



International Space Station Assembly Operations Book

ISS-13A

Mission Operations Directorate
Operations Division

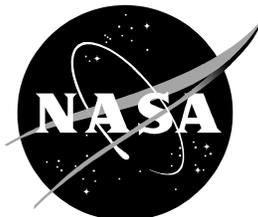
23 FEB 07

This publication replaces
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National Aeronautics and
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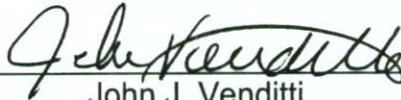
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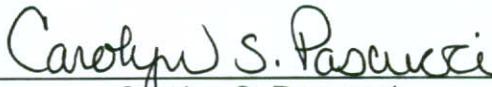
**INTERNATIONAL SPACE STATION
ASSEMBLY OPERATIONS BOOK
ISS-13A**

23 FEB 07

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None

**INTERNATIONAL SPACE STATION
ASSEMBLY OPERATIONS
ISS-13A**

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380	05 FEB 07
381	05 FEB 07
382	23 FEB 07
383	09 FEB 07
384	09 FEB 07
385	09 FEB 07
386	09 FEB 07
387	09 FEB 07
388	09 FEB 07
389	09 FEB 07
390	23 FEB 07
391	07 DEC 06
392	07 DEC 06
393	05 FEB 07
394	05 FEB 07
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400	05 FEB 07
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ACTIVATION AND CHECKOUT

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S3 ACTIVATION

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OBJECTIVE:

Safe connectors for S1 to S3/S4 umbilical connections and activate S3 ITS after umbilicals are mated.

INITIAL CONDITIONS:

LAB RWS Active and Cupola RWS in Backup, MSS LB Channel A selected.

MT at Worksite 2 with 3A and 4B heaters powered.

MBS and SSRMS Operational on Prime (4B) string, MBS Keep-Alive on Redundant (3A) string, MBS VDU(s) powered from Prime (4B) string.

1. CONFIGURING 1553 TO CHANNEL A AND EXT RM

NOTE

ODIN will configure to Channel A on all of the targeted buses one night prior to the EVA. Only checks performed during procedure execution.

1.1 Inhibiting Auto Transition to Diag in the PMCU and PL MDMs

CDH Summary

sel Primary PMCU MDM

Primary PMCU MDM

sel Processing State

PCMU Processing State Transitions

cmd Auto Transition to Diag Inhibit **Execute** (Verify – Inh)

CDH Summary

sel Primary PL MDM

Primary PL MDM

sel Processing State

PL Processing State Transitions

cmd Auto Transition to Diag Inhibit **Execute** (Verify – Inh)

1.2 Verifying 1553 Configured to Channel A

CDH Summary

sel Primary PMCU MDM

Primary PMCU MDM

S3 ACTIVATION

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√LB_PMCU-1 – channel A
√LB_PMCU-3 – channel A

CDH Summary

sel Primary EXT MDM

√LB_Sys_S-1-channel A
√LB_Sys_S-2-channel A
√LB-Mech_S-1- channel A
√LB-Mech_S-2- channel A

CDH Summary

sel Primary PL MDM

√LB_PL_1-channel A

CDH Summary

sel Primary C&C MDM

Primary CCS MDM

√CB_CT-1-channel A

2. POWERDOWN ITS S0, S1, P1 AND P3 LOADS FOR NADIR TRAY CONNECTIONS

2.1 Powering MBS Redundant Off

NOTE

1. Expect '**R1E - MSS Active OCS MBS Redun MCU SRT Comm Fail**' Robotics Advisory messages (SCR 17730).
2. Expect '**R2O - MBS CRPCM 1R(2R, 3R) Cat-2 Transmit (Receive) Msg Err**' Robotics Advisory messages (SCR 21744).

MSS: MBS: MCU

MCU

cmd 'Redundant' Off (Verify – Off)

Ops Name	CIPUI
MBS_Power_Off_Redun_Pre_SPDM	CMRM96IM0207K

S3 ACTIVATION

(ASSY OPS/13A/FIN 1)

CAUTION
The Operational and Survival Rail Heaters for a single power bus should never be powered at the same time. The following commands could place some heaters at risk of damage (SCAN-44 heaters). Reconfiguration of the redundant heater strings may be necessary.

2.2 Configuring DDCU P13A Powered Utility Rail Heaters

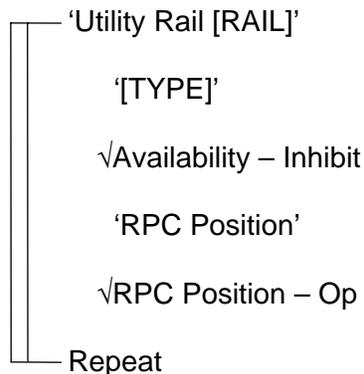
Table 1. DDCU P13A Powered Utility Rail Heaters

Truss [XX]	Display [DISPLAY]	Utility Rail [RAIL]	Heater Type [TYPE]
P1	Pwr Buses P11A P14B Rail Htrs	P11A	Survival
P1	Pwr Buses P11A P14B Rail Htrs	P14B	Survival
P1	Pwr Buses P12B P13A Rail Htrs	P13A	Operational
P3	P3 Rail Heaters	P31A	Survival
P3	P3 Rail Heaters	P34B	Survival
P3	P3 Rail Heaters	P33A	Operational
S0	Pwr Bus S01A Rail Htrs	S01A	Survival
S0	Pwr Bus S04B Rail Htrs	S04B	Survival
S0	Pwr Bus S03A Rail Htrs	S03A	Operational
S1	Pwr Buses S11A S14B Rail Htrs	S11A	Survival
S1	Pwr Buses S11A S14B Rail Htrs	S14B	Survival
S1	Pwr Buses S12B S13A Rail Htrs	S13A	Operational

Refer to Table 1 for [XX], [DISPLAY], [RAIL], and [TYPE] references that follow.

PCS

[XX]: [DISPLAY]
[DISPLAY]



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2.3 Configuring Redundant Utility Rail Heaters

Table 2. Redundant Heaters For DDCU P13A Powered
Utility Rail Heaters

Truss [XX]	Display [DISPLAY]	Utility Rail [RAIL]	Heater Type [TYPE]
P1	Pwr Buses P11A P14B Rail Htrs	P11A	Operational
P1	Pwr Buses P11A P14B Rail Htrs	P14B	Operational
P1	Pwr Buses P12B P13A Rail Htrs	P13A	Survival
P3	P3 Rail Heaters	P31A	Operational
P3	P3 Rail Heaters	P34B	Operational
P3	P3 Rail Heaters	P33A	Survival
S0	Pwr Bus S01A Rail Htrs	S01A	Operational
S0	Pwr Bus S04B Rail Htrs	S04B	Operational
S0	Pwr Bus S03A Rail Htrs	S03A	Survival
S1	Pwr Buses S11A S14B Rail Htrs	S11A	Operational
S1	Pwr Buses S11A S14B Rail Htrs	S14B	Operational
S1	Pwr Buses S12B S13A Rail Htrs	S13A	Survival

Refer to Table 2 for [XX], [DISPLAY], [RAIL], and [TYPE] references that follow.

[XX]: [DISPLAY]

[DISPLAY]

'Utility Rail [RAIL]'

'[TYPE]'

√Availability – Enable

Repeat

3. DEACTIVATING DDCU P13A AND VERIFYING MBSU 3 RBI CONFIGS

NOTE

Prior to removing Channel 3A power, it is necessary to ensure that the downstream EPS ORUs do not have ORU health flags set (i.e., EEPROM Bit Flips). If the health flag is set due to an ORU flip bit, failure to check the ORU health prior to powering it down may result in loss of ORU function upon powering it back. If repowered, these ORUs will boot from unhealthy EEPROM Firmware.

S3 ACTIVATION

(ASSY OPS/13A/FIN 1)

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3.1 Verifying RPCM S02B-B RPC 2 Open

EPS Summary: S0

sel RPCM S02B B
sel RPC 2

RPCM S02B B RPC 2

√RPC Position – Op
√Close Cmd – Inh

3.2 Verifying MBSU 3 RBI 1 and RBI 8 are Open

EPS Summary: S0

sel MBSU 3

MBSU 3

√RBI 1 Position – Open

Verify RBI 1 Voltage = -4.2 to 4.2 V

√RBI 8 Position – Open

Verify RBI 8 Voltage = -4.2 to 4.2 V

sel RBI 1

MBSU 3 RBI 1

√Close Cmd – Inh

EPS Summary: S0: MBSU 3: RBI 8

MBSU 3 RBI 8

√Close Cmd – Inh

3.3 Inhibiting RT FDIR DDCU P13A and ORUs

NOTE

1. Inhibit RT FDIR to RTs that will lose power, but will still be monitored during the powerdown (i.e., RPCMs).
2. Expect multiple loss of comm messages when DDCU P13A converter powered off.
3. ODIN to perform via command script.

CDH Summary: S0 2 MDM

S0 2 MDM

S3 ACTIVATION

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sel UB SEPS S0 23
sel RT Status

S0 2 UB SEPS S0 23 RT Status

cmd RPCM S03A [X] RT FDIR Status – Inhibit FDIR **Execute**
(Verify – Inh) where [X] = [A] [B] [C] [D] [E] [F]

CDH Summary: Primary EXT MDM

Primary EXT MDM

sel LB MT 1
sel RT Status
sel RT Status Cont. RT#16-25

LB MT 1 RT Status Cont

cmd '23 RPCM MT 3A A' Inhibit FDIR **Execute** (Verify – Inh)

CDH Summary: S1 2 MDM

S1 2 MDM

sel UB SEPS S1 23
sel RT Status

S1 2 UB SEPS S1 23 RT Status

cmd RPCM S13A [X] RT FDIR Status – Inhibit FDIR **Execute**
(Verify – Inh) where [X] = [E] [F] [G]

CDH Summary: P1 2 MDM

P1 2 MDM

sel UB SEPS P1 23
sel RT Status

P1 2 UB SEPS P1 23 RT Status

cmd RPCM P13A [X] RT FDIR Status – Inhibit FDIR **Execute**
(Verify – Inh) where [X] = [E] [F] [G]

CDH Summary: P3 2 MDM

P3 2 MDM

sel UB SEPS P3 23
sel RT Status

P3 2 UB SEPS P3 23 RT Status

cmd RPCM P33A [X] RT FDIR Status – Inhibit FDIR **Execute**
(Verify – Inh) where [X] = [C] [E] [F]

S3 ACTIVATION

(ASSY OPS/13A/FIN 1)

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C&DH Summary: Primary PMCU MDM

Primary PMCU MDM

sel LB PMCU 2

sel RT Status

LB PMCU 2 RT Status

cmd '18 DDCU P1 3A' RT FDIR Status – Inhibit FDIR **Execute**
(Verify – Inh)

3.4 Deactivating DDCU P13A

EPS Summary: S0: DDCU P13A

DDCU P13A

sel Converter

DDCU P13A Converter

'Converter'

cmd Off (1-step command, arm not required)

√Output Voltage < 12.8 V

MCC-H ↑ ISS, "Go to connect nadir tray utilities."

3.5 Receiving Go for Channel 2/3 Powerup

NOTE

Crew will give GO for powerup after nadir tray connections completed.

ISS ↓ **MCC-H**, "Go for nadir tray powerup."

4. CONFIGURING 1553 DATA BUS TO CH B

Configuring 1553 to Channel B

C&DH Summary: Primary PMCU

Primary PMCU MDM

sel LB_PMCU-1

sel Bus Status

LB PMCU_1 Bus Status

cmd select channel – B **Execute**

Verify channel selected – B

C&DH Summary: Primary PMCU

Primary PMCU MDM

sel LB_PMCU-3

sel Bus Status

S3 ACTIVATION

(ASSY OPS/13A/FIN 1)

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LB_PMCU_Bus Status

cmd select channel – B **Execute**

Verify channel selected – B

C&DH Summary: Primary EXT

Primary Ext MDM

sel LB_Sys_S-1

sel Bus Status

LB_Sys_S-1 Bus Status

cmd select channel – B **Execute**

Verify channel selected – B

Primary Ext MDM

sel LB_Sys_S-2

sel Bus Status

LB_Sys_S-2 Bus Status

cmd select channel – B **Execute**

Verify channel selected – B

Primary Ext MDM

sel LB_Mech_S-1

sel Bus Status

LB Mech S-1 Bus Status

cmd select channel – B **Execute**

Verify channel selected – B

Primary Ext MDM

sel LB_Mech_S-2

sel Bus Status

LB Mech S-2 Bus Status

cmd select channel – B **Execute**

S3 ACTIVATION

(ASSY OPS/13A/FIN 1)

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Verify channel selected – B

C&DH Summary: Primary PL

sel LB_PL_1
sel Bus Status

cmd select channel – B **Execute**

Verify channel selected – B

CDH Summary

sel Primary C&C MDM

sel CB CT-1
sel Bus Status

cmd select channel – B **Execute**

Verify channel selected – B

5. [ACTIVATING DDCU P13A](#)

5.1 [Activating DDCU P13A](#)

EPS Summary: P1: DDCU P13A

sel Converter

'Converter'

cmd Converter On – Arm

cmd Converter On – On

S3 ACTIVATION

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- √Input Current: -4 to 4 A
- √Input Voltage: 146 to 165 V
- √Out Current: -4 to 4 A
- √Out Voltage: 120.2 to 128.8 V
- √Converter Temp: -37.3 to 43.8° C
- √Power Supply Temp: -37.3 to 49.5° C
- √Baseplate Temp: -37.3 to 40.3° C

5.2 Powering On S3 2 MDM and RPCM S32B-A S3: EPS

sel S02B B RPC 02

RPCM S02B B RPC 02

Verify Integration Counter – incrementing

√Close Cmd – Ena

cmd RPC Position – Close (Verify – Cl)

NOTE

Closing the S02B B RPC 2 will immediately provide power to the S3-2 MDM through RPCM S32B A RPC 1 as this RPC is launched in the preset closed position.

Wait 5 minutes for MDM to go through bootup and POST.

5.3 Closing MBSU 3 RBI 1

S0: EPS: MBSU 3

MBSU 3

sel RBI 1

MBSU 3 RBI 1

'HOT Cross Tie – PMCA R3'

'MBSU 3 Hot Cross Tie'

cmd Enable – Arm

cmd Enable – Enable

Verify MBSU 3 Hot Cross Tie – Ena

'Cmdded Position'

cmd Close – Arm

cmd Close – Close (Verify – Cl)

Verify MBSU 3 RBI 1 Voltage > 148 to 163 V

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'HOT Cross Tie – PMCA R3'
'MBSU 3 Hot Cross Tie'

cmd Inhibit – Arm
cmd Inhibit – Inhibit

Verify MBSU 3 Hot Cross Tie – Inh

6. REPOWERING ITS S0, S1, P1 AND P3 LOADS ON NADIR TRAY

6.1 Verifying MT TUS 2 Gearbox Closed Loop Heater

MSS: MT: Thermal: 'RPCM S03A E' 3

MT TUS 2 Gearbox Heater

√'Htr Availability' – ENA

Table 3.

Ops Name	CIPUI
PTCS_MSS_MT_TUS_2_Htr_Ena	S0TH96IM0040K

√'Control Mode State' – Closed Loop

Table 4.

Ops Name	CIPUI
PTCS_MSS_MT_TUS_2_Htr_Closed_Loop	S0TH96IM0217K

CAUTION

The Operational and Survival Rail Heaters for a single power bus should never be powered at the same time. The following commands could place some heaters at risk of damage (SCAN-44 heaters). Reconfiguration of the redundant heater strings may be necessary.

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6.2 Configuring DDCU S14B Powered Utility Rail Heaters

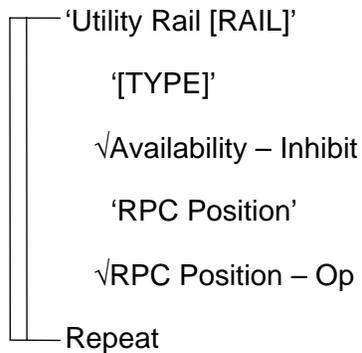
Table 5. DDCU S14B Powered Utility Rail Heaters

Truss [XX]	Display [DISPLAY]	Utility Rail [RAIL]	Heater Type [TYPE]
P1	Pwr Buses P12B P13A Rail Htrs	P12B	Survival
P1	Pwr Buses P12B P13A Rail Htrs	P13A	Survival
P1	Pwr Buses P11A P14B Rail Htrs	P14B	Operational
P3	P3 Rail Heaters	P32B	Survival
P3	P3 Rail Heaters	P33A	Survival
P3	P3 Rail Heaters	P34B	Operational
S0	Pwr Bus S02B Rail Htrs	S02B	Survival
S0	Pwr Bus S03A Rail Htrs	S03A	Survival
S0	Pwr Bus S04B Rail Htrs	S04B	Operational
S1	Pwr Buses S12B S13A Rail Htrs	S12B	Survival
S1	Pwr Buses S12B S13A Rail Htrs	S13A	Survival
S1	Pwr Buses S11A S14B Rail Htrs	S14B	Operational

Refer to Table 5 for [XX], [DISPLAY], [RAIL], and [TYPE] references that follow.

[XX]: [DISPLAY]

[DISPLAY]



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6.3 Configuring Redundant Utility Rail Heaters

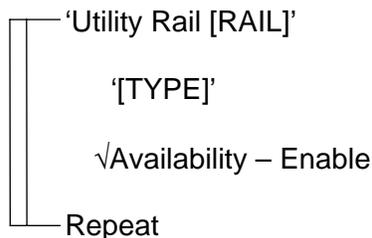
Table 6. Redundant Heaters For DDCU P13A Powered Utility Rail Heaters

Truss [XX]	Display [DISPLAY]	Utility Rail [RAIL]	Heater Type [TYPE]
P1	Pwr Buses P12B P13A Rail Htrs	P12B	Operational
P1	Pwr Buses P12B P13A Rail Htrs	P13A	Operational
P1	Pwr Buses P11A P14B Rail Htrs	P14B	Survival
P3	P3 Rail Heaters	P32B	Operational
P3	P3 Rail Heaters	P33A	Operational
P3	P3 Rail Heaters	P34B	Survival
S0	Pwr Bus S02B Rail Htrs	S02B	Operational
S0	Pwr Bus S03A Rail Htrs	S03A	Operational
S0	Pwr Bus S04B Rail Htrs	S04B	Survival
S1	Pwr Buses S12B S13A Rail Htrs	S12B	Operational
S1	Pwr Buses S12B S13A Rail Htrs	S13A	Operational
S1	Pwr Buses S11A S14B Rail Htrs	S14B	Survival

Refer to Table 6 for [XX], [DISPLAY], [RAIL], and [TYPE] references that follow.

[XX]: [DISPLAY]

[DISPLAY]



7. CONFIGURING VIDEO FOR DDCU S14B POWERDOWN

7.1 Coordinating with ISS Crew

MCC-H

MCC-H notifies ISS crew that MSS video will be lost temporarily, and directs ISS crew to halt all MSS video routing.

Wait for **MCC-H GO** before resuming routing.

7.2 VDS Auto Route - Deroute

To deroute all MSS camera views, perform {2.601 VDS AUTO ROUTE - DEROUTE}, steps 5 and 6 (SODF: C&T: NOMINAL: VIDEO), then:

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7.3 VDS Trunkline Configuration

NOTE

VDS Trunkline Configuration, VDS Activation, and VDS Deactivation (steps 7.3 and 7.4) can be performed in parallel to reduce execution time.

Perform {4.602 [VDS TRUNKLINE CONFIGURATION](#)}, steps 1 to 3 for USOS TLs 19, 20, 21 and 22, and steps 5 to 7 for MSS TLs 1, 8 and 9 (SODF: C&T: NOMINAL: VIDEO), then:

7.4 EVSU 3 Power Reconfiguration

C&T: Video: EVSU 3: RPCM S02B E RPC 3

RPCM S02B E RPC 3

√RPC Position – CI

NOTE

1. To reduce execution time, the RT Inhibit portion of 1.603 VDS DEACTIVATION (SODF: C&T: ACTIVATION AND CHECKOUT: VIDEO) step 9 can be omitted with ODIN concurrence as long as RT FDIR is inhibited.
2. Expect the Robotics Advisory message '**R6D - MBS VDU 2 PFM Carrier On Sync 1 Err.**'

For EVSU 3 Ops Pwr only

Perform {1.603 [VDS DEACTIVATION](#)}, steps 9 and 12 (SODF: C&T: ACTIVATION AND CHECKOUT: VIDEO), then:

8. [CONFIGURING MSS/MT FOR ZENITH TRAY POWERDOWN](#)

8.1 Verifying I/O with Worksite 2 Redundant RPCM

MSS: MT: Worksite Power: RPCM S13A E RPC 1

RPCM S13A E RPC 1

Verify Integration Counter – incrementing

8.2 Video Derouting

Coordinate with CATO to verify all MSS video derouted.

8.3 Powering MSS Redundant to KA

MSS: MBS: MCU

MCU

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cmd 'Redundant' Keep-Alive (Verify – Keep-Alive)

Table 7.

Ops Name	CIPUI
MBS_Power_Keep_Alive_Redun	CMRM96IM0203K

NOTE

Expect the '**R1E - LAB RWS CEU MLB ACU Cmd Resp Sync Msg Err**' Robotics Advisory message (SCR 31294).

MSS: SSRMS: Power

SSRMS Power

cmd 'SSRMS' 'Prime' – Keep-Alive (Verify – Keep-Alive)

Table 8.

Ops Name	CIPUI
SSRMS_Power_Keep_Alive_Prime	CMRM96IM0114K

cmd 'SSRMS' 'Redundant' – Keep-Alive (Verify – Keep-Alive)

Table 9.

Ops Name	CIPUI
SSRMS_Power_Keep_Alive_Redun	CMRM96IM0115K

8.4 Powering MSS Prime to Off

MSS: SSRMS: Power

SSRMS Power

cmd 'SSRMS' 'Prime' – Off (Verify – Off)

Table 10.

Ops Name	CIPUI
SSRMS_Power_Off_Prime_Pre_SPDM	CMRM96IM0116K

NOTE

Expect a transient '**R1E - MSS Active OCS SSRMS Prime MCU SRT Comm Fail**' Robotics Advisory messages (SCR 17730).

MSS: MBS: MCU

MCU

cmd 'Prime' Off (Verify – Off)

Table 11.

Ops Name	CIPUI
MBS_Power_Off_Prime_Pre_SPDM	CMRM96IM0205K

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8.5 RPCM MT3A Powerup

MSS: MT: RPCM MT-3A: RPCM S03A E

RPCM S03A E RPC 18

Verify 'Integration Counter' – incrementing

cmd 'RPC Position' – Close (Verify – CI)

Table 12.

Ops Name	CIPUI
RPCM_S03A_E_RPC_18_MSS_MT_3A_CI	S0PR96IM0257K

MSS: MT: RPCM MT-3A

RPCM MT3A A

Verify 'Integration Counter' – incrementing

8.6 MT3A Heater Powerup

MSS: MT: Thermal: RPCM-MT-3A

RPCM MT3A A Details

sel RPC [X] where [X] = **8** **12** **13** **14** **16**

RPCM MT3A A RPC [X]

cmd 'RPC Position' – Close (Verify – CI)

Repeat

Table 13.

RPC	Ops Name	CIPUI
8	RPCM_MT3A_A_RPC_08_MSS_MT_IUA_Htr_2_UMA_Htr_1_CI	S0PR96IM0347K
12	RPCM_MT3A_A_RPC_12_MSS_MT_LTU_Htr_2_CI	S0PR96IM0351K
13	RPCM_MT3A_A_RPC_13_MSS_MT_AMP_1_Htr_2_and_Operational_Pwr_CI	S0PR96IM0352K
14	RPCM_MT3A_A_RPC_14_MSS_MT_AMP_2_Htr_2_and_Operational_Pwr_CI	S0PR96IM0353K
16	RPCM_MT3A_A_RPC_16_MSS_MT_ED_Htr_1_RSU_Htr_2_CI	S0PR96IM0355K

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8.7 Activating TUS-1 Video Signal Converter Heater 2

MSS: MT: Thermal: RPCM-S0-3A-F: RPC 4

RPCM S03A F RPC 04

cmd 'RPC Position' – Close (Verify – CI)

Table 14.

Ops Name	CIPUI
RPCM_S03A_F_RPC_04_MSS_MT_TUS_1_VSC_Htr_2_CI	S0PR96IM0261K

8.8 Activating TUS-2 Video Signal Converter Heater 1

MSS: MT: Thermal: RPCM-S0-3A-E: RPC 4

RPCM S03A E RPC 04

cmd 'RPC Position' – Close (Verify – CI)

Table 15.

Ops Name	CIPUI
RPCM_S03A_E_RPC_04_MSS_MT_TUS_2_VSC_Htr_1_CI	S0PR96IM0243K

8.9 Activating TUS-1 Video Signal Converter Power 2

MSS: MT: Thermal: RPCM-S0-3A-F: RPC 2

RPCM S03A F RPC 02

cmd 'RPC Position' – Close (Verify – CI)

Table 16.

Ops Name	CIPUI
RPCM_S03A_F_RPC_02_MSS_MT_TUS_1_VSC_Pwr_2_CI	S0PR96IM0259K

8.10 Activating TUS-2 Video Signal Converter Power 1

MSS: MT: Thermal: RPCM-S0-3A-E: RPC 2

RPCM S03A E RPC 02

cmd 'RPC Position' – Close (Verify – CI)

Table 17.

Ops Name	CIPUI
RPCM_S03A_E_RPC_02_MSS_MT_TUS_2_VSC_Pwr_2_CI	S0PR96IM0241K

8.11 Verifying RPCM MT-3A Closed Loop Heater

MSS: MT: Thermal: 'RPCM-MT-3A' RPC 15

RPCM MT 3A Bracket Heater

√'Htr Availability' – ENA

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Table 18.

Ops Name	CIPUI
PTCS_RPCM_Brkt_Htr2_Ena	S0TH96IM0001K

cmd 'Control Mode State' Closed Loop (Verify – Closed Loop)

Table 19.

Ops Name	CIPUI
PTCS_RPCM_Brkt_Htr2_Closed_Loop	S0TH96IM0007K

9. [TRANSITIONING MSS TO OPERATIONAL ON CHANNEL 3A](#)

9.1 [Selecting MSS LB Channel B](#)

MSS: LAS5(LAP5) Bus Config

LAS5(LAP5) CEU Bus Configuration

cmd 'Local Bus' 'MSS' B (Verify – B)

Table 20.

OPS Name	CIPUI
CUP_RWS_Bus_Ch_Select_MSS_LB_Ch_B	CMRM96IM0170K
LAB_RWS_Bus_Ch_Select_MSS_LB_Ch_B	CMRM96IM0067K

9.2 [MBS Redundant String Transition from Keep-Alive to Operational](#)

NOTE

1. The transition from Keep-Alive to Operational can be stopped at any time by commanding SAFING on the DCP.
2. Expect the following Robotics Advisory messages:
'R20 - MBS CRPCM 1P Cat-2 Transmit Msg Err'
'R20 - MBS CRPCM 2P Cat-2 Transmit Msg Err'
'R20 - MBS CRPCM 3P Cat-2 Transmit Msg Err'
'R20 - MBS CRPCM 1P Cat-2 Receive Msg Err'
'R20 - MBS CRPCM 2P Cat-2 Receive Msg Err'
'R20 - MBS CRPCM 3P Cat-2 Receive Msg Err'
(SCR 21744)
3. Expect an 'R20 - MBS CRPCM ... Output Voltage ... Stat Err'
Robotics Advisory message for the SSRMS Redundant string.

MSS: MBS: MCU: MCU

MCU

cmd 'Redundant' Operational (Verify – Operational) (~3 minutes)

Table 21.

Ops Name	CIPUI
MBS_Power_Operational_Redun _Pre_SPDM	CMRM96IM0211K

9.3 SSRMS Redundant String Transition from Keep-Alive to Operational

NOTE

1. SSRMS transition from Keep-Alive to Operational will require at least 6 minutes to complete. The time is contingent on file transfer activity from the C&C MDM.
2. The operator can follow the transition to Operational by looking at the MSS discrete log.

MSS: SSRMS: Power

SSRMS Power

cmd 'SSRMS' Redundant – Operational

Table 22.

Ops Name	CIPUI
SSRMS_Power_Operational_Redun _Pre_SPDM	CMRM96IM0119K

Verify 'Systems State' – Operational

9.4 Turning MSS VDUs On

NOTE

1. Expect '**R6F - MBS... PFM Carrier On Video 1 Err**' Robotics Advisory message as each VDU is powered on. Message may toggle in and out of alarm until video is routed to the defined VDU (SCR 24376).
2. Robotics Advisory message '**R6E - MBS ... Baseband Sync Output Err**' may appear for one cycle when MBS VDU 2 is powered on (SCR 30307).
3. If VDU does not power on within 10 seconds of the On command being issued, safe and reattempt.

MSS: SSRMS: VDU

MSS VDUs

sel '[X]' as required where [X] =

MBS 2	Base LEE	Base Elbow	Tip Elbow	Tip LEE
-------	----------	------------	-----------	---------

cmd On (Verify – On)

Repeat

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Table 23.

Unit	Ops Name	CIPUI
Base LEE	SSRMS_Base_LEE_VDU_Power_On	CMRM96IM0045K:001
Base Elbow	SSRMS_Base_Elb_VDU_Power_On	CMRM96IM0045K:002
Tip Elbow	SSRMS_Tip_Elb_VDU_Power_On	CMRM96IM0045K:003
Tip LEE	SSRMS_Tip_LEE_VDU_Power_On	CMRM96IM0045K:004
MBS VDU 2	MBS_VDU2_Power_On	CMRM96IM0045K:014

9.5 MBS VDU 2 Sync 2 Selection

MSS: Video: VSU1: MSS Sync Config

MSS Sync Config

sel 'Sync Source' – MSS Sync Line 2

sel 'MBS VDU 2' – Enable

sel all others – Inhibit

cmd Set (Verify VDU Sync Status – as commanded)

Table 24.

Ops Name	CIPUI
MSS_Video_Sync_Route_Tmpl	CMRM96IM0158K

Table 25.

Parameter	Value
Sync_Id	2 (Sync_2)
SPDM Body LEE	2 (Disabled)
MBS VDU 2	1 (Enabled)
MBS VDU 1	2 (Disabled)
MBS POA	2 (Disabled)
Tip LEE	2 (Disabled)
Tip Elbow	2 (Disabled)
Base Elbow	2 (Disabled)
Base LEE	2 (Disabled)
SPDM Body 2	2 (Disabled)
SPDM Body 1	2 (Disabled)

cmd Set (Verify VDU Sync Status – as commanded)

Verify Sync selection – Sync 2

Verify sync output to MBS Mast Camera.

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9.6 Configuring MSS Cameras

MSS: MBS: MBS Central Camera Icon

MBS Camera

sel [X] as required where [X] =

B-Elb 22 T-Elb 24 LEE 25 MBS 37

cmd 'Power' On (Verify – On)

Repeat

Table 26.

Unit	Ops Name	CIPUI
Base Elbow	SSRMS_Base_Elb_Camera_Power_On	CMRM96IM0045K:006
Tip Elbow	SSRMS_Tip_Elb_Camera_Power_On	CMRM96IM0045K:007
Tip LEE	SSRMS_Tip_LEE_Camera_Power_On	CMRM96IM0045K:008
MBS	MBS_Mast_Camera_Power_On	CMRM96IM0045K:016

sel [X] as required where [X] =

B-Elb 22 T-Elb 24 LEE 25 MBS 37

cmd Color Bal – Metal

Repeat

Table 27.

Unit	Ops Name	CIPUI
Base Elbow	SSRMS_Base_Elb_Camera_Color_Bal_Metal	LARM96IM0001K:077
Tip Elbow	SSRMS_Tip_Elb_Camera_Color_Bal_Metal	LARM96IM0001K:080
Tip LEE	SSRMS_Tip_LEE_Camera_Color_Bal_Metal	LARM96IM0001K:007
MBS Mast	MBS_Mast_Camera_Color_Bal_Metal	LARM96IM0001K:071

sel [X] as required where [X] =

B-Elb 22 T-Elb 24 LEE 25 MBS 37

cmd Gamma – 0.45

Repeat

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Table 28.

Unit	Ops Name	CIPUI
Base Elbow	SSRMS_Base_Elb_Camera_Gamma_0.45	LARM96IM0001K:078
Tip Elbow	SSRMS_Tip_Elb_Camera_Gamma_0.45	LARM96IM0001K:081
Tip LEE	SSRMS_Tip_LEE_Camera_Gamma_0.45	LARM96IM0001K:075
MBS Mast	MBS_Mast_Camera_Gamma_0.45	LARM96IM0001K:072

MCC-H

9.7 VDS Auto Route

To reroute views per FD4 Robotics Video Configuration Flight Note, perform {2.601 [VDS AUTO ROUTE - DEROUTE](#)}, steps 1 to 4 (SODF: C&T: NOMINAL: VIDEO), then:

9.8 Coordinating with ISS Crew

NOTE

Due to the EVSU 3 powerdown, only two SSRMS Camera views will be available.

MCC-H gives ISS crew Go to resume video routing using a maximum of two simultaneous SSRMS Cameras.

10. [ACTIVATING AND C/O S3 2 MDM](#)

10.1 Enabling S3 2 MDM RT

CDH Summary: S3 2

sel LB SYS S2

sel RT Status

cmd '16 S3 2 MDM RT Status' – Enable **Execute** (Verify – Ena)

10.2 Verifying S3 2 MDM Status in Wait State

S3 2 MDM'

Verify Frame Count – incrementing

Verify Processing State – Wait

'MDM ID'

√Sync Status – In Sync

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```
*****
* If not In Sync
* | sel Sync Status
* |
* | S3 2 Sync Status
* |
* | cmd Sync To BIA Execute
* |
* | Wait at least 30 seconds.
* |
* | S3 2 MDM
* |
* | Verify Sync Status – In Sync
*****
```

sel MDM BIT Status

S3 2 MDM BIT Summary Table A
'Word 1: Summary'

Record all non-blank fields.

Table 29.

Hard Fail	
Rev. Soft Fail	
Soft Fail	
POST Stat	
BIT Stat	
I/O Bus Stat	
I/O List Stat	
SX Card Slot	
I/O BIT Stat	
POST in Prog	

```
*****
* If BST not blank
* | CDH Summary: S3-2 MDM: MDM Utilities
* | 'Software Control'
* |
* | S3 2 MDM Utilities
* | 'Clear Latched Data in BST A'
* |
* | cmd Clear Execute
*****
```

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10.3 Transitioning S3 2 MDM to Normal State

CDH Summary: S3 2

S3 2 MDM

sel Processing State

S3 2 Processing State Transitions

'Current State'

cmd Transition to Normal State **Execute**

Wait 60 seconds.

10.4 Verifying S3 2 MDM in Normal State

CDH Summary: S3 2

S3 2 MDM

Verify Frame Count – incrementing

Verify Processing State – Normal

10.5 Enabling S3 2 MDM RT FDIR

CDH Summary: S3 2

S3 2 MDM

sel LB SYS S2

LB SYS S2

sel RT Status

LB SYS S2 RT Status

cmd 16 S3 2 MDM RT FDIR Status – Enable **Execute**
(Verify – Ena)

10.6 Verifying S3 2 MDM SEPS Control

S3 2 MDM

'SPD 1'

Verify UB SEPS S3 14 – RT

Verify UB SEPS S3 23 – RT

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10.7 Enabling SEPS Control 23 in S3 2 MDM

CDH Summary: S3 2 MDM

'Software Control'

sel Applications

cmd UB_SEPS_S3_23 – Ena **Execute** (Verify – Ena)

'SPD 1'

Verify UB_SEPS_S3_23 – BC

10.8 Verifying S3 1 MDM Heater Control is Closed Loop

CDH Summary: S3 1

sel S3-1 MDM Heater

√Heater Control – Closed_Loop

10.9 Verifying S3 2B/3A RPCM Integration Counters

S3: EPS

sel RPCM S32B A

Verify Integ Cnt – incrementing

sel RPCM S33A [X] where [X] =

Verify Integ Cnt – incrementing

Repeat

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10.10 Enabling PTCS in MDM S3 2

CDH Summary: S3 2 MDM

S3 2 MDM

'Software Control'

sel Applications

S3 2 Applications

cmd PTCS – Ena **Execute** (Verify – Ena)

10.11 Inhibiting Utility Rail Survival Heaters

CAUTION

Scan 44 identified multi-element heaters that are susceptible to heater burnthrough. These include the Utility Rail Heaters on S3. PPLs that would prevent this configuration have not been delivered. Therefore, user action is required to mitigate this risk of heater burnthrough.

S3: EPS: S3 Rail Heaters

S3 Rail Heaters

'S31A Survival (Htr 1)'

cmd Inhibit – Arm (Verify Avail Status – Inh Arm)

cmd Inhibit – Inhibit (Verify Avail Status – Inh)

√RPC Position – Op

'S34B Survival (Htr 1)'

cmd Inhibit – Arm (Verify Avail Status – Inh Arm)

cmd Inhibit – Inhibit (Verify Avail Status – Inh)

√RPC Position – Op

10.12 Enabling SARJ Controller in MDM S3 2

CDH Summary: S3 2 MDM

S3 2 MDM

'Software Control'

sel Applications

S3 2 Applications

cmd SARJ Controller – Ena **Execute** (Verify – Ena)

11. DEACTIVATING DDCU S14B AND VERIFYING MBSU RBI 1 CONFIGS**NOTE**

Prior to removing Channel 4B power, it is necessary to ensure that the downstream EPS ORUs do not have ORU health flags set (i.e., EEPROM Bit Flips). If the health flag is set due to an ORU flip bit, failure to check the ORU health prior to powering it down may result in loss of ORU function upon powering it back. If repowered, these ORUs will boot from unhealthy EEPROM Firmware.

11.1 Verifying RPCM S01A-B RPC 2 Open

EPS Summary: S0: RPCM S01A B

sel RPC 2

RPCM S01A B RPC 2

√RPC Position – Op

√Close Cmd – Inh

11.2 Verifying MBSU 1 RBI 1 and RBI 8 are Open

EPS Summary: S0

sel MBSU 1

MBSU 1

√RBI 1 Position – Open

Verify RBI 1 Voltage = -4.2 to 4.2 V

√RBI 8 Position – Open

Verify RBI 8 Voltage = -4.2 to 4.2 V

sel RBI 1

MBSU 1 RBI 1

√Close Cmd – Inh

EPS Summary: S0: MBSU 1: RBI 8

MBSU 1 RBI 8

√Close Cmd – Inh

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11.3 Inhibiting RT FDIR on ORUs and DDCU S14B

NOTE

1. Inhibit RT FDIR to RTs that will lose power, but will still be monitored during the powerdown (i.e., RPCMs).
2. Expect multiple loss of comm messages when DDCU S14B converter powered off.
3. ODIN to perform via command script.

CDH Summary: Primary EXT MDM

Primary EXT MDM

sel LB MT 1
sel RT Status
sel RT Status Cont. RT#16-25

LB MT 1 RT Status Cont.

cmd '25 RPCM MT 4B A' RT FDIR Status – Inhibit FDIR **Execute**
(Verify – Inh)

CDH Summary: S1 1 MDM

S1 1 MDM

sel UB SEPS S1 14
sel RT Status

S1 1 UB SEPS S1 14 RT Status

cmd RPCM S14B [X] RT FDIR Status – Inhibit FDIR **Execute**
(Verify – Inh) where [X] = [E] [F] [G]

CDH Summary: S0 1 MDM

S0 1 MDM

sel UB SEPS S0 14
sel RT Status

S0 1 UB SEPS S0 14 RT Status

cmd RPCM S04B [X] RT FDIR Status – Inhibit FDIR **Execute**
(Verify – Inh) where [X] = [A] [B] [C] [D] [E] [F]

CDH Summary: P1 1 MDM

P1 1 MDM

sel UB SEPS P1 14
sel RT Status

P1 1 UB SEPS P1 14 RT Status

cmd RPCM P14B [X] RT FDIR Status – Inhibit FDIR **Execute**
(Verify – Inh) where [X] = [E] [F] [G]

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CDH Summary: P3 1 MDM

P3 1 MDM

sel UB SEPS P3 14

sel RT Status

P3 1 UB SEPS P3 14 RT Status

cmd RPCM P34B [X] RT FDIR Status – Inhibit FDIR **Execute**

(Verify – Inh) where [X] = [C] [E] [F]

CDH Summary: Primary PMCU MDM

MDM Primary PMCU

sel LB PMCU 1

sel RT Status

LB PMCU 1 RT Status

cmd '18 DDCU S1 4B' RT FDIR Status – Inhibit FDIR **Execute**

(Verify – Inh)

11.4 Deactivating DDCU S14B

EPS Summary: S1: DDCU S14B

DDCU S14B

sel Converter

DDCU S14B Converter

'Converter'

cmd Off (1-step command, arm not required)

√Output Voltage < 12.8 V

MCC-H ↑ ISS, "Go to connect zenith tray utilities."

11.5 Receiving GO for Channel 1/4 Powerup

NOTE

Crew will give GO for powerup after zenith tray connections completed.

ISS ↓ **MCC-H**, "Go for zenith tray powerup."

12. ACTIVATING DDCU S14B

12.1 Activating DDCU S14B

EPS Summary: S0: DDCU S14B

DDCU S14B

sel Converter

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DDCU S14B Converter

'Converter'

cmd Converter On – Arm

cmd Converter On – On

DDCU S14B

√Input Current: -4 to 4 A

√Input Voltage: 146 to 165 V

√Out Current: -4 to 4 A

√Out Voltage: 120.2 to 128.8 V

√Converter Temp: -37.3 to 43.8° C

√Power Supply Temp: -37.3 to 49.5° C

√Baseplate Temp: -37.3 to 40.3° C

12.2 Powering On S3 1 MDM and RPCM S31A-A

S3: EPS

sel RPCM S01A B RPC 02

RPCM S01A B RPC 02

Verify Integration Counter – incrementing

√Close Cmd – Ena

cmd RPC Position – Close (Verify – Cl)

NOTE

Closing the S01A B RPC 2 will immediately provide power to the S3-1 MDM through RPCM S31A A RPC 1 as this RPC is launched in the preset closed position.

Wait 5 minutes for MDM to go through bootup and POST.

12.3 Closing MBSU 1 RBI 1

S0: EPS: MBSU 1

MBSU 1

sel RBI 1

MBSU 1 RBI 1

'HOT Cross Tie – PMCA R3'

'MBSU 1 Hot Cross Tie'

cmd Enable – Arm

cmd Enable – Enable

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Verify MBSU 1 Hot Cross Tie – Ena

cmd Close – Arm

cmd Close – Close (Verify – Cl)

Verify MBSU 1 RBI 1 Voltage: 148 to 163 V

'HOT Cross Tie – PMCA R3'

'MBSU 1 Hot Cross Tie'

cmd Inhibit – Arm

cmd Inhibit – Inhibit

Verify MBSU 1 Hot Cross Tie – Inh

13. ACTIVATING AND C/O S3 1 MDM

13.1 Enabling S3 1 MDM RT

CDH Summary: S3 1

sel LB SYS S1

sel RT Status

cmd '16 S3 1 MDM' RT Status – Enable **Execute** (Verify – Ena)

13.2 Verifying S3 1 MDM Status in Wait State

'S3 1 MDM'

Verify Frame Count – incrementing

Verify Processing State – Wait

'MDM ID'

√Sync Status – In Sync

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```
*****
* If not In Sync
* | sel Sync Status
* |
* | S3 1 Sync Status
* |
* | cmd Sync To BIA Execute
* |
* | Wait at least 30 seconds.
* |
* | S3 1 MDM
* |
* | Verify Sync Status – In Sync
*****
```

sel MDM BIT Status

S3 1 MDM BIT Summary Table A
'Word 1: Summary'

Record all non-blank fields.

