String 1,2 DLA 2 Position – In between (Prelocked)
Verify String 1,2 DLA 2 Position – Engaged

* If Lock Timer Expired – X, Caution ‘**SARJ Lock**
* **Toothcrash - S3**’ received, or String 1,2 DLA 1
* Position not Locked
* Perform {3.171 SARJ MANUAL RECOVERY FROM
* A TOOTHCRASH WHILE LOCKING}, all (SODF: EPS:
* MALFUNCTION: PRIMARY POWER SYSTEM), then:

21.4 Moving DLA 2 to Neutral

Verify String 1,2 DLA 2 Position – Locked

‘Position DLA’

cmd Position DLA Neutral – Arm

‘Motor’

Verify String 2 Motor Setpoint Engage/Lock: -0.45 to -0.51

‘Position DLA’

cmd Position DLA Neutral – Neutral

Verify String 2 Remaining Distance – Decreasing

<u>NOTE</u> DLA Position will read In between before reading Neutral.
--

Verify String 1,2 DLA 2 Position – In between

Verify String 1,2 DLA 2 Position – Neutral

* If Neutral Timer Expired – X or Caution ‘**SARJ DLA to**
* **Neutral Timeout - S3**’ received and String 1,2 DLA 2
* Position not Neutral
* Perform {3.180 SARJ DLA UNKNOWN POSITION
* RECOVERY}, all (SODF: EPS: MALFUNCTION:
* PRIMARY POWER), then:

21.5 Moving DLA 2 to Engaged

Verify String 1,2 DLA 2 Position – Neutral

‘Position DLA’

cmd Position DLA Engage – Arm

‘Motor’

SARJ INITIAL ACTIVATION AND CHECKOUT

(ASSY OPS/13A/FIN X/HC) Page 29 of 55 pages

Verify String 2 Motor Setpoint Engage/Lock: -0.45 to -0.51

'Position DLA'

cmd Position DLA Engage – Engage

Verify String 2 Remaining Distance – Decreasing

<u>NOTE</u> DLA Position will read In between and Prelocked before reading Locked.

Verify String 1,2 DLA 2 Position – In between (Prelocked)

Verify String 1,2 DLA 2 Position – Locked

* If Lock Timer Expired – X, Caution '**SARJ Lock**
* **Toothcrash - S3**' received, or String 1,2 DLA 1
* Position not Locked
* Perform {3.171 [SARJ MANUAL RECOVERY FROM](#)
* [A TOOTHCRASH WHILE LOCKING](#)}, all (SODF: EPS:
* MALFUNCTION: PRIMARY POWER SYSTEM), then:

21.6 Deselecting DLA 2 Motor

Stbd SARJ Operation

'Motor'

cmd Motor Setpoint – Reset

Verify String 2 Motor Setpoint Engage/Lock: 0

cmd Select – None

Verify String 2 Motor Select – None

22. [MOVING DLA 1 FROM ENGAGED TO NEUTRAL ON STRING 2](#)

22.1 Turning On DLA 1 Engage/Lock Motor

Stbd SARJ Operation

'Motor'

cmd Select DLA 1 – Engage/Lock

Verify String 2 Motor Select – DLA 1 Engage Lock

22.2 Moving DLA 1 to Neutral

Stbd SARJ Operation

Verify String 1,2 DLA 1 Position – Engage

'Position DLA'

cmd Position DLA Neutral – Arm

'Motor'

Verify String 2 Motor Setpoint Engage/Lock: +0.45 to +0.51

'Position DLA'

cmd Position DLA Neutral – Neutral

Verify String 2 Remaining Distance – Decreasing

<u>NOTE</u> DLA Position will read In between before reading Neutral.
--

Verify String 1,2 DLA 1 Position – In between

Verify String 1,2 DLA 1 Position – Neutral

* If Neutral Timer Expired – X or Caution '**SARJ DLA to**
* **Neutral Timeout - S3**' received and String 1,2 DLA 1
* Position not Neutral
* Perform {3.180 SARJ DLA UNKNOWN POSITION
* RECOVERY}, all (SODF: EPS: MALFUNCTION:
* PRIMARY POWER), then:

22.3. Deselecting DLA 1 Motor

Stbd SARJ Operation

'Motor'

cmd Motor Setpoint – Reset

Verify String 2 Motor Setpoint Engage/Lock: 0

cmd Select – None

Verify String 2 Motor Select – None

WARNING
The following steps will rotate the Starboard SARJ approximately 2 degrees. If the Starboard SARJ is rotated with the S4 1A or 3A arrays deployed while the P6 2B array is deployed beyond 20.8 bays, the S4 arrays could collide with the P6 2B arrays. If the SARJ rotates in an unexpected manner, the abort command will be sent to stop motion. If the abort command does not work, power will be removed from the control string RJMC.

SARJ INITIAL ACTIVATION AND CHECKOUT

(ASSY OPS/13A/FIN X/HC) Page 31 of 55 pages

23. STEPPING STARBOARD SARJ ON STRING 2

23.1 Selecting Step Drive Motor

Stbd SARJ Operation

sel Tooth Crash Recovery

Stbd SARJ Manual Tooth Crash Recovery

cmd Motor Select DLA 2 – Step Drive Motor

Verify String 2 Motor Select – Step Drive

23.2 Stepping the SARJ

Stbd SARJ Manual Tooth Crash Recovery

NOTE

The Position DLA Engage Arm or Lock Arm commands are used to send either a negative or positive setpoint to the Drive Motor when selected as Step Drive Motor. Using the Lock Arm command will result in a positive motor setpoint that will move the pinion in the counterclockwise direction, which will move the SARJ in the decreasing direction when the DLA is engaged. Using the Engage Arm command will result in a negative motor setpoint that will move the pinion in the clockwise direction, which will move the SARJ in the increasing direction if the DLA is engaged.

'Position DLA'

cmd Engage Arm

Verify String 2 MDM Motor Setpoint: -0.5

NOTE

Expect '**SARJ Inadvertent Joint Rotation - S3**' Caution to come into alarm when joint is moved.

'Step Drive Motor'

input Steps – 1 8 stp

cmd Step Drive Motor

Verify Step Drive Motor String 2: 18

Stbd SARJ Operation

Verify String 1 Remaining Distance – Decreasing

Verify SARJ Position: 2 deg

```
*****
* If the SARJ moves more than ~2 degrees
*   
*
*   cmd Abort – Abort
*
*   If SARJ continues to move
*     
*
*     sel RPCM S32B A RPC 4
*
*     
*
*     cmd RPC Position – Op (Verify Op)
*
*     SARJ stepper circuitry or control has failed. >>
*****
```

23.3 Deselecting Step Drive Motor

cmd Select – None

Verify String 1 Motor Select – None

23.4 Clearing Inadvertent Joint Rotation Caution (If Required)

cmd SARJ CWA – Clear

Verify SARJ Inadvertent Joint Rotation – S3 caution clear

24. SELECTING SARJ STRING 1

cmd String 2 String Mode – Monitor

Verify String 2 String Mode – Monitor

cmd String 1 String Mode – Commanded

Verify String 1 String Mode – Commanded

25. SWAPPING FROM JOINT RESOLVER 1 TO JOINT RESOLVER 2

Record SARJ Position: _____deg

cmd String 1 Joint Resolver – Off

Verify String 1 Joint Resolver – Off

cmd String 2 Joint Resolver – On

Verify String 2 Joint Resolver – On

Record SARJ Position: _____ deg

26. CHECKING DLA 1 ON STRING 1

26.1 Turning on DLA 1 Engage/Lock Motor

Stbd SARJ Operation
'Motor'

cmd Select DLA 1 – Engage/Lock

Verify String 1 Motor Select – DLA 1 Engage Lock

26.2 Moving DLA 1 to Engage

Stbd SARJ Operation

Verify String 1,2 DLA 1 Position – Neutral

'Position DLA'

cmd Position DLA Engage – Arm

'Motor'

Verify String 1 Motor Setpoint Engage/Lock: -0.45 to -0.51

'Position DLA'

cmd Position DLA Engage – Engage

Verify String 1 Remaining Distance – Decreasing

NOTE
DLA Position will read In between before reading Engaged.

Verify String 1,2 DLA 1 Position – In between

Verify String 1,2 DLA 1 Position – Engaged

* If Engage Timer Expired – X, Caution '**SARJ Engage**
* **Toothcrash - S3**' received, or String 1,2 DLA 1 Position
* not Engaged
* Perform {3.170 SARJ MANUAL RECOVERY FROM A
* **TOOTHCRASH WHILE ENGAGING**}, all (SODF: EPS:
* **MALFUNCTION: PRIMARY POWER SYSTEM**), then:

26.3 Moving DLA 1 to Neutral

Stbd SARJ Operation

Verify String 1,2 DLA 1 Position – Engaged

'Position DLA'

cmd Position DLA Neutral – Arm

'Motor'

Verify String 1 Motor Setpoint Engage/Lock: +0.45 to +0.51

'Position DLA'

cmd Position DLA Neutral – Neutral

Verify String 1 Remaining Distance – Decreasing

NOTE
DLA Position will read In between before reading Neutral.

Verify String 1,2 DLA 1 Position – In between

Verify String 1,2 DLA 1 Position – Neutral

* If Neutral Timer Expired – X or Caution '**SARJ**
* **DLA to Neutral Timeout - S3**' received and
* String 2 DLA 1 Position not Neutral
* Perform {3.180 **SARJ DLA UNKNOWN POSITION**
* **RECOVERY**}, all (SODF: EPS: MALFUNCTION:
* PRIMARY POWER), then:

NOTE
The locked Toothcrash algorithm does not function for locking the DLA on the commanded string. If a toothcrash occurs, recovery must be done manually.

26.4 Moving DLA 1 to Lock

Stbd SARJ Operation

Verify String 1,2 DLA 2 Position – Neutral

'Position DLA'

cmd Position DLA Lock – Arm

'Motor'

Verify String 1 Motor Setpoint Engage/Lock: +0.45 to +0.51

'Position DLA'

cmd Position DLA Lock – Lock

Verify String 1 Remaining Distance – Decreasing

<u>NOTE</u> DLA Position will read In between and then Prelocked before reading Locked.
--

Verify String 1,2 DLA 2 Position – In between

Verify String 1,2 DLA 2 Position – Prelocked

Verify String 1,2 DLA 2 Position – Locked

* If Lock Timer Expired – X, Caution '**SARJ Lock**
* **Toothcrash - S3**' received, or String 1,2 DLA 2
* Position not Locked
* Perform {3.171 SARJ MANUAL RECOVERY FROM
* A TOOTHCRASH WHILE LOCKING}, all (SODF: EPS:
* MALFUNCTION: PRIMARY POWER SYSTEM), then:

26.5 Moving DLA 1 to Neutral

Stbd SARJ Operation

Verify String 1,2 DLA 1 Position – Locked

'Position DLA'

cmd Position DLA Neutral – Arm

'Motor'

Verify String 1 Motor Setpoint Engage/Lock: -0.45 to -0.51

'Position DLA'

cmd Position DLA Neutral – Neutral

Verify String 1 Remaining Distance – Decreasing

<u>NOTE</u> DLA Position will read Prelocked then In between before reading Neutral.

Verify String 1,2 DLA 1 Position – Prelocked or In between

Verify String 1,2 DLA 1 Position – Neutral

* If Neutral Timer Expired – X or Caution ‘**SARJ**
* **DLA to Neutral Timeout - S3**’ received and
* String 2 DLA 1 Position not Neutral
* Perform {3.180 **SARJ DLA UNKNOWN POSITION**
* **RECOVERY**}, all (SODF: EPS: MALFUNCTION:
* PRIMARY POWER), then:

26.6 Moving DLA 1 to Engage

Stbd SARJ Operation

Verify String 1,2 DLA 1 Position – Neutral

‘Position DLA’

cmd Position DLA Engage – Arm

‘Motor’

Verify String 1 Motor Setpoint Engage/Lock: -0.45 to -0.51

‘Position DLA’

cmd Position DLA Engage – Engage

Verify String 1 Remaining Distance – Decreasing

NOTE
DLA Position will read In between before reading Engaged.

Verify String 1,2 DLA 1 Position – In between

Verify String 1,2 DLA 1 Position – Engaged

* If Engage Timer Expired – X, Caution ‘**SARJ Engage**
* **Toothcrash - S3**’ received, or String 1,2 DLA 1 Position
* not Engaged
* Perform {3.170 **SARJ MANUAL RECOVERY FROM A**
* **TOOTHCRASH WHILE ENGAGING**}, all (SODF: EPS:
* MALFUNCTION: PRIMARY POWER SYSTEM), then:

26.7 Deselecting DLA 1 Motor

Stbd SARJ Operation

‘Motor’

cmd Motor Setpoint – Reset

Verify String 1 Motor Setpoint Engage/Lock: 0

cmd Select – None

Verify String 1 Motor Select – None

27. CHECKING OUT DLA 2 ON STRING 1

27.1 Turning On DLA 2 Engage/Lock Motor

Stbd SARJ Operation

'Motor'

cmd Select DLA 2 – Engage/Lock

Verify String 1 Motor Select – DLA 2 Engage Lock

27.2 Moving DLA 2 to Neutral

Stbd SARJ Operation

Verify String 1,2 DLA 2 Position – Engage

'Position DLA'

cmd Position DLA Neutral – Arm

'Motor'

Verify String 1 Motor Setpoint Engage/Lock: +0.45 to +0.51

'Position DLA'

cmd Position DLA Neutral – Neutral

Verify String 1 Remaining Distance – Decreasing

NOTE

DLA Position will read In between before reading Neutral.

Verify String 1,2 DLA 2 Position – In between

Verify String 1,2 DLA 2 Position – Neutral

* If Neutral Timer Expired – X or Caution '**SARJ DLA to**
* **Neutral Timeout - S3**' received and String 1,2 DLA 2
* Position not Neutral
* Perform {3.180 **SARJ DLA UNKNOWN POSITION**
* **RECOVERY**}, all (SODF: EPS: MALFUNCTION:
* PRIMARY POWER), then:

WARNING

If a toothcrash occurs while locking, the Lock Toothcrash algorithm will attempt to rotate the SARJ approximately 0.33 degree during each recovery attempt. If the P6 2B array is still deployed beyond 20.8 bays, and if the SARJ continues to rotate, the S4 arrays could collide with the P6 2B array. If the SARJ rotates in an unexpected manner, the abort command will be sent to stop motion. If the abort command does not work, power will be removed from the control string RJMC.

27.3 Moving DLA 2 to Lock

Stbd SARJ Operation

Verify String 1,2 DLA 2 Position – Neutral

* If String 1,2 DLA 2 Position not Neutral, perform {3.180
* | SARJ DLA UNKNOWN POSITION RECOVERY}, all
* | (SODF: EPS: MALFUNCTION: PRIMARY POWER), then:

'Position DLA'

cmd Position DLA Lock – Arm

'Motor'

Verify String 1 Motor Setpoint Engage/Lock: +0.45 to +0.51

'Position DLA'

cmd Position DLA Lock – Lock

Verify String 1 Remaining Distance – Decreasing

NOTE

DLA Position will read In between and then Prelocked before reading Locked.

Verify String 1,2 DLA 2 Position – In between

Verify String 1,2 DLA 2 Position – Prelocked

Verify String 1,2 DLA 2 Position – Locked


```
*****
* If a toothcrash occurs while locking and the SARJ moves
* more than ~0.33 degrees per recovery attempt
*   Stbd SARJ Operation
*
*   cmd Abort – Abort
*
*   If SARJ continues to move
*   Stbd SARJ
*
*   sel RPCM S31A A RPC 4
*
*   RPCM S31A A RPC 4
*
*   cmd RPC Position – Op (Verify Op)
*
*   SARJ stepper circuitry or control has failed. >>
*****
```

```
*****
* If Lock Timer Expired – X, Caution 'SARJ Lock
* Toothcrash - S3' received, or String 1,2 DLA 2
* Position not Locked
* Perform {3.171 SARJ MANUAL RECOVERY FROM
* A TOOTHCRASH WHILE LOCKING}, all (SODF: EPS:
* MALFUNCTION: PRIMARY POWER SYSTEM), then:
*****
```

27.4 Moving DLA 2 to Neutral

Stbd SARJ Operation

Verify String 1,2 DLA 2 Position – Locked

'Position DLA'

cmd Position DLA Neutral – Arm

'Motor'

Verify String 1 Motor Setpoint Engage/Lock: -0.45 to -0.51

'Position DLA'

cmd Position DLA Neutral – Neutral

Verify String 1 Remaining Distance – Decreasing

NOTE

DLA Position will read Prelocked and then In between before reading Neutral.

Verify String 1,2 DLA 2 Position – Prelocked or In between
Verify String 1,2 DLA 2 Position – Neutral

* If Neutral Timer Expired – X or Caution ‘**SARJ DLA to**
* **Neutral Timeout - S3**’ received and String 1,2 DLA 2
* Position not Neutral
* Perform {3.180 **SARJ DLA UNKNOWN POSITION**
* **RECOVERY**}, all (SODF: EPS: MALFUNCTION:
* **PRIMARY POWER**), then:

WARNING
If a toothcrash occurs while engaging, the Engage Toothcrash algorithm will attempt to rotate the SARJ approximately 0.33 degree during each recovery attempt. If the P6 2B array is still deployed beyond 20.8 bays, and if the SARJ continues to rotate, the S4 arrays could collide with the P6 2B array. If the SARJ rotates in an unexpected manner, the abort command will be sent to stop motion. If the abort command does not work, power will be removed from the control string RJMC.

27.5 Moving DLA 2 to Engage

Stbd SARJ Operation

Verify String 1,2 DLA 2 Position – Neutral

‘Position DLA’

cmd Position DLA Engage – Arm

‘Motor’

Verify String 1 Motor Setpoint Engage/Lock: -0.45 to -0.51

‘Position DLA’

cmd Position DLA Engage – Engage

Verify String 1 Remaining Distance – Decreasing

NOTE
DLA Position will read In between before reading Engaged.

Verify String 1,2 DLA 2 Position – In between

Verify String 1,2 DLA 2 Position – Engaged

```
*****
* If a toothcrash occurs while engaging and the SARJ moves
* more than ~0.33 degrees per recovery attempt
* Stbd SARJ Operation
*
* cmd Abort – Abort
*
* If SARJ continues to move
* Stbd SARJ
*
* sel RPCM S31A A RPC 4
*
* RPCM S31A A RPC 4
*
* cmd RPC Position – Op (Verify Op)
*
* SARJ stepper circuitry or control has failed. >>
*****
```

```
*****
* If Engage Timer Expired – X, Caution 'SARJ Engage
* Toothcrash - S3' received, or String 1,2 DLA 2
* Position not Engaged
* Perform {3.170 SARJ MANUAL RECOVERY FROM A
* TOOTHCRASH WHILE ENGAGING}, all (SODF: EPS:
* MALFUNCTION: PRIMARY POWER SYSTEM), then:
*****
```

27.6 Moving DLA 2 to Neutral

Stbd SARJ Operation

Verify String 1,2 DLA 2 Position – Engaged

'Position DLA'

cmd Position DLA Neutral – Arm

'Motor'

Verify String 1 Motor Setpoint Engage/Lock: 0.45 to 0.51

'Position DLA'

cmd Position DLA Neutral – Neutral

Verify String 1 Remaining Distance – Decreasing

NOTE
DLA Position will read In between before reading Neutral.

SARJ INITIAL ACTIVATION AND CHECKOUT

(ASSY OPS/13A/FIN X/HC) Page 42 of 55 pages

Verify String 1,2 DLA 2 Position – In between
Verify String 1,2 DLA 2 Position – Neutral

27.7 Deselecting DLA 2 Motor

'Motor'

cmd Motor Setpoint – Reset

Verify String 1 Motor Setpoint Engage/Lock: 0

cmd Select – None

Verify String 1 Motor Select – None

WARNING

The following steps will rotate the Starboard SARJ approximately 2 degrees. If the Starboard SARJ is rotated with the S4 1A or 3A arrays deployed while the P6 2B array is deployed beyond 20.8 bays, the S4 arrays could collide with the P6 2B arrays. If the SARJ rotates in an unexpected manner, the abort command will be sent to stop motion. If the abort command does not work, power will be removed from the control string RJMC.

28. STEPPING STARBOARD SARJ ON STRING 1

28.1 Selecting Step Drive Motor

sel Tooth Crash Recovery

cmd Motor Select DLA 1 – Step Drive Motor

Verify String 1 Motor Select – Step Drive

28.2 Stepping the SARJ On String 1

NOTE

The Position DLA Engage Arm or Lock Arm commands are used to send either a negative or positive setpoint to the Drive Motor when selected as Step Drive Motor. Using the Lock Arm command will result in a positive motor setpoint that will move the pinion in the counterclockwise direction, which will move the SARJ in the decreasing direction when the DLA is engaged. Using the Engage Arm command will result in a negative motor setpoint that will move the pinion in the clockwise direction, which will move the SARJ in the increasing direction if the DLA is engaged.

'Position DLA'

cmd Lock Arm

Verify String 1 MDM Motor Setpoint: 0.5

NOTE

Expect '**SARJ Inadvertent Joint Rotation - S3**' Caution to come into alarm when joint is moved.

'Step Drive Motor'

input Steps – 1 8 stp

cmd Step Drive Motor

Verify Step Drive Motor String 1: 18

Stbd SARJ Operation

Verify String 1 Remaining Distance – Decreasing
Verify SARJ Position – 0 deg

```
*****
* If the SARJ moves more than ~2 degrees
*   |
*   | Stbd SARJ Operation
*   |
*   | cmd Abort – Abort
*   |
*   | If SARJ continues to move
*   |   |
*   |   | Stbd SARJ
*   |   |
*   |   | sel RPCM S31A A RPC 4
*   |   |
*   |   | RPCM S31A A RPC 4
*   |   |
*   |   | cmd RPC Position – Op (Verify Op)
*   |   |
*   |   | SARJ stepper circuitry or control has failed. >>
*****
```

28.3 Deselecting Step Drive Motor

Stbd SARJ Operation

cmd Select – None

Verify String 1 Motor Select – None

28.4 Clearing Inadvertent Joint Rotation Caution (If Required)

Stbd SARJ Operation

cmd SARJ CWA – Clear

WARNING

Do not proceed if the P6 2B solar array is still deployed beyond 20.8 bays and the S4 1A or 3A are deployed. The following steps will rotate the Starboard SARJ. If the Starboard SARJ is rotated with the S4 1A or 3A arrays deployed while the P6 2B array is deployed, the S4 arrays could collide with the P6 2B arrays.

NOTE

1. Due to SCR 32367, SARJ Runaway Joint and SARJ String Failure Cautions may momentarily annunciate upon sending the Drive motor select command. Step 29.1 will cycle the selected commanded string to avoid this occurrence (SPN 4131).
2. Caution '**SARJ Inadvertent Joint Rotation - S3**' will be received if the Joint Position MAR is more than 0.5 degrees from the Joint Resolver Position when the drive motor is reselected. This message is latched and will be cleared after the SARJ has been transitioned to autotrack.

29. ROTATING STARBOARD SARJ ON STRING 1

29.1 Cycling Commanded String

Stbd SARJ Operation

cmd String 1 String Mode – Monitor

Verify String 1 String Mode – Monitor

cmd String 1 String Mode – Commanded

Verify String 1 String Mode – Commanded

29.2 Turning on DLA 1 Drive Motor

Stbd SARJ Operation

'Motor'

cmd Select – Drive

√String 1 Motor Select – Drive

29.3 Commanding SARJ Mode to Directed Position

Stbd SARJ Operation
'SARJ Mode'

cmd SARJ Mode – Directed Position

Verify SARJ Mode – Directed Position

29.4 Commanding SARJ to 5 Deg

Stbd SARJ Operation
'SARJ Mode'

input Angle – 5 deg

pick Direction – 1: CCW (Increasing)

cmd Set

Verify Cmded Position: 5 deg
Verify SARJ Position – Increasing

Wait for SARJ to reach position.

Verify SARJ Position: 5 deg

29.5 Commanding SARJ Mode to Checkout

Stbd SARJ Operation
'SARJ Mode'

cmd SARJ Mode – Check Out

Verify SARJ Mode – Checkout

NOTE

The following step will verify that both Joint Resolvers are reading the same value at this position.

29.6 Taking Joint Resolver Readings

Stbd SARJ Operation

Record SARJ Position: _____ deg

cmd String 2 Joint Resolver – Off

SARJ INITIAL ACTIVATION AND CHECKOUT

(ASSY OPS/13A/FIN X/HC) Page 46 of 55 pages

Verify String 2 Joint Resolver – Off

cmd String 1 Joint Resolver – On

Verify String 1 Joint Resolver – On

Record SARJ Position: _____deg

cmd String 1 Joint Resolver – Off

Verify String 1 Joint Resolver – Off

cmd String 2 Joint Resolver – On

Verify String 2 Joint Resolver – On

29.7 Commanding SARJ Mode to Directed Position

Stbd SARJ Operation

'SARJ Mode'

cmd SARJ Mode – Directed Position

Verify SARJ Mode – Directed Position

29.8 Commanding SARJ to 90 Deg

Stbd SARJ Operation

'SARJ Mode'

input Angle – 90 deg

pick Direction – 1: CCW (Increasing)

cmd Set

Verify Cmded Position: 90 deg

Verify SARJ Position – Increasing

Wait for SARJ to reach position.

Verify SARJ Position: 90 deg

√SARJ Inadvertent Joint Rotation – S3 caution clear

29.9 Commanding SARJ Mode to Checkout

Stbd SARJ Operation

'SARJ Mode'

cmd SARJ Mode – Check Out

Verify SARJ Mode – Checkout

29.10 Deselecting Drive Motor

cmd Select – None

Verify String 1 Motor Select – None

30. SELECTING SARJ STRING 2

30.1 Swapping Commanded Strings

cmd String 1 String Mode – Monitor

Verify String 1 String Mode – Monitor

cmd String 2 String Mode – Commanded

Verify String 2 String Mode – Commanded

NOTE

The following step will verify that both Joint Resolvers are reading the same value at this position.

30.2 Swapping from Joint Resolver 2 to Joint Resolver 1

Record SARJ Position: _____deg

cmd String 2 Joint Resolver – Off

Verify String 2 Joint Resolver – Off

cmd String 1 Joint Resolver – On

Verify String 1 Joint Resolver – On

Record SARJ Position: _____deg

30.3 Turning on DLA 2 Engage/Lock Motor

'Motor'

cmd Select DLA 2 – Engage/Lock

Verify String 2 Motor Select – DLA 2 Engage Lock

30.4 Moving DLA 2 to Engage

Stbd SARJ Operation

Verify String 1,2 DLA 2 Position – Neutral

'Position DLA'

cmd Position DLA Engage – Arm

'Motor'

Verify String 1 Motor Setpoint Engage/Lock: -0.45 to -0.51

'Position DLA'

cmd Position DLA Engage – Engage

Verify String 1 Remaining Distance – Decreasing

NOTE
DLA Position will read In between before reading Engaged.