Table 30.

Hard Fail	
Rev. Soft Fail	
Soft Fail	
POST Stat	
BIT Stat	
I/O Bus Stat	
I/O List Stat	
SX Card Slot	
I/O BIT Stat	
POST in Prog	

```
*****
* If BST not blank
* | CDH Summary: S3-1 MDM: MDM Utilities
* | 'Software Control'
* |
* | S3 1 MDM Utilities
* | 'Clear Latched Data in BST A'
* |
* | cmd Clear Execute
*****
```

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13.3 Transitioning S3 1 MDM to Normal State

CDH Summary: S3 1

S3 1 MDM

sel Processing State

S3 1 Processing State Transitions

'Current State'

cmd Transition to Normal State **Execute**

Wait 60 seconds.

13.4 Verifying S3 1 MDM in Normal State

CDH Summary: S3 1

S3 1 MDM

Verify Frame Count – incrementing

Verify Processing State – Normal

13.5 Enabling S3 1 MDM RT FDIR

CDH Summary: S3 1

S3 1 MDM

sel LB SYS S1

LB SYS S1

sel RT Status

LB SYS S1 RT Status

cmd '16 S3 1 MDM' RT FDIR Status – Enable **Execute**
(Verify – Ena)

13.6 Verifying S3 1 MDM SEPS Control

S3 1 MDM

'SPD 1'

Verify UB SEPS S3 14 – RT

Verify UB SEPS S3 23 – RT

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13.7 Enabling SEPS Control 14 in S3 1 MDM

CDH Summary: S3 1 MDM

'Software Control'

sel Applications

cmd UB_SEPS_S3_14 – Ena **Execute** (Verify – Ena)

'SPD 1'

Verify UB_SEPS_S3_14 – BC

13.8 Verifying S3 2 MDM Heater Control is Closed Loop

CDH Summary: S3 2

sel S3-2 MDM Heater

√Heater Control – Closed_Loop

13.9 Verifying S3 2B/3A RPCM Integration Counters

S3: EPS

sel RPCM S31A A

Verify Integ Cnt – incrementing

sel RPCM S34B [X] where [X] =

Verify Integ Cnt – incrementing

Repeat

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13.10 Inhibiting S3 Utility Rail Survival Heaters RPCs

NOTE

Scan 44 identified multi-element heaters that are susceptible to heater burnthrough. These include the Utility Rail Heaters on S3. PPLs that would prevent this configuration have not been delivered. Since these individual heaters can not be inhibited prior to enabling the S3-1 PTCS Logic Thread, these heaters RPCs are close inhibited.

S3: EPS: S3 Rail Heaters: RPCM S34B C RPC 02

RPCM S34B C RPC 02

cmd Close Command – Inhibit (Verify – Inh)

√RPC Position – Op

S3: EPS: S3 Rail Heaters: RPCM S34B C RPC 01

RPCM S34B C RPC 01

cmd Close Command – Inhibit (Verify – Inh)

√RPC Position – Op

13.11 Enabling PTCS in MDM S3 1

CDH Summary: S3 1 MDM

S3 1 MDM

'Software Control'

sel Applications

S3 1 Applications

cmd PTCS – Ena **Execute** (Verify – Ena)

13.12 Inhibiting S3 Utility Rail Survival Heaters

S3: EPS: S3 Rail Heaters

S3 Rail Heaters

'S32B Survival (Htr 1)'

cmd Inhibit – Arm (Verify Avail Status – Inh Arm)

cmd Inhibit – Inhibit (Verify Avail Status – Inh)

'S33A Survival (Htr 1)'

cmd Inhibit – Arm (Verify Avail Status – Inh Arm)

cmd Inhibit – Inhibit (Verify Avail Status – Inh)

13.13 Enabling S3 Utility Rail Survival Heaters RPCs

S3: EPS: S3 Rail Heaters: RPCM S34B C RPC 02

RPCM S34B C RPC 02

cmd Close Command – Enable (Verify – Ena)

S3 ACTIVATION

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S3: EPS: S3 Rail Heaters: RPCM S34B C RPC 01

RPCM S34B C RPC 01

cmd Close Command – Enable (Verify – Ena)

13.14 Enabling SARJ Controller in MDM S3 1

CDH Summary: S3 1 MDM

S3 1 MDM

'Software Control'

sel Applications

S3 1 Applications

cmd SARJ Controller – Ena **Execute** (Verify – Ena)

14. LOADING DEFAULT PPLs INTO EEPROM OF PMCU MDMs

NOTE

ODIN will load new default ORU Existence Table PPL to the Primary and Backup PMCU MDMs.

15. REENABLING FDIR ON ORUS AND DDCUS

15.1 Enabling RT FDIR on DDCU P13A and ORUs

NOTE

1. Enable RT FDIR to RTs from step 3.3.
2. ODIN to perform via command script.

CDH Summary: S0 2 MDM

S0 2 MDM

sel UB SEPS S0 23

sel RT Status

S0 2 UB SEPS S0 23 RT Status

cmd RPCM S03A [X] RT FDIR Status – Enable FDIR **Execute**

(Verify – Ena) where [X] = [A] [B] [C] [D] [E] [F]

CDH Summary: Primary EXT MDM

Primary EXT MDM

sel LB MT 1

sel RT Status

sel RT Status Cont. RT#16-25

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LB MT 1 RT Status Cont

cmd '23 RPCM MT 3A A' Enable FDIR **Execute** (Verify – Ena)

CDH Summary: S1 2 MDM

S1 2 MDM

sel UB SEPS S1 23

sel RT Status

S1 2 UB SEPS S1 23 RT Status

cmd RPCM S13A [X] RT FDIR Status – Enable FDIR **Execute**
(Verify – Ena) where [X] = [E] [F] [G]

CDH Summary: P1 2 MDM

P1 2 MDM

sel UB SEPS P1 23

sel RT Status

P1 2 UB SEPS P1 23 RT Status

cmd RPCM P13A [X] RT FDIR Status – Enable FDIR **Execute**
(Verify – Ena) where [X] = [E] [F] [G]

CDH Summary: P3 2 MDM

P3 2 MDM

sel UB SEPS P3 23

sel RT Status

P3 2 UB SEPS P3 23 RT Status

cmd RPCM P33A [X] RT FDIR Status – Enable FDIR **Execute**
(Verify – Ena) where [X] = [C] [E] [F]

CDH Summary: Primary PMCU MDM

Primary PMCU MDM

sel LB PMCU 2

sel RT Status

LB PMCU 2 RT Status

cmd '18 DDCU P1 3A' RT FDIR Status – Enable FDIR **Execute**
(Verify – Ena)

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15.2 Enabling RT FDIR on ORUs and DDCU S14B

NOTE

1. Enable RT FDIR to RTs from step 11.3.
2. ODIN to perform via command script.

CDH Summary: Primary EXT MDM

Primary EXT MDM

sel LB MT 1
sel RT Status
sel RT Status Cont. RT#16-25

LB MT 1 RT Status Cont.

cmd '25 RPCM MT 4B A' RT FDIR Status – Enable FDIR **Execute**
(Verify – Ena)

CDH Summary: S1 1 MDM

S1 1 MDM

sel UB SEPS S1 14
sel RT Status

S1 1 UB SEPS S1 14 RT Status

cmd RPCM S14B [X] RT FDIR Status – Enable FDIR **Execute**
(Verify – Ena) where [X] = [E] [F] [G]

CDH Summary: S0 1 MDM

S0 1 MDM

sel UB SEPS S0 14
sel RT Status

S0 1 UB SEPS S0 14 RT Status

cmd RPCM S04B [X] RT FDIR Status – Enable FDIR **Execute**
(Verify – Ena) where [X] = [A] [B] [C] [D] [E] [F]

CDH Summary: P1 1 MDM

P1 1 MDM

sel UB SEPS P1 14
sel RT Status

P1 1 UB SEPS P1 14 RT Status

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cmd RPCM P14B [X] RT FDIR Status – Enable FDIR **Execute**
(Verify – Ena) where [X] = [E] [F] [G]

CDH Summary: P3 1 MDM

P3 1 MDM

sel UB SEPS P3 14
sel RT Status

P3 1 UB SEPS P3 14 RT Status

cmd RPCM P34B [X] RT FDIR Status – Enable FDIR **Execute**
(Verify – Ena) where [X] = [C] [E] [F]

CDH Summary: Primary PMCU MDM

Primary PMCU MDM

sel LB PMCU 1
sel RT Status

LB PMCU 1 RT Status

cmd '18 DDCU S1 4B' RT FDIR Status – Enable FDIR **Execute**
(Verify – Ena)

15.3 Enabling Auto Transition to Diag in the PMCU and PL MDMs

CDH Summary

sel Primary PMCU MDM

Primary PMCU MDM

sel Processing State

PCMU Processing State Transitions

cmd Auto Transition to Diag Enable **Execute** (Verify – Ena)

sel Primary PL MDM

Primary PL MDM

sel Processing State

PL Processing State Transitions

cmd Auto Transition to Diag Enable **Execute** (Verify – Ena)

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PCS 15.4 Configuring STR MDM Survival Heaters
CDH Summary: STR MDM: STR Surv Htr:
STR Survival Heater

sel RPCM S13A G RPC 11

RPCM S13A G RPC 11
'RPC Position'

√RPC Position – CI

15.5 Configuring PTR MDM Survival Heaters
CDH Summary: PTR MDM: PTR Surv Htr:
PTR Survival Heater

sel RPCM P14B G RPC 11

RPCM P14B G RPC 11
'RPC Position'

√RPC Position – CI

16. REPOWERING ITS S0, S1, P1 AND P3 LOADS

16.1 Powering MBS Prime to Keep-Alive

MSS: MBS: MCU

MCU

cmd 'Prime' Keep-Alive (Verify – Keep-Alive)

Table 31.

Ops Name	CIPUI
MBS_Power_Keep_Alive_Prime	CMRM96IM0201K

16.2 Verifying TUS 1 Gearbox Heater Activation

MSS: MT: Thermal: 'RPCM S04B F' Heater 3

MT TUS 1 Gearbox Heater

√'Htr Availability' – ENA

Table 32.

Ops Name	CIPUI
PTCS_MSS_MT_TUS_1_Htr_Ena	S0TH96IM0011K

√'Control Mode State' – Closed Loop

Table 33.

Ops Name	CIPUI
PTCS_MSS_MT_TUS_1_Htr_Closed_Loop	S0TH96IM0188K

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16.3 RPCM MT4B Powerup

MSS: MT: RPCM MT-4B: RPCM S04B F

RPCM S04B F RPC 17

Verify 'Integration Counter' – incrementing

cmd 'RPC Position' – Close (Verify – CI)

Table 34.

Ops Name	CIPUI
RPCM_S04B_F_RPC_17_MSS_MT_4B_CI	S0PR96IM0320K

MSS: MT: RPCM MT-4B

RPCM_MT4B_A

Verify 'Integration Counter' – incrementing

16.4 MT-4B Heater and Amp Power Activation

MSS: MT: Thermal: RPCM-MT-4B

RPCM MT4B A Details

sel RPC [X] where [X] =

RPCM MT4B A RPC [X]

cmd 'RPC Position' – Close (Verify – CI)

Repeat

Table 35.

RPC	Ops Name	CIPUI
8	RPCM_MT4B_A_RPC_08_MSS_MT_IUA_Htr_1_UMA_Htr_2_CI	S0PR96IM0329K
12	RPCM_MT4B_A_RPC_12_MSS_MT_LTU_Htr_1_CI	S0PR96IM0333K
13	RPCM_MT4B_A_RPC_13_MSS_MT_AMP_1_Htr_1_and_Operational_Pwr_CI	S0PR96IM0334K
14	RPCM_MT4B_A_RPC_14_MSS_MT_AMP_2_Htr_1_and_Operational_Pwr_CI	S0PR96IM0335K
16	RPCM_MT4B_A_RPC_16_MSS_MT_ED_Htr_2_RSU_Htr_1_CI	S0PR96IM0337K

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16.5 Activating TUS-2 Video Signal Converter Heater 2

MSS: MT: Thermal: RPCM-S0-4B-E: RPC 4

RPCM S04B E RPC 04

cmd 'RPC Position' – Close (Verify – CI)

Table 36.

Ops Name	CIPUI
RPCM_S04B_E_RPC_04_MSS_ MT_TUS_2_VSC_Htr_2_CI	S0PR96IM0289K

16.6 Activating TUS-2 Video Signal Converter Power 2

MSS: MT: Thermal: RPCM-S0-4B-E: RPC 2

RPCM S04B E RPC 02

cmd 'RPC Position' – Close (Verify – CI)

Table 37.

Ops Name	CIPUI
RPCM_S04B_E_RPC_02_MSS_ MT_TUS_2_VSC_Pwr_1_CI	S0PR96IM0287K

16.7 Activating TUS-1 Video Signal Converter Heater 1

MSS: MT: Thermal: RPCM-S0-4B-F: RPC 4

RPCM S04B F RPC 04

cmd 'RPC Position' – Close (Verify – CI)

Table 38.

Ops Name	CIPUI
RPCM_S04B_F_RPC_04_MSS_ MT_TUS_1_VSC_Htr_1_CI	S0PR96IM0307K

16.8 Activating TUS-1 Video Signal Converter Power 1

MSS: MT: Thermal: RPCM-S0-4B-F: RPC 2

RPCM S04B F RPC 02

cmd 'RPC Position' – Close (Verify – CI)

Table 39.

Ops Name	CIPUI
RPCM_S04B_F_RPC_02_MSS_ MT_TUS_1_VSC_Pwr_1_CI	S0PR96IM0305K

16.9 RPCM MT-4B Closed Loop Heater Activation

MSS: MT: Thermal: 'RPCM-MT-4B' RPC 15

RPCM MT 4B Bracket Heater

√'Htr Availability' Ena – ENA

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Table 40.

Ops Name	CIPUI
PTCS_RPCM_Brkt_Htr1_Ena	S0TH96IM0000K

cmd 'Control Mode State' Closed Loop (Verify – Closed Loop)

Table 41.

Ops Name	CIPUI
PTCS_RPCM_Brkt_Htr1_Closed_Loop	S0TH96IM00006K

16.10 IUA Cable Cutter Close Inhibits

NOTE

ROBO will perform this sub-step via a command script.

MSS: MT: RPCM MT4B

RPCM_MT4B_A

sel RPC [X] where [X] = 3 6 17

RPCM MT4B A RPC [X]

cmd Close Cmd Inhibit (Verify – Inh)

Repeat

Table 42.

Ops Name	CIPUI	Owner
RPCM_MT4B_A_RPC_3_CI_Inh	S0PR96IM0378K:1	PHALCON
RPCM_MT4B_A_RPC_6_CI_Inh	S0PR96IM0378K:2	PHALCON
RPCM_MT4B_A_RPC_17_CI_Inh	S0PR96IM0378K:3	PHALCON

MSS: MT: RPCM MT3A

RPCM_MT3A_A

sel RPC [X] where [X] = 3 6 17

RPCM MT3A A RPC [X]

cmd Close Cmd Inhibit (Verify – Inh)

Repeat

Table 43.

Ops Name	CIPUI	Owner
RPCM_MT3A_A_RPC_3_CI_Inh	S0PR96IM0379K:1	PHALCON
RPCM_MT3A_A_RPC_6_CI_Inh	S0PR96IM0379K:2	PHALCON
RPCM_MT3A_A_RPC_17_CI_Inh	S0PR96IM0379K:3	PHALCON

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16.11 VDS Trunkline Configuration

NOTE

VDS Trunkline Configuration and VDS Activation (steps 16.11 and 16.12) can be performed in parallel to reduce execution time.

Perform {4.602 [VDS TRUNKLINE CONFIGURATION](#)}, step 4 for USOS TLs 19, 20, 21 and 22; step 8 for MSS TLs 1, 8 and 9 (SODF: C&T: NOMINAL: VIDEO), then:

Confirm all other TLs are available.

16.12 VDS Activation

For EVSU 3 Ops Pwr only

Perform {1.601 [VDS ACTIVATION](#)}, steps 21 to 23 (SODF: C&T: ACTIVATION AND CHECKOUT: VIDEO), then:

16.13 Coordinating with ISS Crew

MCC-H notifies ISS crew that full video routing capability has been restored.

16.14 ESP-2 Heater Repower

S0: EPS: RPCM S04B-F

RPCM_S04B_F

sel RPC [X] where [X] =

cmd 'RPC Position' – Close (Verify – Cl)

Repeat

CAUTION

The Operational and Survival Rail Heaters for a single power bus should never be powered at the same time. The following commands could place some heaters at risk of damage (SCAN-44 heaters). Reconfiguration of the redundant heater strings may be necessary.

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16.15 Recovering Redundant Utility Rail Heaters

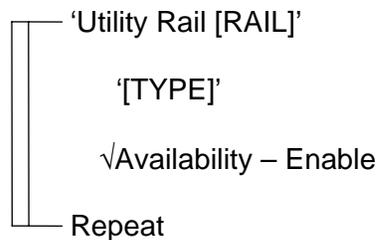
Table 44. Redundant Utility Rail Heaters

Truss [XX]	Display [DISPLAY]	Utility Rail [RAIL]	Heater Type [TYPE]
P1	Pwr Buses P12B P13A Rail Htrs	P12B	Survival
S0	Pwr Bus S01A Rail Htrs	S01A	Survival
S0	Pwr Bus S02B Rail Htrs	S02B	Survival
S0	Pwr Bus S03A Rail Htrs	S03A	Survival
S0	Pwr Bus S04B Rail Htrs	S04B	Operational
S1	Pwr Buses S12B S13A Rail Htrs	S13A	Survival
S1	Pwr Buses S11A S14B Rail Htrs	S14B	Operational

Refer to Table 44 for [XX], [DISPLAY], [RAIL], and [TYPE] references that follow.

[XX]: [DISPLAY]

[DISPLAY]



16.16 Recovering P1 1/4 Rail Heaters

P1: EPS: Pwr Buses P11A and P14B Rail Heaters

Pwr Buses P11A P14B Rail Htrs

'Utility Rail P11A'

'Operational Htr'

√Availability – Inhibit

'RPC Position'

√RPC Position – Op

'Survival Htr'

√Availability – Enable

If Temp, deg C < -23

√RPC Position – CI

Wait until Temp, deg C > -23

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'Operational Htr'

√Availability – Enable

'Utility Rail P14B'

'Survival Htr'

√Availability – Inhibit

'RPC Position'

√RPC Position – Op

'Operational Htr'

√Availability – Enable

If Temp, deg C < -23

√RPC Position – Cl

Wait until Temp, deg C > -23

'Survival Htr'

√Availability – Enable

16.17 Recovering P1 2/3 Rail Heaters

P1: EPS: Pwr Buses P12B and P13A Rail Heaters

Pwr Buses P12B P13A Rail Htrs

'Utility Rail P13A'

'Operational Htr'

√Availability – Inhibit

'RPC Position'

√RPC Position – Op

'Survival Htr'

√Availability – Enable

If Temp, deg C < -23

√RPC Position – Cl

Wait until Temp, deg C > -23

'Operational Htr'

√Availability – Enable

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16.18 Recovering P3 1/4 Rail Heaters

P3: EPS: P3 Rail Heaters

P3 Rail Heaters

'Utility Rail [XX]' where [XX] = P31A P34B

'Survival Htr'

√Availability – Inhibit

'RPC Position'

√RPC Position – Op

'Operational Htr'

√Availability – Enable

Repeat

16.19 Recovering P3 2/3 Rail Heaters

P3: EPS: P3 Rail Heaters

P3 Rail Htrs

'Utility Rail [XX]' where [XX] = P32B P33A

'Survival Htr'

√Availability – Inhibit

'RPC Position'

√RPC Position – Op

'Operational Htr'

√Availability – Enable

Repeat

16.20 Recovering S1 2/3 Rail Heaters

S1: EPS: Pwr Buses S12B and S13A Rail Heaters

Pwr Buses S12B S13A Rail Htrs

'Utility Rail S12B'

'Operational Htr'

√Availability – Inhibit

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'RPC Position'

√RPC Position – Op

'Survival Htr'

√Availability – Enable

If Temp, deg C < -23

√RPC Position – Cl

Wait until Temp, deg C > -23

'Operational Htr'

√Availability – Enable

17. [CONFIGURING 1553 DATA BUS TO CH A](#)

[Configuring 1553 to Channel A](#)

C&DH Summary: Primary PMCU

[Primary PMCU MDM](#)

sel LB_PMCU-1

sel Bus Status

[LB PMCU 1 Bus Status](#)

cmd select channel – A **Execute**

Verify channel selected – A

C&DH Summary: Primary PMCU

[Primary PMCU MDM](#)

sel LB_PMCU-3

sel Bus Status

[LB PMCU 3 Bus Status](#)

cmd select channel – A **Execute**

Verify channel selected – A

C&DH Summary: Primary EXT

[Primary Ext MDM](#)

sel LB_Sys_S-1

sel Bus Status

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LB Sys S-1 Bus Status

cmd select channel – A **Execute**

Verify channel selected – A

Primary Ext MDM

sel LB_Sys_S-2
sel Bus Status

LB Sys S-2 Bus Status

cmd select channel – A **Execute**

Verify channel selected – A

Primary Ext MDM

sel LB_Mech_S-1
sel Bus Status

LB Mech S-1 Bus Status

cmd select channel – A **Execute**

Verify channel selected – A

Primary Ext MDM

sel LB_Mech_S-2
sel Bus Status

LB Mech S-2 Bus Status

cmd select channel – A **Execute**

Verify channel selected – A

C&DH Summary: Primary PL

Primary PL MDM

sel LB_PL_1
sel Bus Status

LB PL 1 Bus Status

cmd select channel – A **Execute**

Verify channel selected – A

S3 ACTIVATION

(ASSY OPS/13A/FIN 1)

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CDH Summary

CDH Summary

sel Primary C&C MDM

Primary C&C MDM

sel CB CT-1

sel Bus Status

CB CT-1 Bus Status

cmd select channel – A **Execute**

Verify channel selected – A

18. PERFORMING POWER ON RESET

For RPCMs [XX]

Perform {5.420 RPCM POWER ON RESET} (SODF: GND SYSTEMS: EPS: CORRECTIVE: SECONDARY POWER SYSTEM).

19. C&W CONFIGURATIONS

NOTE

1. ODIN will enable the applicable 13A Caution and Warning events in the C&C MDM.
2. If a change to the C&W PPL in the Primary C&C is required, the PPL will need to be incorporated prior to the EVA as the C&C MDMs will require a State transition to incorporate.

S3/S4 ACTIVATION FLOWCHART

(ASSY OPS/13A/FIN 1) Page 2 of 2 pages

Tray	CNNCTR	Function	Inhibit	Verification Feedback
ZENITH	P1 TO J1	S4 1A Pri Pwr to S0 Ch 1A MBSU	MBSU 1 RBI 1 OPEN	1.108 S4 PVCU MDM ACTIVATION AND CHECKOUT (SODF: C&DH: ACTIVATION AND CHECKOUT): step 4 for 1A Ch
	P2 TO J2	S6 1B Pri Pwr to S0 Ch 1B MBSU	MBSU 1 RBI 8 OPEN	15A mission
	P3 TO J3	RPCM S01A_B Sec Pwr to RPCM S13A	RPCM S01A B RPC 2 OPEN	Step 13.2: S3 Activation (checked in 13.9 per procedure)
	P4 TO J4	DDCU S14B Sec Pwr to RPCM S34B	DDCU S14B CONVERTER OFF	Step 13.2: S3 Activation (checked in 13.9 per procedure)
	P5 TO J5	EXT MDM 1553 CH A	None Required	Step 17: 1553 buses to Ch A
	P6 TO J6	HRDL (PAS 2/3) & Video	None Required	PAS C/O (post 13A)
NADIR	P11 TO J11	S4 3A Pri Pwr to S0 Ch 3A MBSU	MBSU 3 RBI 1 OPEN	1.108 S4 PVCU MDM ACTIVATION AND CHECKOUT (SODF: C&DH: ACTIVATION AND CHECKOUT): step 4 for 3A Ch
	P12 TO J12	S6 3A Pri Pwr to S0 Ch 3B MBSU	MBSU 3 RBI 8 OPEN	15A mission
	P13 TO J13	RPCM S02B_B Sec Pwr to RPCM S32B	RPCM S02B B RPC 2 OPEN	Step 10.2: S3 Activation (checked in 10.9 per procedure)
	P14 TO J14	DDCU P13A Sec Pwr to RPCM S33A	DDCU P13A CONVERTER OFF	Step 10.2: S3 Activation (checked in 10.9 per procedure)
	P15 TO J15	EXT MDM 1553 CH B	None Required	Step 10.2: S3-2 MDM bootup
	P16 TO J16	HRDL (PAS 1/4)	None Required	PAS C/O (post 13A)
	P17 TO J17	INSTM	None Required	SDMS data take (post 13A)

54

1.3.450 SAW XX SABB INITIAL UNLATCH

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OBJECTIVE:

This procedure will unlatch the blanket boxes and release the Blanket Restraint System (BRS) pins for a single USOS solar array wing. Steps are also included to relatch the blanket boxes in order to protect the hardware from on-orbit loads until the wing can be fully deployed.

CAUTION	
1.	To avoid damage to solar array hardware, all PVM Upper and Lower EPS Prep EVA activities must be completed prior to performing this procedure. Upper and Lower EPS Prep includes the deployment of the 4-bar linkage, the release of three bolts on the Mast tip fitting and rotation of the blanket boxes 90 degrees from the launch configuration.
2.	This procedure assumes that the associated BGA and the nearest SARJ are locked. This procedure can also be performed, if the SARJ launch restraints are still in place. The solar array hardware could be damaged if a Solar Array Blanket Box (SABB) unlatch is attempted while the BGA and SARJ are rotating.
3.	Steps that involve mechanical motion (e.g., latch, unlatch, deploy, retract) of the SAW hardware must <ol style="list-style-type: none">Be performed during insolation to support crew visual cues.Be performed with ISS and orbiter thrusters inhibited to avoid damage to solar array mechanisms.

NOTE

MCC-H will be primary for performing all steps if video downlink is available. If crew is available, they may elect to perform the visual verification steps 2.3, 2.9, 3.8, 4.3, 4.9, and 5.8.

1. CONFIRMING STATUS (MCC-H)

1.1 Verifying EPS Prep Complete

Verify Upper(Lower) EPS Prep has been completed by EVA crew. Refer to Table 1 for PVM and EVA reference.

Table 1. PVM and EVA Reference

PVM	XX	EVA Ref
S4	1A	LWR
S4	3A	UPR
S6	1B	UPR
S6	3B	LWR
P4	2A	LWR
P4	4A	UPR
P6	2B	UPR
P6	4B	LWR

1.3.450 SAW XX SABB INITIAL UNLATCH

(EPS/E12 - ALL/FIN 1) Page 2 of 26 pages

1.2 Verifying ECU Activation Complete

Verify **MCC-H** has completed {1.3.400 ECU XX ACTIVATION}
(SODF: EPS: ACTIVATION AND CHECKOUT: CHANNEL
ACTIVATION), then:

PCS

1.3 Verifying Comm with SAW Controller

PVM: EPS: SAW XX

SAW XX

'ECU XX'

Verify ECU/SAW Integration Counter – incrementing

1.4 Verifying Initial SAW C&W Flags and MDA Data

Configure for continuous data dump of SAW XX. To build dump
command, perform {1.230 CCS BUILD DATA DUMP COMMAND}
(SODF: GND: AVIONICS: C&DH: NOMINAL). For unique PVCU
start location addresses, refer to {5.294 EPS MDM BDT/50Hz
ADDRESS} (SODF: GND: SYSTEMS: EPS: NOMINAL), for SAW
XX with 1 Hz Data Collection, 224 words.

WARNING

Verify EVA crew is clear of SAW XX SABB mechanisms
before proceeding.

NOTE

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

2. UNLATCHING LEFT BLANKET BOX (LBB)

PCS

2.1 Verifying Temperatures are Within Nominal Ranges Prior to Unlatch

PVM: EPS: SAW XX

SAW XX

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

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

Verify LBB MDA Temp, deg C: -54 to 48

2.2 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 XX

'LBB'

sel LBB Commands

1.3.450 SAW XX SABB INITIAL UNLATCH

(EPS/E12 - ALL/FIN 1) Page 3 of 26 pages

SAW XX LBB Commands

'MDA'
'Power'

cmd On – Arm

cmd On – On

√MDA Voltage, V: 120 to 125

2.3 Performing Initial SABB Visual Verification Via Cameras

ISS must be in insolation to perform this verification.

NOTE

1. Crew or **MCC-H**, if video is available, perform a visual verification prior to, during, and at the completion of each blanket box unlatch operation. There are eight latches and seven BRS pins to be released for each blanket box prior to SAW deployment. Seven gold colored posts protrude through the containment box base to provide visual indication of successful pin release.

SAW 4A LBB = Aft Zenith SABB (when Port SARJ = 180 deg, BGA 4A = 0 deg) Fwd Nadir SABB (when

Port SARJ = 0 deg, BGA 4A = 60 deg)

SAW 2A LBB = Fwd Nadir SABB (when Port SARJ = 180 deg BGA 2A = 0 deg) Aft Zenith SABB (when

Port SARJ = 0 deg, BGA 2A = 300 deg)

SAW 3A LBB = Aft Nadir SABB (when Stbd SARJ = 0 deg, BGA 3A = 0 deg)

SAW 1A LBB = Fwd Zenith SABB (when Stbd SARJ = 0 deg, BGA 1A = 0 deg)

SAW 4B LBB = Aft Zenith SABB (when Port SARJ = 0 deg, BGA 4B = 0 deg)

SAW 2B LBB = Fwd Nadir SABB (when Port SARJ = 0 deg BGA 2B = 0 deg)

SAW 3B LBB = Fwd Zenith SABB (when Stbd SARJ = 0 deg, BGA 3B = 0 deg)

SAW 1B LBB = Aft Nadir SABB (when Stbd SARJ = 0 deg, BGA 1B = 0 deg)

2. The BRS Pin status can be ignored for arrays on the P6 truss, or SABBs that have been previously unlatched. They have already been released.

Refer to Figure 1 for SABB launch configuration.

Verify BRS Pin (seven) – Restraint pins engaged

Verify Latch Position (four of eight) – Latched

1.3.450 SAW XX SABB INITIAL UNLATCH

(EPS/E12 - ALL/FIN 1)

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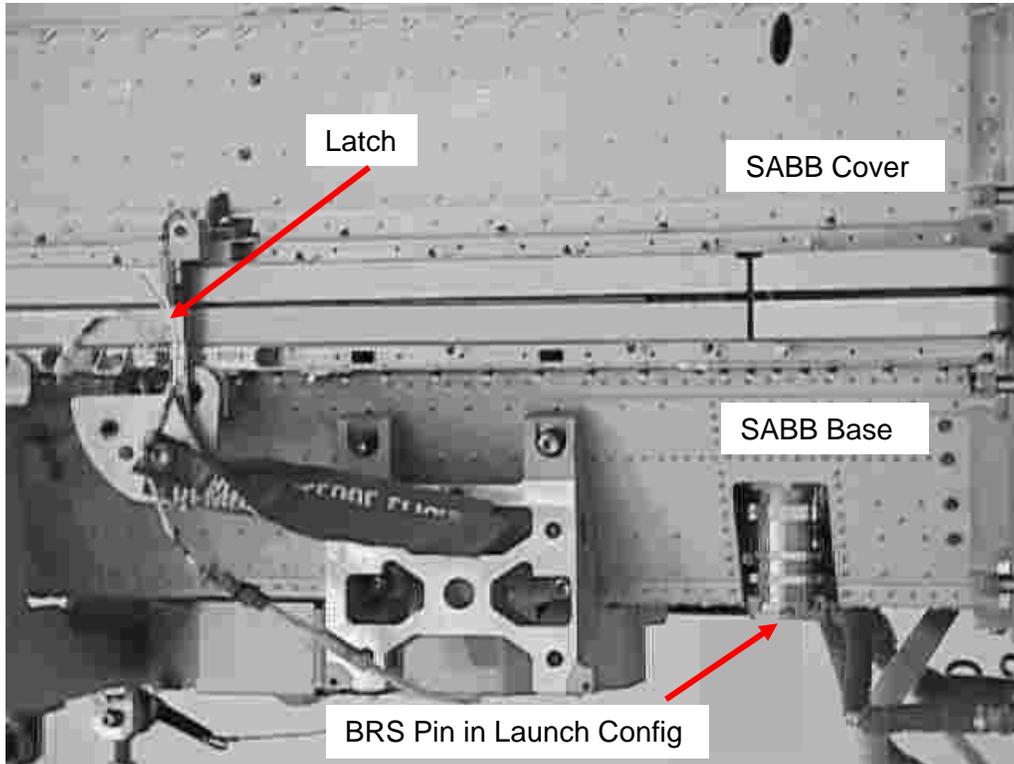


Figure 1.- SABB Launch Configuration.

Notify **MCC-H** of Configuration.

If orbiter is performing mated attitude control, proceed to step 2.6.
Otherwise, proceed to step 2.9 and wait for **MCC-H** to unlatch the left blanket box.

MCC-H proceed to step 2.4.

2.4 Verifying Initial SAW Left Blanket Box Configuration

SAW XX LBB Commands

Verify parameters in Latched column in step 2.8 before executing unlatch command.

2.5 Verifying Conditions are Correct for Visual Verification

CAUTION

Steps 2.7 and 2.9 are to be performed during insolation to support crew visual cues used to determine correct SABB latch configuration.

Verify ISS is in insolation.

1.3.450 SAW XX SABB INITIAL UNLATCH

(EPS/E12 - ALL/FIN 1) Page 5 of 26 pages

2.6 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 2.7.

* 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 2.7.

C3(A6)

* If orbiter is performing mated attitude control

* DAP: FREE

*

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

*

* Go to step 2.9 and wait for **MCC-H** to unlatch the left blanket box.

*

* **MCC-H**, go to step 2.7.

2.7 Unlatching SAW Left Blanket Box

CAUTION

Confirm no crew exercise or Max EVA loads before proceeding.

Verify ISS is in insolation.

MCC-H ↑ ISS, Orbiter, “Ready to unlatch the left blanket box.”

1.3.450 SAW XX SABB INITIAL UNLATCH

(EPS/E12 - ALL/FIN 1) Page 6 of 26 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.

PCS

PVM: EPS: SAW XX

SAW XX

'LBB'

sel LBB Commands

SAW XX LBB Commands

'LBB'

cmd Unlatch – Arm

cmd Unlatch – Unlatch (Be ready to visually monitor latch motion and check parameters in step 2.8 before sending this command. Unlatch nominally takes 14 seconds to complete.)

2.8 Monitoring LBB BRS Pin and Latch Parameters During Unlatch (Approximately 14 Seconds)

Refer to Table 2 for LBB parameters.

NOTE

1. Perform a visual verification prior to, during, and at the completion of each blanket box unlatch operation. Monitor for any obvious anomalies and verify blanket box unlatch operation.
2. Note SABB limit switches are sensitive to thermal conditions and may indicate inaccurate values during eclipse and the first 15 minutes of insolation.

Table 2. LBB Parameters

Parameter	Latched→	Transition→ Approximately 14 Seconds	Unlatched
LBB SW 01,02 Pin Released	No	Yes	Yes
LBB SW 01,02 Latched	Yes	No	No
LBB SW 01,02 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 3.00 (±0.4)	~0.10 (±0.4)
MDA Over Current Trip	blank	blank	blank

1.3.450 SAW XX SABB INITIAL UNLATCH

(EPS/E12 - ALL/FIN 1)

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- * If one Latched or 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 the
- * | 1.3.400 ECU XX Activation procedure.)
- * |
- * If two Latched or Unlatched or Pin Released limit switches fail
- * | Perform steps 2.9 and 2.10 (if orbiter performing attitude
- * | control), then notify **MCC-H** before proceeding.

2.9 Performing Visual Verification Via Cameras

Refer to Figure 2 for bottom view of blanket boxes and Figure 3 for SABB unlatched configuration.

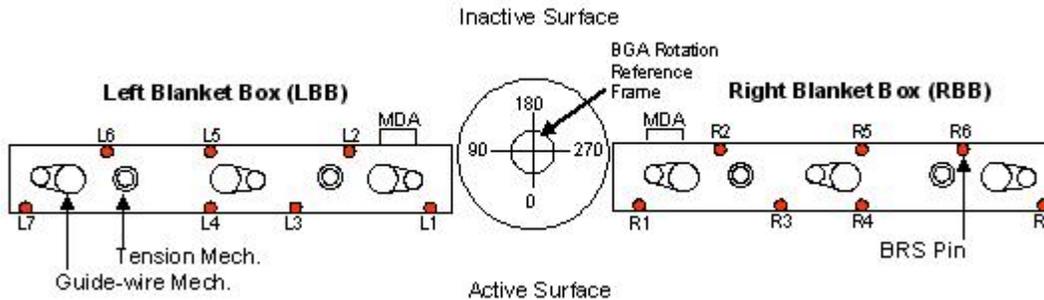


Figure 2.- Bottom View of Blanket Boxes (BRS Pin Map).

NOTE

The BRS Pin status can be ignored for arrays on the P6 truss. They have already been released.

Verify BRS Pin Release (seven) – Restraint pins released
Verify Latch Position (four of eight) – Unlatched

CAUTION

Visual verification of all seven BRS pins is required before performing the 1.3.452 SAW XX Deploy procedure.

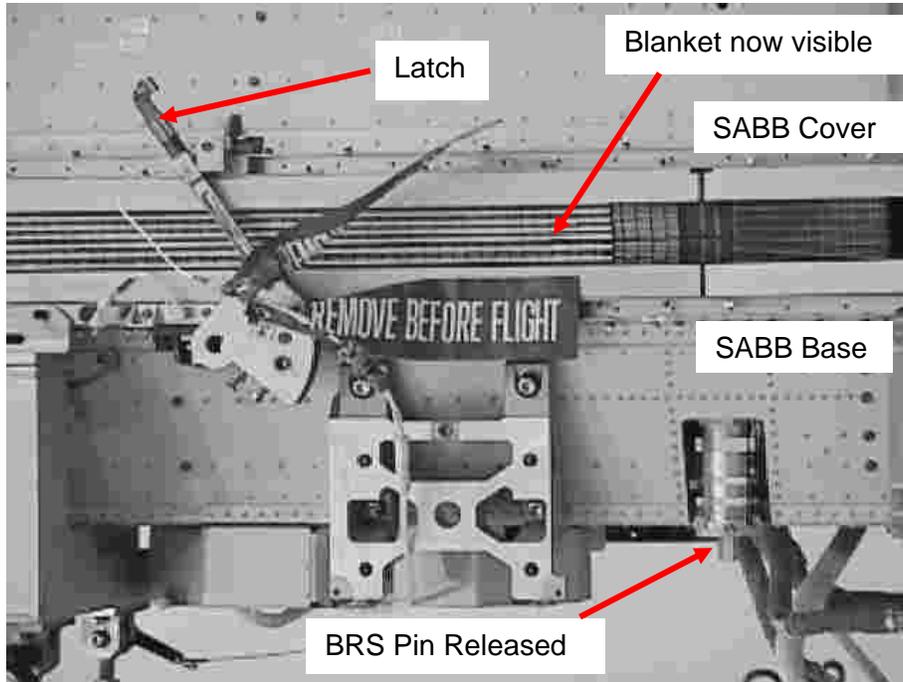


Figure 3.- SABB Unlatched.

ISS ↓ **MCC-H**, “We confirm, seven BRS Pins released and the left blanket box is unlatched.”

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

If orbiter is performing mated attitude control, proceed to step 2.10; otherwise, proceed to step 2.11.

MCC-H proceed to step 2.10.

 * 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} (SODF: EPS: MALFUNCTION: PRIMARY POWER), then:
 * |

2.10 Configuring for Nominal Attitude Control

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)
 Go to step 2.11.

1.3.450 SAW XX SABB INITIAL UNLATCH

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```
*****
* 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 2.11.
*****
```

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 2.11.
*****
```

2.11 Determining SABB Relatch Operations

Check with **MCC-H**.

If latches are to remain unlatched, proceed to step 4.3.

| **MCC-H** perform step 2.12 then proceed to step 4.1.

If immediately relatching

| If orbiter is performing mated attitude control, proceed to step 3.5 and wait for **MCC-H** Go. Otherwise, proceed to step 3.8 and wait for **MCC-H** to latch the left blanket box.

| **MCC-H** proceed to step 3.4.

If not immediately relatching, proceed to step 4.3.

| **MCC-H** perform step 2.12; then, proceed to step 4.1. Perform step 3 when ready to relatch.

2.12 Powering Off Left Blanket Box MDA

PCS

PVM: EPS: SAW XX

SAW XX

'LBB'

sel LBB Commands

SAW XX LBB Commands

'MDA'

'Power'

cmd Off – Off

√MDA Voltage, V < 10 (±2.8)

1.3.450 SAW XX SABB INITIAL UNLATCH

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3. RELATCHING LEFT SOLAR ARRAY BLANKET BOX (If Necessary to Support Operational Loads Until Array is Deployed)

If orbiter is performing mated attitude control, proceed to step 3.5.

Otherwise, proceed to step 3.8 and wait for **MCC-H** to latch the left blanket box.

MCC-H proceed to step 3.1.

PCS

3.1 Verifying Temperatures are Within Nominal Ranges Prior to Latch

PVM: EPS: SAW XX

SAW XX

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

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

Verify LBB MDA Temp, deg C: -54 to 48

3.2 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 XX

'LBB'

sel LBB Commands

SAW XX LBB Commands

'MDA'

'Power'

cmd On – Arm

cmd On – On

√MDA Voltage, V: 120 to 125

3.3 Verifying SAW Left Blanket Box Configuration

SAW XX LBB Commands

Verify parameters in Unlatched column in step 3.7 before executing latch command.