Verify String 1,2 DLA 2 Position – In between

Verify String 1,2 DLA 2 Position – Engaged

* If Engage Timer Expired – X, Caution '**SARJ Engage**
* **Toothcrash - S3**' received, or String 1,2 DLA 2
* Position not Engaged
* Perform {3.170 SARJ MANUAL RECOVERY FROM A
* **TOOTHCRASH WHILE ENGAGING**}, all (SODF: EPS:
* **MALFUNCTION: PRIMARY POWER SYSTEM**), then:

30.5 Deselecting DLA 2 Motor

Stbd SARJ Operation

'Motor'

cmd Motor Setpoint – Reset

Verify String 2 Motor Setpoint Engage/Lock: 0

cmd Select – None

Verify String 2 Motor Select – None

30.6 Turning On DLA 1 Engage/Lock Motor

Stbd SARJ Operation

'Motor'

cmd Select DLA 1 – Engage/Lock

Verify String 2 Motor Select – DLA 1 Engage Lock

30.7 Moving DLA 1 to Neutral

Stbd SARJ Operation

Verify String 1,2 DLA 1 Position – Engage

'Position DLA'

cmd Position DLA Neutral – Arm

'Motor'

Verify String 2 Motor Setpoint Engage/Lock: +0.45 to +0.51

'Position DLA'

cmd Position DLA Neutral – Neutral

Verify String 2 Remaining Distance – Decreasing

NOTE
DLA Position will read In between before reading Neutral.

Verify String 1,2 DLA 1 Position – In between

Verify String 1,2 DLA 1 Position – Neutral

* If Neutral Timer Expired – X or Caution '**SARJ DLA to**
* **Neutral Timeout - S3**' received and String 1,2 DLA 1
* Position not Neutral
* Perform {3.180 SARJ DLA UNKNOWN POSITION
* RECOVERY}, all (SODF: EPS: MALFUNCTION:
* PRIMARY POWER), then:

30.8 Deselecting DLA 1 Motor

Stbd SARJ Operation

'Motor'

cmd Motor Setpoint – Reset

Verify String 2 Motor Setpoint Engage/Lock: 0

cmd Select – None

Verify String 2 Motor Select – None

SARJ INITIAL ACTIVATION AND CHECKOUT

(ASSY OPS/13A/FIN X/HC) Page 50 of 55 pages

31. ROTATING STARBOARD SARJ ON STRING 2

NOTE

1. Due to SCR 32367, SARJ Runaway Joint and SARJ String Failure Cautions may momentarily annunciate upon sending the Drive motor select command. Resend the command in this case.
2. Caution '**SARJ Inadvertent Joint Rotation - S3**' will be received if the Joint Position MAR is more than 0.5 degrees from the Joint Resolver Position when the drive motor is reselected. This message is latched and will be cleared after the SARJ has been transitioned to autotrack.

31.1 Turning on DLA 2 Drive Motor

Stbd SARJ Operation

'Motor'

cmd Select – Drive

√String 2 Motor Select – Drive

31.2 Commanding SARJ Mode to Directed Position

Stbd SARJ Operation

'SARJ Mode'

cmd SARJ Mode – Directed Position

Verify SARJ Mode – Directed Position

31.3 Commanding SARJ to 95 Deg

Stbd SARJ Operation

'SARJ Mode'

input Angle – 9 5 deg

pick Direction – 1: CCW (Increasing)

cmd Set

Verify Cmded Position: 95 deg

Verify SARJ Position – Increasing

Wait for SARJ to reach position.

Verify SARJ Position: 95 deg

SARJ INITIAL ACTIVATION AND CHECKOUT

(ASSY OPS/13A/FIN X/HC) Page 51 of 55 pages

31.4 Commanding SARJ Mode to Checkout

Stbd SARJ Operation

'SARJ Mode'

cmd SARJ Mode – Check Out

Verify SARJ Mode – Checkout

NOTE

The following step will verify that both Joint Resolvers are reading the same value at this position.

31.5 Taking Joint Resolver Readings

Stbd SARJ Operation

Record SARJ Position: _____ deg

cmd String 1 Joint Resolver – Off

Verify String 1 Joint Resolver – Off

cmd String 2 Joint Resolver – On

Verify String 2 Joint Resolver – On

Record SARJ Position: _____ deg

cmd String 2 Joint Resolver – Off

Verify String 2 Joint Resolver – Off

cmd String 1 Joint Resolver – On

Verify String 1 Joint Resolver – On

31.6 Commanding SARJ Mode to Directed Position

Stbd SARJ Operation

'SARJ Mode'

cmd SARJ Mode – Directed Position

Verify SARJ Mode – Directed Position

31.7 Commanding SARJ to 270 Deg

Stbd SARJ Operation

'SARJ Mode'

input Angle – 2 7 0 deg

SARJ INITIAL ACTIVATION AND CHECKOUT

(ASSY OPS/13A/FIN X/HC) Page 52 of 55 pages

pick Direction – 1: CCW (Increasing)

cmd Set

Verify Cmded Position: 270 deg

Verify SARJ Position – Increasing

Wait for SARJ to reach position.

Verify SARJ Position: 270 deg

31.8 Taking Joint Resolver Readings

Record SARJ Position: _____ deg

cmd String 1 Joint Resolver – Off

Verify String 1 Joint Resolver – Off

cmd String 2 Joint Resolver – On

Verify String 2 Joint Resolver – On

Record SARJ Position: _____ deg

cmd String 2 Joint Resolver – Off

Verify String 2 Joint Resolver – Off

cmd String 1 Joint Resolver – On

Verify String 1 Joint Resolver – On

31.9 Commanding SARJ Mode to Directed Position

'SARJ Mode'

cmd SARJ Mode – Directed Position

Verify SARJ Mode – Directed Position

32. COMMANDING SARJ MODE TO AUTOTRACK ON STRING 2

32.1 Commanding SARJ to Autotrack

'SARJ Mode'

SARJ INITIAL ACTIVATION AND CHECKOUT

(ASSY OPS/13A/FIN X/HC) Page 53 of 55 pages

Verify SARJ Mode – Directed Position
Verify GNC Target Valid – Valid
Verify RGAC Orbit Period – Valid

cmd SARJ Mode – Autotrack

Verify SARJ Mode – Autotrack

32.2 Clearing Inadvertent Joint Rotation Caution (If Required)

Stbd SARJ Operation

cmd SARJ CWA – Clear

Verify SARJ Inadvertent Joint Rotation – S3 caution clear

NOTE

It is desired that the SARJ be in Autotrack for at least approximately half an orbit. It is desired to watch the SARJ catch up with the targets and track through at least one eclipse(insolation) or insolation(eclipse) transition. Once nominal autotracking has been confirmed, an automatic string swap to string 1 will be performed. It is desired for that swap to occur when the SARJ is at ~90 or ~270 degrees. The 90 and 270 degrees place the solar arrays vertical. These are safe angles should thruster firing occur during the string swap.

32.3 Monitoring Autotrack On String 2

Verify SARJ Position = GNC Target \pm 1.0 degrees.

May take up to 30 minutes depending on initial position.

Monitor SARJ autotracking.

Wait for SARJ to reach ~90 or ~270 degrees.

NOTE

Expect Cautions '**SARJ String 2 RJMC Loss of Comm - S3**,' '**SARJ String Failure - S3**,' and '**SARJ Joint Failure - S3**' will be annunciated when the RPC to RJMC 2 is opened.

33. TESTING AUTOMATIC STRING SWAP FROM STRING 2 TO STRING 1

33.1 Opening RPCM S32B A RPC 4 to RJMC 2

Stbd SARJ

sel RPCM S32B A RPC 4

RPCM S32B A RPC 04

cmd RPC Position – Open (Verify – Op)

NOTE

The sequence below will happen quickly. Due to telemetry rates, it may not be possible to monitor all steps of the sequence. For example, the telemetry may change directly from DLA 1 Engage Lock motor selected to DLA 2 Engage Lock motor selected without the state of None in between.

33.2 Monitoring Switchover Routine

Stbd SARJ

sel Operation

Stbd SARJ Operation

- Verify SARJ Mode – Switchover
- Verify String 1 Joint Resolver – On
- Verify String 2 Mode – Monitor
- Verify String 1 Mode – Commanded
- Verify String 1 Motor Select – DLA 1 Engage Lock
- Verify String 1,2 DLA 1 Position – moves from Neutral to Engaged
- Verify String 1 Motor Select – None
- Verify String 1 Motor Select – DLA 2 Engage Lock
- Verify String 1,2 DLA 2 Position – moves from Engaged to Neutral
- Verify String 1 Motor Select – None
- Verify String 1 Motor Select – Drive
- Verify SARJ Mode – Autotrack

Verify SARJ Position = GNC Target ± 1.0 degrees.

 * If Caution '**SARJ Switchover Failure - S3**' received
 * | Perform {[3.173 SARJ SWITCHOVER FAILURE](#)}, all
 * | (SODF: EPS: MALFUNCTION: PRIMARY POWER
 * | SYSTEM), then:

NOTE

'**SARJ String 2 RJMC Loss of Comm - S3**' should clear when the RPC to RJMC 2 is closed.

34. REPOWERING STRING 2 RJMC

Stbd SARJ

sel RPCM S32B A RPC 4

RPCM S32B A RPC 04

cmd RPC Position – Close (Verify – Cl)

Stbd SARJ

sel RJMC 2

Verify Power On Flag – X

cmd Reset

Verify Power On Flag – blank

35. SWAPPING JOINT RESOLVERS

cmd String 1 Joint Resolver – Off

Verify String 1 Joint Resolver – Off

cmd String 2 Joint Resolver – On

Verify String 2 Joint Resolver – On

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OGS H2/N2 VENT ASSEMBLY FINAL INSTALLATION AND LEAK CHECK

(ASSY OPS/13A/FIN X) Page 1 of 32 pages

OBJECTIVE:

Complete installation of H2/N2 Vent Hose Assembly and perform leak checks for IV and EV installation.

LOCATION:

LAB Forward Endcone

DURATION:

6 (7.5) Hours Total Time (Depends on time available for leak characterization #2)

1.5 Hours Total Crew Time + 4.5 (6) hours of dwell time

CREW:

One

MATERIALS:

9V Alkaline Battery

Earplugs

Braycote

Disposable Gloves

Dry wipes

Kapton Tape

TOOLS:

H2/N2 Vent Male Purge Adapter P/N 683-64435-2

MPEV Internal Sampling Adapter (ISA) P/N 97M55830-1

VAJ-78-1 (5 ft) P/N 683-17111-1

ISA Scopemeter Pressure Probe P/N 1525,760MMHGA/30PSIA

Threaded Fluid Fittings (one) (0.5" Female Gamah Cap) P/N 683-16347-841

DCS 760 Camera

Multimeter Kit: P/N 10118-10018-04

Multimeter

FFTD and Gamah Seal Maintenance Kit:

Fluid Fitting Torque Device P/N 990204-101 (S/N 001)

0.625" Reaction Gear

1.00" Drive Gear

Metal Seals, 1/2" Gamah Fitting (2)

Retaining Rings, 1/2" Gamah Fitting (2)

Gamah Seal Removal Tool, 1/2" Gamah Fitting

Retaining Ring Installation/Removal Tool, 1/2" Gamah Fitting

Latex Gloves

OGS H2/N2 VENT ASSEMBLY FINAL INSTALLATION AND LEAK CHECK

(ASSY OPS/13A/FIN X) Page 2 of 32 pages

ISS IVA Toolbox

Drawer 2:

- Ratchet, 3/8" Drive
- 1" Crowfoot, 3/8" Drive (FC32B)
- (10-50 in-lbs) Trq Wrench, 1/4" Drive
- 1/4" to 3/8" Adapter
- 6" Ext, 3/8" Drive
- 4" Ext, 3/8" Drive
- 3/8" Socket, 1/4" Drive
- Ratchet, 1/4" Drive
- (40-200 in-lbs) Trq Wrench, 3/8" Drive

Drawer 3:

- #0 Phillips Screwdriver
- 2" Crowfoot, 3/8" Drive
- 1 5/8" Crowfoot, 3/8" Drive
- 1 1/4" Crowfoot, 3/8" Drive
- (200-1000 in-lbs) Trq Wrench, 3/8" Drive

Drawer 5:

- Breaker Bar, 3/8" Drive

REFERENCED PROCEDURE(S):

A.2.13 GAMAH SEAL R&R

A.2.1 FLUID FITTING TORQUE DEVICE (FFTD) ASSEMBLY AND USAGE

A.2.3 MATING GAMAH FITTINGS USING THE FFTD

2.201 760 NOMINAL SETUP - WITH FLASH

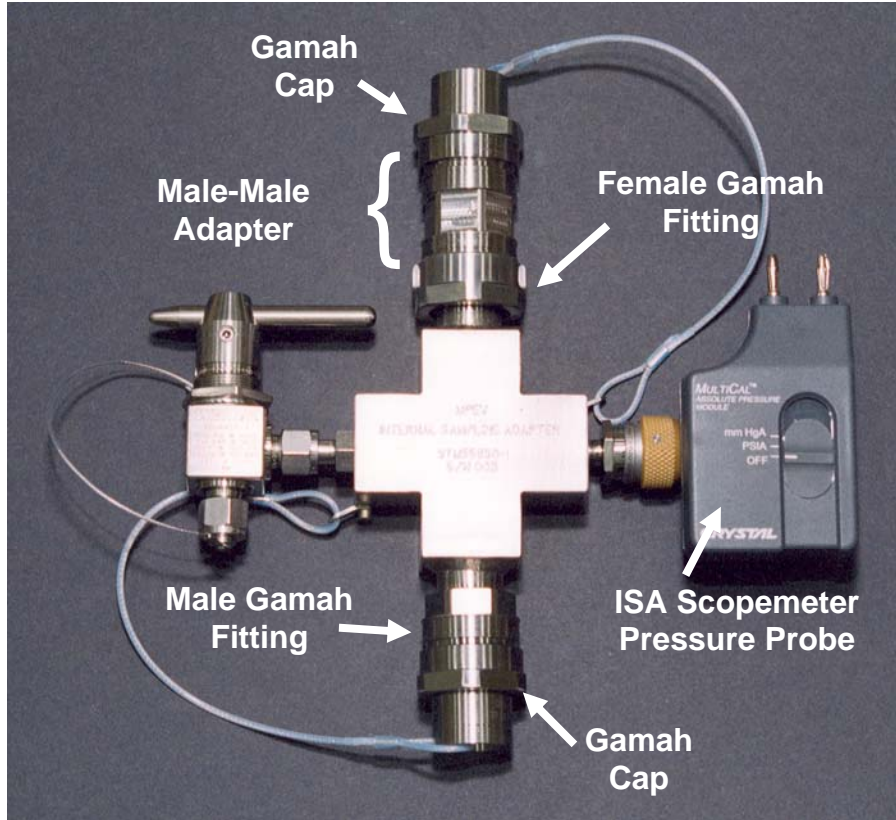


Figure 1.- Internal Sample Adapter (Shown With Gamah Caps Installed).

1. [REMOVING MALE-MALE ADAPTER FROM ISA](#)

NOTE

1. Figures at the end of this procedure contain step-by-step configuration diagrams.
2. The Male-Male adapter will stay attached to the cap as a temporary stowage location.

Male-Male Adapter ←|→ ISA (Breaker Bar, 3/8" Drive; 1 5/8" Crowfoot, 3/8" Drive; Ratchet, 3/8" Drive; 1 1/4" Crowfoot, 3/8" Drive)

Inspect seals for visible damage.

Notify **MCC-H** if any damage noted to seals.

2. H2/N2 VENT MALE PURGE ADAPTER SETUP AND ISA CONNECT

LAB1P1
RIP

- 2.1 H2/N2 Vent Male Purge Adapter QD (bent end) →|← OGS H2/N2 Vent Jumper labelled TO: OGS H2/N2 WASTE GAS (Verify connected)
- 2.2 Gamah Cap ←|→ H2/N2 Vent Male Purge Adapter Gamah Fitting (straight end)
Refer to Figure 2.

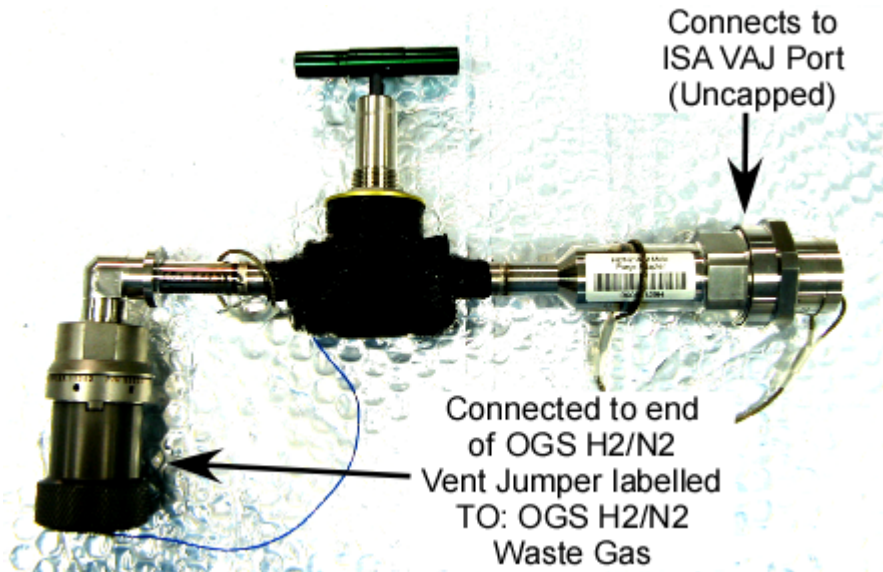


Figure 2.- H2/N2 Vent Male Purge Adapter (Displayed in OPEN Position).

- 2.3 H2/N2 Vent Male Purge Adapter Gamah Fitting (straight end)
→|← ISA VAJ Port (uncapped), hand tighten

Tighten, torque to 270 in-lbs [Breaker Bar, 3/8" Drive; 1 1/4" Crowfoot, 3/8" Drive; Ratchet, 3/8" Drive; 1 5/8" Crowfoot, 3/8" Drive; (200-1000 in-lbs) Trq Wrench, 3/8" Drive].

WARNING

Setup will move when pressurized or evacuated. Failure to secure assembly may result in injury to crew and/or damage to equipment.

- 2.4 Secure H2/N2 Vent Male Purge Adapter, ISA Assembly.
- 2.5 Gamah Cap →|← ISA VAJ Port (remaining)

Tighten, torque to 270 in-lbs [Breaker Bar, 3/8" Drive; 1 1/4" Crowfoot, 3/8" Drive; Ratchet, 3/8" Drive; 1 5/8" Crowfoot, 3/8" Drive; (200-1000 in-lbs) Trq Wrench, 3/8" Drive].

2.6 Verify ISA Scopemeter Pressure Probe →|← ISA

3. SETTING UP MULTIMETER

NOTE

1. Plug marked "COM" must be inserted in COM jack on Multimeter. ISA Scopemeter Pressure Probe slide switch will face toward Multimeter Rotary Switch.
2. ISA Scopemeter Pressure Probe Battery is replaced to ensure that the pressure probe does not fail during the dwell times.

3.1 Replace ISA Scopemeter Pressure Probe 9V Battery by removing noncaptive screw on back of probe (#0 Phillips Screwdriver).

3.2 ISA Scopemeter Pressure Probe V plug →|← VΩ jack (right side, red)
COM plug →|← COM jack

3.3 √ISA Scopemeter Pressure Probe – OFF

3.4 Rotary Switch ↻ \overline{mV}

3.5 Verify voltage reading > 100 mVDC (good ISA Scopemeter Pressure Probe Battery indication).

If voltage reading < 100 mVDC, ISA Scopemeter Pressure Probe Battery must be replaced.

The 9V Battery is replaced by removing noncaptive screw on back of probe (#0 Phillips Screwdriver).

4. VERIFYING ISA SCOPEMETER PRESSURE PROBE ACCURACY

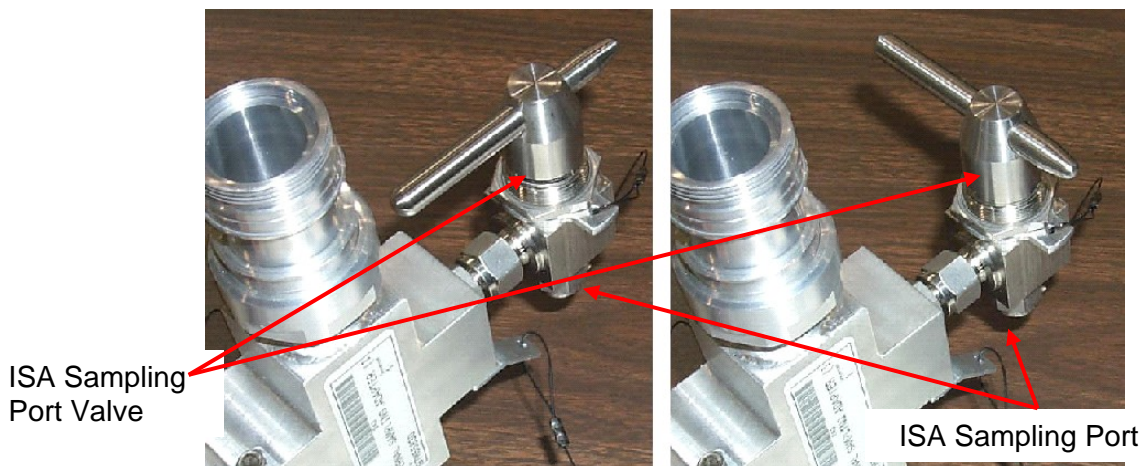


Figure 3.- ISA Sample Port Valve.

4.1 Cap ←|→ ISA Sample Port

ISA Sampling Port Valve → OPEN
 Refer to Figure 3.

NOTE

ISA Scopemeter Pressure Probe outputs 1 mV per pressure unit measured.
 Example: 0.760V = 760 mV = 760 mmHgA

- Multimeter 4.2 Rotary Switch ↻ \bar{V}
- 4.3 ISA Scopemeter Pressure Probe → mmHgA
- 4.4 Record ISA Scopemeter Pressure Probe P₁: _____ mmHgA

MCC-H/
PCS

- 4.5 US Lab: ECLSS
Lab: ECLSS

Record Cab Press P₂: _____ mmHg

 * If $\Delta P |P_2 - P_1| > 20$ mmHg
 * | ISS ↓ **MCC-H** ISA Scopemeter Pressure Probe inaccurate.
 * |
 * | √**MCC-H** for further instructions

- 4.6 ISA Sampling Port Valve → CLOSED
 Cap →|← ISA Sample Port
 Refer to Figure 3.

5. LEAK CHARACTERIZATION #1: H2 VENT ASSEMBLY

LAB1P1
 RIP

- 5.1 ISA Sampling Port Valve → CLOSED (√CLOSED)
 Cap →|← ISA Sample Port (Verify connected)

- 5.2 H2/N2 Vent Male Purge Adapter Valve → OPEN (three turns)
 Refer to Figure 2.

MCC-H/
PCS

- 5.3 Verify valves are powered.

US Lab: ECLSS: H2O Vent: System Commands:
 RPCM LA1B B RPC 11
RPCM LA1B B RPC 11
 'RPC Position'

√Position – CI

OGS H2/N2 VENT ASSEMBLY FINAL INSTALLATION AND LEAK CHECK

(ASSY OPS/13A/FIN X) Page 7 of 32 pages

5.4 Commanding the Water Vent System to Manual by Effector

US Lab: ECLSS: H2O Vent: Effector Commands

Water Vent Effector Commands

If System Status – Inhibited (Enabled)

cmd Manual Effector Control (√System Status – Man by Effect)

NOTE

In order to actuate the H2 Vent Valve at this point (PCS R9 Onboard) during the installation of the H2 Vent Assembly, commands must be sent to the Port Bulkhead Isolation Valve.

5.5 Opening the H2 Vent Valve

'Port Isolation Valves'

'Bulkhead'

cmd Open (√Position – Open)

NOTE

In order to actuate the Port Bulkhead Isolation Valve at this point during the installation of the H2 Vent Assembly, commands must be sent to the Port Inboard Isolation Valve.

5.6 Opening the Port Bulkhead Isolation Valve

'Port Isolation Valves'

'Inboard'

cmd Open (√Position – Open)

Wait 1 minute.

5.7 Rotary Switch ↻ \overline{mV}

Multimeter 5.8 Record ISA Scopemeter Pressure Probe P₃: _____ mmHg
Record GMT ____/____:____:____ GMT

Notify **MCC-H** of pressure reading.

MCC-H/
PCS 5.9 Closing Port Bulkhead Isolation Valve
'Port Isolation Valves'
'Inboard'

cmd Close (√Position – Closed)

Multimeter 5.10 Record ISA Scopemeter Pressure Probe P₄: _____ mmHg
Record GMT ____/____:____:____ GMT

Notify **MCC-H** of pressure reading.

5.11 ISA Scopemeter Pressure Probe → OFF

5.12 Rotary Switch ↻ OFF

Wait 90 minutes.

```

*****
* If crew time is available for leak check assessment
*
* After 45 minutes:
*
* ISA Scopemeter Pressure Probe → mmHgA
*
* Rotary Switch ↻  $\overline{mV}$ 
*
* Record ISA Scopemeter Pressure Probe P5: _____ mmHg
* Record GMT ____/____:____:____ GMT
*
* Notify MCC-H of pressure reading.
*
* ISA Scopemeter Pressure Probe → OFF
*
* Rotary Switch ↻ OFF
*****
  
```

5.13 ISA Scopemeter Pressure Probe → mmHgA

5.14 Rotary Switch ↻ \overline{mV}

5.15 Record ISA Scopemeter Pressure Probe P₆: _____ mmHg
 Record GMT ____/____:____:____ GMT

Notify **MCC-H** of pressure reading.

```

*****
* If  $\Delta P | P_6 - P_4 | > 123$  mmHg during monitoring period
* ISS ↓ MCC-H suspected leak.
*
* √MCC-H for further instructions
*****
  
```

5.16 Closing the H2 Vent Valve
 US Lab: ECLSS: H2O Vent: Effector Commands
Water Vent Effector Commands
 'Port Isolation Valves'
 'Bulkhead'

cmd Close (√Position – Closed)

OGS H2/N2 VENT ASSEMBLY FINAL INSTALLATION AND LEAK CHECK

(ASSY OPS/13A/FIN X) Page 9 of 32 pages

LAB1P1 5.17 H2/N2 Vent Male Purge Adapter Valve → Closed (three turns)
RIP Refer to Figure 2.

5.18 ISA Scopemeter Pressure Probe → OFF

Multimeter 5.19 Rotary Switch ↻ OFF

5.20 Temporarily stow setup.

6. SAFING FOR LEAK CHECK # 1: H2/N2 VENT LEAK CHECK

**MCC-H/
PCS**

6.1 Unpowering Heaters and Close Inhibiting RPC
US Lab: ECLSS: H2O Vent: System Commands:
RPCM LA1B B RPC 11
RPCM LA1B B RPC 11
'RPC Position'

cmd Open (√Position – Op)

'Close Cmd'

cmd Inhibit (√Inh)

MCC-H/IV 6.2 Inform EVA crewmember that the H2/N2 Vent can be installed.