3.4 Verifying Conditions are Correct for Visual Verification

CAUTION

Steps 3.6 and 3.8 are to be performed during insolation to support crew visual cues, use to determine correct SABB latch configuration.

Verify ISS is in insolation.

3.5 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 3.6.

* 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 3.6.

C3(A6)

* If orbiter is performing mated attitude control
* DAP: FREE
*
* Orbiter ⇒ ISS, **MCC-H**, “Orbiter is in Free Drift.”
*
* Go to step 3.8 and wait for **MCC-H** to latch the left blanket box.
*
* **MCC-H**, go to step 3.6.

3.6 Latching SAW Left Blanket Box (Engage High Tension Mode)

CAUTION

Confirm no crew exercise or Max EVA loads before proceeding.

Verify ISS is in insolation.

MCC-H ↑ ISS, Orbiter, “Ready to latch the left blanket box.”

1.3.450 SAW XX SABB INITIAL UNLATCH

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NOTE

Upon successful Latch 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.

PCS

PVM: EPS: SAW XX

SAW XX

'LBB'

sel LBB Commands

SAW XX LBB Commands

'LBB'

cmd Latch – Arm

cmd Latch – Latch (Be ready to visually monitor latch motion and check parameters in step 3.7 before sending this command. Latch nominally takes 14 seconds to complete.)

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

Refer to Table 3 for LBB parameters.

NOTE

1. Perform a visual verification prior to, during, and at the completion of each Blanket Box unlatch operation. Monitor for any obvious anomalies and verify Blanket Box latching operation.
2. Note SABB limit switches are sensitive to thermal conditions and may indicate inaccurate values during eclipse and the first 15 minutes of insolation.

Table 3. LBB Parameters

Parameter	Unlatched→	Transition→ Approximately 14 Seconds	Latched
LBB SW 01,02 Pin Released	Yes	Yes	Yes
LBB SW 01,02 Latched	No	No	Yes
LBB 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 3.00 (±0.4)	~0.10 (±0.4)
MDA Over Current Trip	blank	blank	blank

- *****
- * If one Latched or 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 the 1.3.400 ECU XX Activation procedure.)
 - * |
 - * If two Latched or Unlatched or Pin Released limit switches fail
 - * | Perform steps 3.8 and 3.9 (if orbiter is performing attitude control), notify **MCC-H** before proceeding.
 - * |
- *****

3.8 Perform Visual Verification Via Cameras
Verify Latch Position (four of eight) – latched (tensioned position)

Refer to Figure 4 for SABB related configuration.

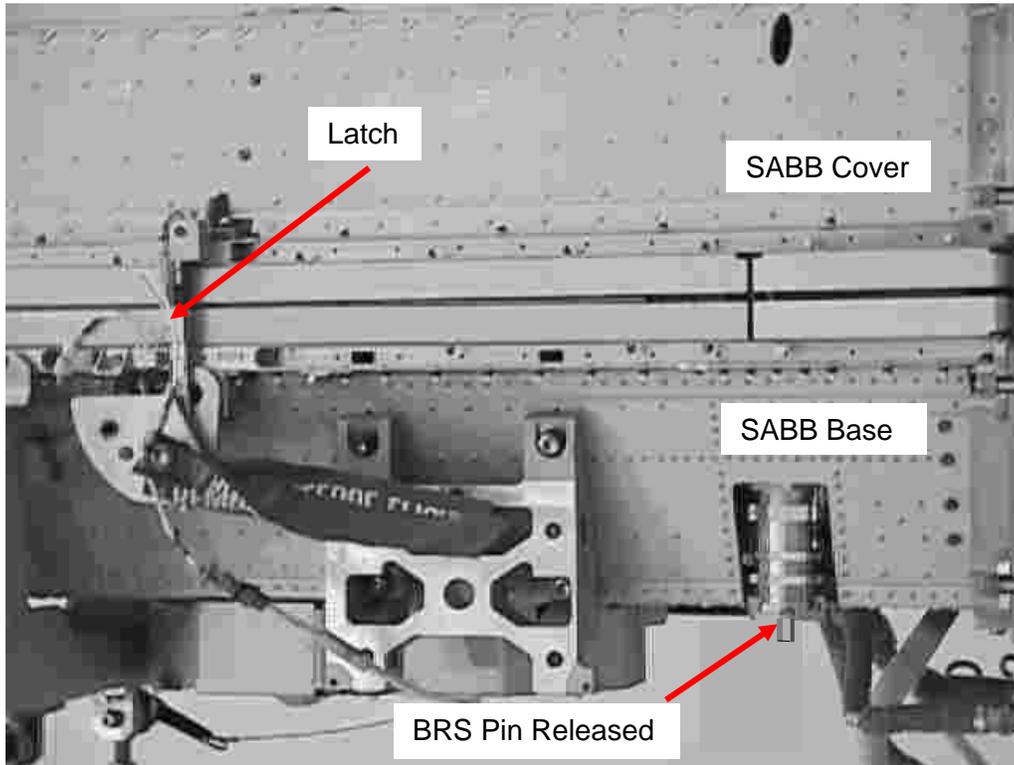


Figure 4.- SABB Related.

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

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

1.3.450 SAW XX SABB INITIAL UNLATCH

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If right blanket box is unlatched
If orbiter is performing mated attitude control, perform step 3.9; then, proceed to step 5.5 and wait for **MCC-H Go**.
Otherwise, proceed to step 5.8 and wait for **MCC-H** to latch the right blanket box.

MCC-H proceed to step 3.9.

If right blanket box is latched
If orbiter is performing mated attitude control, perform step 3.9, then, proceed to step 4.3. Otherwise, proceed to step 4.3.

MCC-H proceed to step 3.9.

* 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} (SODF: EPS: MALFUNCTION: PRIMARY
* POWER), then:

3.9 Configuring for Nominal Attitude Control

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)
Go to step 3.10.

* 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 3.10.

C3(A6)

* If orbiter is performing mated attitude control
* Perform rate damping DOCKED CONFIGURATION DAP
* REFERENCE, (FDF: ORB OPS, REBOOST/DAP), then:

*

* If right blanket box is unlatched

* Proceed to step 5.5 and wait for **MCC-H Go**.

*

* **MCC-H** proceed to step 3.10.

*

* If right blanket box is latched

* Proceed to step 4.3.

*

* **MCC-H** proceed to step 3.10.

1.3.450 SAW XX SABB INITIAL UNLATCH

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PCS 3.10 Power Off Left Blanket Box MDA
PVM: EPS: SAW XX
SAW XX
'LBB'

sel LBB Commands

SAW XX LBB Commands
'MDA'
'Power'

cmd Off – Off

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

If right blanket box is unlatched
| **MCC-H** proceed to step 5.1.

If right blanket box is latched
| **MCC-H** proceed to step 4.1.

4. UNLATCHING RIGHT BLANKET BOX (RBB)

PCS 4.1 Verifying Temperatures Are Within Nominal Ranges Prior to Unlatch
PVM: EPS: SAW XX
SAW XX

Verify SAW PS Temp, deg C: -33 to 51
Verify BGA PS Temp, deg C: -33 to 51
Verify RBB MDA Temp, deg C: -54 to 48

4.2 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 XX
'RBB'

sel RBB Commands

SAW XX RBB Commands
'MDA'
'Power'

cmd On – Arm

cmd On – On

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

1.3.450 SAW XX SABB INITIAL UNLATCH

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4.3 Performing Initial SABB Visual Verification Via Cameras ISS must be in insolation to perform this verification.

NOTE

1. Crew or **MCC-H**, if video is available, perform a visual verification prior to, during, and at the completion of each blanket box unlatch operation. There are eight latches and seven BRS pins to be released for each blanket box prior to deployment. Seven gold colored posts protrude through the containment box base to provide visual indication of successful pin release.
SAW 4A RBB = Aft Nadir SABB (when Port SARJ = 180 deg, BGA 4A = 0 deg) Fwd Nadir SABB (when Port SARJ = 0 deg, BGA 4A = 60 deg)
SAW 2A RBB = Fwd Zenith SABB (when Port SARJ = 180 deg, BGA 2A = 0 deg) Aft Zenith SABB (when Port SARJ = 0 deg, BGA 2A = 300 deg)
SAW 3A RBB = Aft Zenith SABB (when Stbd SARJ = 0 deg, BGA 3A = 0 deg)
SAW 1A RBB = Fwd Nadir SABB (when Stbd SARJ = 0 deg, BGA 1A = 0 deg)
SAW 4B RBB = Aft Nadir SABB (when Port SARJ = 0 deg, BGA 4B = 0 deg)
SAW 2B RBB = Fwd Zenith SABB (when Port SARJ = 0 deg BGA 2B = 0 deg)
SAW 3B RBB = Fwd Nadir SABB (when Stbd SARJ = 0 deg, BGA 3B = 0 deg)
SAW 1B RBB = Aft Zenith SABB (when Stbd SARJ = 0 deg, BGA 1B = 0 deg)
2. The BRS Pin status can be ignored for arrays on the P6 truss, or SABBs that have been previously unlatched. They have already been released.

Verify BRS Pin (seven) – Restraint pins engaged
Verify Latch Position (four of eight) – Latched

Notify **MCC-H** of Configuration (refer to Figure 1 in step 2.3).

If orbiter is performing mated attitude control, proceed to step 4.6.
Otherwise, proceed to step 4.9 and wait for **MCC-H** to unlatch the right blanket box.

MCC-H proceed to step 4.4

4.4 Verifying Initial SAW Right Blanket Box Configuration

SAW XX RBB Commands

Verify parameters in Latched column in step 4.8 before executing unlatch command.

4.5 Verifying Conditions are Correct for Visual Verification

CAUTION
Steps 4.7 and 4.9 are to be performed during insolation to support crew visual cues use to determine correct SABB latch configuration.

Verify ISS is in insolation.

4.6 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 4.7.

* 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 4.7.

C3(A6)

* If orbiter is performing mated attitude control

* DAP: FREE

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

* Go to step 4.9 and wait for **MCC-H** to unlatch the right blanket box.

* **MCC-H**, go to step 4.7.

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4.7 Unlatching SAW Right Blanket Box

CAUTION

Confirm no crew exercise or Max EVA loads before proceeding.

Verify ISS is in insolation.

MCC-H ↑ ISS, Orbiter, “Ready to unlatch the right blanket box.”

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.

PCS

PVM: EPS: SAW XX

SAW XX

'RBB'

sel RBB Commands

SAW XX RBB Commands

'RBB'

cmd Unlatch – Arm

cmd Unlatch – Unlatch (Be ready to visually monitor latch motion and check parameters in step 4.8 before sending this command. Unlatch nominally takes 14 seconds to complete.)

4.8 Monitoring RBB BRS Pin and Latch Parameters During Unlatch (Approximately 14 Seconds)

Refer to Table 4 for RBB parameters.

NOTE

1. Perform a visual verification prior to, during, and at the completion of each Blanket Box unlatch operation. Monitor for any obvious anomalies and verify Blanket Box unlatch operation.
2. Note SABB limit switches are sensitive to thermal conditions and may indicate inaccurate values during eclipse and the first 15 minutes of insolation.

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Verify BRS Pin Release (seven) – Restraint pins released
Verify Latch Position (four of eight) – Unlatched
Refer to Figure 3 in step 2.9.

CAUTION
Visual verification of all seven BRS pins is required before performing the 1.3.452 SAW XX Deploy procedure.

ISS ↓ **MCC-H**, “We confirm, seven BRS Pins released and the right blanket box is unlatched.”

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

If orbiter is performing mated attitude control, proceed to step 4.10; otherwise, proceed to step 4.11.

MCC-H proceed to step 4.10.

* 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} (SODF: EPS: MALFUNCTION:
* | PRIMARY POWER), then:

4.10 Configuring for Nominal Attitude Control

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)
Go to step 4.11.

* 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 4.11.

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 4.11.

1.3.450 SAW XX SABB INITIAL UNLATCH

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4.11 Determining SABB Relatch Operations

Check with **MCC-H**.

If latches are to remain unlatched

Exit procedure.

MCC-H perform step 4.12 then exit procedure.

If immediately relatching

If orbiter is performing mated attitude control, proceed to step 5.5 and wait for **MCC-H** Go. Otherwise, proceed to step 5.8 and wait for **MCC-H** to latch the right blanket box.

MCC-H proceed to step 5.4.

If not immediately relatching

Exit procedure.

MCC-H perform step 4.12; then, exit procedure. Perform step 5 when ready to relatch.

PCS

4.12 Powering Off Right Blanket Box MDA

PVM: EPS: SAW XX

SAW XX

'RBB'

sel RBB Commands

SAW XX RBB Commands

'MDA'

'Power'

cmd Off – Off

√MDA Voltage, V < 10 (±2.8)

5. RELATCHING RIGHT SOLAR ARRAY BLANKET BOX (If Necessary, to Support Operational Loads Until Array is Deployed)

If orbiter is performing mated attitude control, proceed to step 5.5.

Otherwise, proceed to step 5.8 and wait for **MCC-H** to latch the right blanket box.

MCC-H proceed to step 5.1.

PCS

5.1 Verifying Temperatures are Within Nominal Ranges Prior to Latch

PVM: EPS: SAW XX

SAW XX

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

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

Verify RBB MDA Temp, deg C: -54 to 48

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5.2 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 XX

'RBB'

sel RBB Commands

SAW XX RBB Commands

'MDA' 'Power'

cmd On – Arm

cmd On – On

√MDA Voltage, V: 120 to 125

5.3 Verifying SAW Right Blanket Box Configuration

SAW XX RBB Commands

Verify parameters in Unlatched column in step 5.7 before executing latch command.

5.4 Verifying Conditions are Correct for Visual Verification

CAUTION

Steps 5.6 and 5.8 are to be performed during insolation to support crew visual cues, use to determine correct SABB latch configuration.

Verify ISS is in insolation.

5.5 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 5.6.

 * 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 5.6.

C3(A6)

 * If orbiter is performing mated attitude control
 * Perform rate damping DOCKED CONFIGURATION DAP
 * REFERENCE, (FDF: ORB OPS, REBOOST/DAP), then:
 *
 * Orbiter ⇒ ISS, **MCC-H**, “Orbiter is in Free Drift.”
 *
 * Go to step 5.8 and wait for **MCC-H** to latch the right blanket box.
 *
 * **MCC-H**, go to step 5.6.

5.6 Latching SAW Right Blanket Box (Engage High Tension Mode)

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

Verify ISS is in insolation.

MCC-H ↑ ISS, Orbiter, “Ready to latch the right blanket box.”

NOTE
Upon successful Latch 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.

PCS

PVM: EPS: SAW XX
 SAW XX
 'RBB'

sel RBB Commands

SAW XX RBB Commands

'RBB'

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cmd Latch – Arm

cmd Latch – Latch (Be ready to visually monitor latch motion and check parameters in step 5.7 before sending this command. Latch nominally takes 14 seconds to complete.)

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

Refer to Table 5 for RBB parameters.

NOTE

1. Perform a visual verification prior to, during, and at the completion of each blanket box unlatch operation. Monitor for any obvious anomalies and verify blanket box latching operation.
2. SABB limit switches are sensitive to thermal conditions and may indicate inaccurate values during eclipse and the first 15 minutes of insolation.

Table 5. 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 3.00 (±0.4)	~0.10 (±0.4)
MDA Over Current Trip	blank	blank	blank

- * If one Latched or 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 the 1.3.400 ECU XX Activation
- * | procedure.)
- * |
- * If two Latched or Unlatched or Pin Released limit switches fail
- * | Perform steps 5.8 and 5.9 (if orbiter is performing attitude
- * | control), then notify **MCC-H** before proceeding.

5.8 Performing Visual Verification Via Cameras

Verify Latch Position (four of eight) – Latched (tensioned position)
Refer to Figure 4 in step 3.8.

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

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

If orbiter is performing mated attitude control, proceed to step 5.9;
otherwise, exit procedure.

MCC-H proceed to step 5.9.

* 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} (SODF: EPS:
* | MALFUNCTION: PRIMARY POWER), then:

5.9 Configuring for Nominal Attitude Control

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)
Go to step 5.10.

* 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 5.10.

C3(A6)

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

* Exit procedure.
*

* **MCC-H** proceed to step 5.10.

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PCS 5.10 Powering Off Right Blanket Box MDA
PVM: EPS: SAW XX
SAW XX
'RBB'

sel RBB Commands

SAW XX RBB Commands

'MDA'
'Power'

cmd Off – Off

√MDA Voltage, V: < 10 (±2.8)

MCC-H exit procedure.

6. UNLATCHING SABBS AGAIN PRIOR TO SAW XX DEPLOY (If Necessary)

WARNING

Verify EVA crew is clear of SAW XX SABB mechanisms before proceeding.

NOTE

The BRS Pin status can be ignored. The pins have already been released. Any BRS Pin limit switch failures will be overridden in step 9.3 of the 1.3.452 SAW XX Deploy procedure.

Perform steps 2 and 4 of this procedure. >>

1.3.452 SAW XX DEPLOY

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OBJECTIVE:

This procedure supports the initial deploy of a single USOS Solar Array Wing (SAW) and it is applicable to all arrays. A unique solar array thermal conditioning attitude is required for initial deploy operations. This procedure also supports redeploy of an array previously retracted to support Sequential Shunt Unit (SSU) Remove and Replace (R&R) activities. Solar array redeployment can be performed in any attitude that supports the visual verification requirements. Redeploy of the P6 arrays after the P6 truss is relocated, should be treated as an initial deploy for this procedure.

NOTE

1. For initial solar array deployments, this procedure assumes that the Solar Array Blanket Boxes (SABBs) are unlatched and the associated Beta Gimbal Assembly (BGA) is locked. If the SABBs are not unlatched, refer to {1.3.450 SAW XX SABB INITIAL UNLATCH}, step 6 (SODF: EPS: ACTIVATION AND CHECKOUT: CHANNEL ACTIVATION). If the BGA is not locked, refer to {2.106 PVM CONFIGURE BGA XX TO SAFE/LOCK MODE}, all (SODF: EPS: NOMINAL: PRIMARY POWER SYSTEM).
2. Crew will be primary for performing steps 12.3, 12.7, 12.9, 13.8, 14.8, 15.3, 15.6 to 15.9, 17.3, 17.6 to 17.7, 17.9, 17.10.
MCC-H will be primary for performing all remaining steps.

Overview of Crew Steps for SAW Deploy

1. Deploy 1 Bay of Mast, then stop deploy.
 2. Latch Left Blanket Box (LBB) and Right Blanket Box (RBB) for high tension deploy.
 3. Deploy Mast to 49 %, then stop deploy.
 4. Thermal condition for 24 to 30 minutes.
 5. Complete Mast deploy.
3. For redeploy of a solar array after an SSU R&R, this procedure assumes the array is fully retracted with the latches in high tension position, the SABBs are physically unlatched, and the associated BGA is locked. It also assumes no orbiter is present. Perform steps 1 to 4, 5.4, 6 to 9.1, 9.3 to 12, 17 to 19, and 20.2.
 4. Refer to this procedure for all applicable SAWs. Refer to Table 1 for PVM power channel connectivity.

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Table 1. PVM Connectivity

PVM	XX	YY
S4	1A	3A
S4	3A	1A
S6	1B	3B
S6	3B	1B
P4	2A	4A
P4	4A	2A
P6	2B	4B
P6	4B	2B

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 to avoid damage to solar array mechanisms.

1. VERIFYING SARJ CONFIGURATION

CAUTION

1. If SARJ is not in correct position, there is a risk of P4(S4) solar arrays contacting the P6 SAW 4B(2B) array while P6 is attached to the Z1 truss and the SAW 4B(2B) is deployed. In which case, both the P6 and P4(S4) solar arrays could sustain damage.
2. The SARJ nearest the SAW to be deployed, must be stopped and locked. The SARJ farthest from the SAW to be deployed, can continue to be rotated. These configurations are required to minimize dynamic loading on the array and to support visual verification requirements.

PCS

For SARJ nearest the SAW to be deployed

P4 (S4): EPS: Port (Stbd) SARJ

Port (Stbd) SARJ

Verify Position, deg: 0.0 (200 deg if redeploying 2A or 4B; 20 deg if redeploying 2B or 4A; 160 deg if redeploying 3A or 1B; 340 deg if redeploying 3B or 1A after an SSU R&R, this assumes P6 is on the main truss.)

Verify DLA 1(2) Position – Locked

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For SARJ farthest from the SAW to be deployed

P4 (S4): EPS: Port (Stbd) SARJ

Port (Stbd) SARJ

Verify DLA 1(2) Position – Engaged or Locked (No restrictions to SARJ rotation during SAW deploy.)

2. CONFIRMING SSU XX SHUNTED

CAUTION

If SSU has failed, and the SSU shunt plug is not available, do not attempt deploy. The array must remain retracted until the SSU is replaced. During insolation, there is a potential for array damage, if the SSU is not installed and the array is deployed.

PVM: EPS: SSU XX

SSU XX

'SSU'

Verify Integration Counter – incrementing

Verify Shunt Current 1 (LBB), A: ~0.0

Verify Shunt Current 2 (RBB), A: ~0.0

'PVCE'

'Error Voltage'

Verify 1: -0.7 to 0.7 V

Verify 2: -0.7 to 0.7 V

Verify 3: -0.7 to 0.7 V

'Output'

Verify Error Bus Voltage, V: <0.6

* If SSU is not shunted, then Shunt SSU at this time

* PVM: EPS: SSU XX

* SSU XX

* sel PVCE

* SSU XX PVCE

* 'All PVCEs Off'

* cmd Arm

* cmd Off

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3. VERIFYING COMM WITH BGA CONTROLLER

PVM: EPS: BGA XX

BGA XX

'ECU XX'

Verify ECU/BGA Integ Cnt – incrementing

4. VERIFYING COMM WITH SAW CONTROLLER

sel SAW XX

SAW XX

'ECU XX'

Verify ECU/SAW Integ Cnt – incrementing

5. REDUCING LOAD ON SUPPORTING CHANNEL PRIOR TO SAW DEPLOY OPERATIONS

If redeploying the array after an SSU R&R

Perform step 5.4; then, proceed to step 6.

5.1 Verifying Which Support Channel (ZZ) is Providing Prime Power to ECU XX

NOTE

It is possible for both ECUs on a particular PVM to be powered from the same channel. This configuration will determine which channel should be powered down to support the peak power load of 580 watts.

PVM: EPS: BGA XX

BGA XX

sel RPCM XX A RPC 01

RPCM XX A RPC 01

Verify RPC Position – Close (Verify – Cl)

BGA XX

sel RPCM YY A RPC 02

RPCM YY A RPC 02

Verify RPC Position – Close (Verify – Cl)

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If ECU XX is receiving power from one closed RPC, use Table 2 to determine which support channel is affected.

If both RPCs, providing input power to ECU XX, are closed, RPCM XX A and RPCM YY A input current must be used to determine which source is providing prime power to ECU XX. Once this is determined, use Table 2 to determine which support channel is affected.

NOTE

Table 2 provides expected support channel connectivity. A support channel provides initial power to the channel being activated until the SAW is deployed and the batteries are charged (e.g., Ch 4B supports Ch 4A until Ch 4A is fully activated). If redeploying the array after an SSU R&R, confirm support channel with **MCC-H**.

Table 2. Support Power Channel Connectivity

XX	YY	ZZ
1A	3A	4A
3A	1A	2A
1B	3B	1A
3B	1B	3A
2A	4A	2B
4A	2A	4B
2B	4B	2A
4B	2B	4A

Record

RPCM XX (YY) - A, Providing Prime Power to ECU XX: _____

DDCU XX (YY) Supporting the RPCM: _____

Supporting Power Channel ZZ: _____

5.2 Terminating All Battery Charging/Warming on Channel XX (Same Channel That the SAW is to be Deployed)

NOTE

1. Reducing load on the supporting power channel protects for a peak power load of 580 watts during SAW deployment operations. If unique attitude is required to support SAW thermal conditioning, load reduction also protects for power balance of the supporting channel.
2. BCDU/Battery caution messages are suppressed to prevent nuisance tones, during initial battery charging.

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Confirm the following Caution messages are suppressed,
where [Y] = 1,2,3

BCDU XXY Battery SOC Low Failure
BCDU XXY Trip
Batt XXY1(XXY2) Undervoltage Condition
Battery XXY1(XXY2) Trip

If batteries are charging

PVM: EPS: Energy Storage XX

Energy Storage XX

'BCDU XXY'

Perform for BCDU XXY, where [Y] = (as required)

sel Conv

BCDU XXY Converter FI

'Converter'

cmd Converter Off – Arm

cmd Converter Off – Off (Verify – Off)

'Fault Isolator'

cmd Open – Arm

cmd Open – Open (Verify – Op)

Repeat

If batteries are warming, check with **MCC-H** for warming status.

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PVM: EPS: Energy Storage XX

Energy Storage XX

Perform for BCDU XXY, where [Y] = 1 2 3 and
[Z] = 1 2 (as required)

'BCDU XXY'

Verify Htr Sw A(B) – On (green icon)

sel Software Inhibits

BCDU XXY Software

cmd Batt XXYZ Htr Cntl Inhibit – Arm

cmd Batt XXYZ Htr Cntl Inhibit – Inhibit (Verify – Inh)

sel BCDU XXY SoftwareBU

BCDU XXY SoftwareBU

cmd Batt XXYZ Htr Cntl Inhibit – Arm

cmd Batt XXYZ Htr Cntl Inhibit – Inhibit (Verify – Inh)

'Battery XXYZ'

sel BSCCM

Battery XXY

cmd Battery XXYZ Heater 1,2; Off – Arm

cmd Battery XXYZ Heater 1,2; Off – Off (Verify – Off)

Repeat

5.3 Powering Down ISS (As Necessary)

NOTE

If a unique attitude is required to support SAW thermal conditioning, loads may be reduced to protect overall ISS energy balance.

Powerdown ISS loads so that energy balance is maintained while in the SAW Deploy attitude.

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5.4 Reducing Load on DDCU XX (YY) Prior to SAW Deploy

NOTE

Power can be supplied to ECU XX from DDCU XX or DDCU YY for the solar array deploy. Therefore, it may be necessary to reduce loads on the appropriate DDCU to support a peak power load of 580 watts during array deployment.

Verify enough margin exist on DDCU XX (YY) to support a potential peak power load of 580 watts during array deployment. Reduce load as necessary to meet this requirement.

6. VERIFYING ECU POWER SUPPLY TEMPERATURES AND VOLTAGE STATUS

PVM: EPS: BGA XX

BGA XX

'ECU XX'

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. VERIFYING CHANNEL MODE AND BGA MODE

BGA XX

'BGA XX'

Verify PV Ch XX Mode, Primary PVCU – Non-Solar Tracking or Fully Commanded

Verify BGA Mode, Primary PVCU – Safe Lock (Null if BGA is still in launch configuration)

8. VERIFYING BGA STATUS

8.1 Verifying BGA Antirotation Pin Engaged

CAUTION

Prior to deploying the solar array, the BGAs must be prepositioned and locked in order to support thermal conditioning (warming) of the inactive surface of the solar array blankets and visual verification requirements during deployment. Thermal conditioning begins once the array has been deployed to 49 %.

BGA XX

'BGA XX'

Verify BGA XX Actual Angle, deg: At Required Position for SAW XX Deploy

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NOTE

BGA 4B Latch 2 failed during the 5A.1 mission, this latch is unlatched and no longer used.

'Latch 1' or 'Latch 2'

Verify Pin Status – Latched

Record BGA XX Actual Angle, deg: _____

Record BGA XX Latch 1 Pin Status: _____

Record BGA XX Latch 2 Pin Status: _____

8.2 Inhibiting Motor Velocity 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 XX Observed vs Last Commanded State Discrepancy - PVM'
'BGA XX Pointing Control Command Response Failed - PVM'

If the BGA at 0.0 (± 0.5) degrees

PVM: EPS: BGA XX

sel 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

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9. VERIFYING SAW STATUS

9.1 Verifying Initial SAW C&W Flags and MDA Data (MCC-H)

Configure for continuous Data Dump of SAW XX. To build dump command, perform {1.230 [CCS BUILD DATA DUMP COMMAND](#)}, all (SODF: GND AVIONICS: C&DH: NOMINAL). For unique start location addresses, refer to {5.294 [EPS MDM BDT/50HZ ADDRESS](#)}, all (SODF: GND SYSTEMS: EPS: NOMINAL), for SAW XX with 1 Hz Data Collection, 224 words.

If redeploying the array after an SSU R&R, go to step 9.3.

9.2 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 for during mast deployment.

sel SAW XX

SAW XX

'LBB'

NOTE

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

Verify SW01,02 Pin Released – Yes
Verify SW01,02 Latched – No
Verify SW01,02 Unlatched – Yes
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 – Yes
Verify SW01,02 Deployed – 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

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'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 SW01,02 Pin Released – Yes
Verify SW01,02 Latched – No
Verify SW01,02 Unlatched – Yes
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 XX'

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

* If any MDA Temp is out of range, $\sqrt{\text{MCC-H}}$ before proceeding.

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NOTE
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 Temp is greater than 48° C, inhibit MDA Over Temp Safing.

'ECU XX'

sel SAW Software Inhibits

SAW XX Software Inhibits

sel SAW XX Temp Safing

SAW XX Temp Safing

'LBB (RBB)(Mast) Over Temp Safing'

'Primary PVCU'

cmd Inhibit – Arm

cmd Inhibit – Inhibit

$\sqrt{\text{Over Temp Safing}}$ – Inh

'Backup PVCU'

cmd Inhibit – Arm

cmd Inhibit – Inhibit

$\sqrt{\text{Over Temp Safing}}$ – Inh

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9.3 Verifying SABB Limit Switch Override

NOTE

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

PVM: EPS: SAW XX

SAW XX

'ECU XX'

sel SAW Software Inhibits

SAW XX Software Inhibits

'Deploy Reject'

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

9.4 Verifying Mast Limit Switch Override

NOTE

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

PVM: EPS: SAW XX

SAW XX

'ECU XX'

sel SAW Software Inhibits

SAW XX Software Inhibits

'Latch Reject'

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

PVM: EPS: BGA XX

BGA XX

sel BGA Software Inhibits

BGA XX Software Inhibits

'SAW Deployment'

'Primary PVCU'

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√SAW Deployment – Ena (Allows BGA to be operated when SAW mast is in an undetermined state)

'Backup PVCU'

√SAW Deployment – Ena

10. VERIFYING MDA HI TEMP REJECT FUNCTION INHIBITED

PVM: EPS: SAW XX

SAW XX

sel SAW Software Inhibits

SAW XX Software Inhibits

sel SAW XX Temp Safing

SAW XX Temp Safing

'Hi Temp Reject'

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

11. VERIFYING MDA SAFING CONFIGURATION

sel SAW Software Inhibits

SAW XX Software Inhibits

√Config Complete MDA Off Safing, Primary PVCU – Ena

√Config Complete MDA Off Safing, Backup PVCU – Ena

(Turns motor off upon limit switch contact, if MDA current above limit.)

√Limit Sw Turnoff Function – Ena

(Stops motor upon limit switch contact but does not turn motor off)

sel SAW XX Motor Stall Safing

SAW XX 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.)

If deploying both arrays on a PVM the same day

Perform steps 1 to 11 for both channels before proceeding to step 12.

If redeploying the array after an SSU R&R

Go to step 17.

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12. DEPLOYING FIRST BAY OF SOLAR ARRAY

WARNING

All SABB initial unlatch activities (i.e., all BRS pins released and SABBs are unlatched) must be completed prior to performing the following steps. Verify EVA crew is clear of SAW mechanisms before proceeding.

MCC-H ↑ ISS, “Steps 1 to 11 of the Solar Array Deploy procedure have been completed. Proceed to step 12.3 and confirm correct camera and RWS configuration for solar array XX deploy.”

NOTE

Overview of Crew Steps for SAW Deploy

1. Deploy 1 Bay of Mast, then stop deploy.
2. Latch LBB and RBB for high tension deploy.
3. Deploy Mast to 49 %, then stop deploy.
4. Thermal condition for 24 to 30 minutes.
5. Complete Mast deploy.

12.1 Verifying Temperatures are Within Nominal Ranges Prior to SAW Deploy

PVM: EPS: SAW XX

SAW XX

Verify SAW PS Temp, deg C: -33 to 51
Verify BGA PS Temp, deg C: -33 to 51
Verify Mast MDA Temp, deg C: -54 to 48

12.2 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 XX

‘Mast’

sel Mast Commands

SAW XX 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

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12.3 Verifying Camera Configuration

ISS must be in insolation to perform this verification.

NOTE

Perform a visual verification prior to, during, and at the completion of the mast deploy operation. This ensures all launch restraints have been removed, minimizes the risk of potential collision hazards, and monitor for any obvious 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 deployment before proceeding.

If orbiter is performing mated attitude control, proceed to step 12.6. Otherwise, proceed to step 12.7 and wait for **MCC-H GO** for 1 Mast Bay deployment.

MCC-H proceed to step 12.4.

12.4 Verifying Initial SAW Mast Configuration

NOTE

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

SAW XX Mast Commands

√Mast SW01,SW02 Retracted – Yes

√Mast SW01,SW02 Deployed – No

12.5 Verifying Conditions are Correct for Visual Verification

CAUTION

Steps 12.7 and 12.9 are to be performed during insolation to support crew visual cues used to determine when to abort the solar array deployment.

Verify ISS is in insolation.

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12.6 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 array deployment 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 12.7.

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 12.7.

C3(A6)

If orbiter is performing mated attitude control

DAP: FREE

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

Go to step 12.7. Notify **MCC-H** before sending the Deploy command.

12.7 Deploying First Bay of SAW

CAUTION

Confirm no crew exercise or Max EVA loads before proceeding.

NOTE

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

MCC-H ↑ ISS, Orbiter, “Crew is GO to Deploy Mast 1 Bay.”

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PCS

PVM: EPS: SAW XX

SAW XX

'Mast'

sel Mast Commands

SAW XX Mast Commands

'Mast'

cmd Deploy – Arm

cmd Deploy – Deploy

```
*****
* If at any time during the array deploy the blanket box
* begins to distort
* 'Mast'
*
* cmd Abort – Abort
*
* √MCC-H before proceeding.
*****
```

Wait approximately 20 seconds (~1 Bay).

'Mast'

cmd Abort – Abort

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

NOTE

1. The Mast - Abort command removes power from the MDA.
2. SAW 2B SW 02 Deployed limit switch failed prior to the 4A mission, No is always indicated.

√MDA Voltage, V: <10 (±2.8)

√Mast SW01,SW02 Retracted – No

√Mast SW01,SW02 Deployed – No

MCC-H proceed to step 12.8.

1.3.452 SAW XX DEPLOY

MCC-H 12.8 Configuring for Nominal Attitude Control
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.

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 blanket box covers clear of latch hooks (left and right SABB).
Verify number of visible mast bays ~1.

ISS ↓ **MCC-H**, "We confirm 1 mast bay deployed."

MCC-H ↑ ISS, "We confirm nominal mast deployment."

If orbiter is performing mated attitude control, proceed to step 13.5.
Otherwise, proceed to step 13.8 and wait for **MCC-H** to latch the
left blanket box.

MCC-H proceed to step 13.1.

* If deploy sequence is not successful, √**MCC-H** before
* proceeding.
*
* If **MCC-H** unavailable, perform {3.191 SAW XX FAILURE TO
* | EXTEND MAST REMOTELY}, all (SODF: EPS:
* | MALFUNCTION: PRIMARY POWER SYSTEM), then:

1.3.452 SAW XX DEPLOY

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13. LATCHING LEFT SOLAR ARRAY BLANKET BOX (ENGAGING HIGH TENSION MODE)

PCS

13.1 Verifying Temperatures are Within Nominal Ranges Prior to SAW Deploy

PVM: EPS: SAW XX

SAW XX

Verify SAW PS Temp, deg C: -33 to 51
Verify BGA PS Temp, deg C: -33 to 51
Verify LBB MDA Temp, deg C: -54 to 48

13.2 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 XX

'LBB'

sel LBB Commands

SAW XX LBB Commands

'MDA'

'Power'

cmd On – Arm

cmd On – On

√MDA Voltage, V: 120 to 125

13.3 Verifying SAW Left Blanket Box Configuration

Verify parameters in UNLATCHED column in step 13.7 before executing latch command.

13.4 Verifying Conditions are Correct for Visual Verification

CAUTION

Steps 13.6 and 13.8 are to be performed during insolation, to support crew visual cues use to determine correct SABB latch configuration.

Verify ISS is in insolation.

1.3.452 SAW XX DEPLOY

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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.”

Proceed to step 13.8 and wait for **MCC-H** to latch LBB.

MCC-H proceed to step 13.6.

13.6 Latch SAW Left Blanket Box (Engage High Tension Mode)

CAUTION

Confirm no crew exercise or max EVA loads before proceeding.

1.3.452 SAW XX DEPLOY

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NOTE

1. Latching the blanket box engages high tension mode (75 lbs) and provides more control over stiction between blanket panels during array deployment.
2. Upon successful Latch commanding, 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.

MCC-H ↑ ISS, Orbiter, "Ready to latch the left blanket box."

PCS

PVM: EPS: SAW XX

SAW XX

'LBB'

sel LBB Commands

SAW XX LBB Commands

'LBB'

cmd Latch – Arm

cmd Latch – Latch (Be ready to visually monitor latch motion and check parameters in step 13.7 before sending this command. Latch nominally takes 14 seconds to complete.)

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

Refer to Table 3.

NOTE

1. Perform a visual verification prior to, during, and at the completion of each blanket box unlatch operation. Monitor for any obvious anomalies and verify blanket box latching operation.
2. SABB limit switches are sensitive to thermal conditions and may indicate inaccurate values during eclipse and the first 15 minutes of insolation.

1.3.452 SAW XX DEPLOY

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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 3.00 (±0.4)	~0.10 (±0.4)
MDA Over Current Trip	blank	blank	blank

- * If one Latched, Unlatched, or Pin Released limit switch fails
- * | Confirm configuration visually and √**MCC-H** before proceeding.
- * |
- * | SABB limit switch status that would restrict mast commanding
- * | has already been overridden as part of 1.3.400 ECU
- * | Activation.
- * |
- * | If two Latched, Unlatched, or Pin Released limit switches fail
- * | Perform step 13.8 and 13.9 (if orbiter performing attitude
- * | control), then √**MCC-H** before proceeding.
- * |

13.8 Performing Visual Verification Via Cameras

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

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

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

If orbiter is performing mated attitude control, proceed to step 13.9.
Otherwise, proceed to step 14.8 and wait for **MCC-H** to latch the right blanket box.

MCC-H proceed to step 13.9.

- * If latch sequence is not successful, √**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:
- * |

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MCC-H	<p>13.9 <u>Configuring for Nominal Attitude Control</u></p> <p>If ISS is performing attitude control and ISS is in TEA (MCC-H) Go to step 13.10.</p> <p>If ISS is performing attitude control and ISS is not in TEA (MCC-H) Perform {2.405 <u>MODING FREE DRIFT TO CMG TA</u>} (SODF: MCS: NOMINAL: GNC MODING), then:</p> <p>MCC-H ↑ ISS, Orbiter, "ISS is in Attitude Control."</p> <p>Go to step 3.10.</p>
C3(A6)	<p>If orbiter is performing mated attitude control Perform rate damping DOCKED CONFIGURATION DAP REFERENCE, (FDF: ORB OPS, <u>REBOOST/DAP</u>), then:</p> <p>If orbiter continues to perform mated attitude control, proceed to step 14.5 and wait for MCC-H Go. Otherwise, proceed to step 14.8 and wait for MCC-H to latch the right blanket box.</p> <p>MCC-H proceed to step 13.10.</p>
PCS	<p>13.10 <u>Powering Off Left Blanket Box MDA</u></p> <p>PVM: EPS: SAW XX</p> <p>SAW XX</p> <p>'LBB'</p> <p>sel LBB Commands</p> <p>SAW XX LBB Commands</p> <p>'MDA'</p> <p>'Power'</p> <p>cmd Off – Off</p> <p>√MDA Voltage, V: <10 (±2.8)</p>

1.3.452 SAW XX DEPLOY

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14. LATCHING RIGHT SOLAR ARRAY BLANKET BOX (ENGAGING HIGH TENSION MODE)

PCS

14.1 Verifying Temperatures are Within Nominal Ranges Prior to SAW Deploy

PVM: EPS: SAW XX

SAW XX

Verify SAW PS Temp, deg C: -33 to 51
Verify BGA PS Temp, deg C: -33 to 51
Verify RBB MDA Temp, deg C: -54 to 48

14.2 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 XX

'RBB'

sel RBB Commands

SAW XX RBB Commands

'MDA'

'Power'

cmd On – Arm

cmd On – On

√MDA Voltage, V: 120 to 125

14.3 Verifying SAW Right Blanket Box Configuration

Verify parameters in UNLATCHED column in step 14.7 before executing latch command.

14.4 Verifying Conditions are Correct for Visual Verification

CAUTION

Steps 14.6 and 14.8 are to be performed during insolation, to support crew visual cues use to determine correct SABB latch configuration.

Verify ISS is in insolation.

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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 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 14.6.

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 14.6.

C3(A6)

If orbiter is performing mated attitude control

DAP: FREE

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

Proceed to step 14.8 and wait for **MCC-H** to latch RBB.

MCC-H proceed to step 14.6.

14.6 Latching SAW Right Blanket Box (Engage High Tension Mode)

CAUTION

Confirm no crew exercise or Max EVA loads before proceeding.

1.3.452 SAW XX DEPLOY

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NOTE

1. Latching the blanket box engages high tension mode (75 lbs) and provides more control over stiction between blanket panels during array deployment.
2. Upon successful latch commanding, 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.

MCC-H ↑ ISS, Orbiter, "Ready to latch the right blanket box."

PCS

PVM: EPS: SAW XX

SAW XX

'RBB'

sel RBB Commands

SAW XX RBB Commands

'RBB'

cmd Latch – Arm

cmd Latch – Latch (Be ready to visually monitor latch motion and check parameters in step 14.7 before sending this command. Latch nominally takes 14 seconds to complete.)

14.7 Monitoring RBB latch parameters during latch (approximately 14 seconds)

NOTE

1. Perform a visual verification prior to, during, and at the completion of each blanket box unlatch operation. Monitor for any obvious anomalies and verify blanket box latching operation.
2. SABB limit switches are sensitive to thermal conditions and may indicate inaccurate values during eclipse and the first 15 minutes of insolation.