7. LEAK CHECK # 1: H2/N2 VENT LEAK CHECK

7.1 Repeat step 4.

MCC-H/IV 7.2 Verify with EVA crewmember that the H2/N2 Vent is installed and Closed.

LAB1P1 7.3 H2/N2 Vent Male Purge Adapter Valve → OPEN (three turns)
RIP Refer to Figure 2.

**MCC-H/
PCS** 7.4 Close Enabling RPC and Powering Valves
US Lab: ECLSS: H2O Vent: System Commands:
RPCM LA1B B RPC 11
RPCM LA1B B RPC 11
'Close Cmd'

cmd Enable (√Ena)

'RPC Position'

cmd Close (√Position – Cl)

OGS H2/N2 VENT ASSEMBLY FINAL INSTALLATION AND LEAK CHECK

(ASSY OPS/13A/FIN X) Page 10 of 32 pages

7.5 Opening the H2 Vent Valve

US Lab: ECLSS: H2O Vent: Effector Commands

Water Vent Effector Commands

'Port Isolation Valves'

'Bulkhead'

cmd Open (√Position – Open)

7.6 Opening the Port Bulkhead Isolation Valve

'Port Isolation Valves'

'Inboard'

cmd Open (√Position – Open)

7.7 Cap ←|→ ISA Sample Port

ISA Sampling Port Valve → OPEN

Refer to Figure 3.

Wait 3 minutes for equalization and thermal stabilization.

Multimeter 7.8 Record ISA Scopemeter Pressure Probe P₇: _____ mmHg
Record GMT ____/____:____:____ GMT

Notify **MCC-H** of pressure reading.

7.9 ISA Sampling Port Valve → CLOSED

7.10 Cap →|← ISA Sample Port

7.11 Record ISA Scopemeter Pressure Probe P₈: _____ mmHg
Record GMT ____/____:____:____ GMT

Notify **MCC-H** of pressure reading.

7.12 ISA Scopemeter Pressure Probe → OFF

7.13 Rotary Switch ↻ OFF

Wait 90 minutes.

```
*****
* If crew time is available for leak check assessment
*
* After 45 minutes.
*
* ISA Scopemeter Pressure Probe → mmHgA
*
* Rotary Switch ↻  $\overline{mV}$ 
*
* Record ISA Scopemeter Pressure Probe P9: _____ mmHg
* Record GMT ____/____:____:____ GMT
*
* Notify MCC-H of pressure reading.
*
* ISA Scopemeter Pressure Probe → OFF
*
* Rotary Switch ↻ OFF
*****
```

7.14 ISA Scopemeter Pressure Probe → mmHgA

7.15 Rotary Switch ↻ \overline{V}

7.16 Record ISA Scopemeter Pressure Probe P₁₀: _____ mmHg
 Record GMT ____/____:____:____ GMT

Notify **MCC-H** of pressure reading.

```
*****
* If  $\Delta P | P_{10} - P_8 | > 103$  mmHg during monitoring period
* | ISS ↓ MCC-H of suspected leak.
* |
* | √MCC-H for further instructions
*****
```

MCC-H/
PCS

7.17 Closing the H2 Vent Valve
 US Lab: ECLSS: H2O Vent: Effector Commands
Water Vent Effector Commands
 'Port Isolation Valves'
 'Bulkhead'

cmd Close (√Position – Closed)

OGS H2/N2 VENT ASSEMBLY FINAL INSTALLATION AND LEAK CHECK

(ASSY OPS/13A/FIN X) Page 12 of 32 pages

- 7.18 Closing Port Bulkhead Isolation Valve
'Port Isolation Valves'
'Inboard'

cmd Close (\surd Position – Closed)

- LAB1P1 7.19 H2/N2 Vent Male Purge Adapter Valve → Closed (three turns)
RIP Refer to Figure 2.

- 7.20 ISA Scopemeter Pressure Probe → OFF

- Multimeter 7.21 Rotary Switch \curvearrowright OFF

8. SAFING SYSTEM FOR INBOARD BULKHEAD CONNECTION

Unpowering Valves and Close Inhibiting RPC

US Lab: ECLSS: H2O Vent: System Commands: RPCM LA1B B RPC 11

RPCM LA1B B RPC 11

'RPC Position'

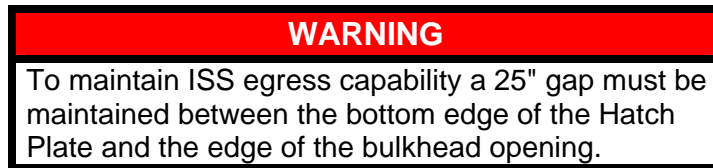
cmd Open (\surd Position – Op)

'Close Cmd'

cmd Inhibit (\surd Inh)

9. H2/N2 VENT ASSEMBLY INBOARD BULKHEAD CONNECTION

- 9.1 If leak check is being performed with shuttle docked



Partially Close LAB Fwd Hatch for access to worksite.

- 9.2 Remove Beta Cloth above hatchway as required.

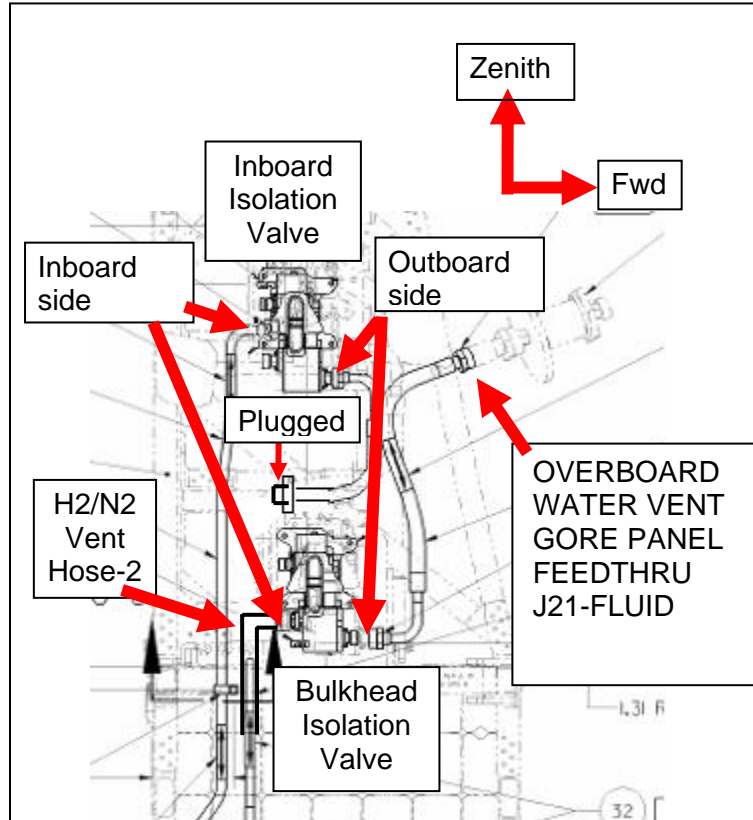


Figure 4.- Port Water Vent Valves: LAB Fwd Hatchway Overhead Port.

LAB Fwd Hatchway

9.3 Port Water Vent Hose Connected to Bulkhead ←|→ OVERBOARD WATER VENT GORE PANEL FEEDTHRU J21-FLUID (Port Water Vent Bulkhead Feedthru) (FFTD; 0.625" Reaction Gear; 1" Drive Gear; Ratchet, 3/8" Drive)

Refer to {A.2.1 FLUID FITTING TORQUE DEVICE (FFTD) ASSEMBLY AND USAGE} (SODF: IFM: REFERENCE: APPENDIX A: ISS IVA TOOLS).

Refer to Figure 4.

9.4 Port Water Vent Hose Connected to outboard side of Bulkhead Isolation Valve ←|→ Bulkhead Isolation Valve (1" Crowfoot, 3/8" Drive; Ratchet, 3/8" Drive).

Refer to Figure 4.

9.5 H2/N2 VENT HOSE-2 labeled TO: OVERBOARD WATER VENT GORE PANEL FEEDTHRU J21-FLUID ←|→ Inboard side of Bulkhead Isolation Valve (1" Crowfoot, 3/8" Drive; Ratchet, 3/8" Drive)

Refer to Figure 4.

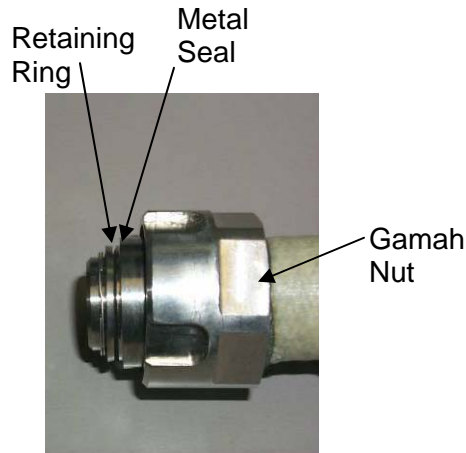


Figure 5.- Unmated Female Gamah Fitting.

- 9.6 Remove metal retaining ring from H2/N2 VENT HOSE-2 (0.5" Gamah Retaining Ring Removal Tool).
Refer to Figure 5 and [{A.2.13 GAMAH SEAL R&R}](#), step 1 (SODF: ISS IFM: REFERENCE).
- 9.7 Remove metal seal from Upper Hose (0.5" Gamah Seal Removal Tool).
Refer to Figure 5 and [{A.2.13 GAMAH SEAL R&R}](#), step 2 (SODF: ISS IFM: REFERENCE: APPENDIX A: ISS IVA TOOLS).
- 9.8 Clean Pressure sealing surfaces visibly clean (Dry wipes).
- 9.9 Retrieve and install new 0.5" metal seal by hand.
- 9.10 Install new retaining ring (Retaining Ring Installation Tool).
Refer to Figure 5 and [{A.2.13 GAMAH SEAL R&R}](#), step 3 (SODF: ISS IFM: REFERENCE: APPENDIX A: ISS IVA TOOLS).
- 9.11 Don Latex Gloves.
- 9.12 Place one drop of Braycote on first two threads of OVERBOARD WATER VENT GORE PANEL FEEDTHRU J21-FLUID.
Refer to Figure 4.

Smear lubricant around first two threads of fitting.
- 9.13 Doff, discard Latex Gloves.

OGS H2/N2 VENT ASSEMBLY FINAL INSTALLATION AND LEAK CHECK

(ASSY OPS/13A/FIN X) Page 15 of 32 pages

Table 1. Torque Information for Bulkhead Feedthru Connection

Reaction Gear	Drive Gear	Input Torque	Output torque
0.625"	1.00"	60	345

- 9.14 Tighten, torque H2/N2 VENT HOSE-2 end labeled TO:
OVERBOARD WATER VENT GORE PANEL FEEDTHRU
J21-FLUID →|← OVERBOARD WATER VENT GORE PANEL
FEEDTHRU J21-FLUID (Port Water Vent Bulkhead Feedthru) to
345 in-lbs according to Table 1 [FFTD; 0.625" Reaction Gear;
1" Drive Gear; (40-200 in-lbs) Trq Wrench, 3/8" Drive]

Refer to {A.2.3 MATING GAMAH FITTINGS USING THE FFTD},
(SODF: IFM: REFERENCE: APPENDIX A: ISS IVA TOOLS).

NOTE

The Port Bulkhead Isolation Valve is going to be left in place as a spare to the starboard water vent valves. To preserve the valve, Kapton Tape will be placed over the valve openings.

- 9.15 Tape over Bulkhead Isolation Valve inlet and outlet openings with Kapton Tape.

10. VAJ (5 FT) TO VAP SETUP FOR LEAK CHECK # 2 H2/N2 VENT ASSEMBLY LEAK CHECK

LAB Fwd
Endcone

- 10.1 Remove Closeout Panel LAB1D0-02, 1/4 Turn Fasteners (nine).
10.2 Gamah Cap ←|→ PCA Vacuum Access Port (VAP)
Temporarily stow Gamah Cap on Closeout Panel (Gray Tape).

Verify soft seal installed in VAJ Gamah fitting
Inspect soft seal for damage, debris.

NOTE

A 2" Crowfoot, although a bit loose, will suffice as a reaction tool on the 1 7/8" VAP jam nut.

- 10.3 VAJ-78-1 (5 ft) (bent end) →|← PCA VAP

Tighten, torque to 270 in-lbs [Breaker Bar, 3/8" Drive; 6" Ext, 3/8" Drive; 2" Crowfoot, 3/8" Drive; Ratchet, 3/8" Drive; 4" Ext, 3/8" Drive; 1 5/8" Crowfoot; (200-1000 in-lbs) Trq Wrench, 3/8" Drive].

LAB1P1
RIP

- 10.4 Gamah Cap ←|→ ISA VAJ Port (remaining), (1 5/8" Crowfoot, Breaker Bar, 3/8" Drive).

Verify soft seal installed in VAJ Gamah fitting
Inspect soft seal for damage, debris.

OGS H2/N2 VENT ASSEMBLY FINAL INSTALLATION AND LEAK CHECK

(ASSY OPS/13A/FIN X) Page 16 of 32 pages

- 10.5 VAJ-78-1 (5 ft) (straight end) →|← ISA VAJ Port (remaining)
Tighten, torque to 270 in-lbs [Breaker Bar, 3/8" Drive; 1 1/4" Crowfoot, 3/8" Drive; Ratchet, 3/8" Drive; 1 5/8" Crowfoot, 3/8" Drive; (200-1000 in-lbs) Trq Wrench, 3/8" Drive].

WARNING

VAJ will move when pressurized or evacuated.
Failure to secure ISA/VAJ Assembly may result in injury to crew and/or damage to equipment.