1.3.452 SAW XX DEPLOY

(EPS/E12 - ALL/FIN 2)

Table 4. RBB Parameters

PARAMETER	UNLATCHED→	TRANSITION→ Approximately 14 seconds	LATCHED
RBB SW01,02 Pin Released	Yes	Yes	Yes
RBB SW01,02 Latched	No	No	Yes
RBB 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 3.00 (±0.4)	~0.10 (±0.4)
MDA Over Current Trip	blank	blank	blank

- * If one Latched, Unlatched, or Pin Released limit switch fails
- * | Confirm configuration visually and √**MCC-H** before
- * | proceeding.
- * |
- * | SABB limit switch status that would restrict mast commanding
- * | has already been overridden as part of 1.3.400 ECU
- * | Activation.
- * |
- * If two Latched, Unlatched, or Pin Released limit switches fail
- * | Perform step 14.8 and 14.9 (if orbiter performing attitude
- * | control), then √**MCC-H** before proceeding.

14.8 Performing Visual Verification Via Cameras

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

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

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

If orbiter is performing mated attitude control, proceed to step 14.9.
Otherwise, proceed to step 15.4.

MCC-H proceed to step 14.9.

- * If latch sequence is not successful, √**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:
- * |

1.3.452 SAW XX DEPLOY

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MCC-H	<p>14.9 <u>Configuring for Nominal Attitude Control</u></p> <p>If ISS is performing attitude control and ISS is in TEA (MCC-H) Go to step 14.10.</p> <p>If ISS is performing attitude control and ISS is not in TEA (MCC-H) Perform {2.405 <u>MODING FREE DRIFT TO CMG TA</u>} (SODF: MCS: NOMINAL: GNC MODING), then: MCC-H ↑ ISS, Orbiter, "ISS is in Attitude Control." Go to step 14.10.</p>
C3(A6)	<p>If orbiter is performing mated attitude control Perform rate damping DOCKED CONFIGURATION DAP REFERENCE, (FDF: ORB OPS, <u>REBOOST/DAP</u>), then: Proceed to step 15.3. MCC-H proceed to step 14.10.</p>
PCS	<p>14.10 <u>Powering Off Right Blanket Box MDA</u> PVM: EPS: SAW XX SAW XX 'RBB'</p> <p>sel RBB Commands</p> <p>SAW XX RBB Commands 'MDA' 'Power'</p> <p>cmd Off – Off</p> <p>√MDA Voltage, V: <10 (±2.8)</p> <p>If deploying both arrays on a PVM the same day Perform steps 12 to 14 for both arrays before proceeding to step 15. Once both arrays have one bay deployed and both SABBs are in the high tension mode (Latched) Proceed to step 15.3. MCC-H proceed to step 15.1.</p> <p>If deploying only one array Proceed to step 15.3. MCC-H proceed to step 15.1.</p>

1.3.452 SAW XX DEPLOY

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15. DEPLOYING 49 % OF SOLAR ARRAY

CAUTION
1. If unable to engage high tension mode (latching both LBB and RBB) then complete (100 %), deploy will not be attempted. Blanket stiction force will exceed capability of low tension mode causing a repeat of the 4A mission deployment anomaly. Due to increased storage time for subsequent wings, potentially greater consequences may result. The array may be deployed to 49 % in low tension mode if a SABB MDA failure is at fault, and EVA can later override it. Operations are restricted (as if array is partially deployed) with a fully deployed yet untensioned array.
2. ISS and orbiter attitude control is restricted from the time an array is deployed more than 1 bay (step 15) to when the array is feathered (step 18). The orbiter must maintain attitude control when deploying an array in the aft direction and ISS must maintain attitude control when deploying an array in the forward direction. This is to prevent damaging the array with thruster plumes.

15.1 Verifying Temperatures are Within Nominal Ranges Prior to SAW

Deploy

PVM: EPS: SAW XX

SAW XX

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

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

Verify Mast MDA Temp, deg C: -54 to 48

15.2 Powering On Mast Motor Drive Assembly (MDA)

NOTE

1. Mast MDA temperatures may be high due to direct sunlight in deploy configuration. MDA Over Temp Trip occurs at 77.8° C. At a minimum, a 30° C mast MDA temperature increase should be protected for during mast deployment. Delay MDA activation, until just prior to deploy time to minimize temperature increase if necessary.
2. MDA Slow alert will be Nominal until MDA power is applied. Once this is done, the indication is Slow.

SAW XX

'Mast'

sel Mast Commands

SAW XX Mast Commands

'MDA'

'Power'

cmd On – Arm

1.3.452 SAW XX DEPLOY

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cmd On – On

- √MDA Voltage, V: 120 to 125
- √MDA Current, A: ~0.10 (± 0.4)
- √MDA Slow Alert – Slow

15.3 Verifying Camera Configuration

ISS must be in insolation to perform this verification.

NOTE

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

Verify camera configuration correct for solar array deployment before proceeding.

If orbiter is performing mated attitude control, proceed to step 15.6. Otherwise, proceed to step 15.7 and wait for **MCC-H GO** to deploy 15.5 (49 %) Mast Bays.

15.4 Verifying Initial SAW Mast Configuration

NOTE

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

SAW XX Mast Commands

- √Mast SW01, SW02 Retracted – No
- √Mast SW01, SW02 Deployed – No

15.5 Verifying Conditions are Correct for Visual Verification

CAUTION

Steps 15.7 and 15.9 must be performed during insolation to support crew visual cues used to determine when to abort the solar array deployment.

Verify ISS is in insolation.

1.3.452 SAW XX DEPLOY

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15.6 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 array deployment 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 15.7.

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 15.7.

C3(A6)

If orbiter is performing mated attitude control

DAP: FREE

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

Then go to step 15.7, notify **MCC-H** before sending the deploy command.

15.7 Deploying 49 % of SAW (Approximately 15.5 Bays Visible)

WARNING

If deploying a solar array during EVA operations, confirm EVA crew outside of area that could be subject to solar array structural collapse.

1.3.452 SAW XX DEPLOY

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CAUTION
1. Confirm no crew exercise or maximum EVA loads before proceeding.
2. If the mast is in motion and the deploy to 49 % will not be completed before entering eclipse, the deploy must be stopped using the Mast – Abort command upon entering eclipse due to loss of visual insight. Once the deploy is stopped, the crew will perform step 15.8, if the orbiter is performing attitude control, then contact MCC-H . Otherwise, crew will contact MCC-H before proceeding.

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

PCS

PVM: EPS: SAW XX

SAW XX

'Mast'

sel Mast Commands

SAW XX Mast Commands

'Mast'

cmd Deploy – Arm

cmd Deploy – Deploy

Monitor RBB and LBB inboard tension mechanisms and tension bars for motion.

* If tension mechanism motion is indicated, immediately abort the
* deploy.
*

NOTE
While the mast is being deployed, the tension mechanisms may experience small oscillations. This is acceptable and not cause for an abort.

* 'Mast'

* cmd Abort – Abort

* √MCC-H before proceeding.
*

CAUTION
Panel forces are higher than expected and the likelihood of the tension bar rising is increased. Problem may not be due to stiction.

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Wait approximately 5 minutes (confirm 15.5 Bays are visible).

'Mast'

cmd Abort – Abort

Record Time Mast – Abort command sent: _____ GMT

If orbiter is performing attitude control, proceed to step 15.8.
Otherwise, proceed to step 15.9.

NOTE

1. The Mast – Abort command removes power from the MDA.
2. SAW 2B SW 02 Deployed limit switch failed prior to the 4A mission, No is always indicated.

√MDA Voltage, V: <10 (±2.8)

√Mast SW01, SW02 Retracted – No

√Mast SW01, SW02 Deployed – No

MCC-H

15.8 Configuring for Nominal Attitude Control

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

Go to step 15.9.

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 15.9.

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 15.9.

15.9 Performing Visual Verification Via Cameras

Verify Number of visible mast bays: 15.5

Verify LBB blanket alignment and condition.

Verify LBB inboard tension mechanism visual indicator aligned.

Verify LBB tension bar resting on blanket box sill.

Verify RBB blanket alignment and condition.

Verify RBB inboard tension mechanism visual indicator aligned.

Verify RBB tension bar resting on blanket box sill.

1.3.452 SAW XX DEPLOY

ISS ↓ **MCC-H**, “We confirm 15.5 Mast Bays deployed.”

MCC-H ↑ ISS, “We confirm nominal deploy to 49 %.”

Proceed to step 17.3.

MCC-H proceed to step 16.

* If Deploy sequence is not successful, √**MCC-H** before proceeding.
*
* If **MCC-H** unavailable, perform {3.191 SAW XX FAILURE TO
* | **EXTEND MAST REMOTELY**}, all (SODF: EPS: MALFUNCTION:
* | PRIMARY POWER SYSTEM), then:
*

MCC-H 16. DETERMINING WHEN TO CONTINUE SOLAR ARRAY DEPLOYMENT

CAUTION
A Sun incidence angle of 90 degrees (± 30), on the inactive surface of the solar array is required to achieve adequate thermal conditioning. This conditioning minimizes sticky panels during the deploy.

NOTE
<ol style="list-style-type: none">1. If the deployment spans one insolation period, 24 to 30 minutes of thermal condition time is required. If the deployment spans two insolation periods, deployment cannot be resumed until orbital noon of insolation period 2 or after 30 minutes of thermal conditioning.2. The thermal clock begins once the array is 49 % deployed and a Sun incidence angle of 90 degrees (± 30) to the array is achieved.

If the Sun incidence angle can be maintained at 90 degrees (± 2) throughout the thermal conditioning period
|
| 24 minutes of thermal conditioning time is required.

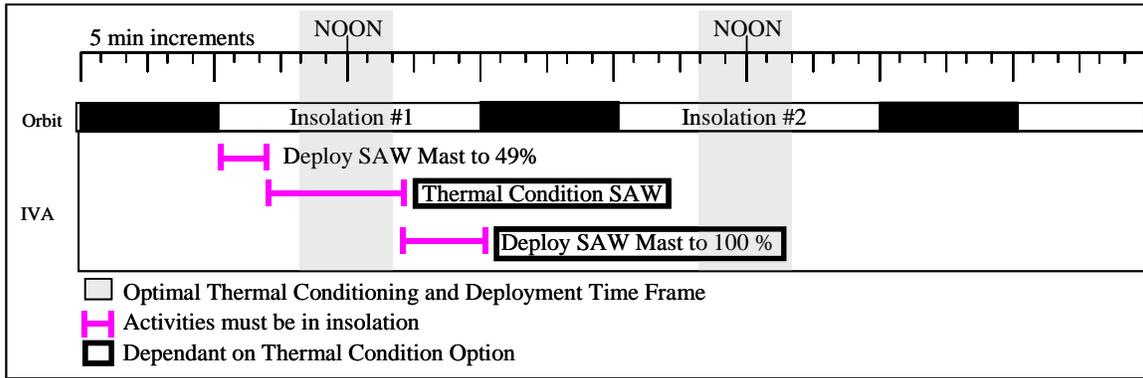
If the Sun incidence angle can be maintained at 90 degrees (± 30) throughout the thermal conditioning period
|
| 30 minutes of thermal conditioning time is required.

If the Sun incidence angle cannot be maintained at 90 degrees (± 30) throughout the thermal conditioning period
|
| Do not continue deploy.

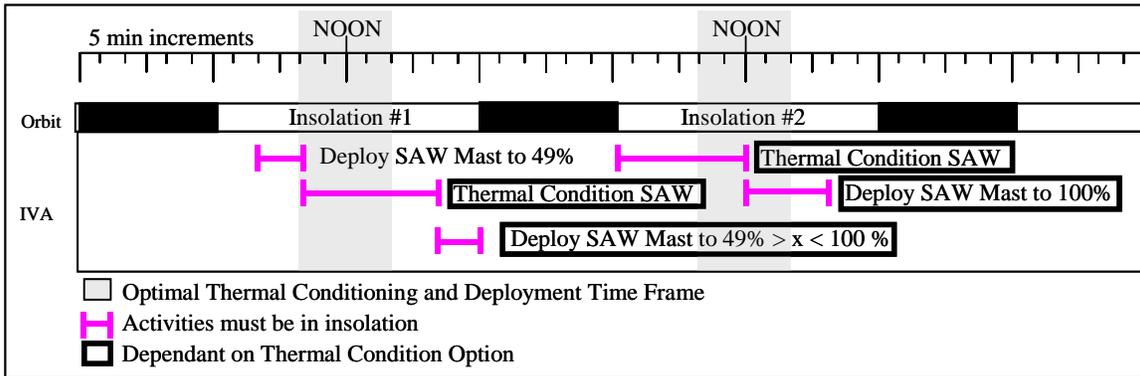
1.3.452 SAW XX DEPLOY

(EPS/E12 - ALL/FIN 2)

OPTION A: 100 % Deploy in 1 Insolation Period



OPTION B: > 49 % Deploy in 1 Insolation Period and 100 % Deploy in 2 Insolation Periods



OPTION C: 49 % Deploy in 1 Insolation Period and 100 % Deploy in 2 Insolation Periods

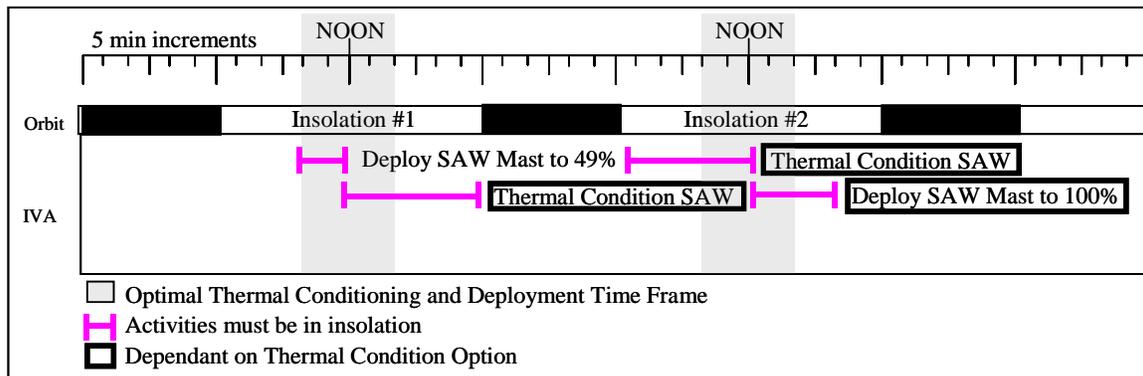


Figure 1.- Solar Array Deployment.

1.3.452 SAW XX DEPLOY

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If the Mast – Abort time recorded in step 15.8 occurred at or before orbital noon of the present (insolation 1) insolation period, Option A or B will be attempted.

Determine deploy times.

Mast – Abort Time (from step 15.8) +24 minutes = Earliest Deploy Time

Record earliest time deploy (step 17.8) can be performed: _____ GMT

Mast – Abort Time (from step 15.8) +30 minutes = Nominal Deploy Time

Record nominal time deploy (step 17.8) can be performed: _____ GMT

Proceed to step 17.

If the Mast – Abort time recorded in step 15.8 occurred after orbital noon of the present (insolation 1) insolation period, Option C will be attempted.

Determine deploy time.

Next Orbital Sunrise +30 Minutes = Contingency Deploy Time

Record contingency time deploy (step 17.8) can be performed: _____ GMT

NOTE

Steps 17.1 through 17.6 can be performed early.

17. COMPLETING SOLAR ARRAY DEPLOYMENT

17.1 Verifying Temperatures are Within Nominal Ranges Prior to SAW

Deploy

PCS

PVM: EPS: SAW XX

SAW XX

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

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

Verify Mast MDA Temp, deg C: -54 to 48

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17.2 Powering On Mast Motor Drive Assembly (MDA)

NOTE

1. Mast MDA temperatures may be high due to direct sunlight in deploy configuration. MDA Over Temp Trip occurs at 77.8° C. At a minimum, a 30° C mast MDA temperature increase should be protected for during mast deployment. Delay MDA activation, until just prior to deploy time to minimize temperature increase if necessary.
2. MDA Slow alert will be Nominal until MDA power is applied. Once this is done, the indication is Slow.

SAW XX

'Mast'

sel Mast Commands

SAW XX 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

17.3 Verifying Camera Configuration

ISS must be in insolation to perform this verification.

NOTE

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

Verify camera configuration is correct for solar array deploy to 100 %, before proceeding.

If orbiter is performing mated attitude control, wait for deploy time from **MCC-H**, then proceed to step 17.6. Otherwise, proceed to step 17.7 and wait for **MCC-H GO** to complete Mast deploy.

MCC-H proceed to step 17.4.

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17.4 Verifying Initial SAW Mast Configuration

NOTE

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

SAW XX Mast Commands

√Mast SW01,SW02 Retracted – No

√Mast SW01,SW02 Deployed – No

17.5 Verifying Conditions are Correct for Visual Verification

CAUTION

Steps 17.7 and 17.10 must be performed during insolation to minimize sticky panels during the deploy and support crew visual cues use to determine when to abort the solar array deployment. A Sun incidence angle between 60 degrees and 90 degrees (optimal) on the inactive surface of the solar array is required to achieve an adequate thermal environment throughout the deploy.

Verify ISS is in insolation (orbital noon ± 10 minutes is optimal for deploy).

17.6 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 array deployment 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 17.7.

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

Perform {2.404 MODING CMG TA TO FREE DRIFT}, all

(SODF: MCS: NOMINAL: GNC MODING), then:

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

Go to step 17.7.

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C3(A6)

If orbiter is performing mated attitude control

DAP: FREE

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

Go to step 17.8, notify **MCC-H** before sending the deploy command.

17.7 Deploying 100 % of SAW (Approximately 31.5 Bays Visible)

WARNING

If deploying a solar array during EVA operations, confirm EVA crew outside of area that could be subject to solar array structural collapse.

CAUTION

1. Confirm no crew exercise or maximum EVA loads before proceeding.
2. If the mast is in motion and the deploy will not be completed (100 %) before entering eclipse, the deploy must be stopped using the Mast – Abort command upon entering eclipse due to loss of visual insight. Once deploy is stopped, crew will perform step 17.9, if orbiter is performing attitude control. Otherwise, crew will hold in step 17.7 and wait for **MCC-H GO** to complete mast deploy. **MCC-H** return to step 16, then perform steps 17.1 to 17.2 and 17.6.

NOTE

Upon successful deploy 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.

PCS

PVM: EPS: SAW XX

SAW XX

'Mast'

sel Mast Commands

SAW XX Mast Commands

'Mast'

cmd Deploy – Arm

cmd Deploy – Deploy (Nominal deploy takes ~6 minutes. Tension mechanism monitoring is not required for redeploy after an SSU R&R. Redeploy takes 13 minutes.)

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If <24 Bays visible

Monitor RBB and LBB inboard tension mechanisms and tension bars for motion during deployment of the first 24 bays (75 % deployed mast).

* If motion (inboard tension mechanism rotates approximately
* 1/8 turn) is indicated between 49 % (15.5 bays) and 75 %
* (24 Bays) deployed, immediately abort deploy.

NOTE

While the Mast is being deployed, the tension mechanisms may experience small oscillations. This is acceptable and not cause for an abort.

'Mast'

cmd Abort – Abort

√**MCC-H** before proceeding.

CAUTION

Panel stiction forces are higher than expected and the likelihood of the tension bar rising is increased. Note that panels will separate from least to greatest stiction force.

If >24 Bays visible

Monitor RBB and LBB inboard tension mechanisms and tension bars for motion until the last Mast Bay begins to deploy.

NOTE

During deployment of the last half Mast Bay (at Mast Bay 31) the tension bars of both blankets will rise off the blanket box sill (~20 inches) and the tension mechanisms will rotate approximately 1.5 turns.

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* If motion (inboard tension mechanism rotates a quarter turn) is
* indicated between 75 % (24 Bays) and 98 % (31 Bays)
* deployed, immediately abort the deploy.

NOTE

While the mast is being deployed, the tension mechanisms may experience small oscillations. This is acceptable and not cause for an abort.

'Mast'

cmd Abort – Abort

If either tension bar rises up excessively (>3") from the blanket box sill and does not return to the sill after the abort is issued, then immediately

SAW XX Mast Commands

'MDA'

'Power'

cmd On – Arm

cmd On – On

√MDA Voltage, V: 120 to 125

'Mast'

cmd Retract – Arm

cmd Retract – Retract

Retract the mast until the tension bar reaches the sill.

'Mast'

cmd Abort – Abort

√MDA Voltage, V: <10 (±2.8)

√**MCC-H** before proceeding.

If **MCC-H** unavailable, perform {3.194 SAW XX BLANKET PANEL STICTION DURING DEPLOYMENT}, all (SODF: EPS: MALFUNCTION: PRIMARY POWER SYSTEM), then:

Otherwise, √**MCC-H** before proceeding.

If **MCC-H** unavailable, perform {3.194 SAW XX BLANKET PANEL STICTION DURING DEPLOYMENT}, all (SODF: EPS: MALFUNCTION: PRIMARY POWER SYSTEM), then:

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Wait approximately 6 minutes (13 minutes for redeploy post SSU R&R) until 100 % deployed (confirm 31.5 bays are visible).

If orbiter is performing mated attitude control, proceed to step 17.9. Otherwise, proceed to step 17.10.

MCC-H proceed to step 17.8

17.8 Verifying Final SAW Mast Configuration

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

SAW XX Mast Commands

- √Mast SW01,SW02 Retracted – No
- √Mast SW01,SW02 Deployed – Yes
- √MDA Voltage, V: 120 to 125
- √MDA Current, A: ~0.10 (±0.4)
- √MDA Slow Alert – Slow

- * If one Deployed or Retracted limit switch fails
- * | Confirm configuration visually and √**MCC-H** before
- * | proceeding.
- * |
- * | Mast limit switch status that would restrict SABB and BGA
- * | commanding has already been overridden as part of ECU
- * | activation.
- * |
- * If two Deployed or Retracted limit switches fail
- * | Perform steps 17.9 (if orbiter performing attitude control) and
- * | 17.10, then √**MCC-H** before proceeding.

17.9 Configuring for Nominal Attitude Control

MCC-H

If ISS is performing attitude control and ISS is in TEA (**MCC-H**)
| Go to step 17.10.

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 17.10.

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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 17.10.

17.10 Performing Visual Verification Via Cameras

- Verify mast position – Deployed
- Verify tension bar – Pulled away from blanket box
~20" (as last mast bay deploys)
- Verify number of visible mast bays – 31.5
- Verify solar array blanket – Flat

- Verify guide rollers on final bay – Visible (final yellow flex batten)
- Or
- Verify Last Bay barber pole decal – Visible

NOTE
Last Bay barber pole indication can be seen with the cameras only when the array is positioned at or near 180 degrees (Mast MDA side).

ISS ↓ **MCC-H**, “Solar Array XX deploy complete.”

MCC-H ↑ ISS, “We confirm solar array fully deployed.”

MCC-H proceed to 17.11.

If deploying both arrays on a PVM the same day, return to step 15.3 and reconfigure cameras for deploy of the next array.

If deploying only one array or redeploying the array after an SSU R&R, exit procedure.

```
*****
* If deploy sequence is not successful, √MCC-H before
* | proceeding.
* |
* If MCC-H unavailable, perform {3.191 SAW XX FAILURE
* | TO EXTEND MAST REMOTELY}, all (SODF: EPS:
* | MALFUNCTION: PRIMARY POWER SYSTEM), then:
*****
```

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PCS 17.11 Power Off Mast MDA
PVM: EPS: SAW XX
SAW XX
'Mast'

sel Mast Commands

SAW XX Mast Commands
'MDA'
'Power'

cmd Off – Off

√MDA Voltage, V: <10 (±2.8)

18. FEATHERING SOLAR ARRAY TO PROTECT AGAINST ISS/ORBITER PLUME LOADS

WARNING

Confirm EVA, SSRMS, and SRMS, clear of solar array rotation path before unlatching and rotating BGA.

CAUTION

Once deployed, the solar array must be placed edge-on to ISS and orbiter thruster plume, to minimize array structural loads and contamination. The active surface of the array will be pointed toward the Sun. This requirement is not applicable to P6 arrays, when P6 is located on the Z1 truss.

PVM: EPS: BGA XX

BGA XX
'BGA XX'

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

Refer to Table 5 for the BGA XX Cmd Angle and perform {2.102 PVM CONFIGURE BGA XX TO DIRECTED POSITION MODE}, steps 5 to 8 (SODF: EPS: NOMINAL: PRIMARY POWER SYSTEM), then:

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Table 5. Solar Array Feather Angles

PVM	BGA/SA W (XX)	Cmd Angle, deg
S4	1A	90
S4	3A	270
S6	1B	270
S6	3B	90
P4	2A	90
P4	4A	270
P6 on Z1	2B	Not Required
P6 on Z1	4B	Not Required
P6	2B	270
P6	4B	90

If deploying both arrays on a PVM the same day

Perform steps 15 to 18 for both channels before proceeding to step 19.

If deploying only one array or redeploying the array after an SSU R&R,
go to step 19.

19. [ENABLING MOTOR VELOCITY SAFING \(IF REQUIRED\)](#)

NOTE

If BGA is at 0 degrees, then delay this velocity limit safing -
enable step until next time the BGA is reconfigured.

If the BGA is not at 0.0 (± 0.5) degrees

PVM: EPS: BGA XX

sel Motor

'Velocity Limit Safing, Primary PVCU'

cmd Enable – Arm

cmd Enable – Enable

Verify Primary PVCU – Ena

'Velocity Limit Safing, Backup PVCU'

cmd Enable – Arm

cmd Enable – Enable

Verify Backup PVCU – Ena

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20. POST SAW DEPLOY RECONFIGURATION

NOTE

1. Once this procedure is complete, SSU XX is still shunted, and the array is not yet supporting channel XX. Channel XX IEA hardware is still receiving power from a support channel.
2. Table 6 provides support channel connectivity. A support channel, provides initial power to the channel being activated until the SAW is deployed and the batteries are charged (e.g., Ch 4B supports Ch 4A until Ch 4A is fully activated). If redeploying the array after an SSU R&R, confirm support channel with **MCC-H**.

If the array was redeployed after an SSU R&R, perform step 20.2 then exit procedure.

Table 6. Support Power Channel Connectivity

XX	YY	ZZ
1A	3A	4A
3A	1A	2A
1B	3B	1A
3B	1B	3A
2A	4A	2B
4A	2A	4B
2B	4B	2A
4B	2B	4A

20.1 Powering Up Loads on ISS (As Necessary)

NOTE

Loads previously powered down, may be reactivated if no longer in the solar array deploy attitude.

Reactivate those loads previously deactivated for array deployment.

20.2 Recover Loads on DDCU XX (YY) After SAW Deploy

NOTE

Power can be supplied to ECU XX from DDCU XX or DDCU YY for the solar array deploy. Therefore, it may have been necessary to reduce loads on the appropriate DDCU to support a peak power load of 580 watts during array deployment.

Reactivate those loads previously deactivated on DDCU XX (YY) for array deployment.

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20.3 Configure for Charging Batteries from Channel XX Array (Same Channel the SAW Was Deployed)

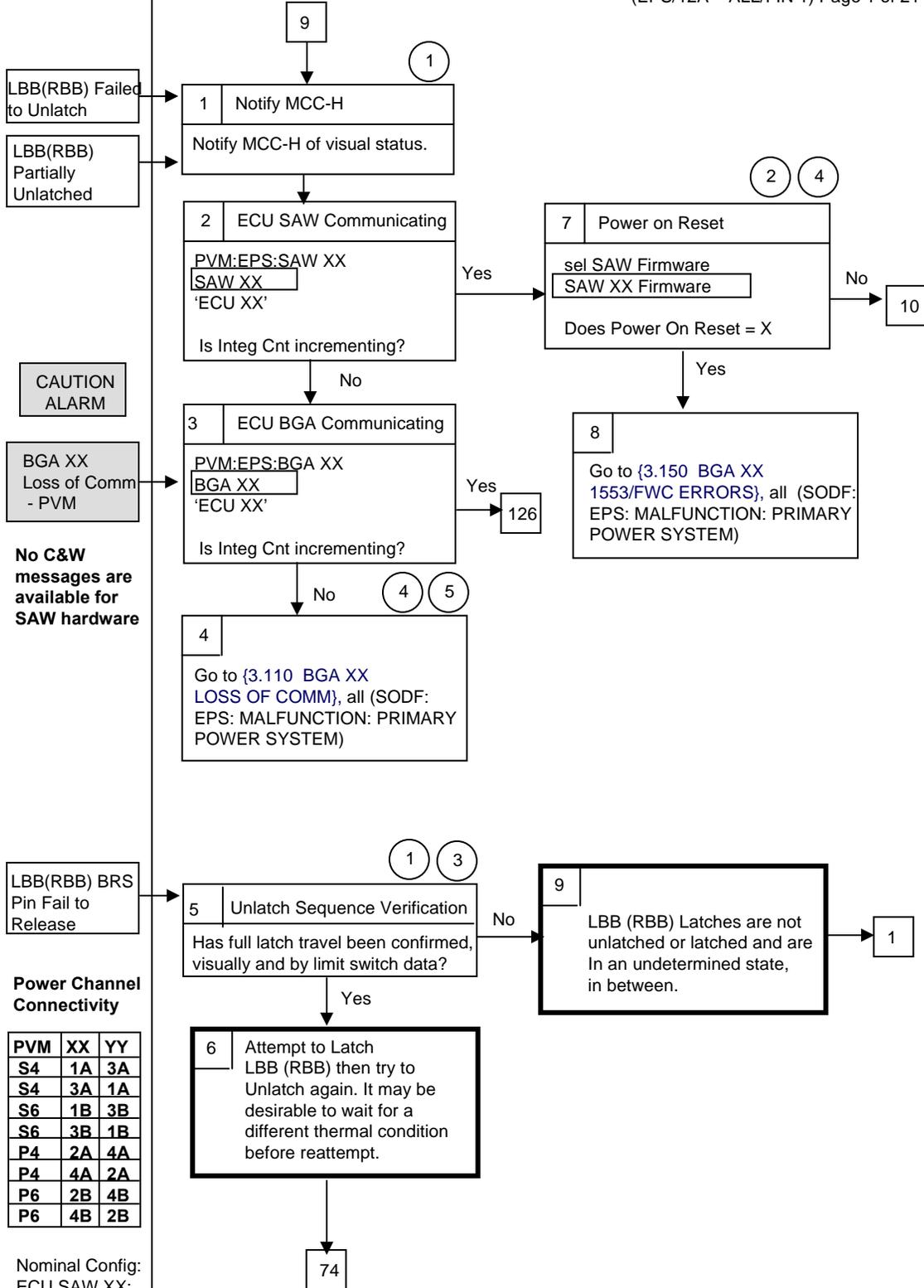
Go to {[1.3.100 PRIMARY POWER CHANNEL ACTIVATION](#)}, step 72 (SODF: EPS: ACTIVATION AND CHECKOUT: CHANNEL ACTIVATION).

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EPS

3.190 SAW XX FAILURE TO UNLATCH SABB REMOTELY

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LBB(RBB) Failed to Unlatch
LBB(RBB) Partially Unlatched

CAUTION ALARM

BGA XX Loss of Comm - PVM

No C&W messages are available for SAW hardware

LBB(RBB) BRS Pin Fail to Release

Power Channel Connectivity

PVM	XX	YY
S4	1A	3A
S4	3A	1A
S6	1B	3B
S6	3B	1B
P4	2A	4A
P4	4A	2A
P6	2B	4B
P6	4B	2B

Nominal Config:
ECU SAW XX:
RPCM XX A
RPC 1 - CI
RPCM YY A
RPC 2 - CI

1 This procedure assumes the SABBs will be unlatched at specific times during the mission. For Deployments: 1) Initial SABB Unlatch, 2) Unlatch SABBs Day of Deploy. For Retractions: 1) Unlatch SABBs when Mast at 1 Bay.

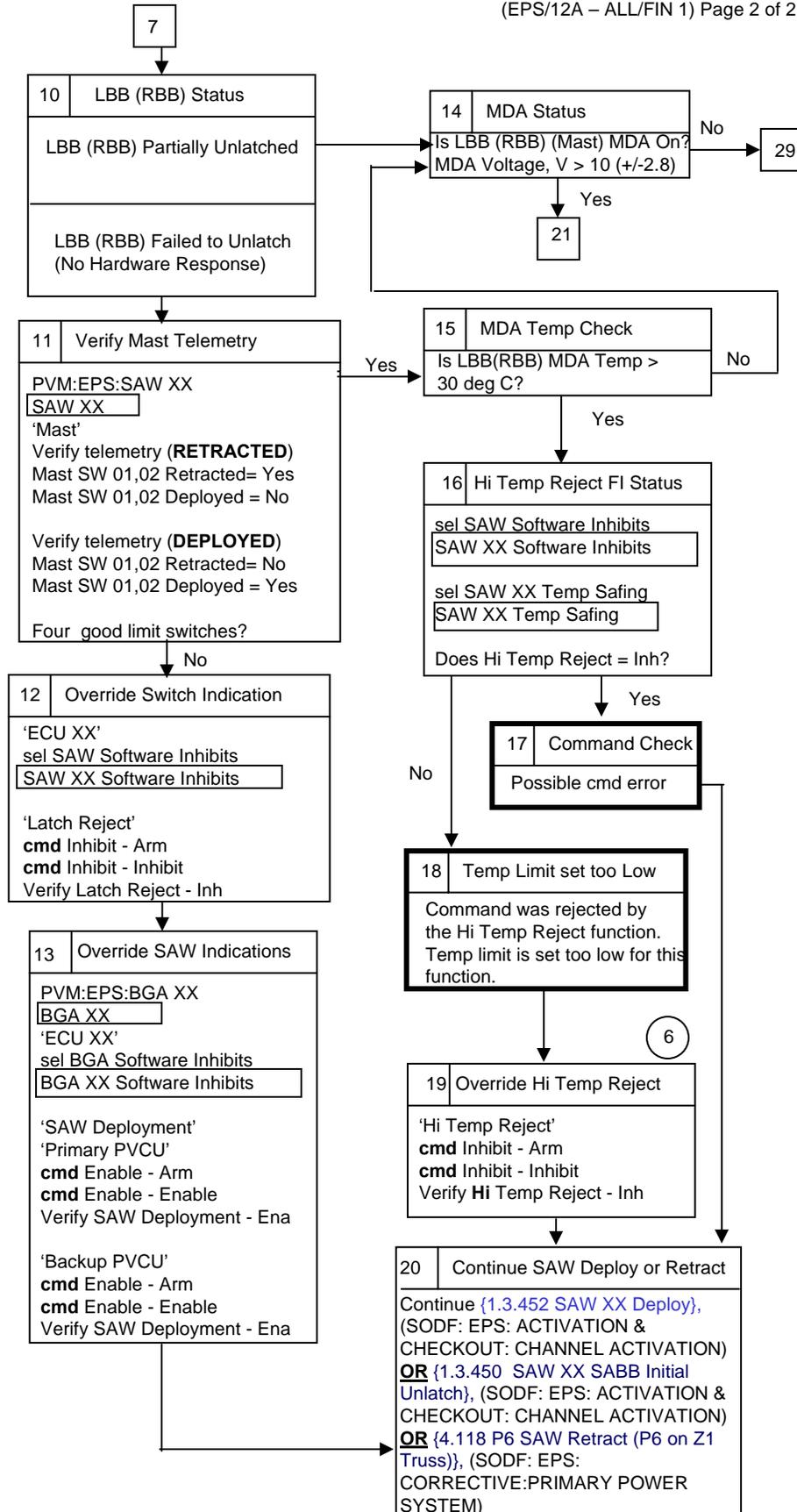
2 Caution message BGA XX 1553/FWC Errors- PVM may also be received if a Power on Reset has occurred.

3 Damage to SABB hardware when driving a MDA in the opposite direction from the initial cmded direction.

4 If power was removed from the ECU you must begin again with step 1 of the Deploy/Retract procedure, to reset the F/W inhibits.

5 If Current sensor fails high > 0.78 A RPCs providing power to ECU will be opened. A new PPL with a higher Current limit must be uploaded before the ECU can be recovered. There is no inhibit for SAW MDA Config Complete Persistent Current Safing.

3.190 SAW XX FAILURE TO UNLATCH SABB REMOTELY



6

MDA operating temperature range is -54 to 48 deg C.

3.190 SAW XX FAILURE TO UNLATCH SABB REMOTELY

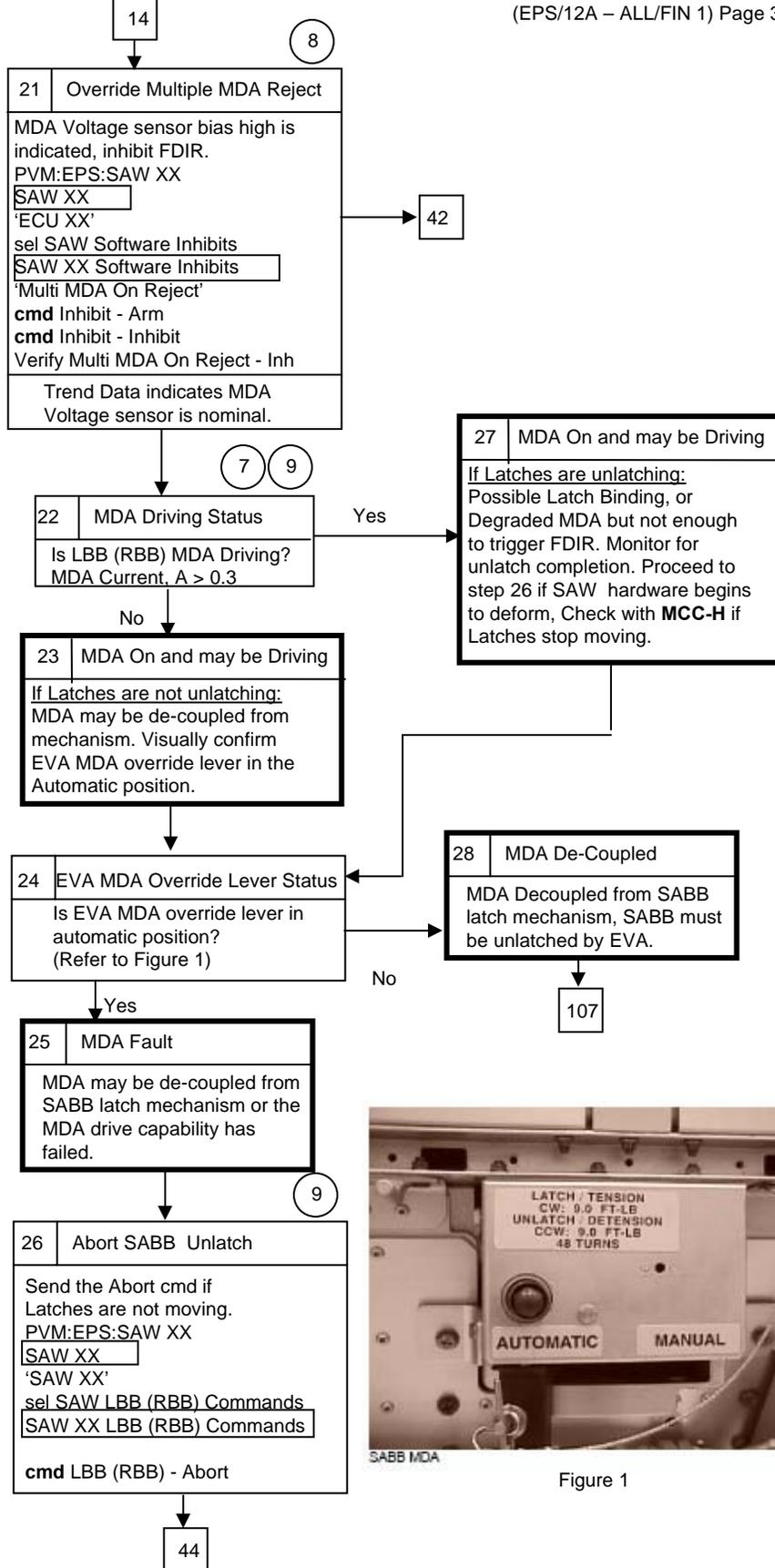


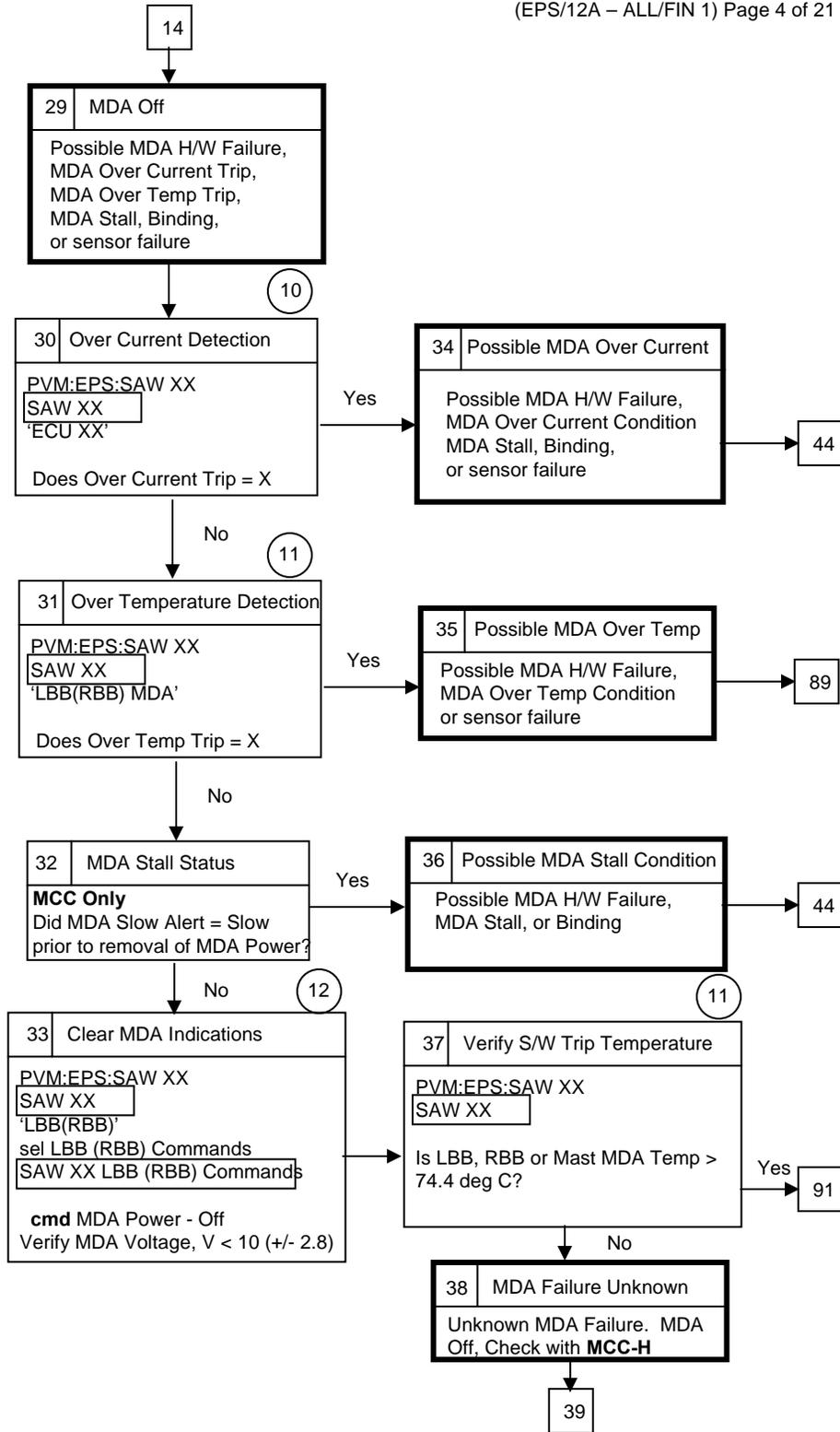
Figure 1

7 The manual MDA override lever is located on the back (inactive side) of the SABB base. (MDA current with no load = 0.3A)

8 There is no overvoltage FDIR for the MDA. The MDA will continue to operate if a Voltage sensor has failed high. Check voltages of all MDAs. The multiple MDA On Reject FDIR will reject an MDA on command if another MDA is already on.