- 10.6 Secure ISA/VAJ Assembly.

11. INHIBITING POSITIVE PRESSURE RELIEF

NOTE

'Positive P Relief Failure - LAB' caution will be received after PPR is inhibited.
No action required. This message will return to normal once PPR is reenabled.

PCS

US Lab: ECLSS: PCA: PCA Commands

LAB PCA Commands

'Positive Press Relief'

'Inhibit'

cmd Arm (√Status – Armed)

cmd Inhibit

√Positive Pressure Relief Status – Inhibited

12. LEAK CHARACTERIZATION #2: 5 FT VAJ AND H2 VENT ASSEMBLY

- 12.1 If Leak Characterization #2 not performed same day as Leak Check #1
| Repeat step 4.

- 12.2 ISA Sampling Port Valve → CLOSED (√CLOSED)

Cap →|← ISA Sample Port (Verify connected)

Multimeter

- 12.3 Rotary Switch ∩ $\overline{\overline{mV}}$

√ISA Scopemeter Pressure Probe – mmHgA

LAB1P1

RIP

- 12.4 H2/N2 Vent Male Purge Adapter Valve → OPEN (three turns)
Refer to Figure 2.

WARNING

Opening the VRIV will vent the ISA and VAJs to space and may cause a loud hissing noise. Crew in the vicinity should don Earplugs.

12.5 Don Earplugs.

PCS

12.6 Opening PCA VRIV
US Lab: ECLSS: PCA
Lab ACS

'Pressure Control Assembly'

sel VRIV

LAB PCA VRIV

'Open'

cmd Arm (√Status – Armed)
cmd Open

√Position – Open
√Open Indicator – √

12.7 Wait 1 minute to depressurize ISA/VAJ setup.

12.8 Doff Earplugs.

12.9 Closing PCA VRIV
'Close'

cmd Close

√Position – Closed
√Closed Indicator – √

12.10 Wait 3 minutes for thermal stabilization.

MCC-H/
PCS

12.11 Enabling Positive Pressure Relief
US Lab: ECLSS: PCA: PCA Commands
LAB PCA Commands
'Positive Press Relief'

cmd Enable (√Positive Pressure Relief Status – Enabled)

Multimeter 12.12 Record ISA Scopemeter Pressure Probe P₁₁: _____ mmHg
Record GMT ____/____:____:____ GMT

Notify **MCC-H** of pressure reading.

12.13 If Leak Characterization #2 is performed during 13A EVA docked timeframe

Wait 5 minutes.

Record ISA Scopemeter Pressure Probe P₁₂: _____ mmHg

Record GMT ____/____:____:____ GMT

Notify **MCC-H** of pressure reading.

* If $\Delta P | P_{12} - P_{11} | > 5$ mmHg during monitoring period

* | ISS ↓ **MCC-H** of suspected leak.

*

* | √**MCC-H** for further instructions

If Leak Characterization #2 not performed during 13A docked timeframe

Wait 90 minutes.

Record ISA Scopemeter Pressure Probe P₁₂: _____ mmHg

Record GMT ____/____:____:____ GMT

Notify **MCC-H** of pressure reading.

* If $\Delta P | P_{12} - P_{11} | > 54$ mmHg during monitoring period

* | ISS ↓ **MCC-H** of suspected leak.

*

* | √**MCC-H** for further instructions

13. LEAK CHECK # 2: H2/N2 VENT ASSEMBLY LEAK CHECK

13.1 Opening H2 Vent Valve

MCC-H/
PCS

13.1.1 Close Enabling RPC and Powering Valves

US Lab: ECLSS: H2O Vent: System Commands:

RPCM LA1B B RPC 11

RPCM LA1B B RPC 11

'Close Cmd'

cmd Enable (√Ena)

'RPC Position'

cmd Close (√Position – Cl)

OGS H2/N2 VENT ASSEMBLY FINAL INSTALLATION AND LEAK CHECK

(ASSY OPS/13A/FIN X) Page 19 of 32 pages

NOTE

In order to actuate the H2 Vent Valve at this point (PCS R9 Onboard) during the installation of the H2 Vent Assembly, commands must be sent to the Port Bulkhead Isolation Valve.

13.1.2 Opening the H2 Vent Valve

US Lab: ECLSS: H2O Vent: Effector Commands

Water Vent Effector Commands

'Port Isolation Valves'

'Bulkhead'

cmd Open (\sqrt Position – Open)

WARNING

Opening the VRIV will vent the ISA and VAJs to space and may cause a loud hissing noise. Crew in the vicinity should don Earplugs.

13.2 Don Earplugs.

13.3 US Lab: ECLSS: PCA: PCA Commands

LAB PCA Commands

'Positive Press Relief'

'Inhibit'

cmd Arm (\sqrt Status – Armed)

cmd Inhibit

\sqrt Positive Pressure Relief Status – Inhibited

13.4 Opening PCA VRIV

US Lab: ECLSS: PCA

Lab ACS

'Pressure Control Assembly'

sel VRIV

LAB PCA VRIV

'Open'

cmd Arm (\sqrt Status – Armed)

cmd Open

\sqrt Position – Open

\sqrt Open Indicator – \sqrt

13.5 Wait 1 minute to depressurize ISA/VAJ setup.

13.6 Doff Earplugs.

13.7 Closing PCA VRIV
'Close'

cmd Close

√Position – Closed
√Closed Indicator – √

13.8 Wait 3 minutes for thermal stabilization.

13.9 Enabling Positive Pressure Relief
US Lab: ECLSS: PCA: PCA Commands
LAB PCA Commands
'Positive Press Relief'

cmd Enable (√Positive Pressure Relief Status – Enabled)

Multimeter 13.10 Record ISA Scopemeter Pressure Probe P₁₃: _____ mmHg
Record GMT ____/____:____:____ GMT

Notify **MCC-H** of pressure reading.

13.11 ISA Scopemeter Pressure Probe → OFF

13.12 Rotary Switch ↻ OFF

Wait 90 minutes.

* If crew time is available for leak check assessment

* |

* | After 45 minutes:

* |

* | ISA Scopemeter Pressure Probe → mmHgA

* |

* | Rotary Switch ↻ \overline{mV}

* |

* | Record ISA Scopemeter Pressure Probe P₁₄: _____ mmHg

* | Record GMT ____/____:____:____ GMT

* |

* | Notify **MCC-H** of pressure reading.

* |

* | ISA Scopemeter Pressure Probe → OFF

* |

* | Rotary Switch ↻ OFF

13.13 ISA Scopemeter Pressure Probe → mmHgA

13.14 Rotary Switch ↷ \overline{mV}

13.15 Record ISA Scopemeter Pressure Probe P₁₅: _____ mmHg
 Record GMT ____/____:____:____ GMT

Notify **MCC-H** of pressure reading.

 * If $\Delta P | P_{15} - P_{13} | > 52$ mmHg during monitoring period
 * | ISS ↓ **MCC-H** of suspected leak.
 * |
 * | √**MCC-H** for further instructions

13.16 Closing the H2 Vent Valve

US Lab: ECLSS: H2O Vent: Effector Commands

Water Vent Effector Commands

'Port Isolation Valves'

'Bulkhead'

cmd Close (√Position – Closed)

LAB1P1 13.17 H2/N2 Vent Male Purge Adapter Valve → Closed (three turns)
 RIP Refer to Figure 2.

13.18 ISA Scopemeter Pressure Probe → OFF

Multimeter 13.19 Rotary Switch ↷ OFF

14. OPENING H2 VENT
On MCC-H GO

MCC-H/IV Notify EV Crew, "Open H2 Vent."

EV H2/N2 Vent → Open

15. REMOVING LINE FROM PORT INBOARD ISOLATION VALVE

NOTE

Physically, the Port Inboard Isolation Valve will be disconnected from the 1553 bus and its power supply at this time. There is no way to verify that it is closed before breaking the connection, other than what was done in an earlier phase of installation.

15.1 Plugged line attached to the outlet of the Port Inboard Isolation Valve ←|→ Port Inboard Isolation Valve (1" Crowfoot, 3/8" Drive; Ratchet, 3/8" Drive)
 Refer to Figure 4.

OGS H2/N2 VENT ASSEMBLY FINAL INSTALLATION AND LEAK CHECK

(ASSY OPS/13A/FIN X) Page 22 of 32 pages

15.2 Don Latex Gloves.

15.3 Place one drop of Braycote on first two threads of the Gamah Fitting on the outboard side of the Port Inboard Isolation Valve. Smear lubricant around first two threads of fitting.

15.4 Tighten, torque 1" Female gamah cap (P/N 683-16347-841)
→|← Outboard side of Port Inboard Isolation Valve to 345 in-lbs
[1" Crowfoot, 3/8" Drive; (200-1000 in-lbs) Trq Wrench, 3/8" Drive].
Refer to Figure 4.

16. REPRESSURIZING SETUP

Cap ←|→ ISA Sampling Port

ISA Sampling Port Valve → OPEN
Wait 30 seconds to pressurize setup.

ISA Sampling Port Valve → CLOSED

Cap →|← ISA Sampling Port
Refer to Figure 3.

17. INHIBITING WATER VENT SYSTEM

**MCC-H/
PCS**

US Lab: ECLSS: H2O Vent: System Commands
Water Vent System Commands
'Commands'
'Auto Venting'

cmd Inhibit

√System Status – Inhibited

18. DISASSEMBLING AND STOWING EQUIPMENT

18.1 DCS 760 Camera setup {2.201 760 NOMINAL SETUP - WITH FLASH}, all (SODF: ISS PTV: KODAK 760), then:

Photo document final configuration (DCS 760 Camera).

18.2 Reinstall Beta Cloth above hatchway as required.

18.3 Multimeter ←|→ ISA Scopemeter Pressure Probe

18.4 VAJ-78-1 5 ft (straight end) ←|→ ISA VAJ Port (Breaker Bar, 3/8" Drive; 1 1/4" Crowfoot, 3/8" Drive; Ratchet, 3/8" Drive; 1 5/8" Crowfoot, 3/8" Drive).

OGS H2/N2 VENT ASSEMBLY FINAL INSTALLATION AND LEAK CHECK

(ASSY OPS/13A/FIN X) Page 23 of 32 pages

- 18.5 VAJ-78-1 5 ft (bent end) ←|→ PCA VAP
(Breaker Bar, 3/8" Drive; 4" Ext, 3/8" Drive; 2" Crowfoot, 3/8" Drive; Ratchet, 3/8" Drive; 6" Ext, 3/8" Drive; 1 5/8" Crowfoot, 3/8" Drive)
- 18.6 Gamah Cap →|← ISA VAJ Port, hand tighten
- 18.7 Inspect seal on PCA VAP Gamah Cap for any visible damage. Notify **MCC-H** if any damage noted to seals.

Gamah Cap →|← PCA VAP, hand tighten
- 18.8 ISA ←|→ H2/N2 Vent Male Purge Adapter (straight end)
(Breaker Bar, 3/8" Drive; 1 1/4" Crowfoot, 3/8" Drive; Ratchet, 3/8" Drive; 1 5/8" Crowfoot, 3/8" Drive).
- 18.9 Gamah Cap (tethered) →|← H2/N2 Vent Male Purge Adapter (straight end), hand tighten
Refer to Figure 2.
- 18.10 H2/N2 Vent Male Purge Adapter (bent end) ←|→ OGS H2/N2 Vent Jumper
- 18.11 QD Cap (tethered) →|← OGS H2/N2 Vent Jumper (free end)
- 18.12 QD Cap (tethered) →|← H2/N2 Vent Male Purge Adapter (bent end)
- 18.13 Gamah Cap ←|→ Male-Male Adapter
Refer to Figure 1.
- 18.14 Male-Male Adapter →|← ISA
Torque to 40 in-lbs [(10-50 in-lbs) Trq Wrench, 1/4" Drive; 1/4" to 3/8" Adapter; 1 5/8" Crowfoot, 3/8" Drive; Ratchet, 3/8" Drive; 1 1/4" Crowfoot, 3/8" Drive].
Refer to Figure 1.
- 18.15 Inspect ISA Gamah fitting soft seal on Gamah Cap for damage, debris.
- 18.16 Gamah Cap →|← Male-Male Adapter, hand tighten
- 18.17 Unsecure Assembly.
- 18.18 Check for FOD within 1m radius.
- 18.19 Install Closeout Panel LAB1D0-02, 1/4 Turn Fasteners (nine).

- 18.20 Stow tools and materials.
Update IMS with stowage location of hardware.

NOTE
 The Figures that follow contain step-by-step configuration diagrams.

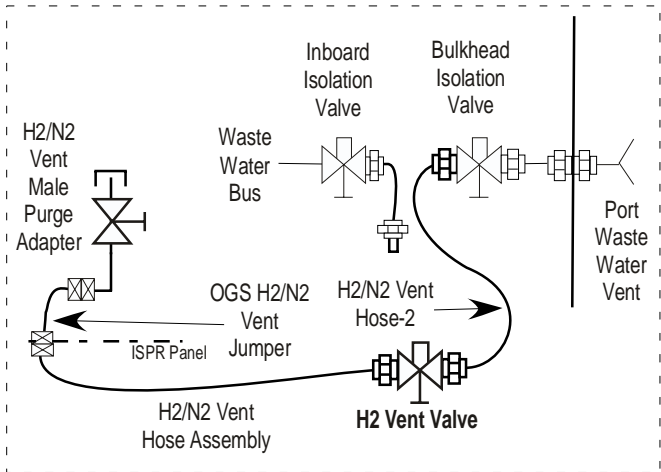


Figure 6.- Initial Config.