9 If MDA de-coupled you may not be able to tell if the MDA is driving based on the current.

3.190 SAW XX FAILURE TO UNLATCH SABB REMOTELY



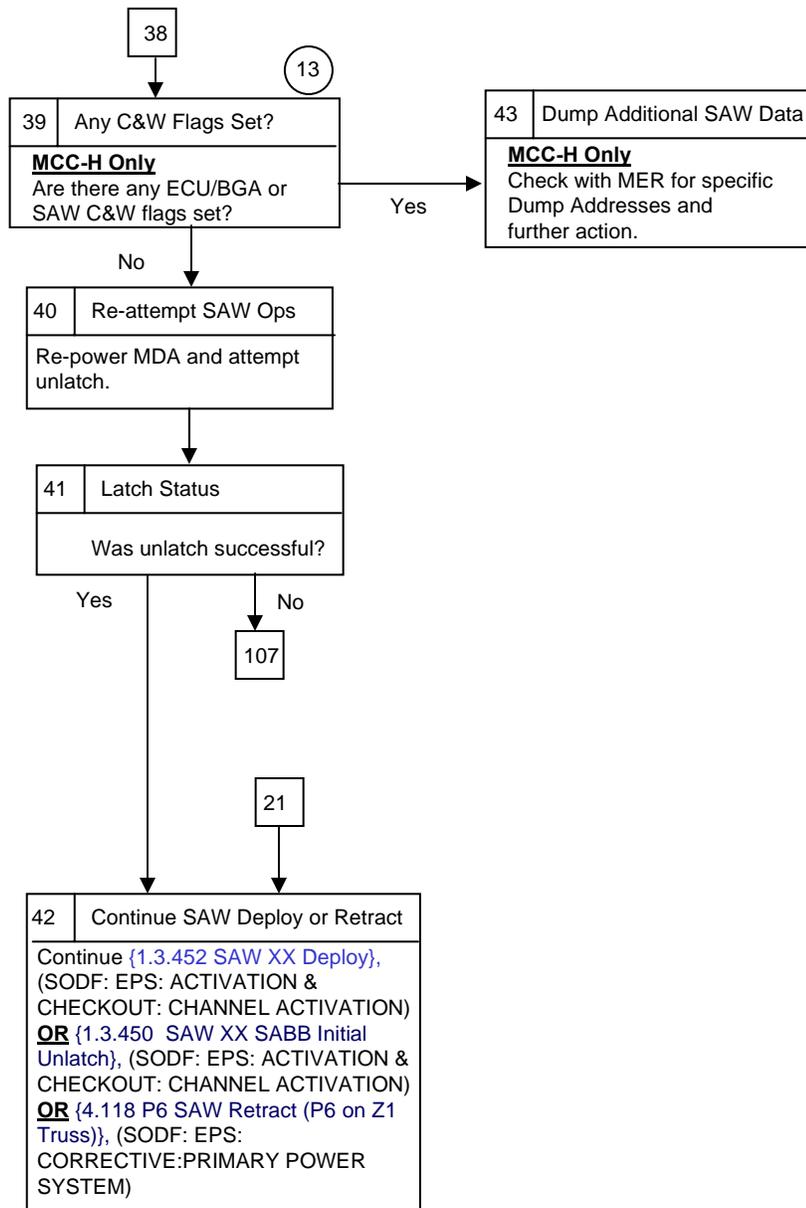
10 ECU Firmware MDA Over Current Trip occurs at 6.2 Amps. S/W Limit (0.78 A) is reached first and it does **not** set the MDA Over Current Trip Flag.

11 Disconnects are present in the MDA Over Temp FDIR. S/W Trip level = 77.7 deg C. F/W Trip level = 140 deg C. H/W damage occurs at 120 deg C. S/W Temp limit is reached first and it does **not** set the MDA Over Temp Trip Flag.

12 MDA Power off is a one step command.

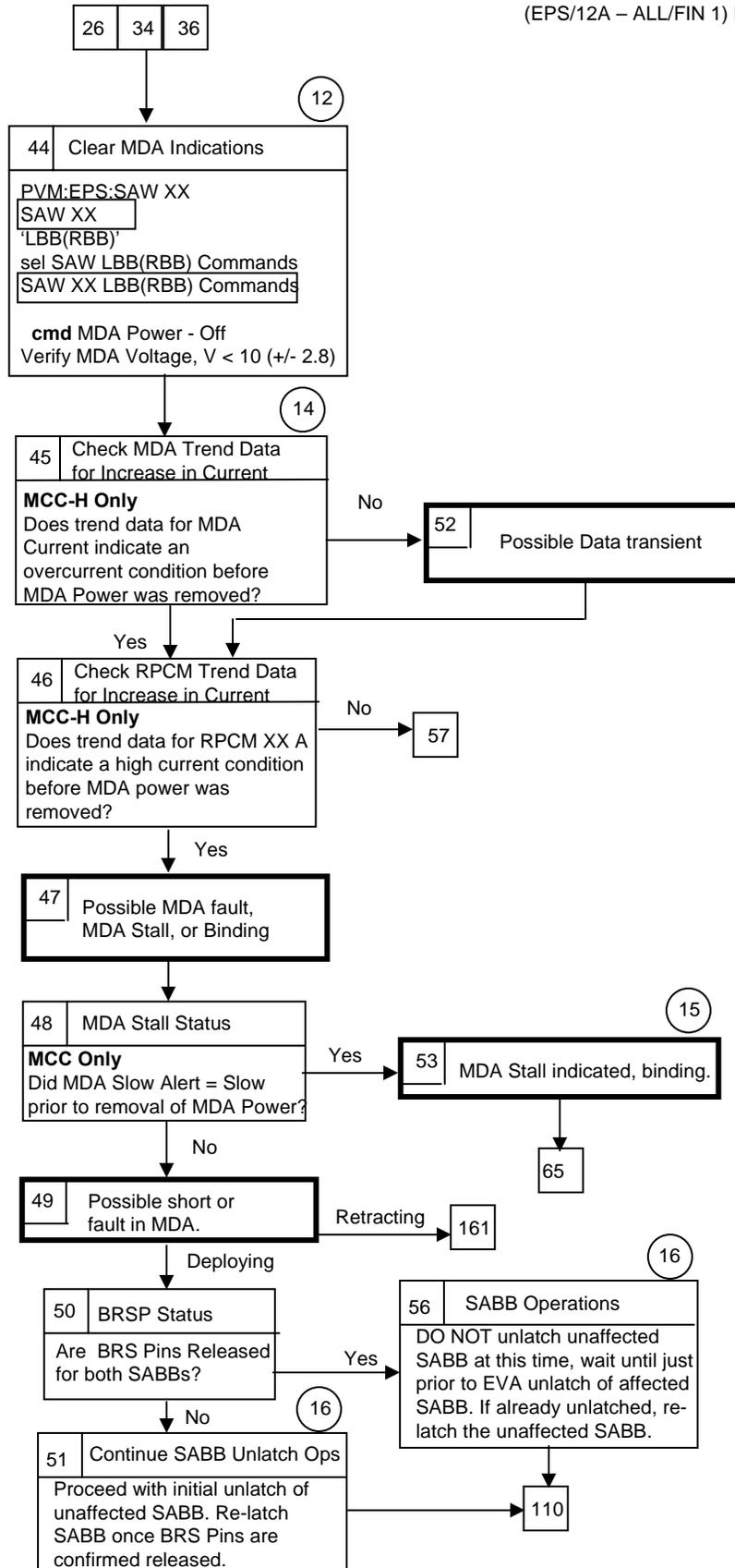
3.190 SAW XX FAILURE TO UNLATCH SABB REMOTELY

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13
 SAW Caution and Warning Flags are available for downlink only during missions that scheduled SAW activities. (e.g 12A) Flags are not available on PCS displays.

3.190 SAW XX FAILURE TO UNLATCH SABB REMOTELY



12 MDA Power off is a one step command.

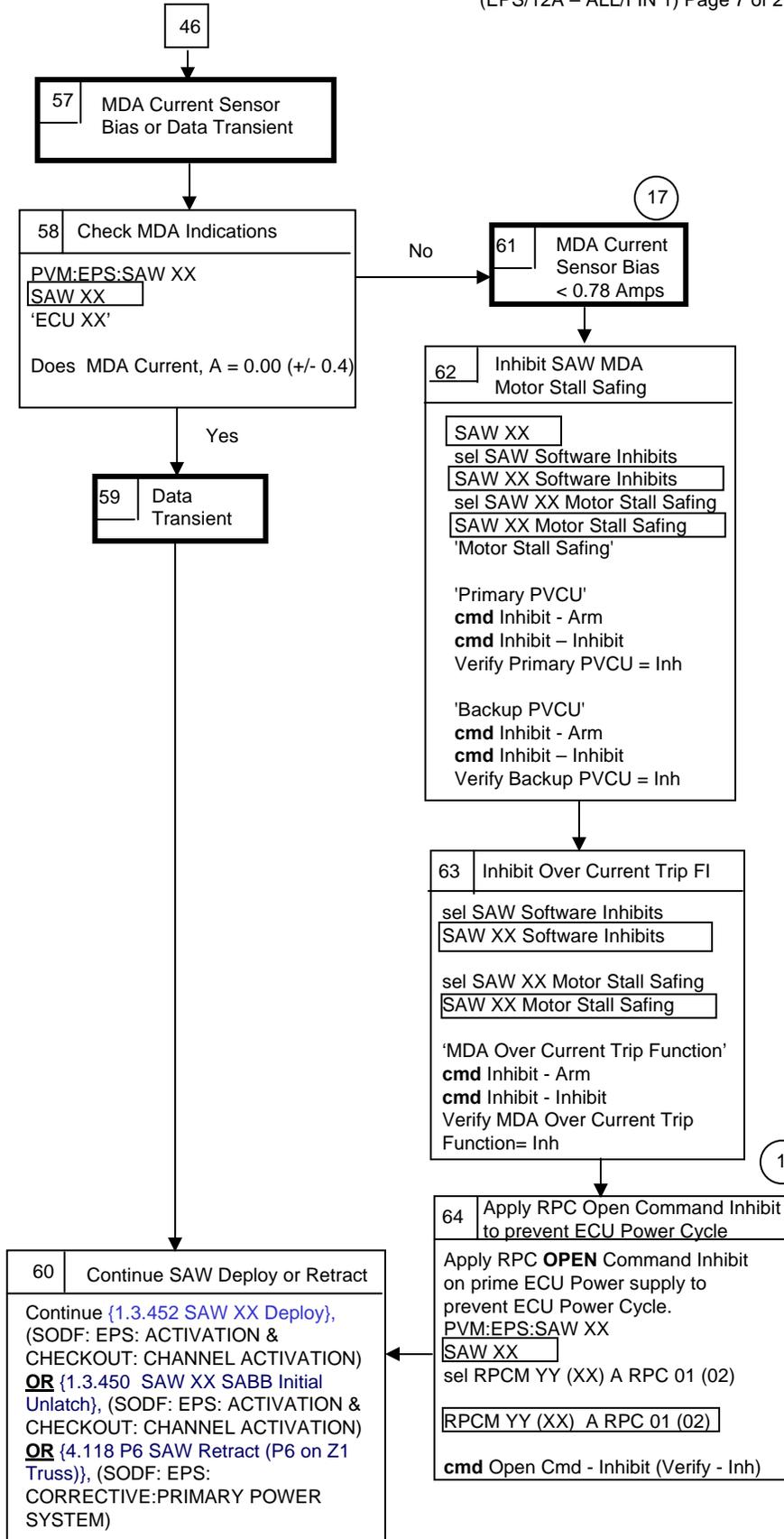
14 PVCU Software MDA Over Current Trip occurs at 0.78 Amps.

15 If a Stall Condition is indicated, Current > 0.78 A and motor speed is < 25 RPM, power is removed from the MDA

16 Re-latch SABB to protect blanket from external loads.

3.190 SAW XX FAILURE TO UNLATCH SABB REMOTELY

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17

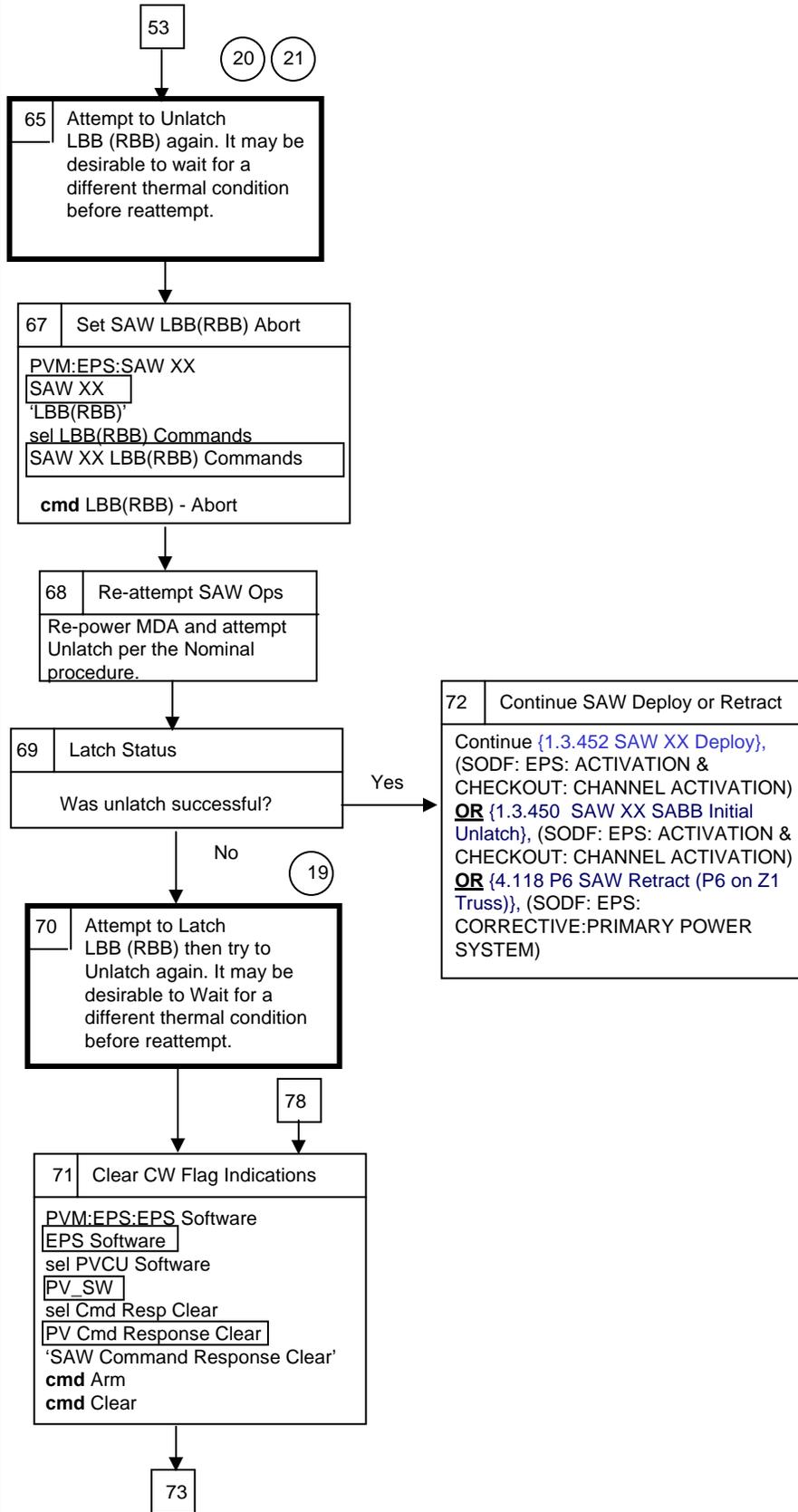
If Current sensor fails high > 0.78 A RPCs providing power to ECU will be opened. A new PPL with a higher current limit must be uploaded before the ECU can be recovered. There is no inhibit for SAW MDA Motor Stall Persistent Current Safing. Refer to block 3.

18

Nominal SABB unlatch, takes approximately 14 seconds to complete. However, all MDAs use the same current sensor. A new PPL 69 must be uplinked prior to SAW operations or Inhibit the RPC Open Command to avoid power cycling the ECU.

18

3.190 SAW XX FAILURE TO UNLATCH SABB REMOTELY



19

There is a very limited partially unlatched range in which a re-latch can be attempted without damaging the hardware. This must be confirmed visually by MCC-H. CAUTION Re-latch cannot be attempted if BRSP are not released. Damage to hardware can occur

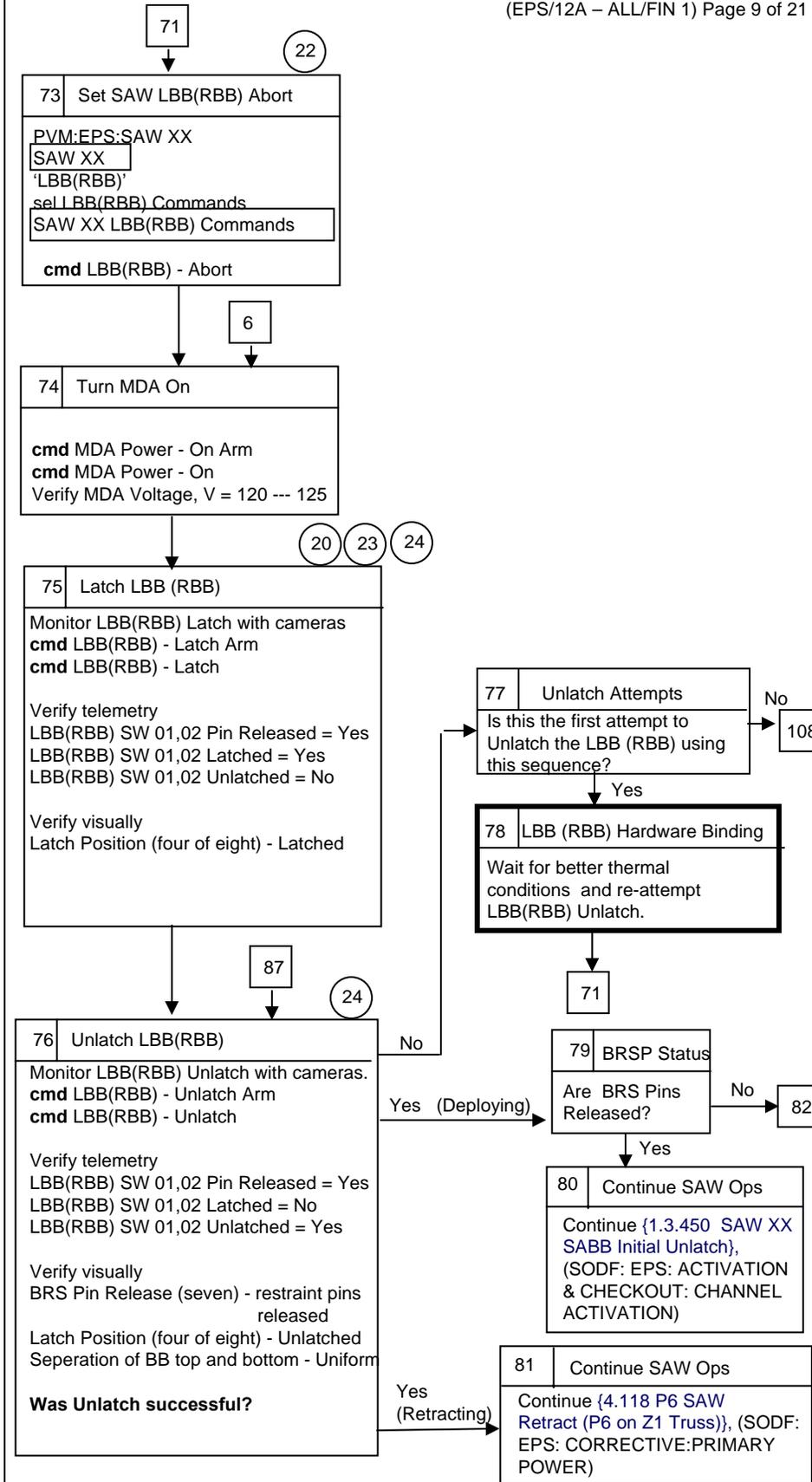
20

Damage to SABB hardware when driving a MDA in the opposite direction from the initial cmded direction.

21

Re-attempt will be made at the end of insolation or end of eclipse, whichever case is opposite initial attempt.

3.190 SAW XX FAILURE TO UNLATCH SABB REMOTELY



20 Damage to SABB hardware when driving a MDA in the opposite direction from the initial cmded direction.

22 MDA Abort must sent to prevent MDA from driving once power is re-applied. This is a single step cmd.

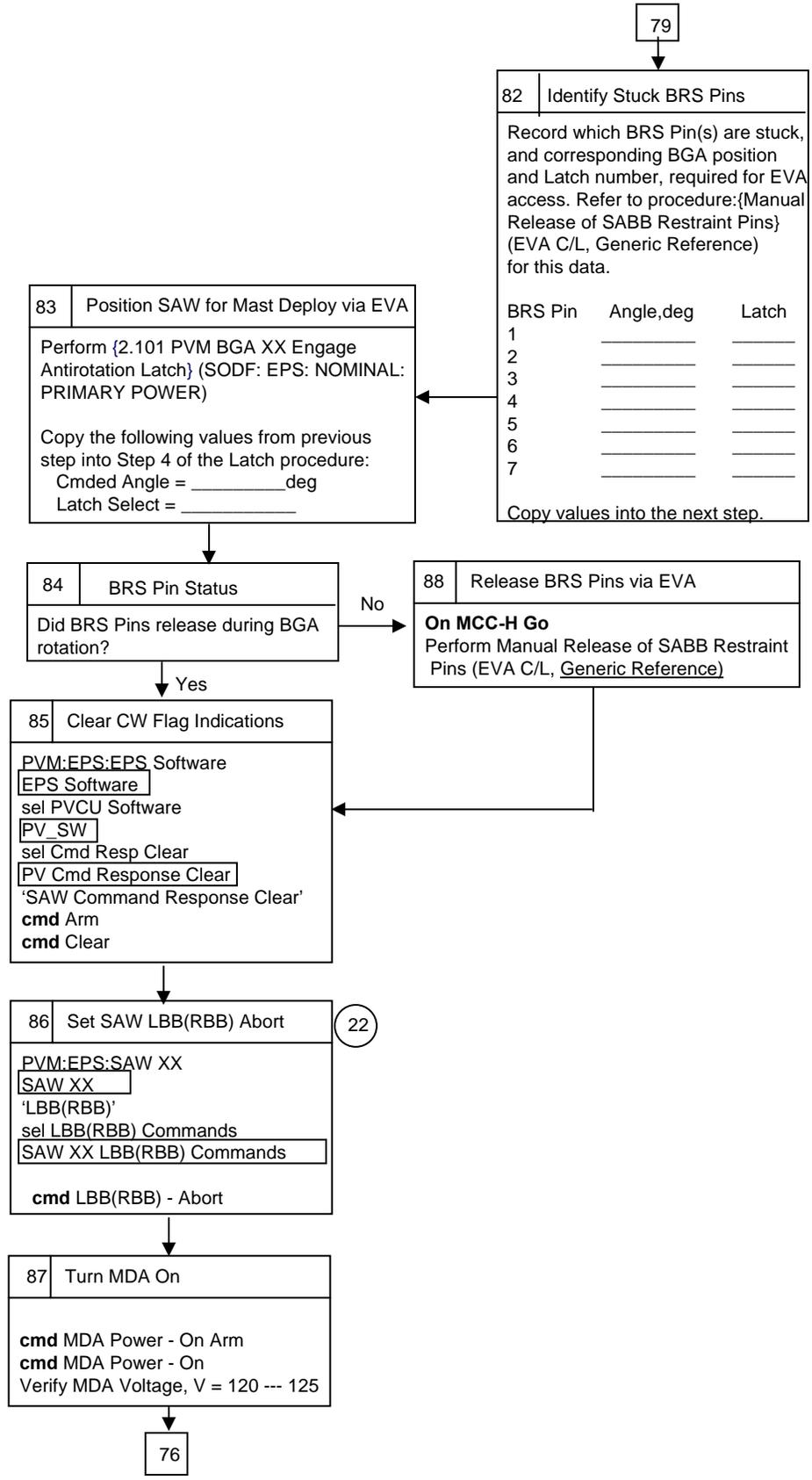
23 There is a very limited partially unlatched range in which a re-latch can be attempted without damaging the hardware. This must be confirmed visually by MCC-H before block 75 can be executed. If block 75 cannot be performed continue in block 76.

24 Confirm that ISS Thrusters are inhibited or ISS/Orbiter in Free Drift and no crew exercise or max EVA loads prior to sending the Unlatch or Latch command. If at any time the array mechanical movement is stopped or aborted, attitude control may be resumed.

3.190 SAW XX FAILURE TO UNLATCH SABB REMOTELY

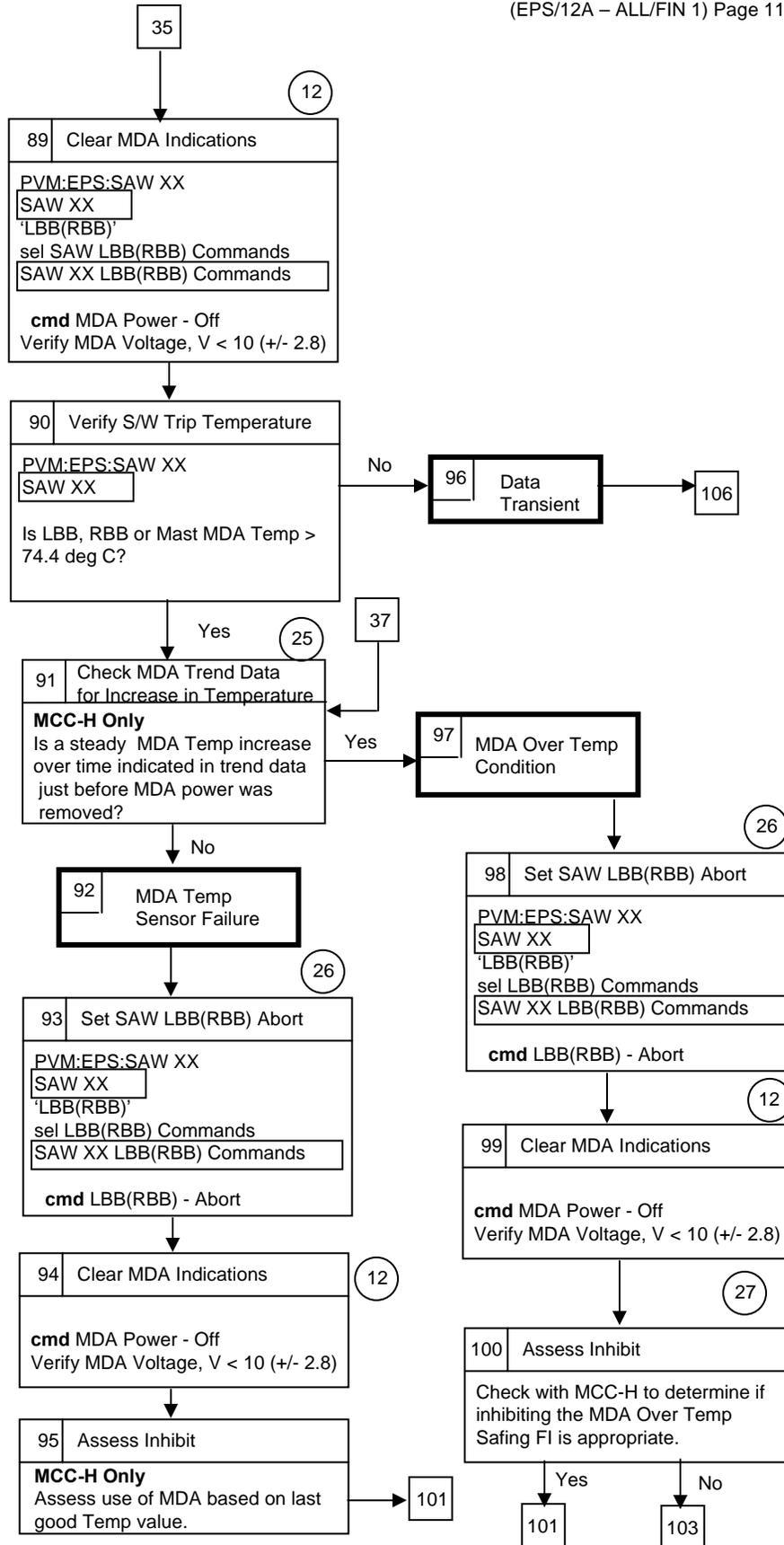
(EPS/12A – ALL/FIN 1) Page 10 of 21

22



MDA Abort must be sent to prevent MDA from driving once power is re-applied. This is a single step cmd.

3.190 SAW XX FAILURE TO UNLATCH SABB REMOTELY



12

MDA Power off is a one step command.

25

Disconnects are present in the MDA Over Temp FDIR. S/W Trip level = 77.7 deg C. F/W Trip level = 140 deg C. H/W damage occurs at 120 deg C.

26

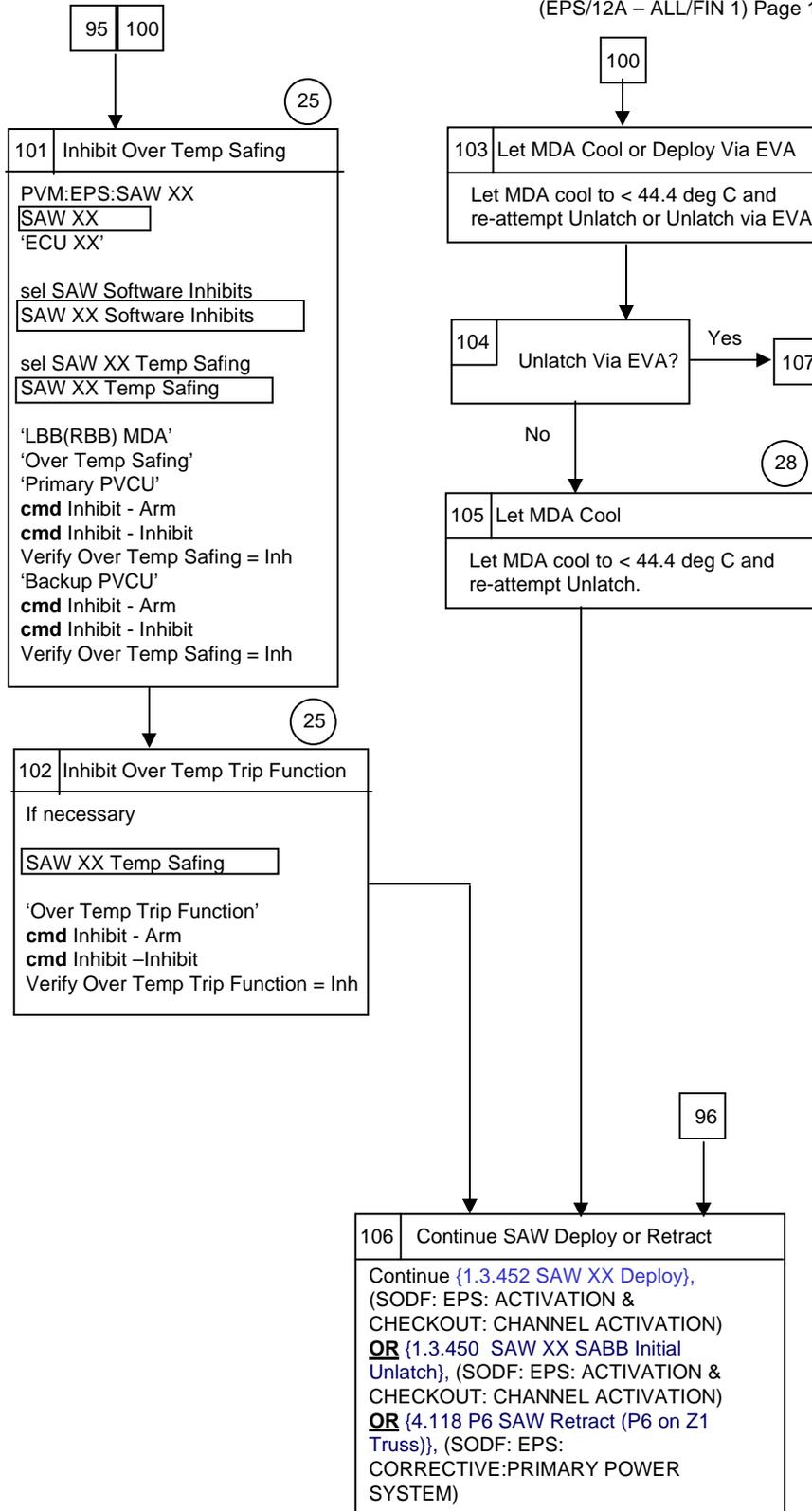
Since S/W Temp limit is reached first and it does not set the MDA Over Temp Trip flag, a MDA Abort must be sent to prevent MDA from driving, once power is re-applied. This is a single step cmd.

27

Per Flight Rule B9-207, MDA operations can proceed even if MDA temp is high in order to meet critical mission objectives. SABB unlatch takes approximately 14 seconds. Measurement Out of Range will be indicated if MDA temp >72.2 deg C.

3.190 SAW XX FAILURE TO UNLATCH SABB REMOTELY

(EPS/12A – ALL/FIN 1) Page 12 of 21

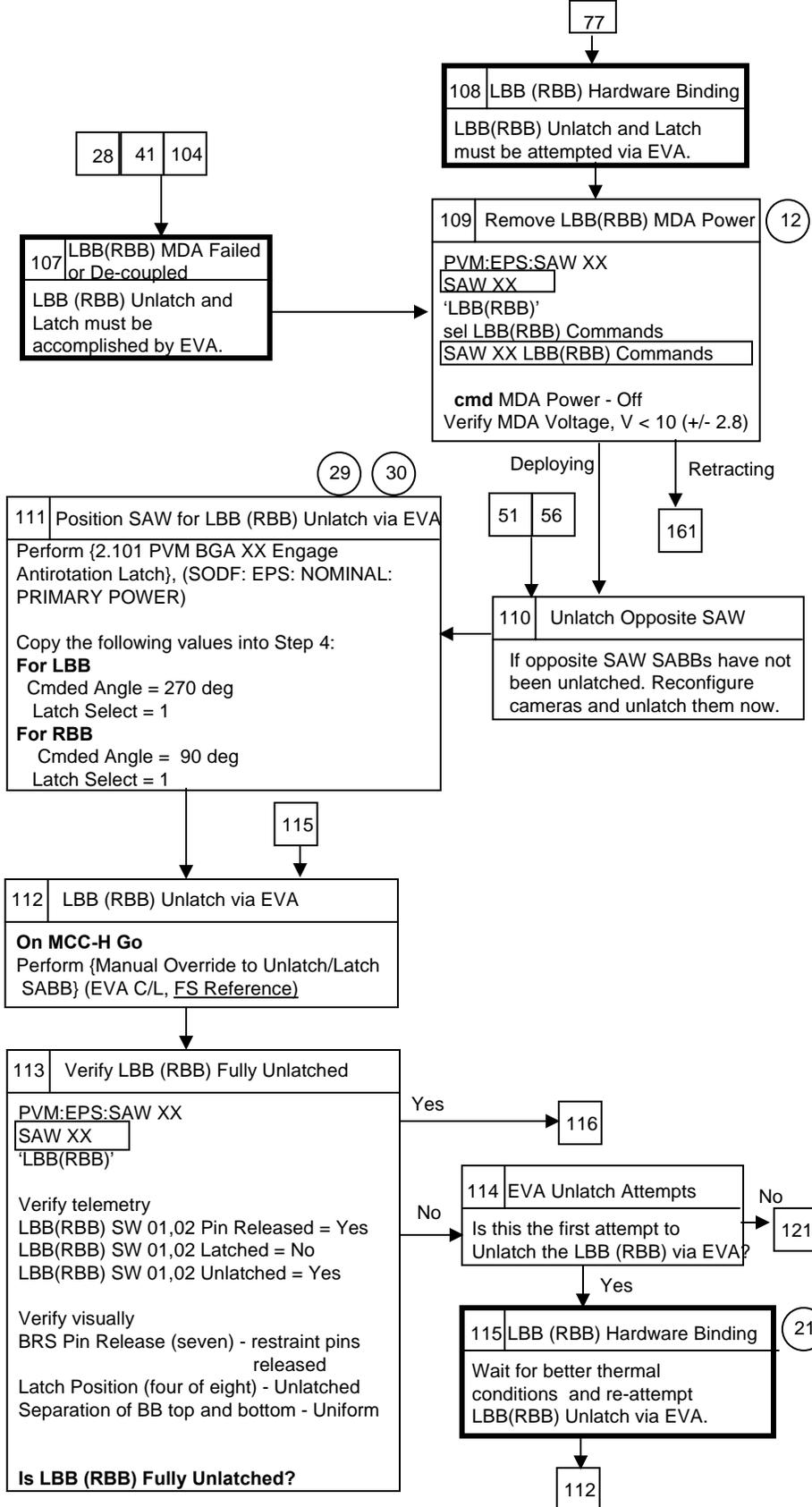


25
 Disconnects are present in the MDA Over Temp FDIR. S/W Trip level = 77.7 deg C. F/W Trip level = 140 deg C. H/W damage occurs at 120 deg C.

28
 Retry temperatures can be higher for SABBs since they are only operated a few seconds.

3.190 SAW XX FAILURE TO UNLATCH SABB REMOTELY

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12
MDA Power off is a one step command.

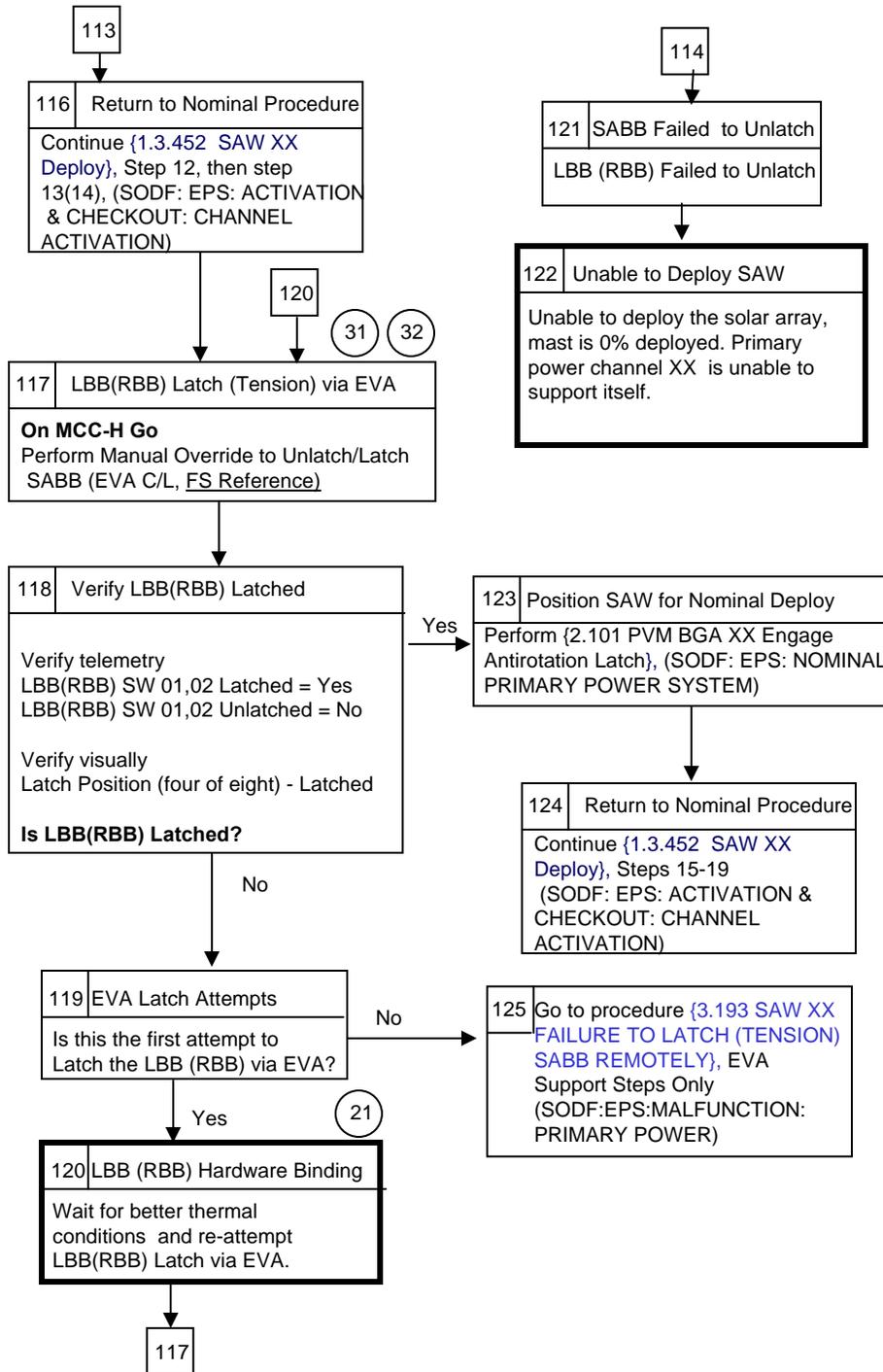
21
Re-attempt will be made at the end of insolation or end of eclipse, which ever case is opposite initial attempt.

29
This step can take up to 1 hr to complete. The latch cmd can be sent when the BGA Actual Angle is within 1 deg of the commanded value in order to save time.

30
This step may be omitted if EVA crew can free float and drive the MDA.

3.190 SAW XX FAILURE TO UNLATCH SABB REMOTELY

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21

Re-attempt will be made at the end of insolation or end of eclipse, whichever case is opposite initial attempt.

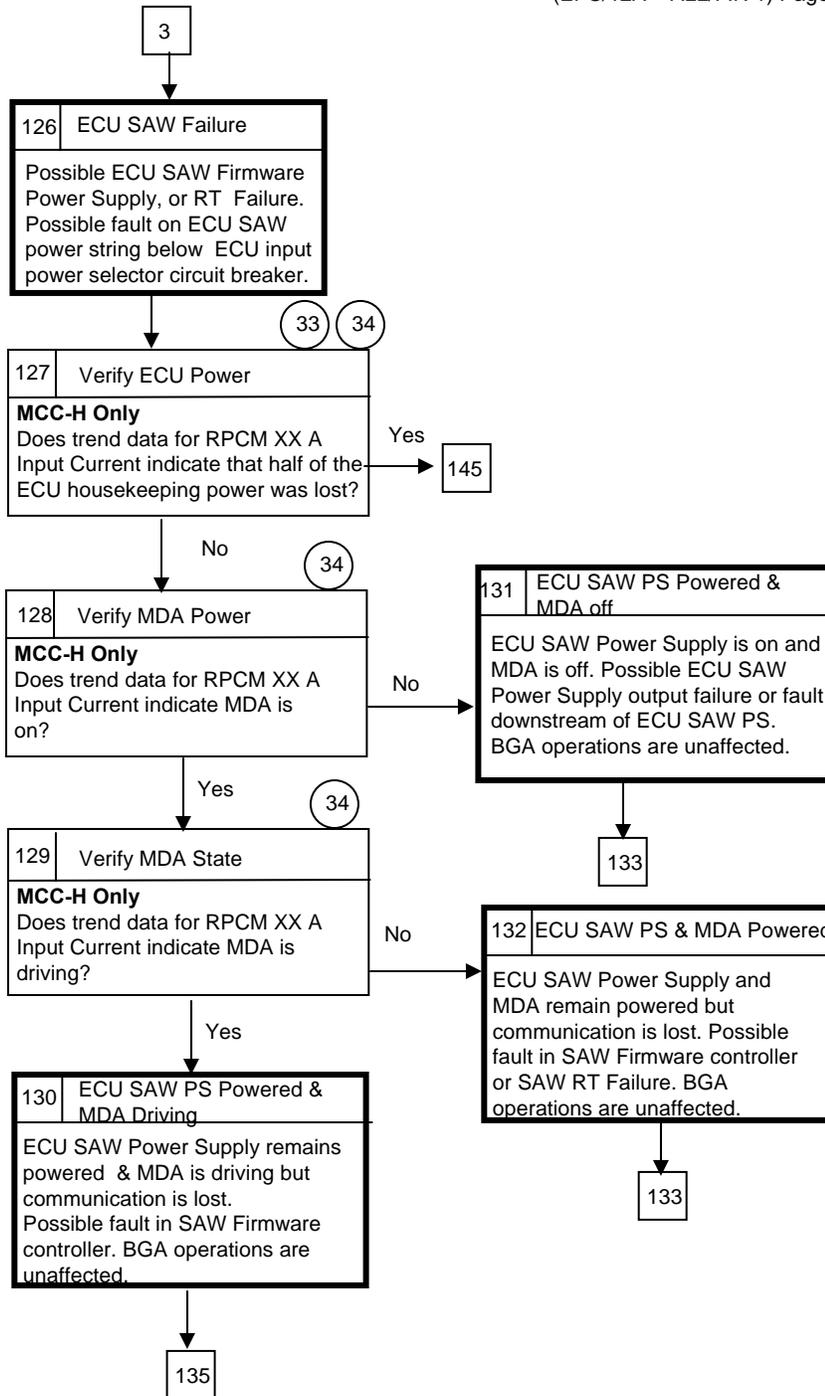
31

Assumes that one or more mast bays have already been deployed.

32

Both SABBs must be Latched (Hi Tension Mode) before the SAW can be deployed, to protect H/W against damage due to high stiction forces.

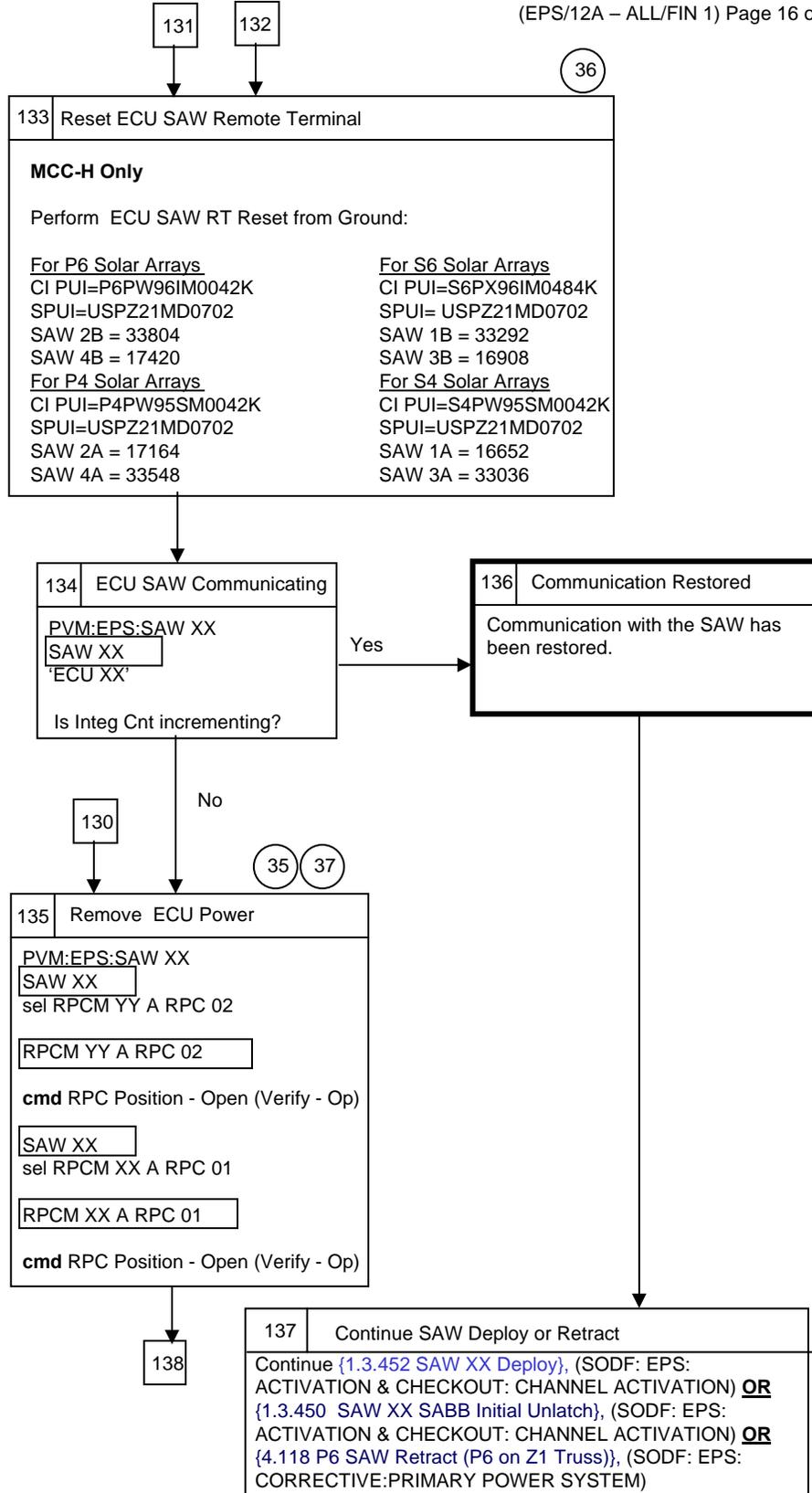
3.190 SAW XX FAILURE TO UNLATCH SABB REMOTELY



33
Total ECU housekeeping power is 115W (0.93A) at initialization and before BGA mtr or MDAs are turned on. Half of the ECU housekeeping power is 57.5W (0.47A)

34
It only takes 14 sec to unlatch SABBs. When the MDA is on it draws about 0.22A. When the MDA is driving it can draw as high as 3.0A. MDA over current trip occurs at 0.78A. The MDA will stop driving but will remain on if one of the two "Unlatched" limit switches have contacted.

3.190 SAW XX FAILURE TO UNLATCH SABB REMOTELY

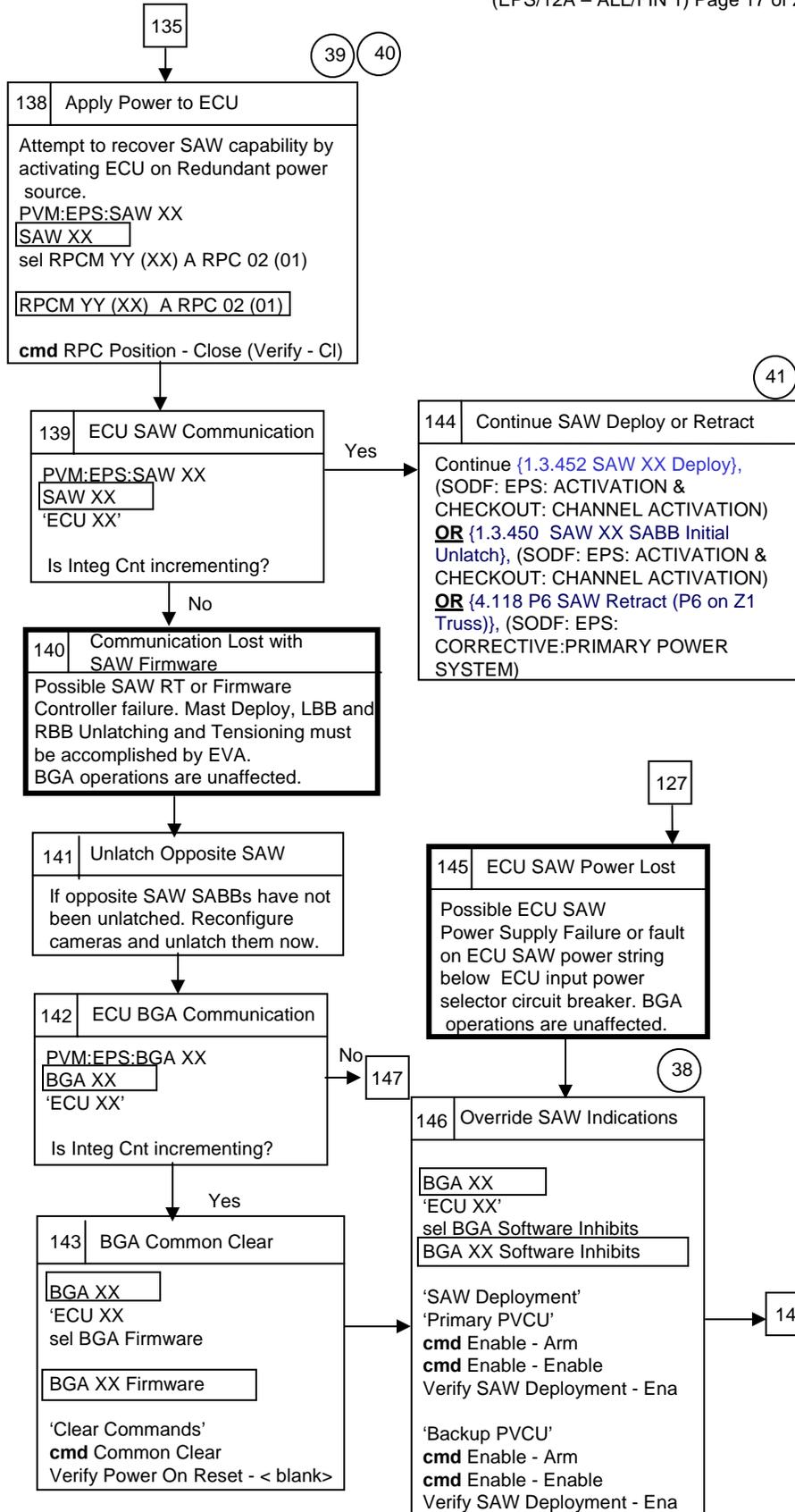


35 Removes Power from MDA. When power is re-applied to the ECU the MDA will be off.

36 MCC-H must build and perform this step from command inventory.

37 Expect Caution message BGA XX Loss of Comm - PVM when RPC 01 is cmded open.

3.190 SAW XX FAILURE TO UNLATCH SABB REMOTELY

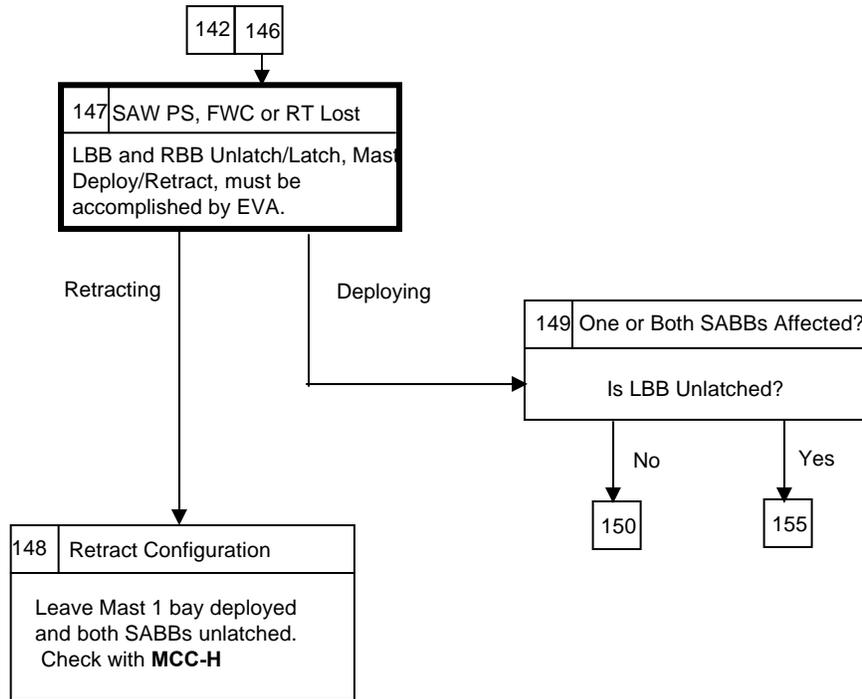


38 Allows BGA to be operated when SAW Mast is in an undetermined state, or comm is lost with SAW FWC

39 Caution message BGA XX 1553/ FWC Errors- PVM may be received after RPC 01 is closed.

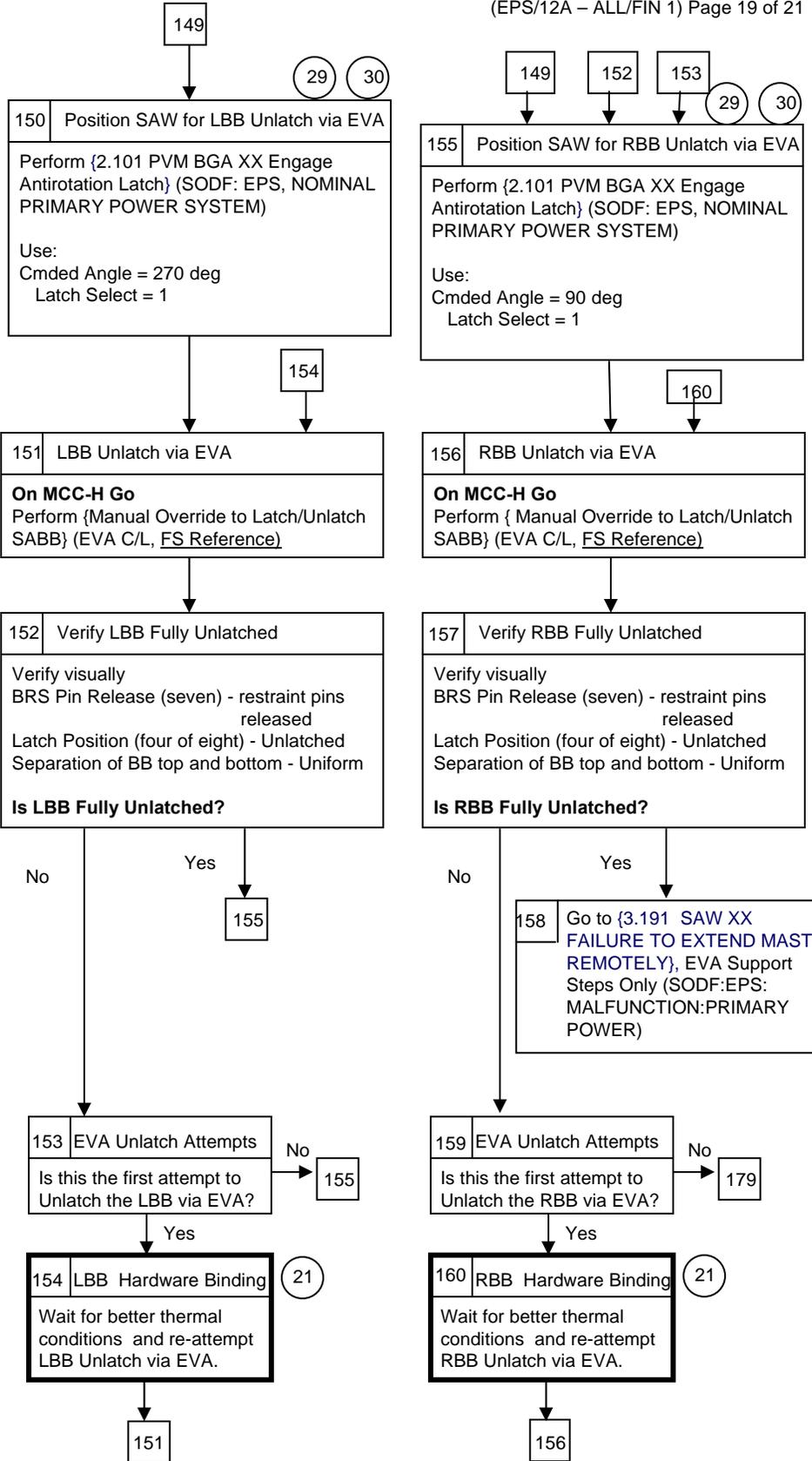
40 ECU power is supplied by the opposite deck channel (YY) for SAW Retraction Operations and Channel (XX) for Deploy Operations

41 If power was removed from the ECU you must begin again with step 1 of the Deploy/Retract procedure, to reset the F/W inhibits.



3.190 SAW XX FAILURE TO UNLATCH SABB REMOTELY

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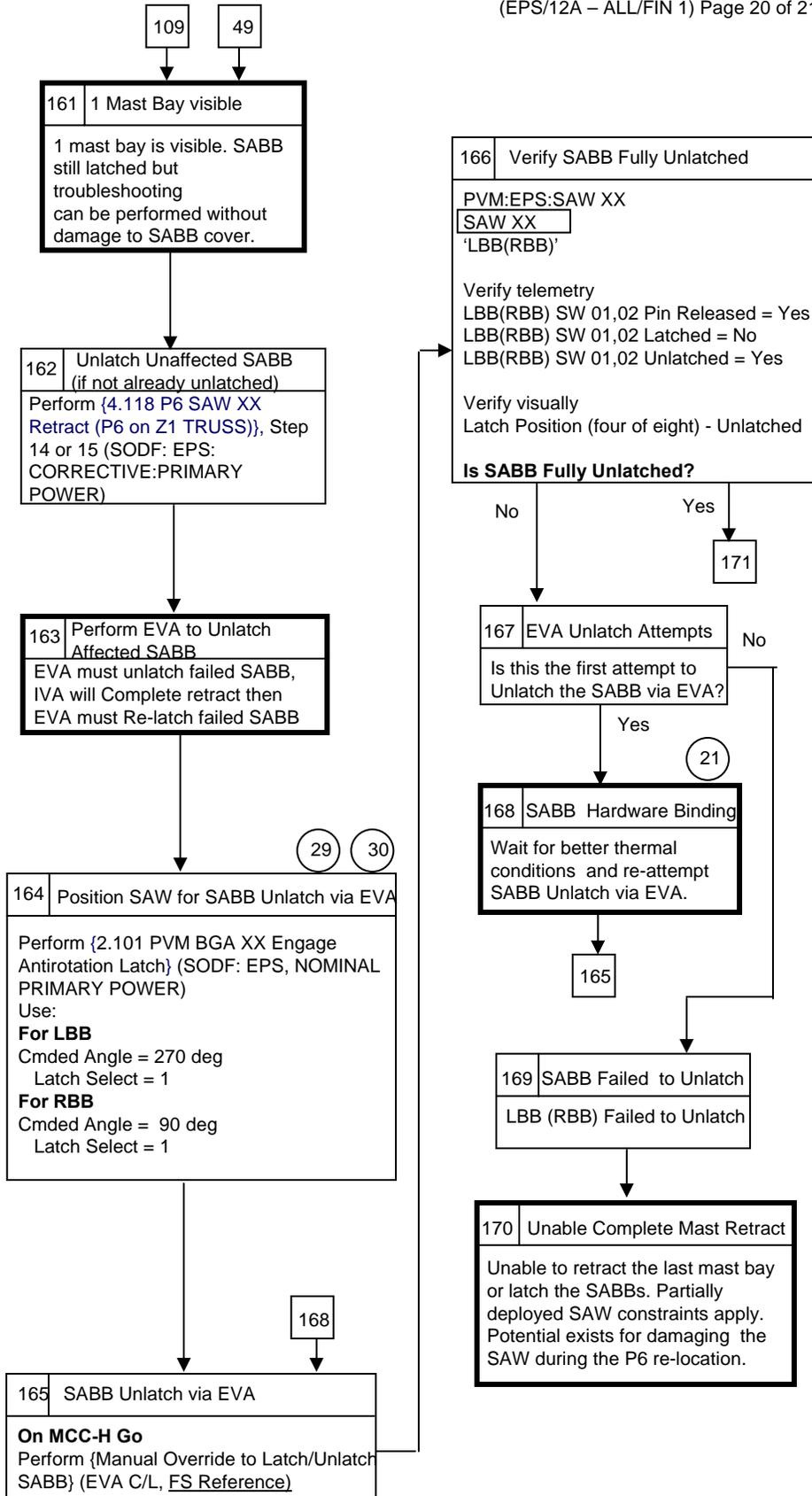


21 Re-attempt will be made at the end of insolation or end of eclipse, which ever case is opposite initial attempt.

29 This step can take up to 1 hr to complete. The latch cmd can be sent when the BGA Actual Angle is within 1 deg of the commanded value in order to save time.

30 This step may be omitted if EVA crew can free float and drive the MDA.

3.190 SAW XX FAILURE TO UNLATCH SABB REMOTELY



21

Re-attempt will be made at the end of insolation or end of eclipse, whichever case is opposite initial attempt.

29

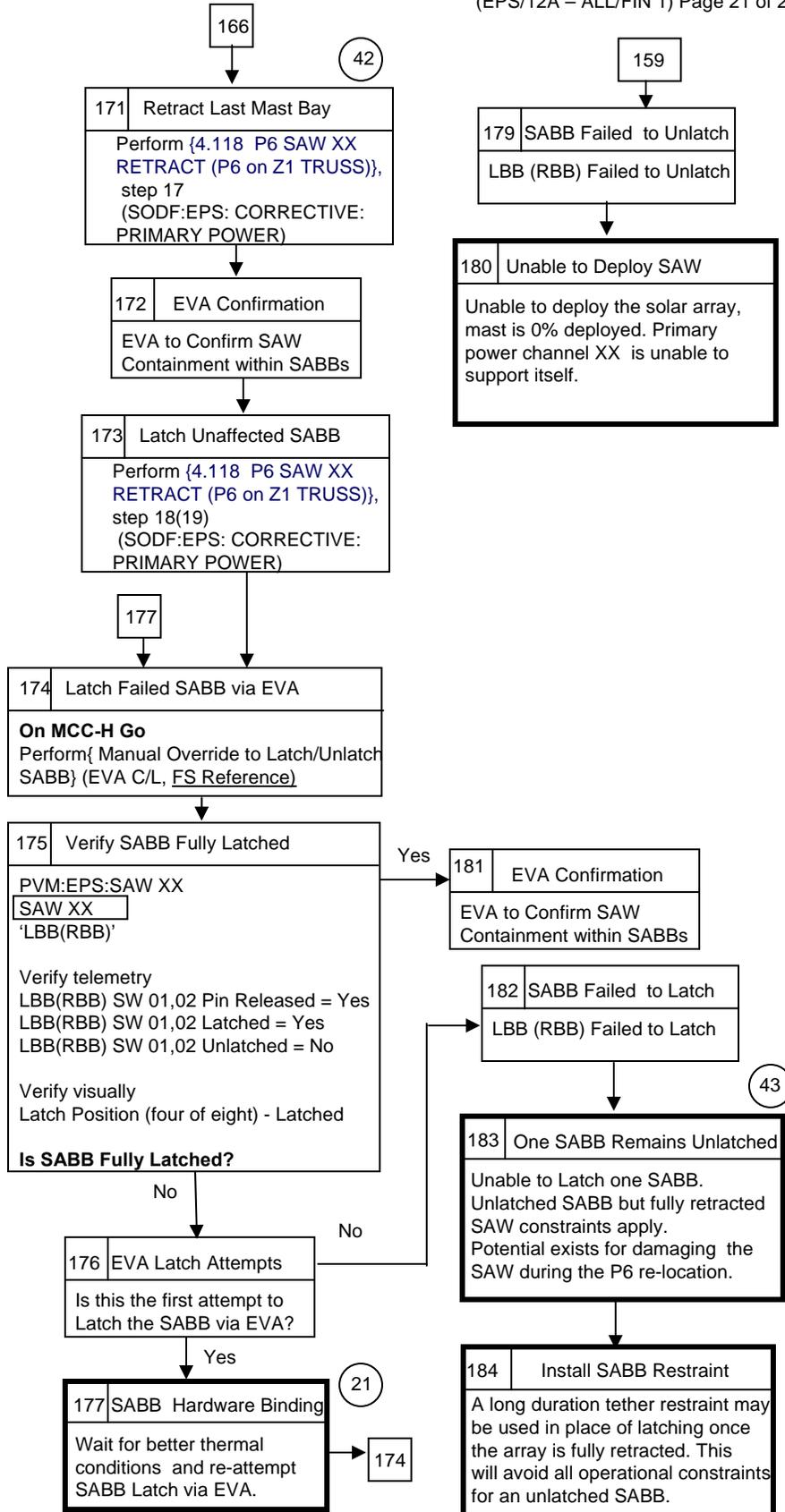
This step can take up to 1 hr to complete. The latch cmd can be sent when the BGA Actual Angle is within 1 deg of the commanded value in order to save time.

30

This step may be omitted if EVA crew can free float and drive the MDA.

3.190 SAW XX FAILURE TO UNLATCH SABB REMOTELY

(EPS/12A – ALL/FIN 1) Page 21 of 21



21
Re-attempt will be made at the end of insolation or end of eclipse, whichever case is opposite initial attempt.

42
The Mast can be fully retracted without unlatching however, further latch troubleshooting cannot be performed without damaging the SABB cover.

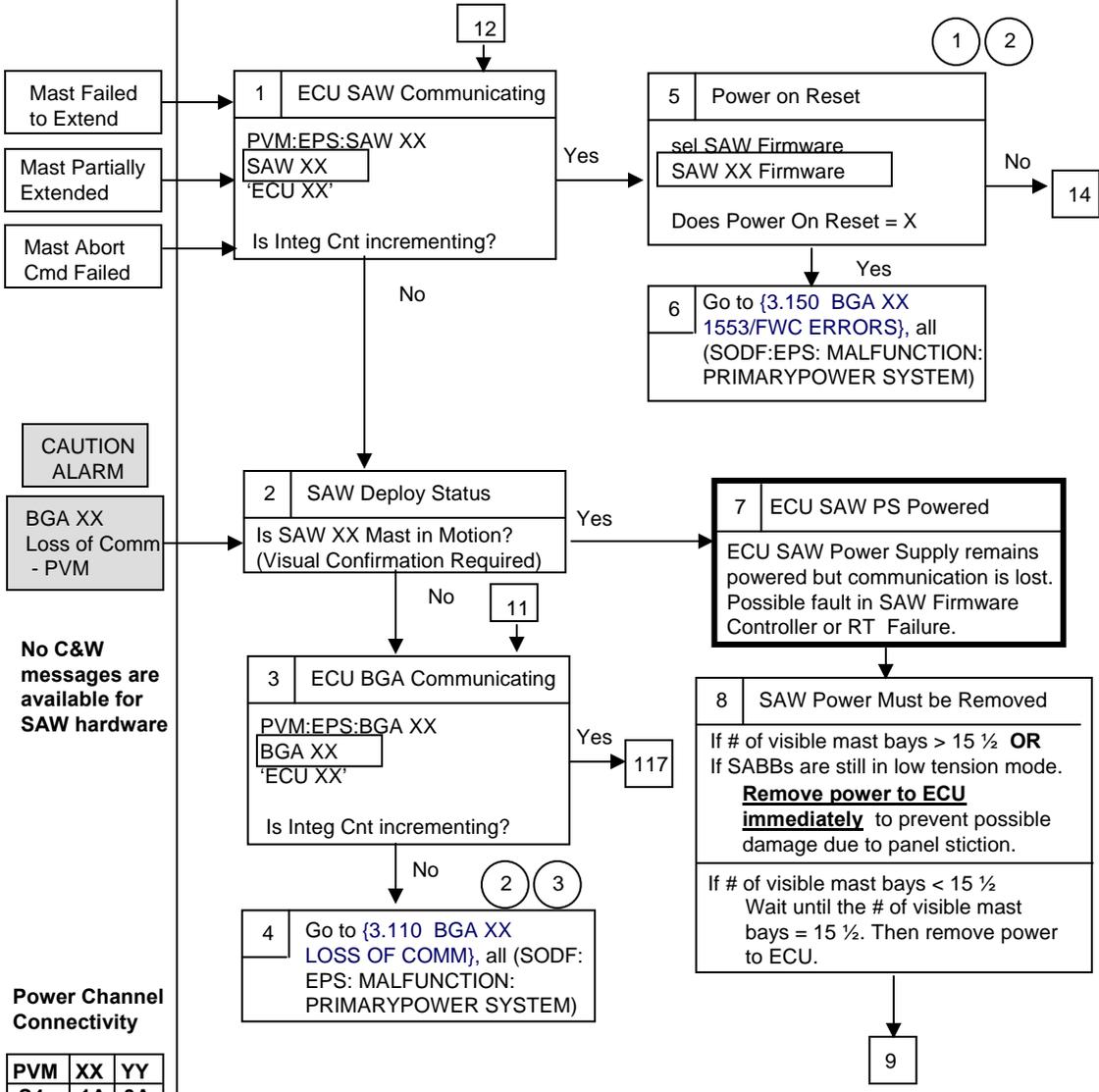
43
The SABB must be latched if the array is 100% retracted, to prevent damage to the blanket from operational loads. These include but are not limited to crew exercise, thruster firings, etc.

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3.191 SAW XX FAILURE TO EXTEND MAST REMOTELY

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CAUTION ALARM

BGA XX Loss of Comm - PVM

No C&W messages are available for SAW hardware

Power Channel Connectivity

PVM	XX	YY
S4	1A	3A
S4	3A	1A
S6	1B	3B
S6	3B	1B
P4	2A	4A
P4	4A	2A
P6	2B	4B
P6	4B	2B

Nominal Config:
 ECU SAW XX:
 RPCM XX A
 RPC 1 - CI
 RPCM YY A
 RPC 2 - CI

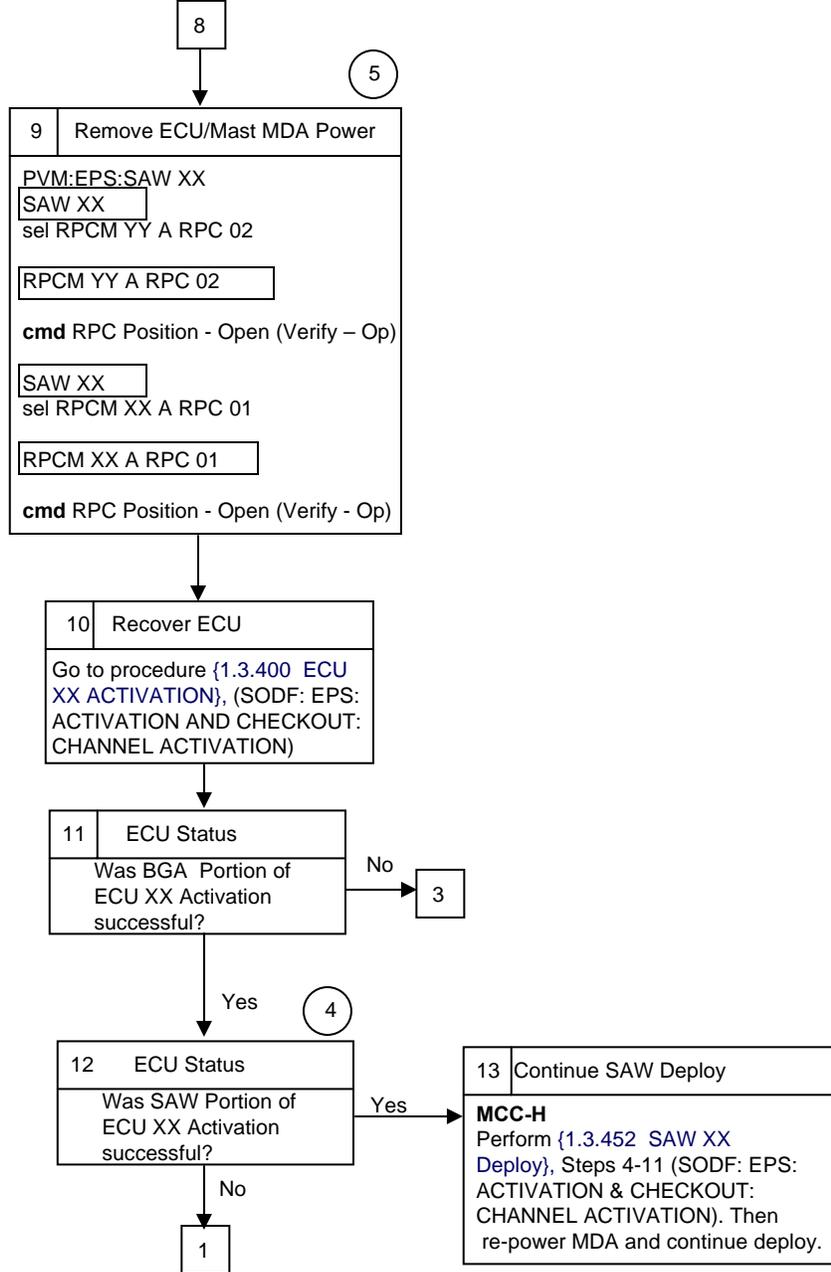
1 Caution message BGA XX 1553/ FWC Errors- PVM may also be received if a Power on Reset has occurred.

2 If power was removed from the ECU you must begin again with step 1 of the Deploy/Retract procedure, to reset the F/W inhibits.

3 If Current sensor fails high > 0.78 A RPCs providing power to ECU will be opened. A new PPL with a higher Current limit must be uploaded before the ECU can be recovered. There is no inhibit for SAW MDA Config Complete Persistent Current Safing.

3.191 SAW XX FAILURE TO EXTEND MAST REMOTELY

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4

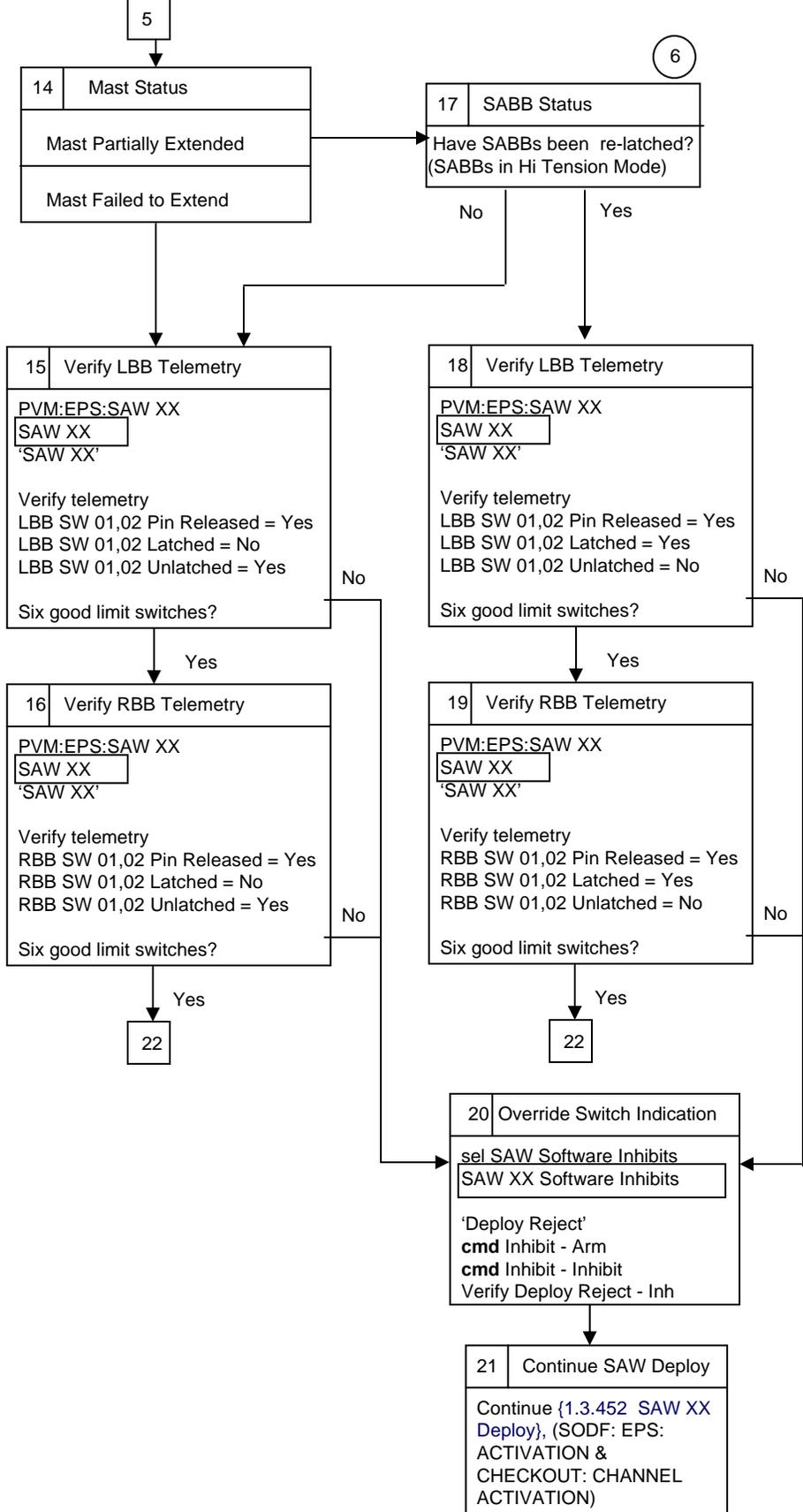
Communication with the BGA is not required in order to complete SAW deploy/retract This assumes that the BGA is already locked and at the SAW deployment position. BGA trouble-shooting can wait until after the array is deployed.

5

Remove the ECU power to remove power from the MDA. Note the ECU may attempt a power on reset after the first RPC is opened depending on which channel is supplying prime power to the ECU. Expect Caution message BGA XX Loss of Comm - PVM when RPC 01 is cmded open.

3.191 SAW XX FAILURE TO EXTEND MAST REMOTELY

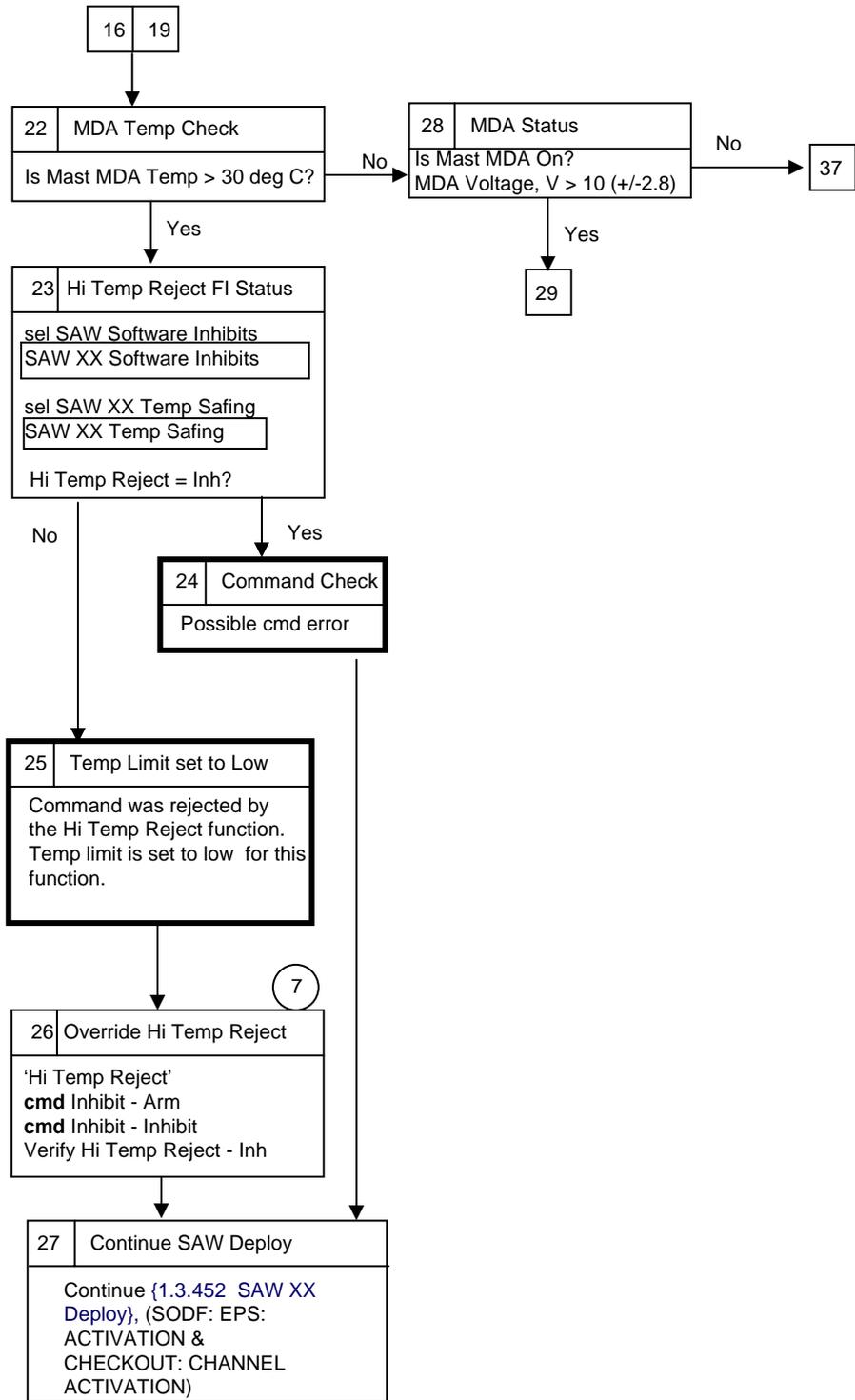
(EPS/12A – ALL/FIN 1) Page 3 of 19



6
SABBs are latched after the mast has been deployed 1 mast bay in order to clear the latch mechanisms. Hi tension mode is used to reduce the potential for damage due to panel stiction problems.