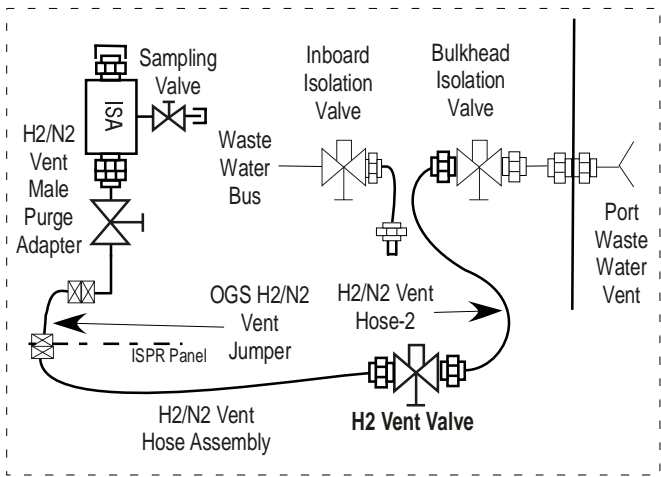


Figure 7.- After Step 2 (ISA Hookup).

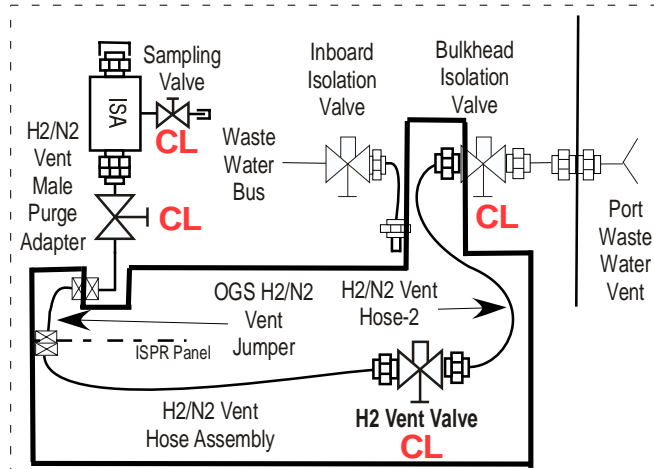


Figure 8.- After Step 5.1 (Config Prior to H2 Vent Assembly Leak Characterization).

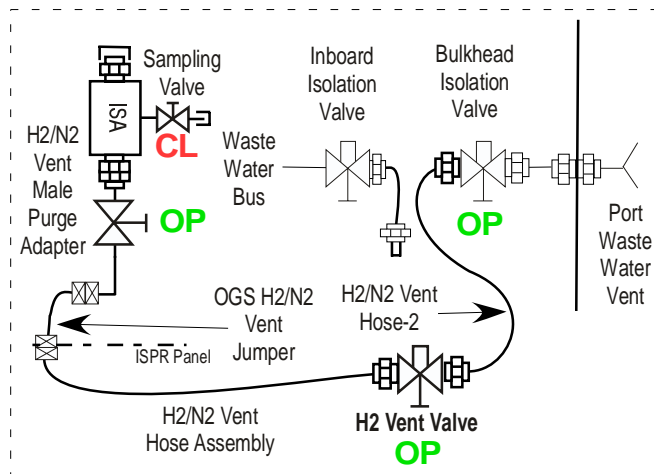


Figure 9.- After Step 5.6 (Venting H2 Vent Assembly to Vacuum).

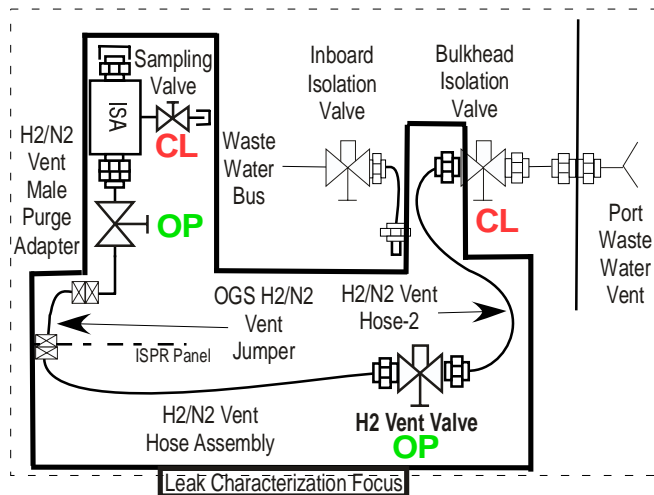


Figure 10.- After Step 5.9 (Beginning of Leak Characterization with Black Box Indicating Focus of Leak Characterization).

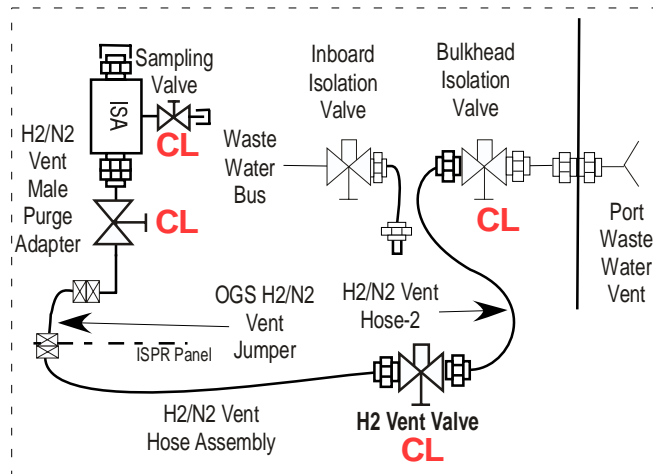


Figure 11.- After Step 5.17 (Conifig Post Leak Characterization).

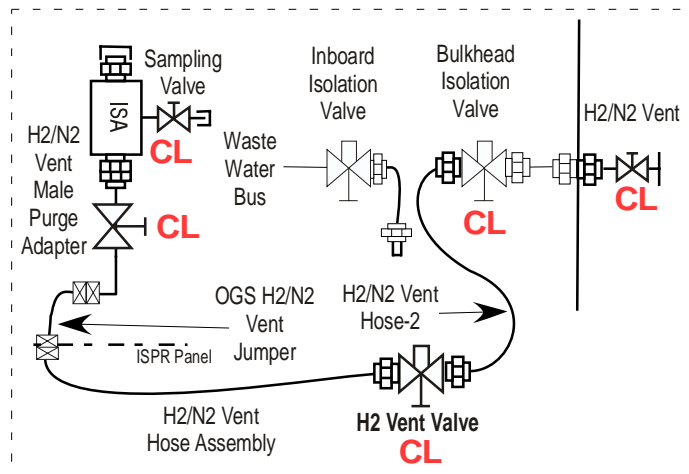


Figure 12.- After Step 7.2 (EV Crew Just Installed H2 Vent).

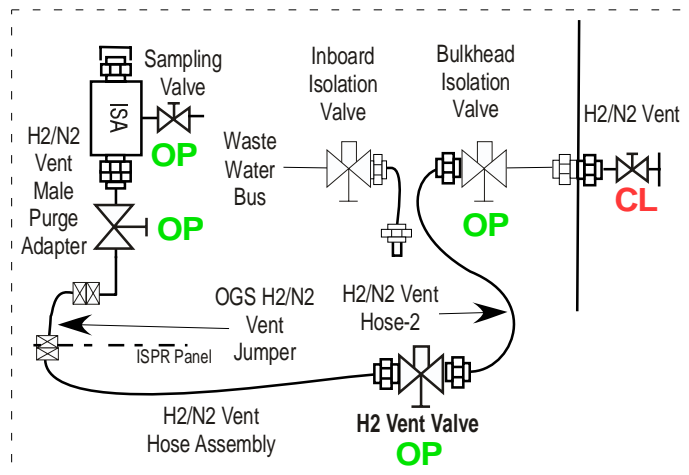


Figure 13.- After Step 7.7 (Pressurizing H2 Vent Assembly for Leak Check).

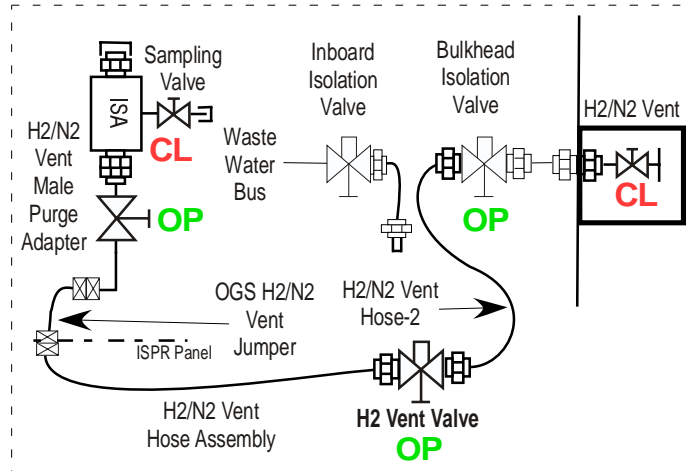


Figure 14.- After Step 7.10 (Beginning of Leak Check # 1: With Leak Check Focus Outlined in Back).

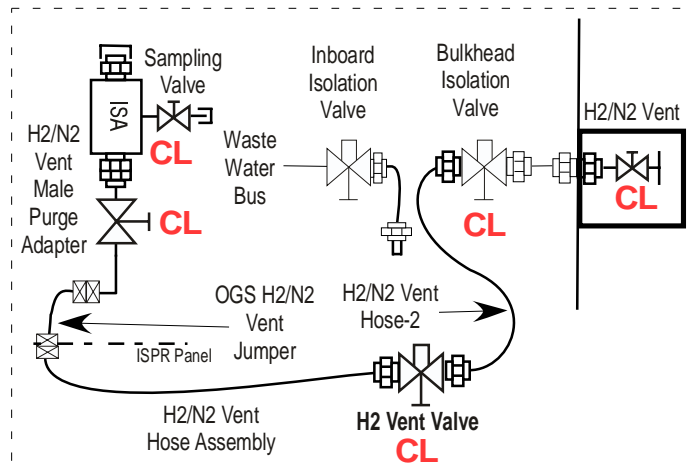


Figure 15.- After Step 7.19 (Config Post Leak Check # 1).

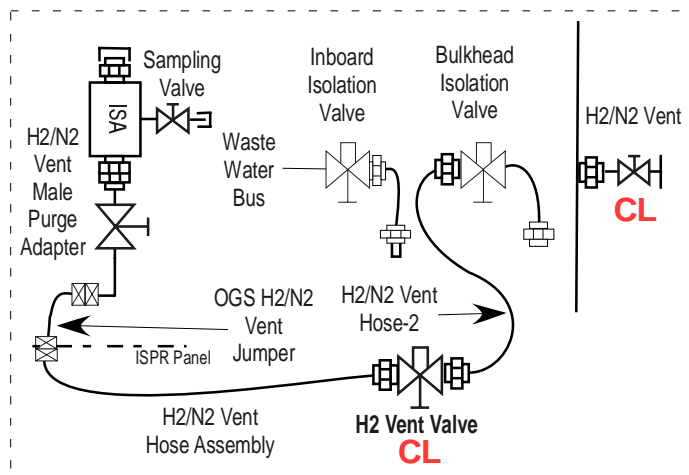


Figure 16.- After Step 9.3 (Crew Removed Water Vent Hose from Bulkhead).

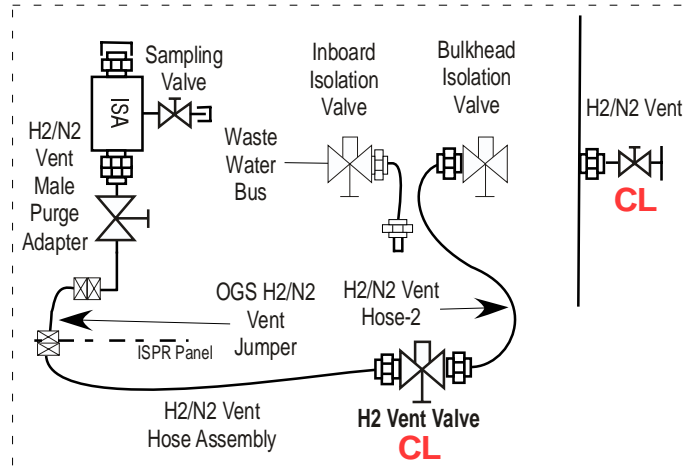


Figure 17.- After Step 9.4 (Crew Removed Water Vent Hose Bulkhead Valve).

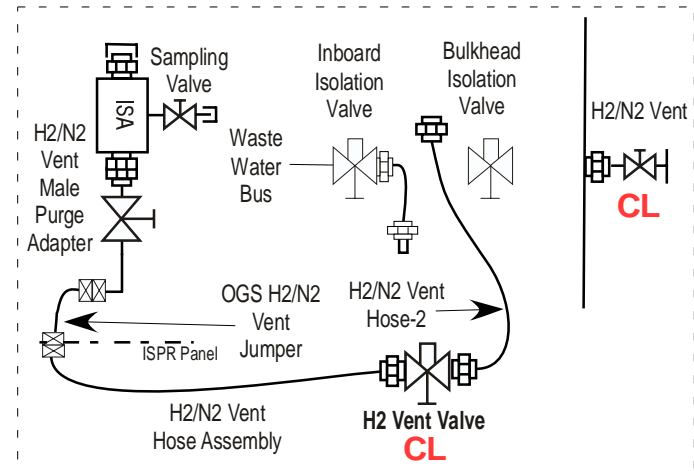


Figure 18. After Step 9.5 (Crew Removed H2/N2 Vent Hose from Inboard Side of Bulkhead Valve).

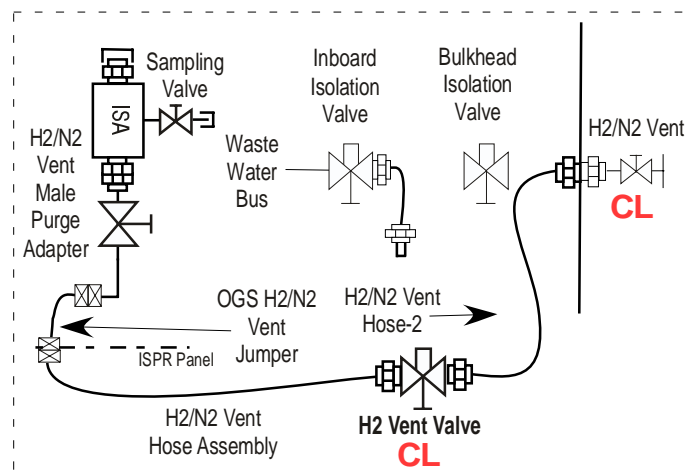


Figure 19.- After step 9.14 (H2/N2 Vent Hose-2 Installed on Bulkhead).

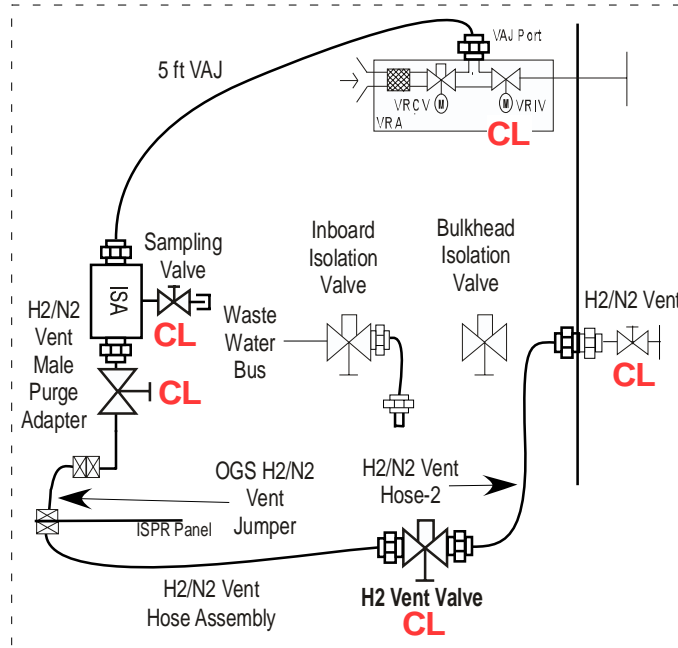


Figure 20.- After step 12.10 (Leak Characterization # 2: Vent VAJ Assembly Up to H2 Vent Valve then Monitor Pressure).

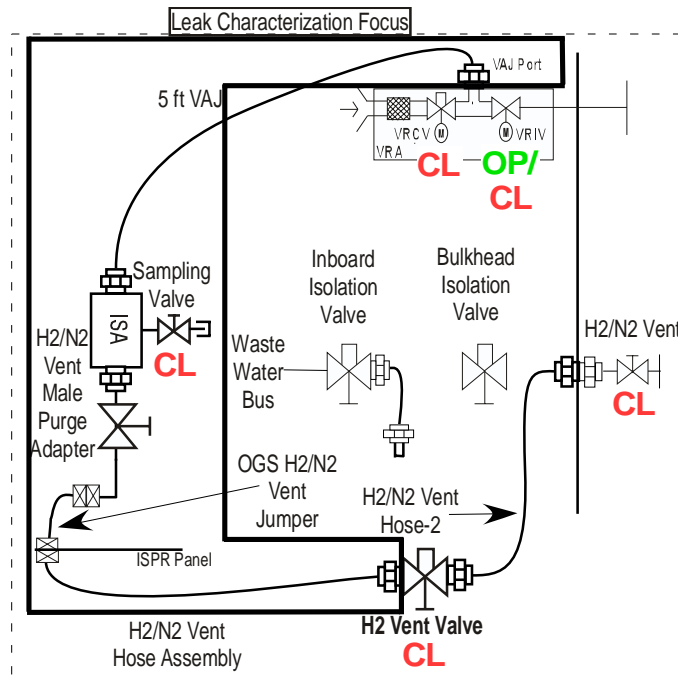


Figure 21.- After step 10.6 (Config Prior to Leak Check Characterization # 2: 5 FT VAJ Connected to LAB PCA VAP and ISA).

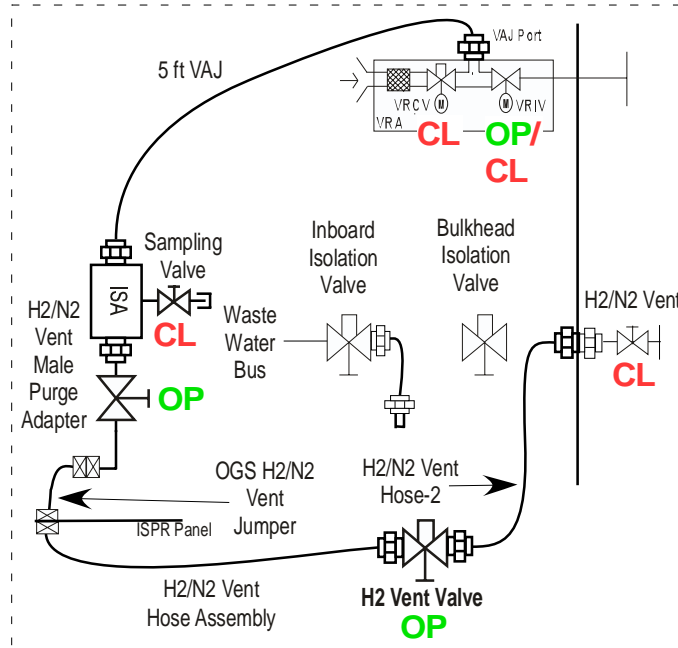


Figure 22.- After Step 13.7 (Venting H2 Vent Assembly and VAJ).

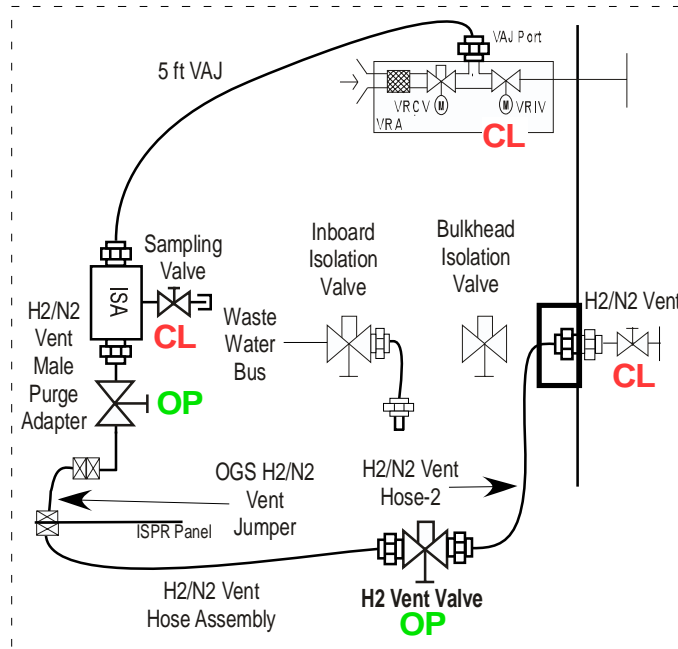


Figure 23.- After Step 13.12 (Beginning of Leak Check # 2. Note: A Black Box Indicates the Leak Check Focus).

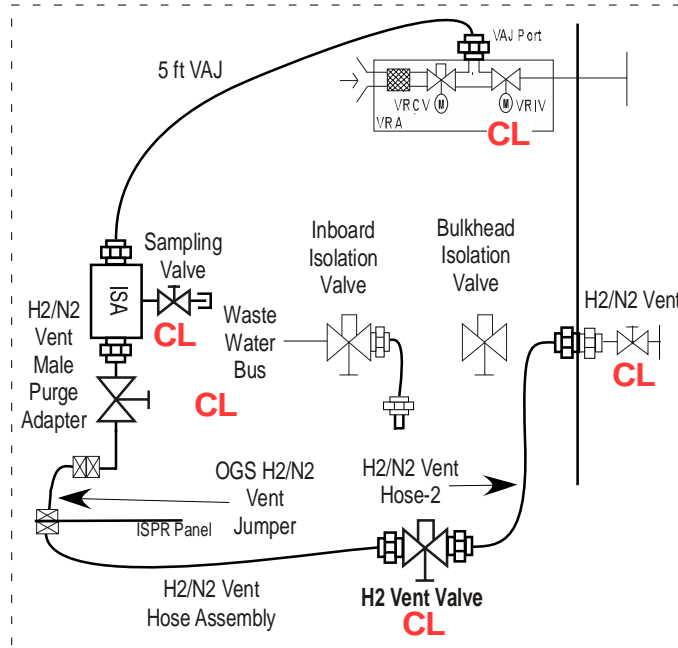


Figure 24.- After Step 13.19 (Leak Check # 2 Complete).

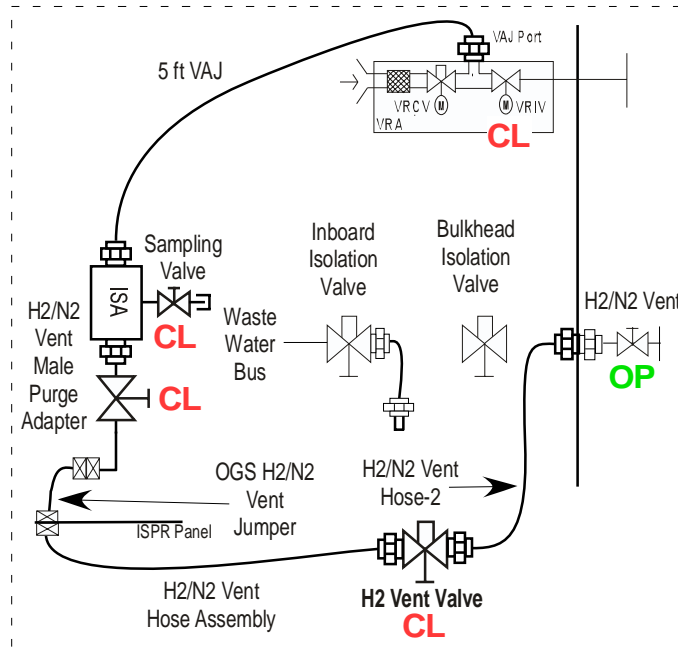


Figure 25.- After Step 14 (H2 Vent Valve Opened).

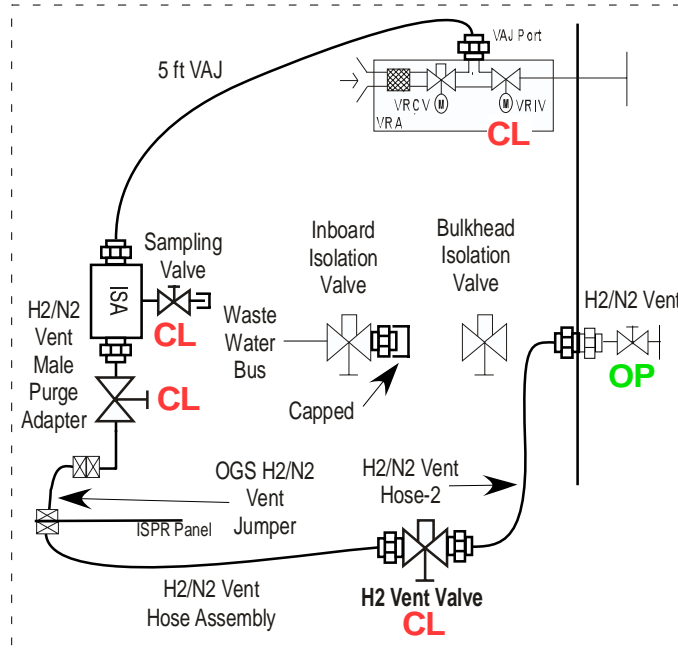


Figure 26.- After Step 15 (Line Removed from Inboard Isolation Valve and Inboard Isolation Valve Capped).

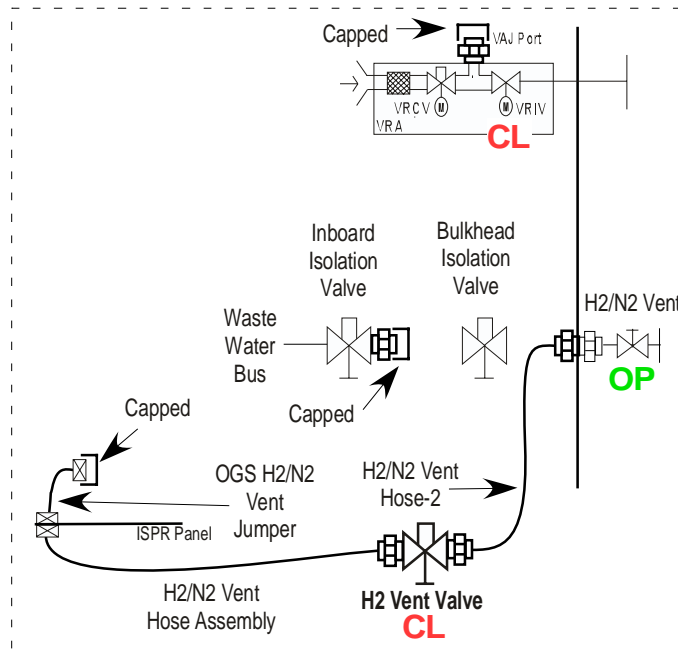


Figure 27.- After Step 18 (Final Configuration).