3.191 SAW XX FAILURE TO EXTEND MAST REMOTELY

(EPS/12A – ALL/FIN 1) Page 4 of 19



7

MDA operating temperature range is -54 to 48 deg C.

3.191 SAW XX FAILURE TO EXTEND MAST REMOTELY

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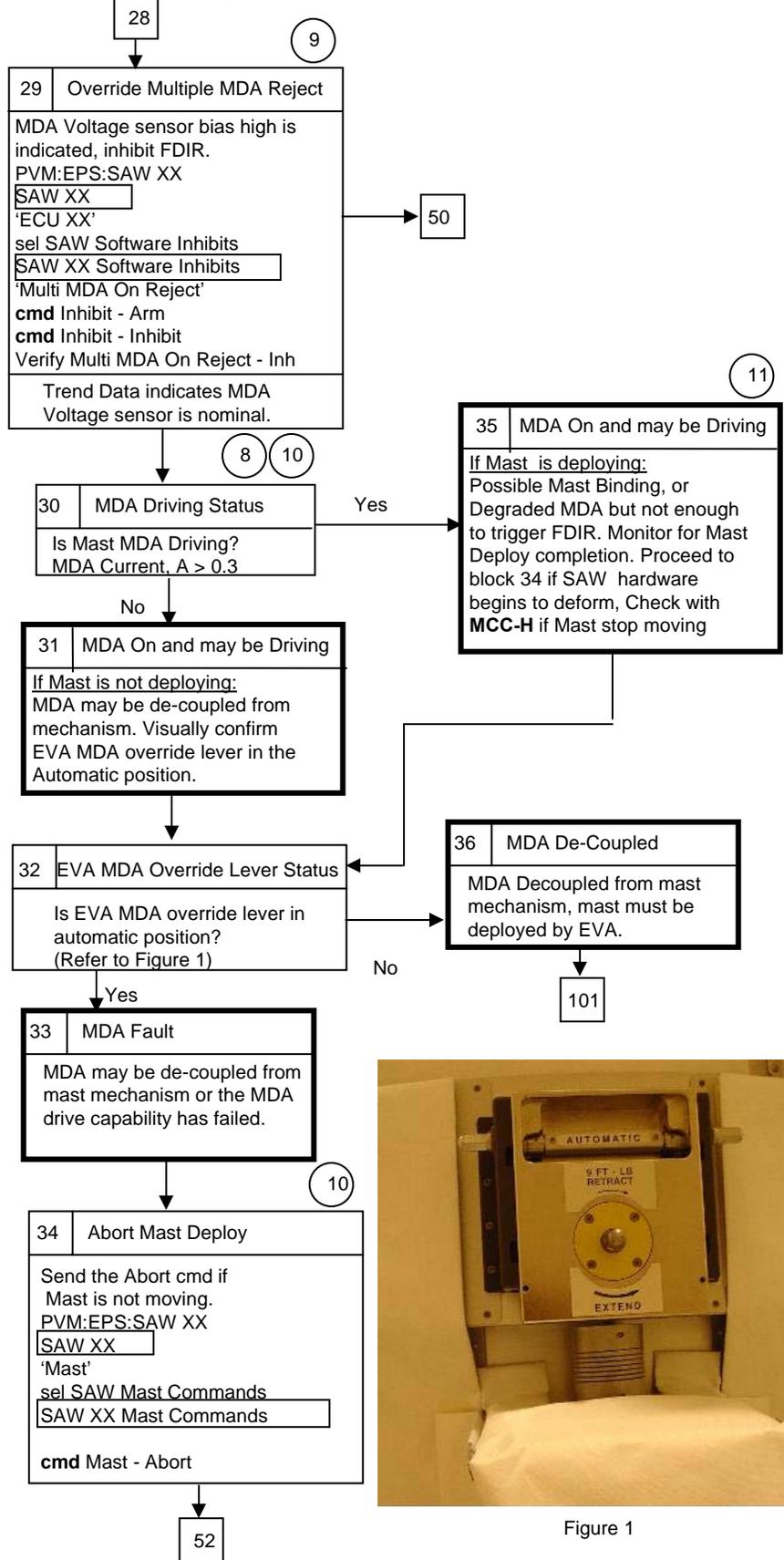


Figure 1

8 The manual MDA override lever is located on the back (inactive side) of the mast canister. (MDA current with no load = 0.3A)

9 There is no overvoltage FDIR for the MDA. The MDA will continue to operate if a Voltage sensor has failed high. Check voltages of all MDAs. The multiple MDA On Reject FDIR will reject an MDA on command if another MDA is already on.

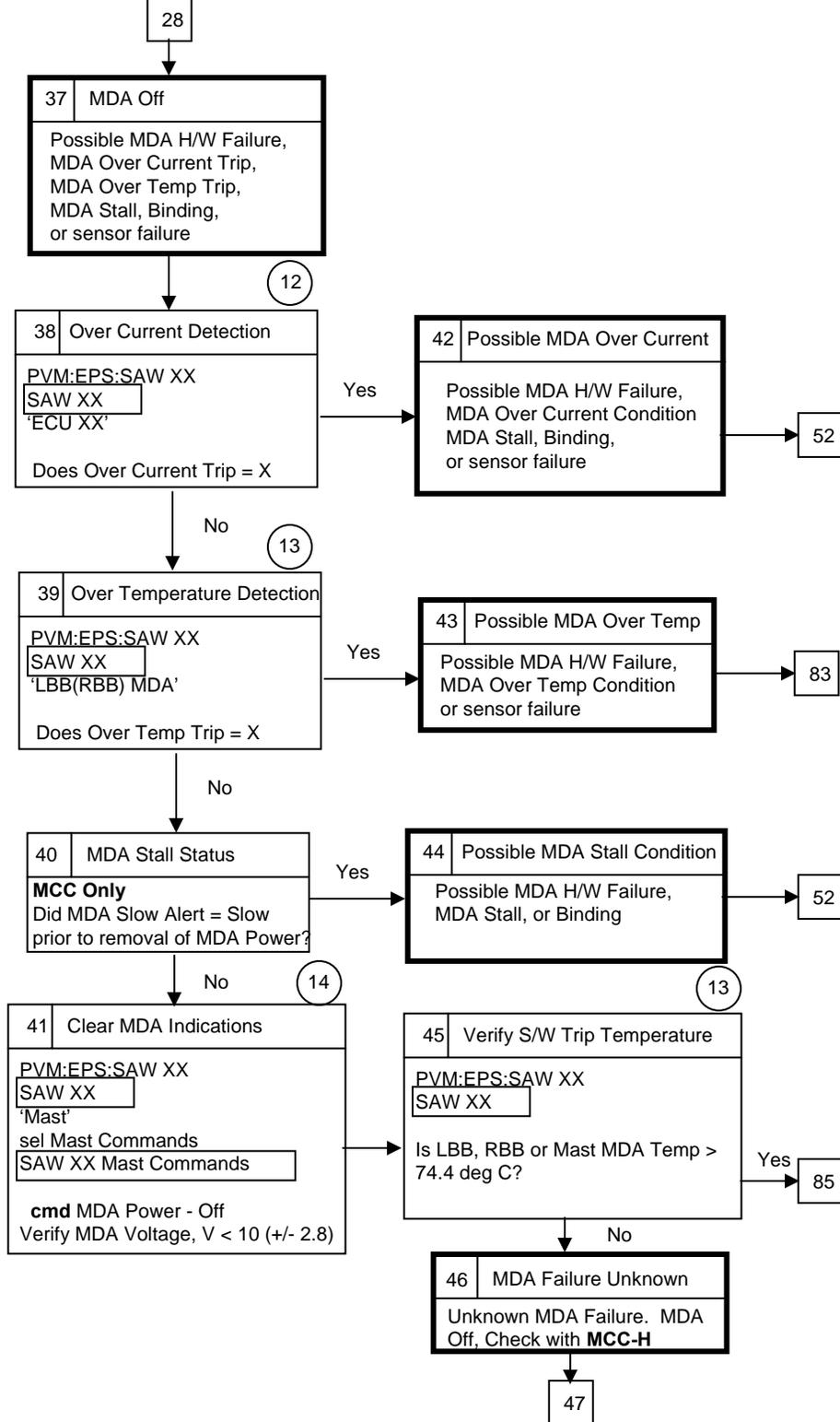
10 If MDA de-coupled you may not be able to tell if the MDA is driving based on the current.

11 Possible overdrive of MDA brake during retract of P6 arrays.

EPS

3.191 SAW XX FAILURE TO EXTEND MAST REMOTELY

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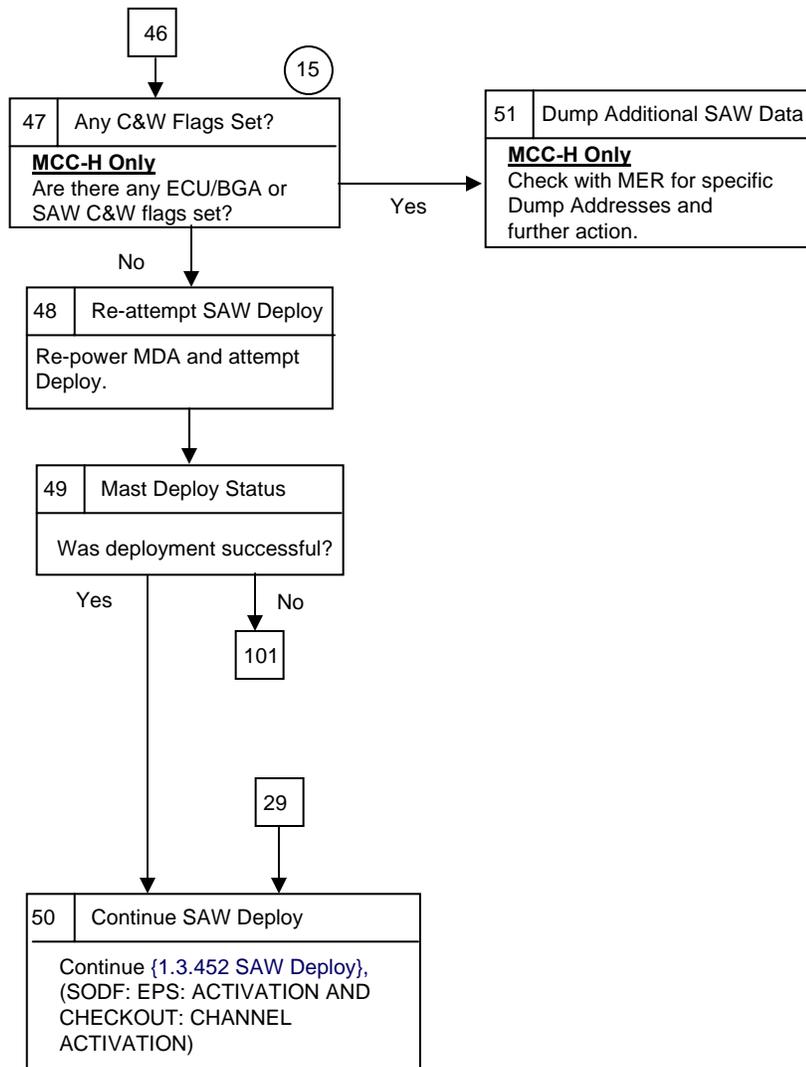
12
ECU Firmware MDA Over Current Trip occurs at 6.2 Amps. S/W Limit (0.78 A) is reached first and it does **not** set the MDA Over Current Trip Flag.

13
Disconnects are present in the MDA Over Temp FDIR. S/W Trip level = 77.7 deg C. F/W Trip level = 140 deg C. H/W damage occurs at 120 deg C. S/W Temp limit is reached first and it does **not** set the MDA Over Temp Trip Flag.

14
MDA Power off is a one step command.

3.191 SAW XX FAILURE TO EXTEND MAST REMOTELY

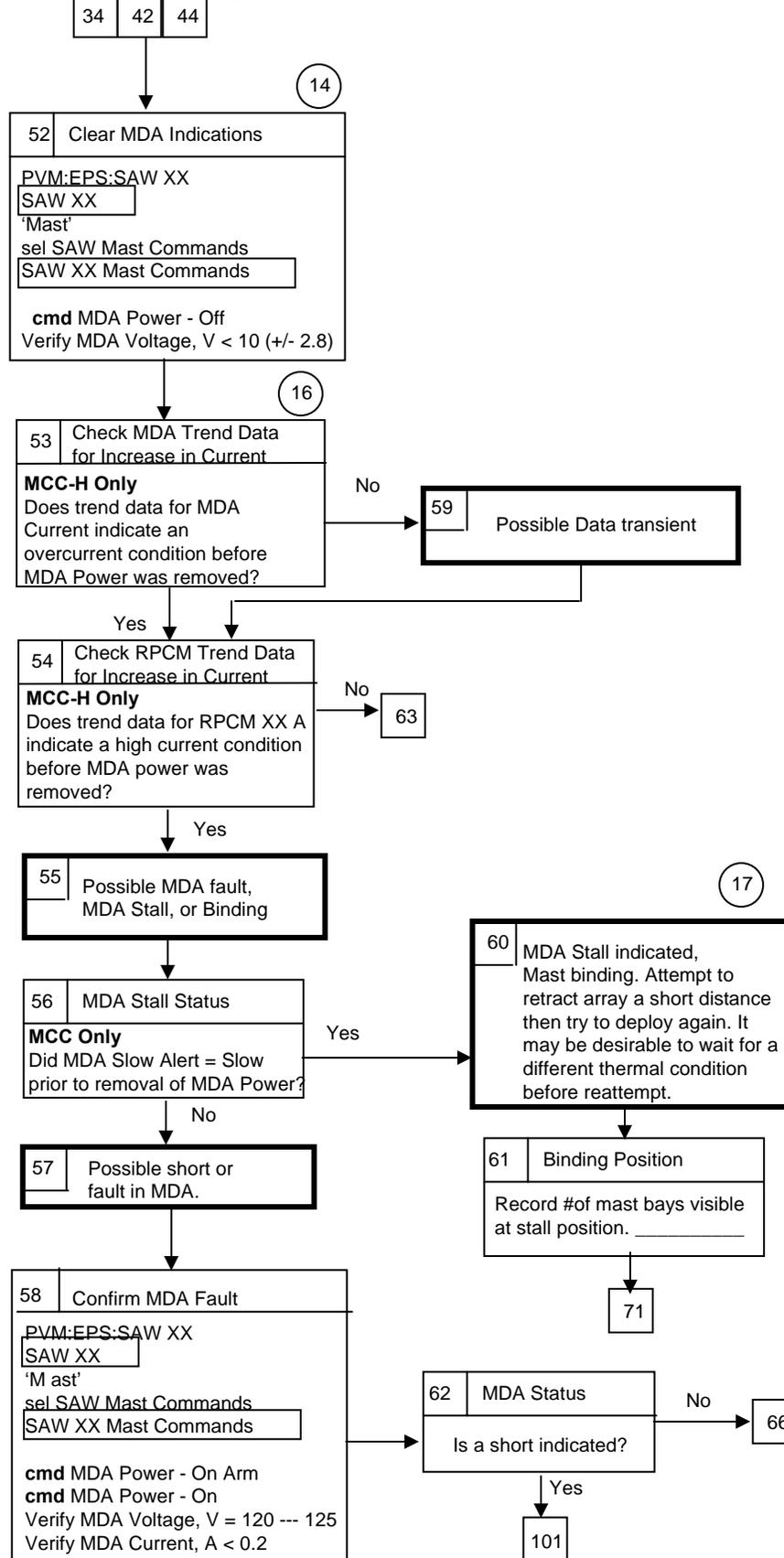
(EPS/12A – ALL/FIN 1) Page 7 of 19



15
SAW Caution and Warning Flags are available for downlink only during missions that scheduled SAW activities. (e.g 12A) Flags are not available on PCS displays.

3.191 SAW XX FAILURE TO EXTEND MAST REMOTELY

(EPS/12A - ALL/FIN 1) Page 8 of 19



14

MDA Power off is a one step command.

16

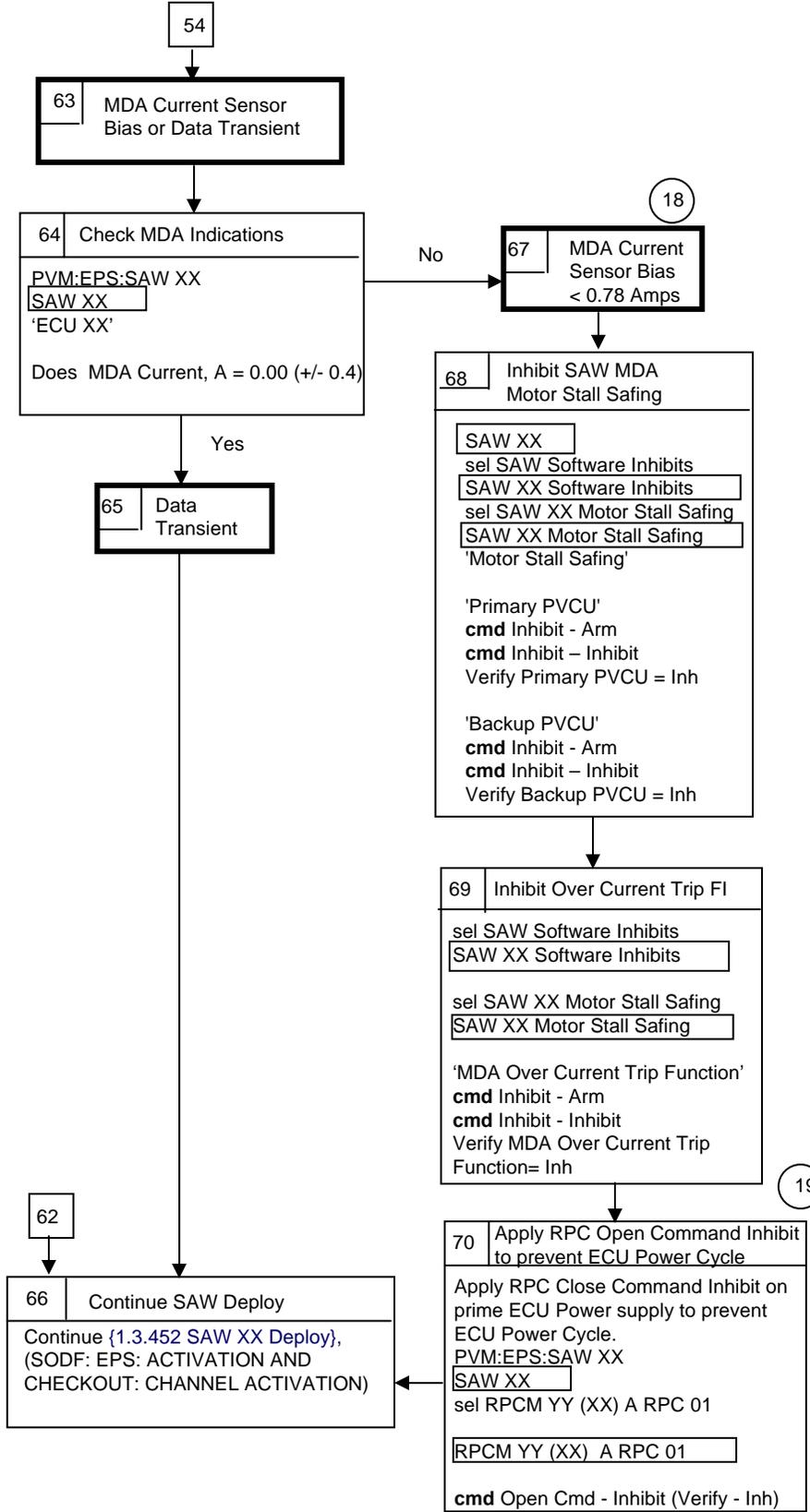
PVCU Software MDA Over Current Trip occurs at 0.78 Amps.

17

If a Stall Condition is indicated, Current > 0.78 A and motor speed is < 25 RPM, power is removed from the MDA

3.191 SAW XX FAILURE TO EXTEND MAST REMOTELY

(EPS/12A – ALL/FIN 1) Page 9 of 19



18

If Current sensor fails high > 0.78 A RPCs providing power to ECU will be opened. A new PPL with a higher current limit must be uploaded before the ECU can be recovered. There is no inhibit for SAW MDA Motor Stall Persistent Current Safing. Refer to block 3.

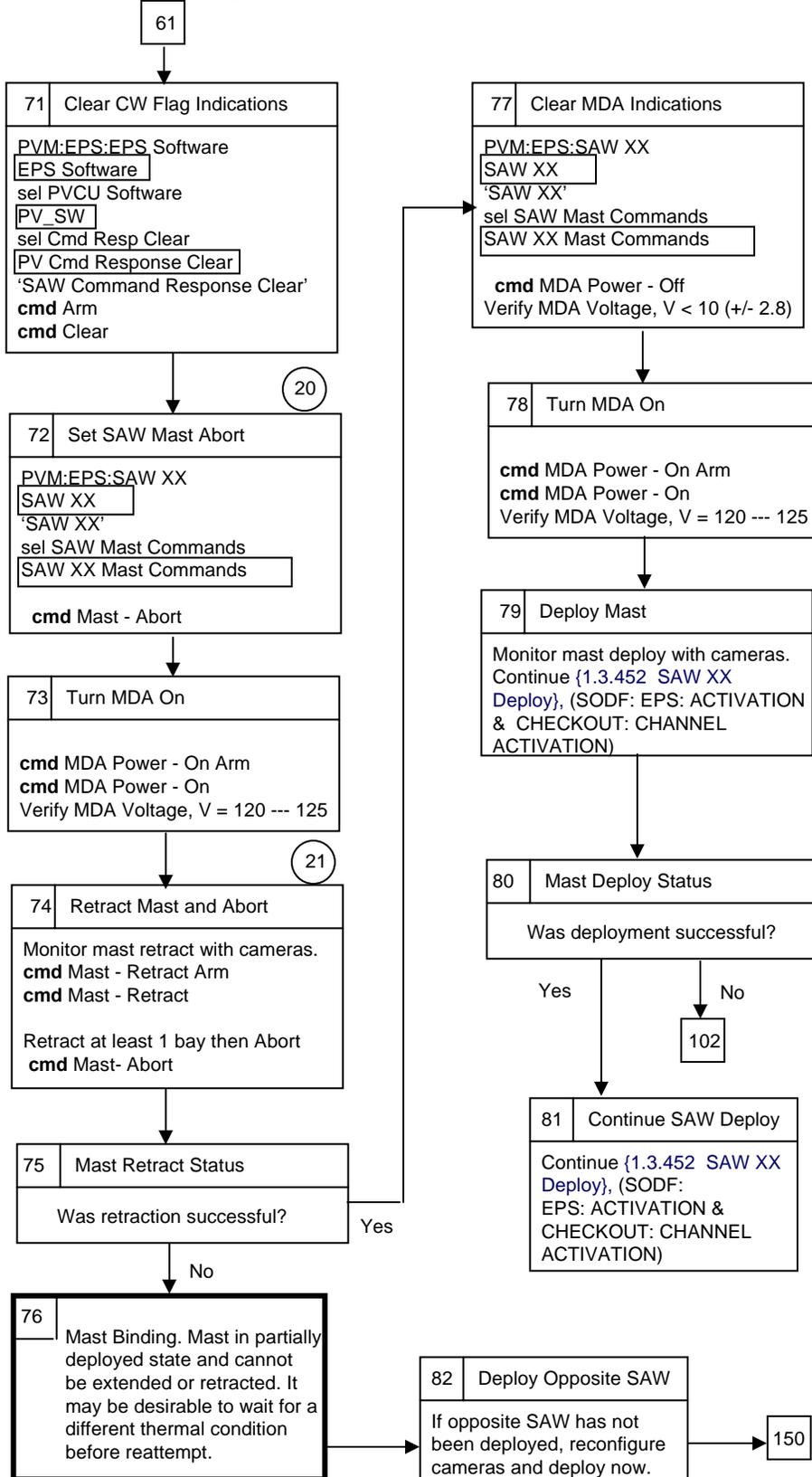
19

However, all MDAs use the same current sensor. A new PPL 69 must be unlinked prior to SAW operations or Inhibit the RPC Open Command to avoid power cycling the ECU.

19

3.191 SAW XX FAILURE TO EXTEND MAST REMOTELY

(EPS/12A – ALL/FIN 1) Page 10 of 19



20

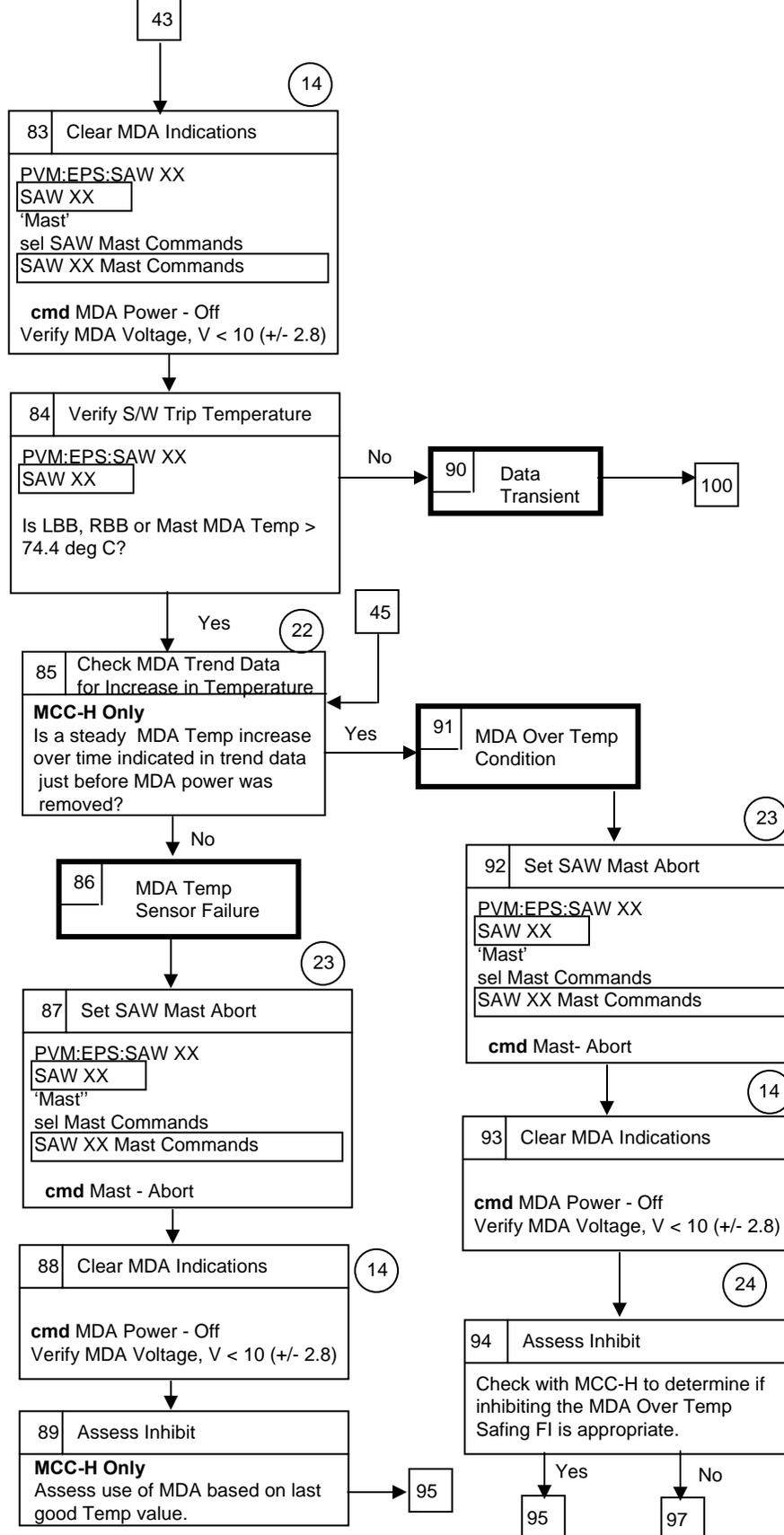
MDA Abort must be sent to prevent MDA from driving once power is re-applied. This is a single step cmd

21

Confirm that ISS Thrusters are inhibited or ISS/Orbiter in Free Drift and no crew un-isolated exercise or max EVA loads prior to sending the Deploy or Retract command. If at any time mechanical movement is stopped or aborted, attitude control may be resumed.

3.191 SAW XX FAILURE TO EXTEND MAST REMOTELY

(EPS/12A – ALL/FIN 1) Page 11 of 19



14

MDA Power off is a one step command.

22

Disconnects are present in the MDA Over Temp FDIR. S/W Trip level = 77.7 deg C. F/W Trip level = 140 deg C. H/W damage occurs at 120 deg C. At a minimum a 30 deg C Mast MDA Temp increase should be protected for during mast deploy/retract

23

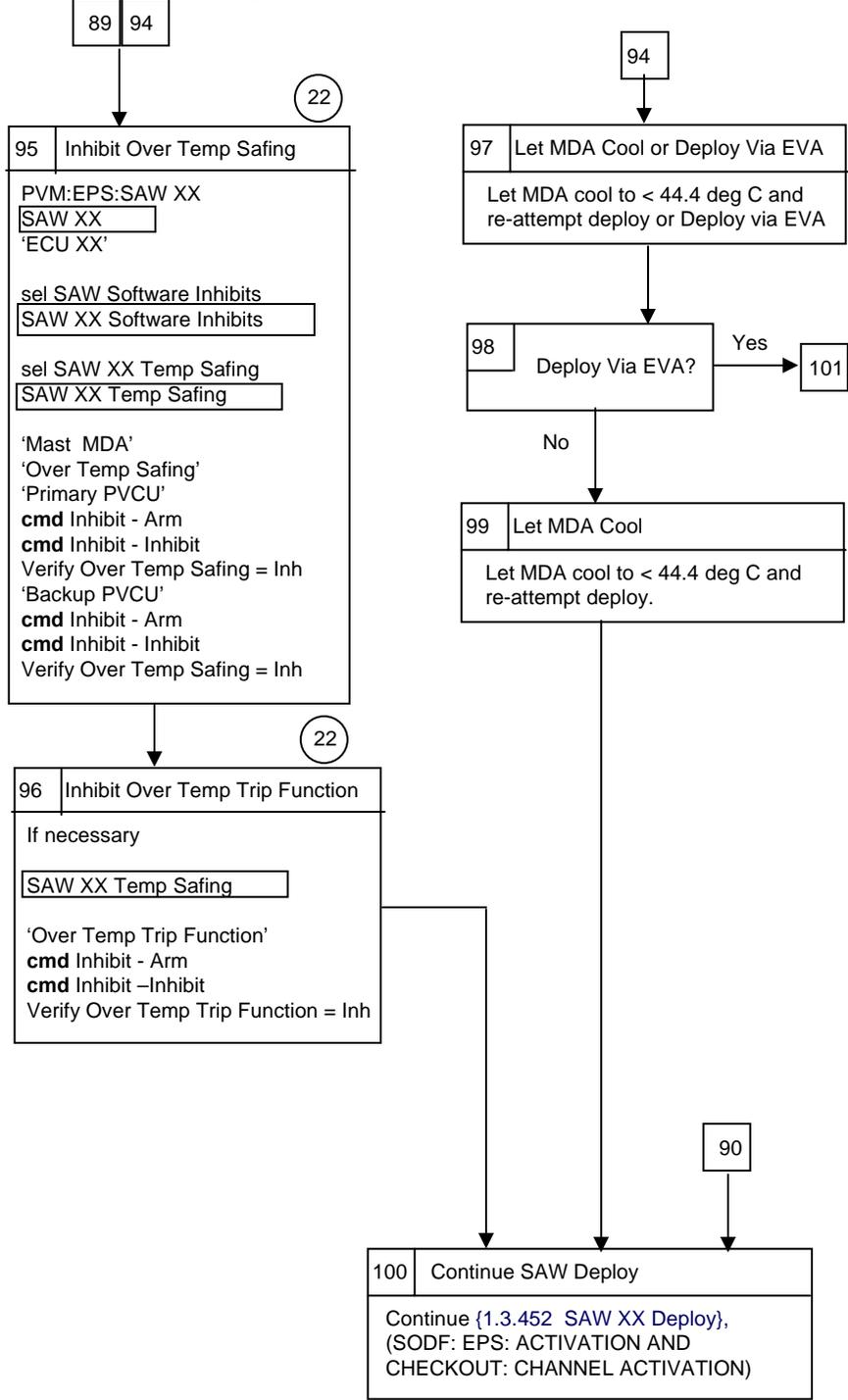
Since S/W Temp limit is reached first and it does not set the MDA Over Temp Trip flag, a MDA Abort must sent to prevent MDA from driving, once power is re-applied. This is a single step cmd.

24

Per Flight Rule B9-207, MDA operations can proceed even if MDA temp is high in order to meet critical mission objectives. Measurement Out of Range will be indicated if MDA temp >72.2 deg C.

3.191 SAW XX FAILURE TO EXTEND MAST REMOTELY

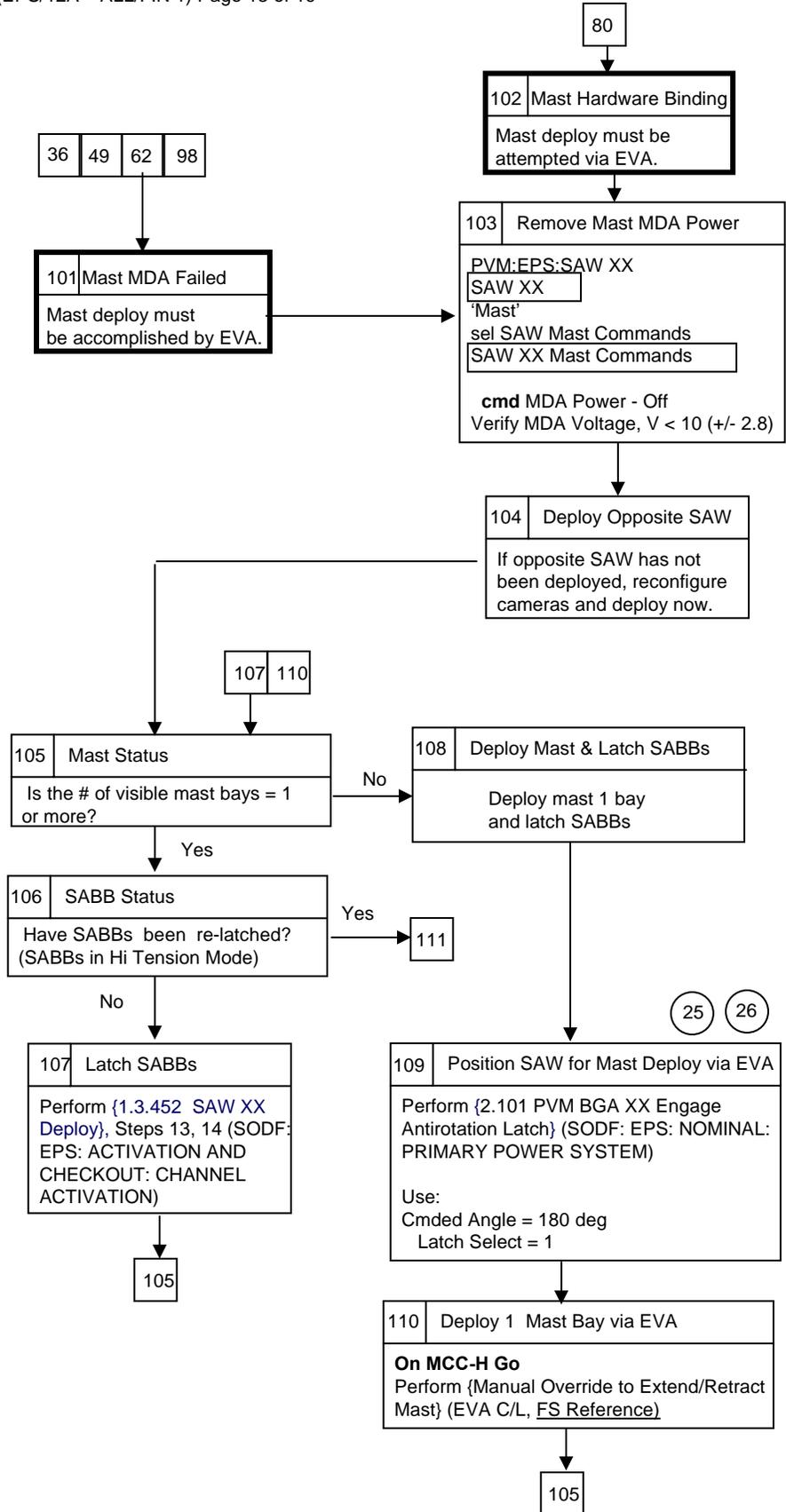
(EPS/12A – ALL/FIN 1) Page 12 of 19



22
 Disconnects are present in the MDA Over Temp FDIR. S/W Trip level = 77.7 deg C. F/W Trip level = 140 deg C. H/W damage occurs at 120 deg C. At a minimum a 30 deg C Mast MDA Temp increase should be protected for during mast deploy/retract

3.191 SAW XX FAILURE TO EXTEND MAST REMOTELY

(EPS/12A – ALL/FIN 1) Page 13 of 19

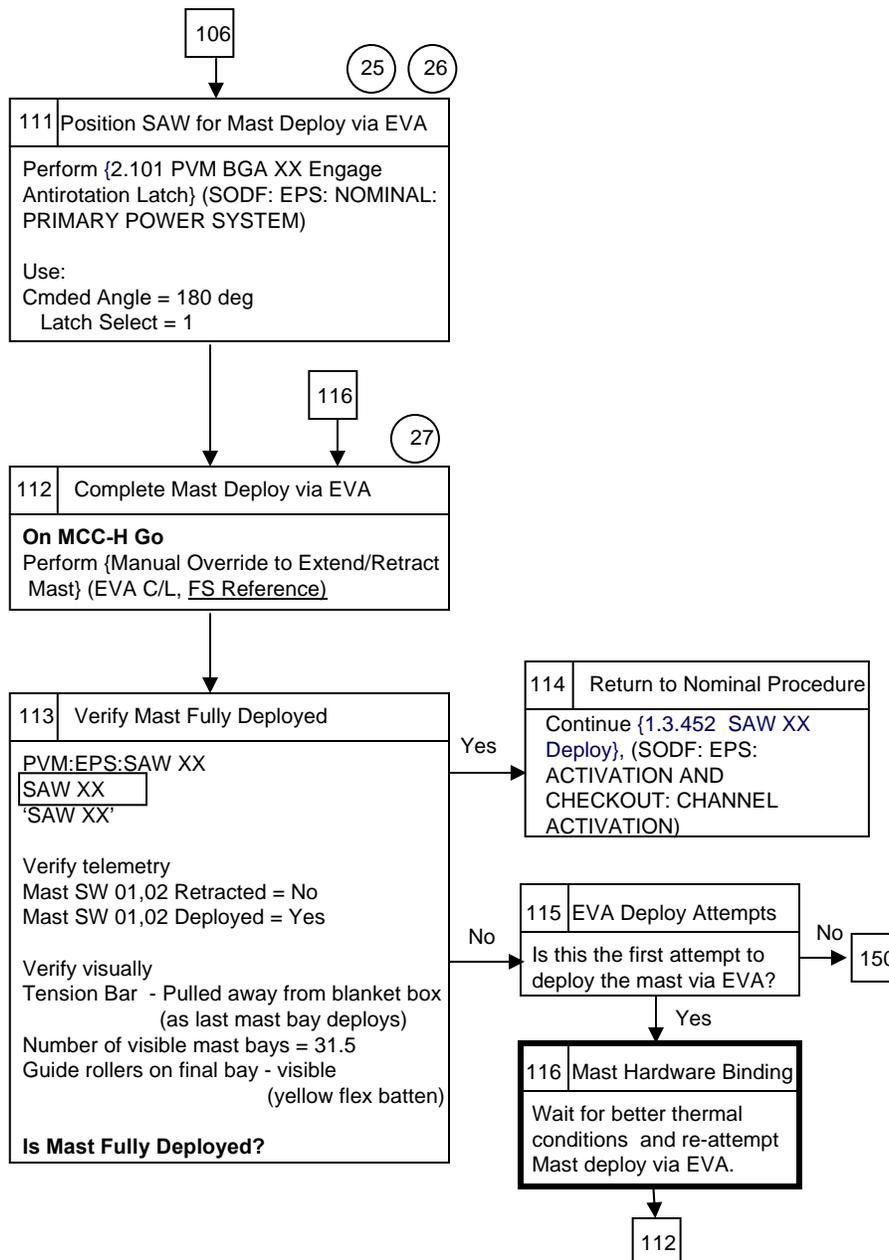


25
This step can take up to 1 hr to complete. The latch cmd can be sent when the BGA Actual Angle is within 1 deg of the commanded value in order to save time.

26
This step may be omitted if EVA crew can free float and drive the Mast MDA.

3.191 SAW XX FAILURE TO EXTEND MAST REMOTELY

(EPS/12A – ALL/FIN 1) Page 14 of 19



25

This step can take up to 1 hr to complete. The latch cmd can be sent when the BGA Actual Angle is within 1 deg of the commanded value in order to save time.

26

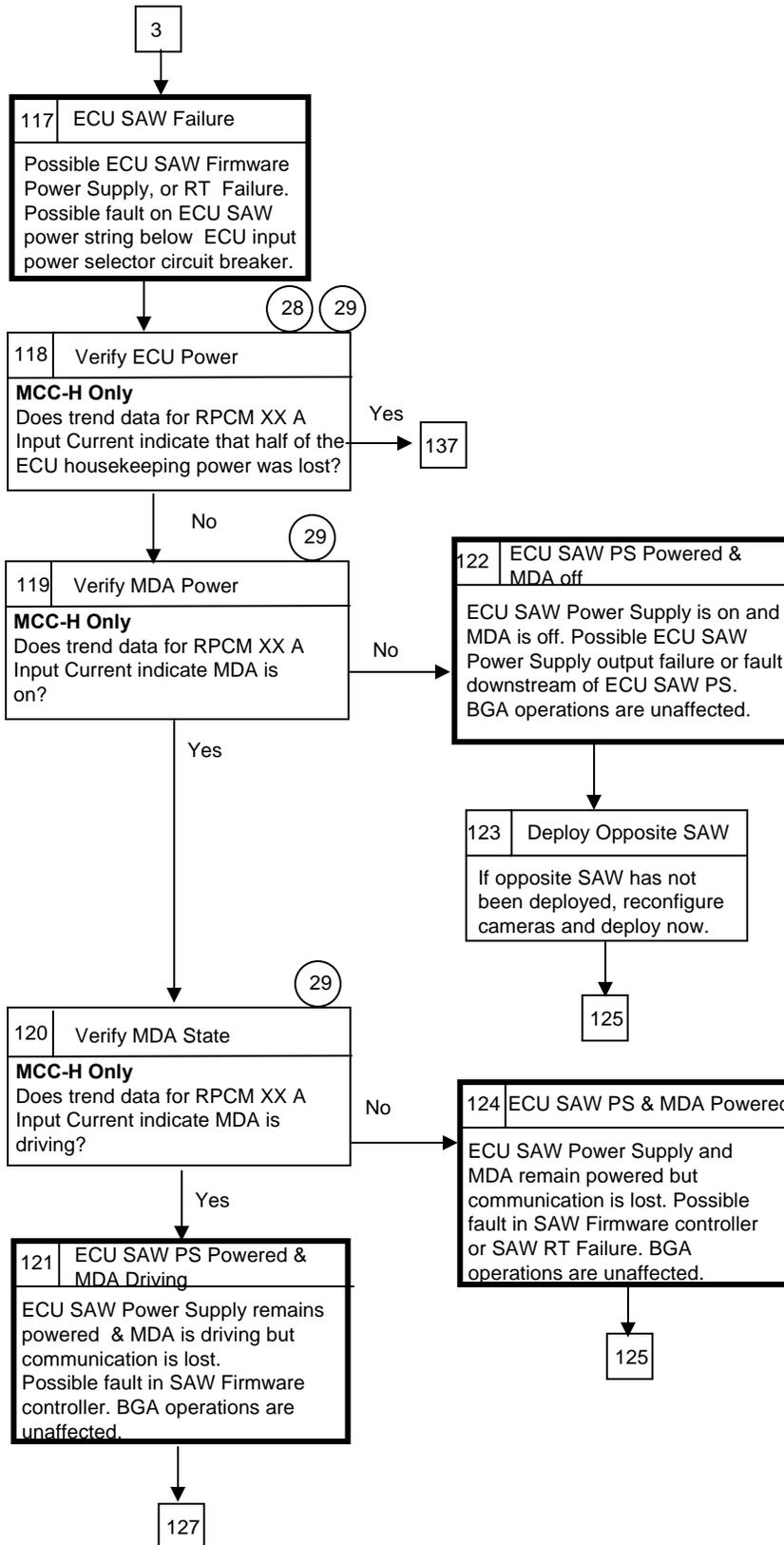
This step may be omitted if EVA crew can free float and drive the Mast MDA.

27

No thermal conditioning of the SAW is required if manually deploying, due to fact that it takes longer to deploy and it is warming throughout the manual deploy, also the crew can respond faster to stop the deploy.

3.191 SAW XX FAILURE TO EXTEND MAST REMOTELY

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28
Total ECU housekeeping power is 115W (0.93A) at initialization and before BGA mtr or MDAs are turned on. Half of the ECU housekeeping power is 57.5W (0.47A)

29
When the MDA is on it draws about 0.22A. When the MDA is driving it can draw as high as 3.0A. MDA over current trip occurs at 0.78A. The MDA will stop driving but will remain on if one of the two "Deployed" limit switches have contacted.

3.191 SAW XX FAILURE TO EXTEND MAST REMOTELY

(EPS/12A – ALL/FIN 1) Page 16 of 19

123 124

31

125	Reset ECU SAW Remote Terminal
MCC-H Only	
Perform ECU SAW RT Reset from Ground:	
<u>For P6 Solar Arrays</u> CI PUI=P6PW96IM0042K SPUI=USPZ21MD0702 SAW 2B = 33804 SAW 4B = 17420	<u>For S6 Solar Arrays</u> CI PUI=S6PX96IM0484K SPUI= USPZ21MD0702 SAW 1B = 33292 SAW 3B = 16908
<u>For P4 Solar Arrays</u> CI PUI=P4PW95SM0042K SPUI=USPZ21MD0702 SAW 2A = 17164 SAW 4A = 33548	<u>For S4 Solar Arrays</u> CI PUI=S4PW95SM0042K SPUI=USPZ21MD0702 SAW 1A = 16652 SAW 3A = 33036

126	ECU SAW Communicating
PVM:EPS:SAW XX SAW XX 'ECU XX'	
Is Integ Cnt incrementing?	

128	Communication Restored
Communication with the SAW has been restored. Confirm SAW and BGA configurations are as expected before continuing nominal procedure.	

127	Remove ECU Power
PVM:EPS:SAW XX SAW XX sel RPCM YY A RPC 02	
RPCM YY A RPC 02	
cmd RPC Position - Open (Verify - Op)	
SAW XX sel RPCM XX A RPC 01	
RPCM XX A RPC 01	
cmd RPC Position - Open (Verify - Op)	

130

129	Continue SAW Deploy
Continue {1.3.452 SAW XX Deploy}, (SODF: EPS: ACTIVATION AND CHECKOUT: CHANNEL ACTIVATION)	

30

31

32

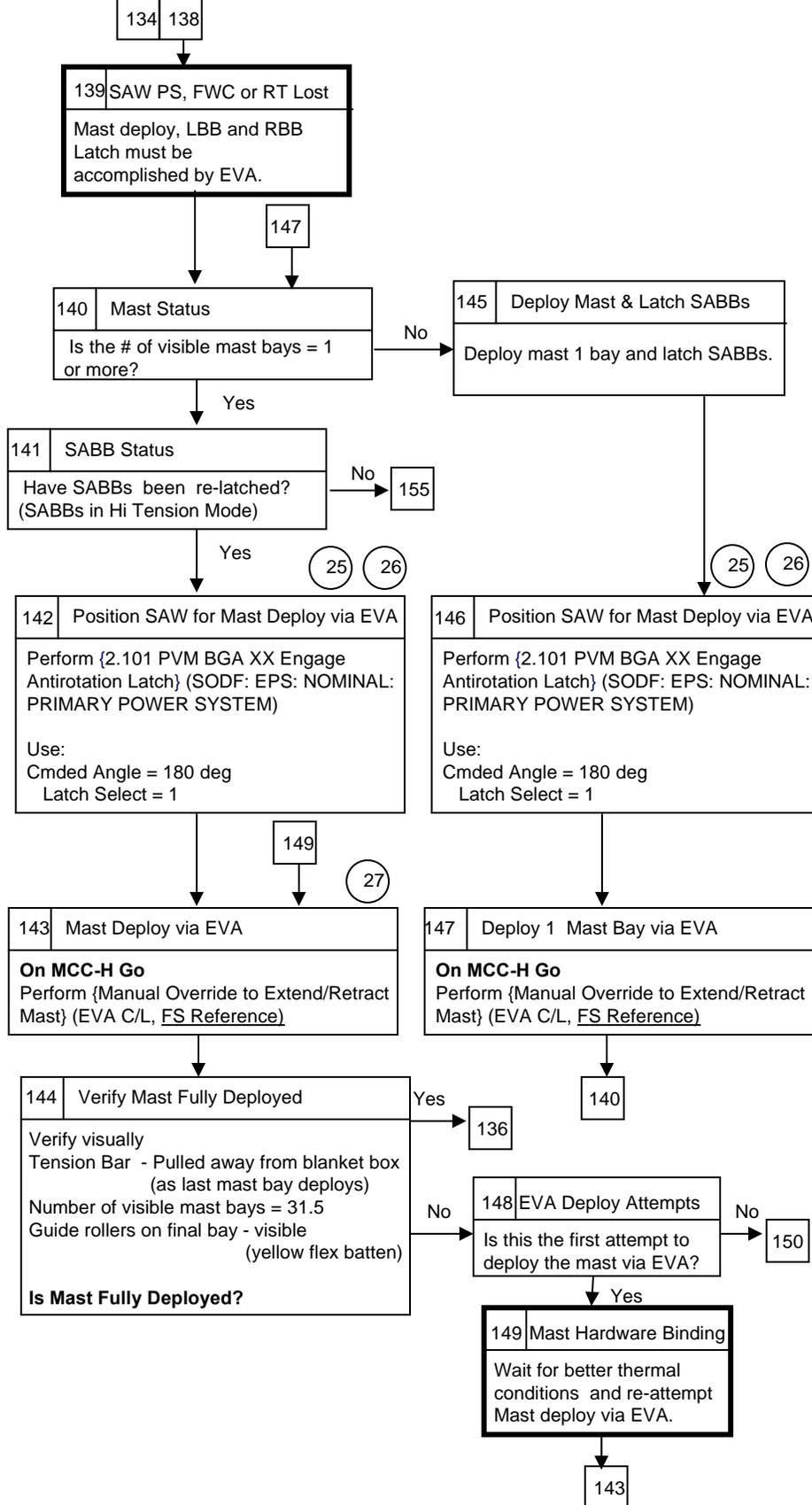
Removes Power from MDA. When power is re-applied to the ECU the MDA will be off.

MCC-H must build and perform this step from command inventory.

Expect Caution message BGA XX Loss of Comm - PVM when RPC 01 is cmded open.

3.191 SAW XX FAILURE TO EXTEND MAST REMOTELY

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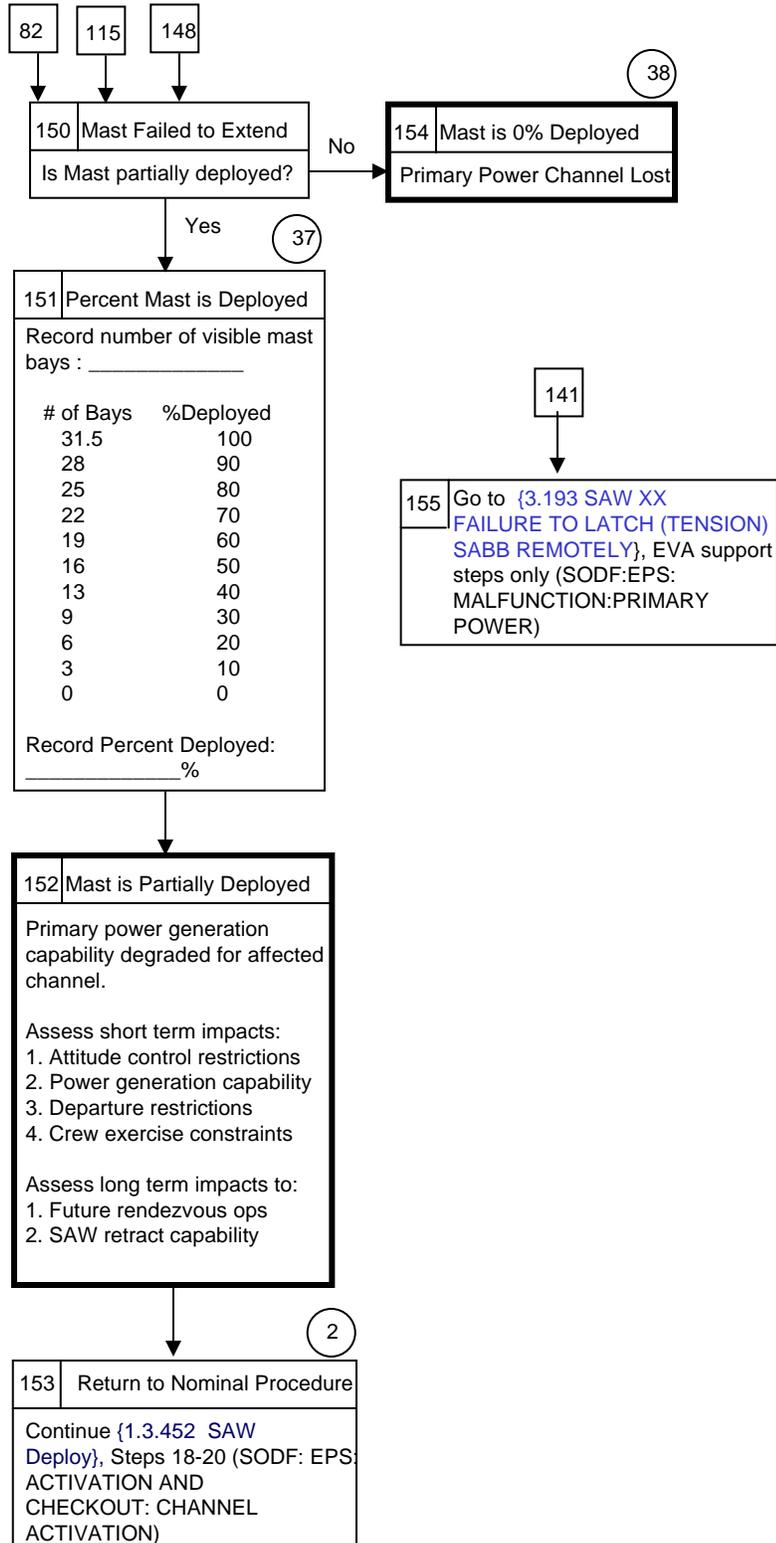
25 This step can take up to 1 hr to complete. The latch cmd can be sent when the BGA Actual Angle is within 1 deg of the commanded value in order to save time.

26 This step may be omitted if EVA crew can free float and drive the Mast MDA.

27 No thermal conditioning of the SAW is required if manually deploying, due to fact that it takes longer to deploy and it is warming throughout the manual deploy, also the crew can respond faster to stop the deploy.

3.191 SAW XX FAILURE TO EXTEND MAST REMOTELY

(EPS/12A – ALL/FIN 1) Page 19 of 19



37
Tensioning the SAW is ineffective if < 31.5 bays are visible.

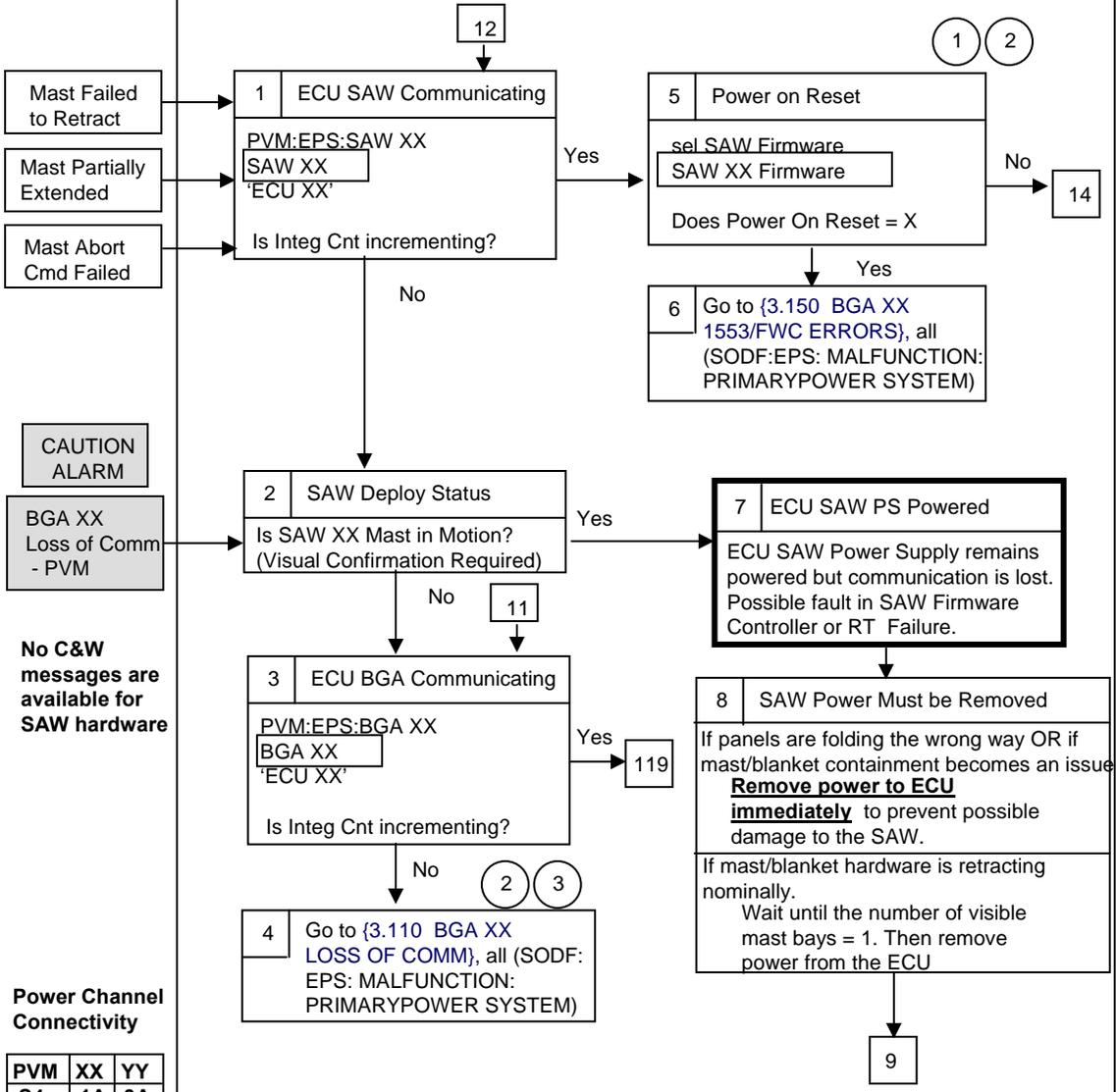
38
Remove MDA Power (Mast MDA-Off) if you have not already done so.

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EPS

3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY

(EPS/12A – ALL/FIN) Page 1 of 20



CAUTION ALARM

BGA XX Loss of Comm - PVM

No C&W messages are available for SAW hardware

Power Channel Connectivity

PVM	XX	YY
S4	1A	3A
S4	3A	1A
S6	1B	3B
S6	3B	1B
P4	2A	4A
P4	4A	2A
P6	2B	4B
P6	4B	2B

Nominal Config:
 ECU SAW XX:
 RPCM XX A
 RPC 1 - CI
 RPCM YY A
 RPC 2 - CI

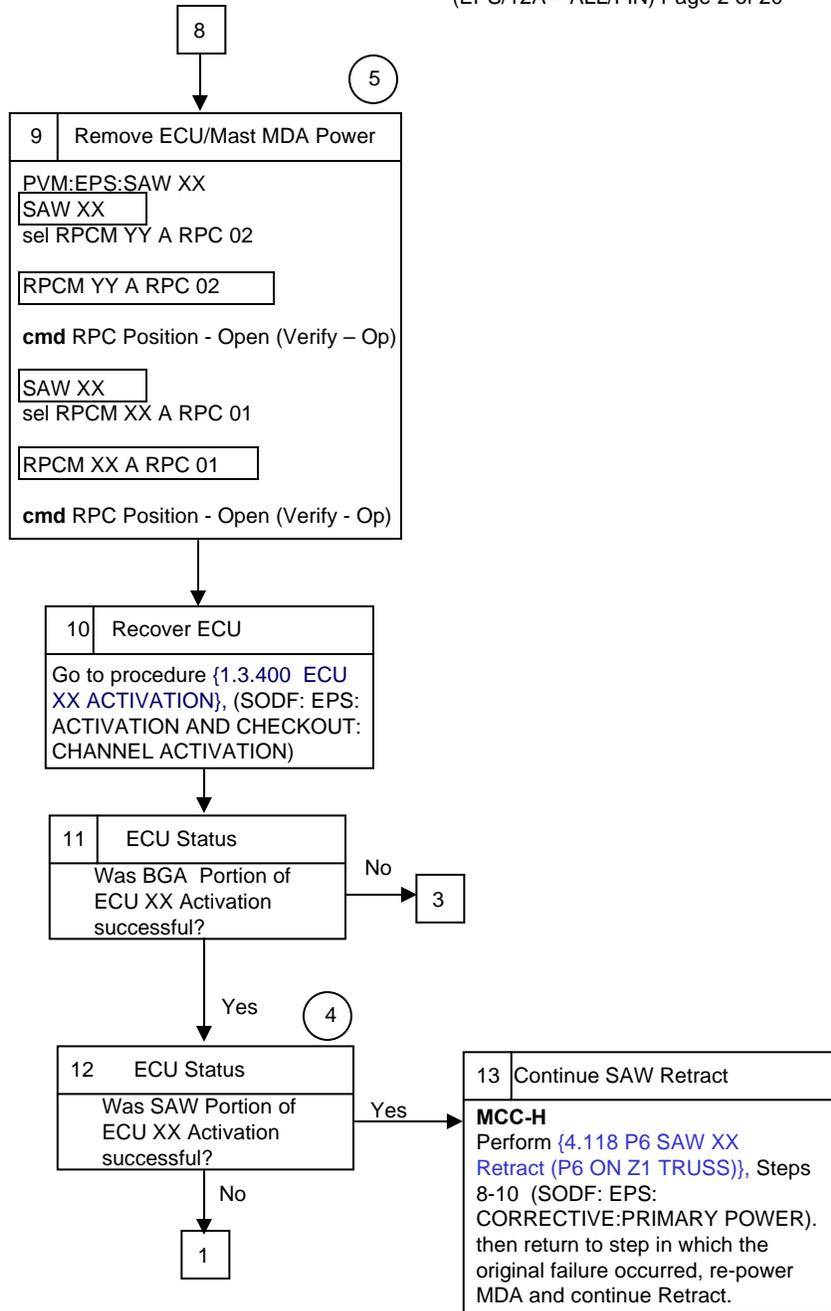
1 Caution message BGA XX 1553/ FWC Errors- PVM may also be received if a Power on Reset has occurred.

2 If power was removed from the ECU you must begin again with step 1 of the Deploy/Retract procedure, to reset the F/W inhibits.

3 If Current sensor fails high > 0.78 A RPCs providing power to ECU will be opened. A new PPL with a higher Current limit must be uploaded before the ECU can be recovered. There is no inhibit for SAW MDA Config Complete Persistent Current Safing.

3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY

(EPS/12A – ALL/FIN) Page 2 of 20



4

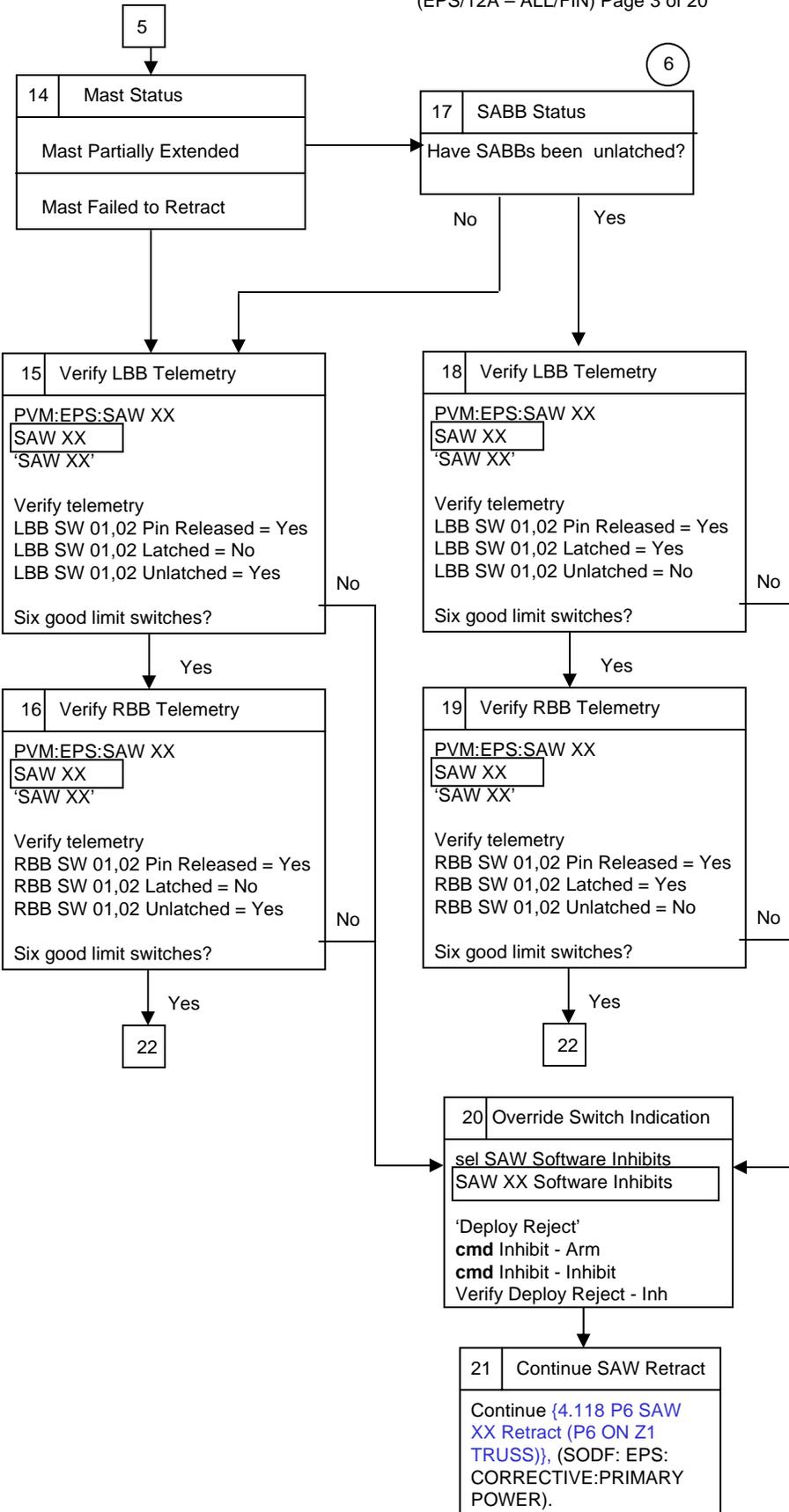
Communication with the BGA is not required in order to complete SAW deploy/retract This assumes that the BGA is already locked and at the SAW retraction position. BGA trouble-shooting can wait until after the array is retracted.

5

Remove the ECU power to remove power from the MDA. ECU power is supplied by the opposite deck channel (YY) for SAW Retraction operations. Expect Caution message BGA XX Loss of Comm - PVM when RPC 01 is cmded open.

3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY

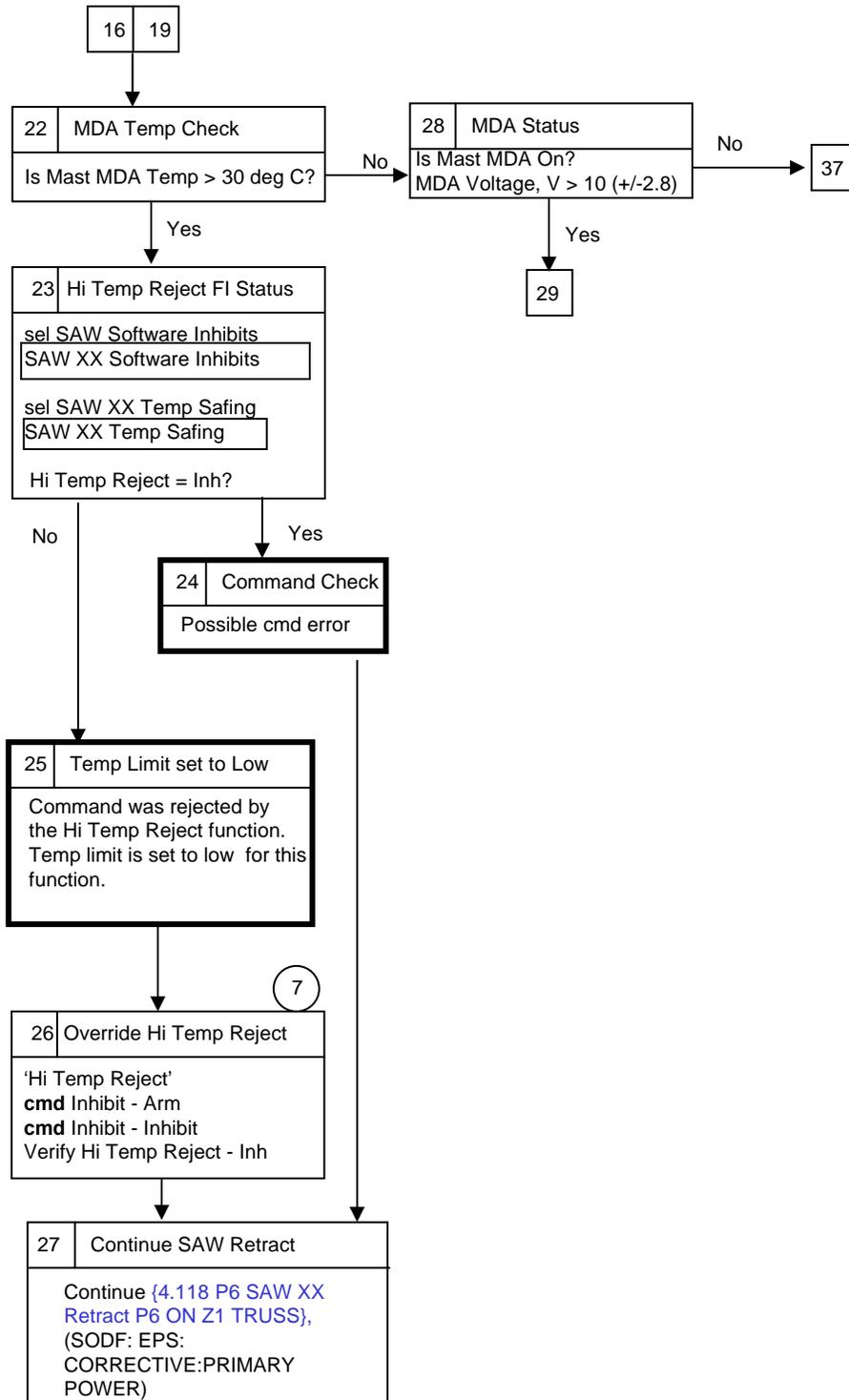
(EPS/12A – ALL/FIN) Page 3 of 20



6
SABBs are unlatched after the mast has been retracted until only 1 mast bay is visible so the SABB cover is clear of the latch operations.

3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY

(EPS/12A – ALL/FIN) Page 4 of 20



7

MDA operating temperature range is -54 to 48 deg C.

3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY

(EPS/12A – ALL/FIN) Page 5 of 20

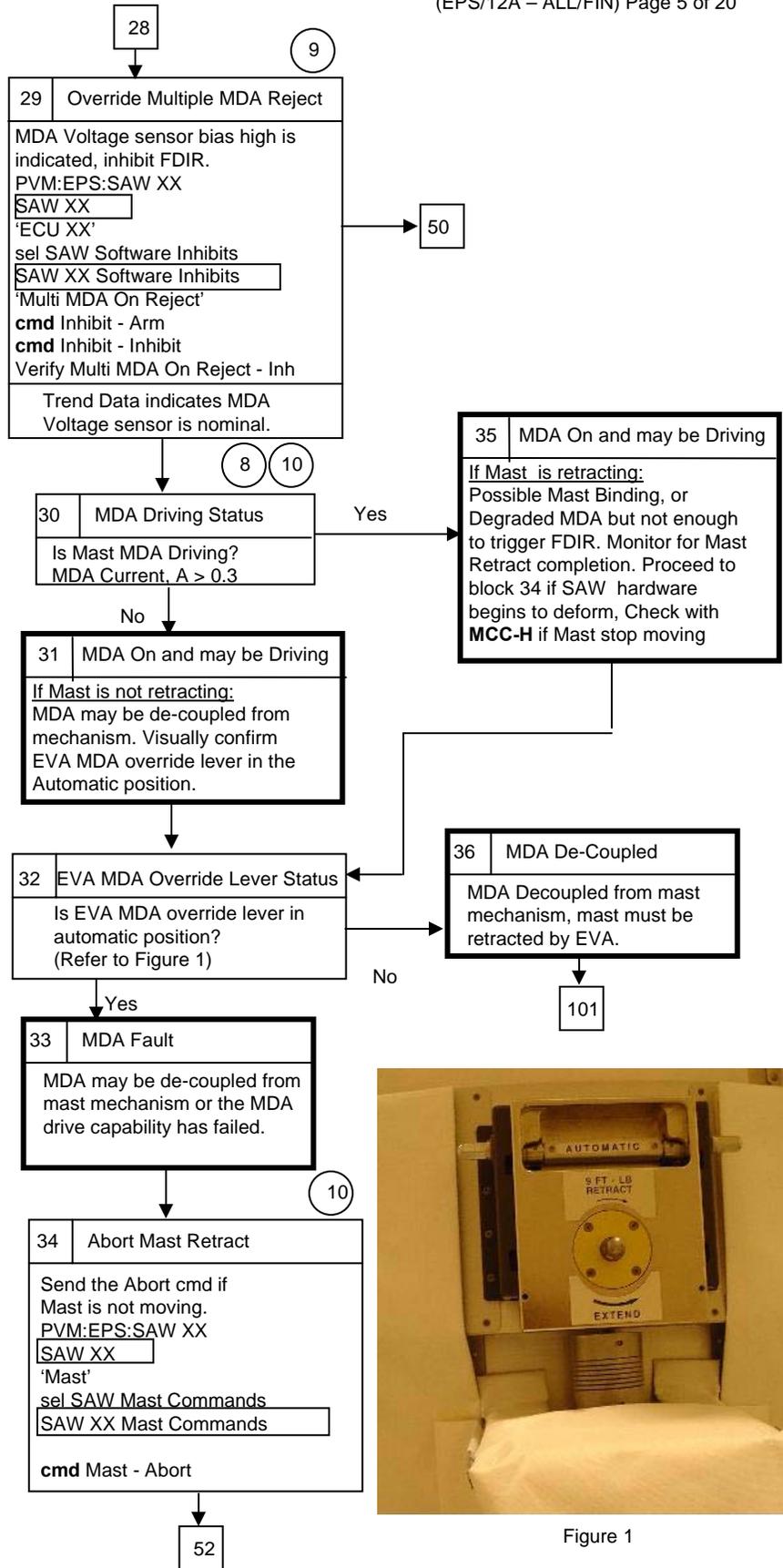


Figure 1

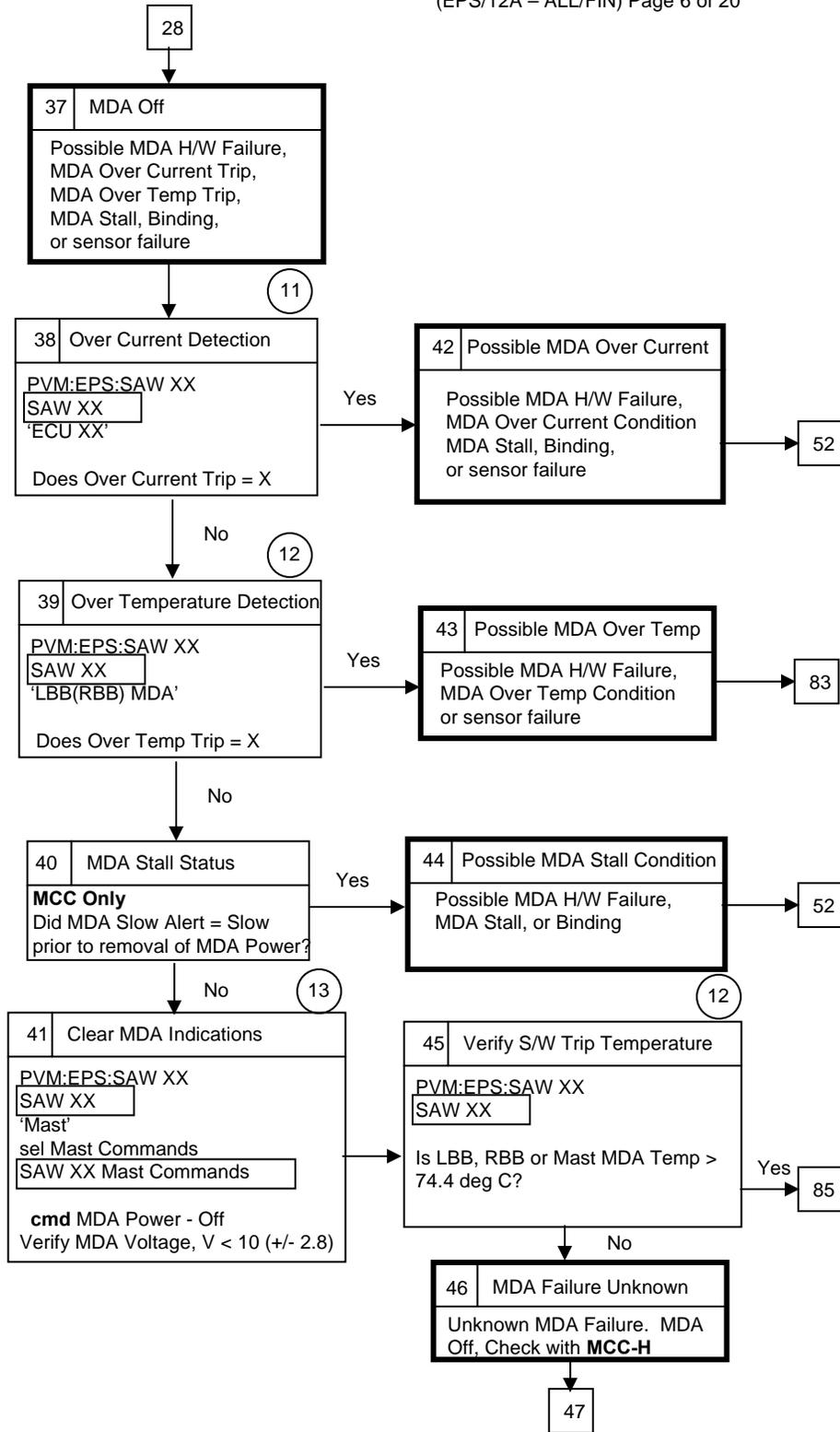
8 The manual MDA override lever is located on the back (inactive side) of the mast canister. (MDA current with no load = 0.3A)

9 There is no overvoltage FDIR for the MDA. The MDA will continue to operate if a Voltage sensor has failed high. Check voltages of all MDAs. The multiple MDA On Reject FDIR will reject an MDA on command if another MDA is already on.

10 If MDA de-coupled you may not be able to tell if the MDA is driving based on the current.

3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY

(EPS/12A – ALL/FIN) Page 6 of 20



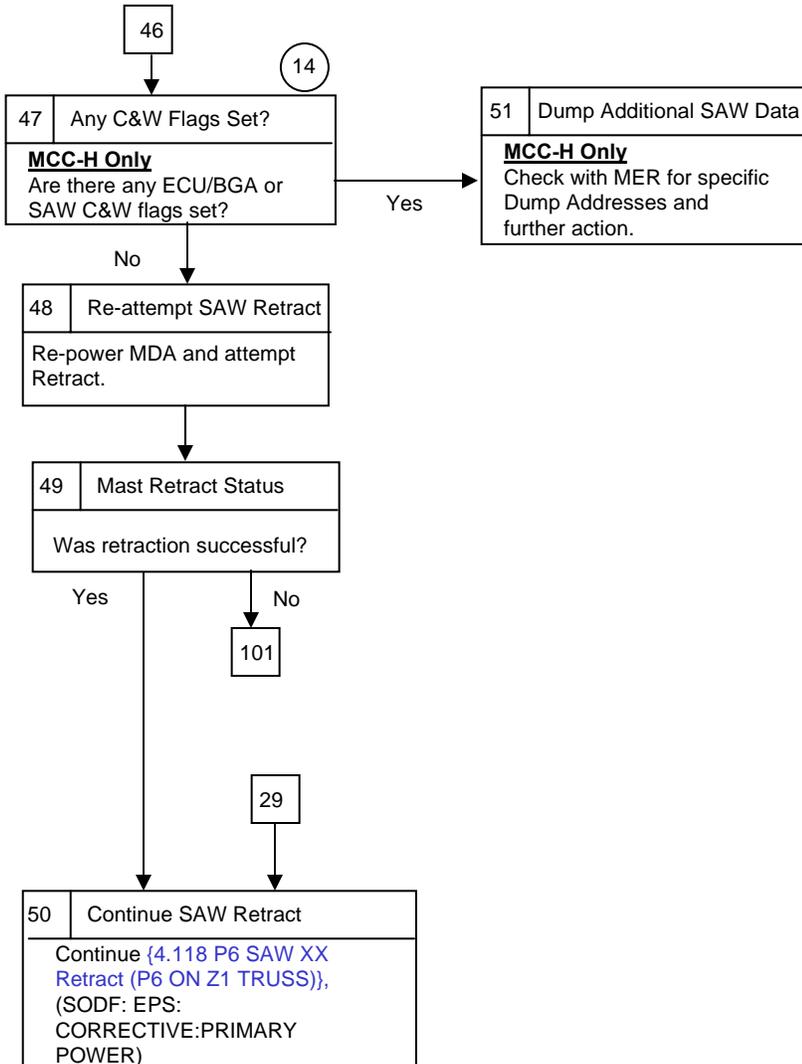
11 ECU Firmware MDA Over Current Trip occurs at 6.2 Amps. S/W Limit (0.78 A) is reached first and it does **not** set the MDA Over Current Trip Flag.

12 Disconnects are present in the MDA Over Temp FDIR. S/W Trip level = 77.7 deg C. F/W Trip level = 140 deg C. H/W damage occurs at 120 deg C. S/W Temp limit is reached first and it does **not** set the MDA Over Temp Trip Flag.

13 MDA Power off is a one step command.

3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY

(EPS/12A – ALL/FIN) Page 7 of 20

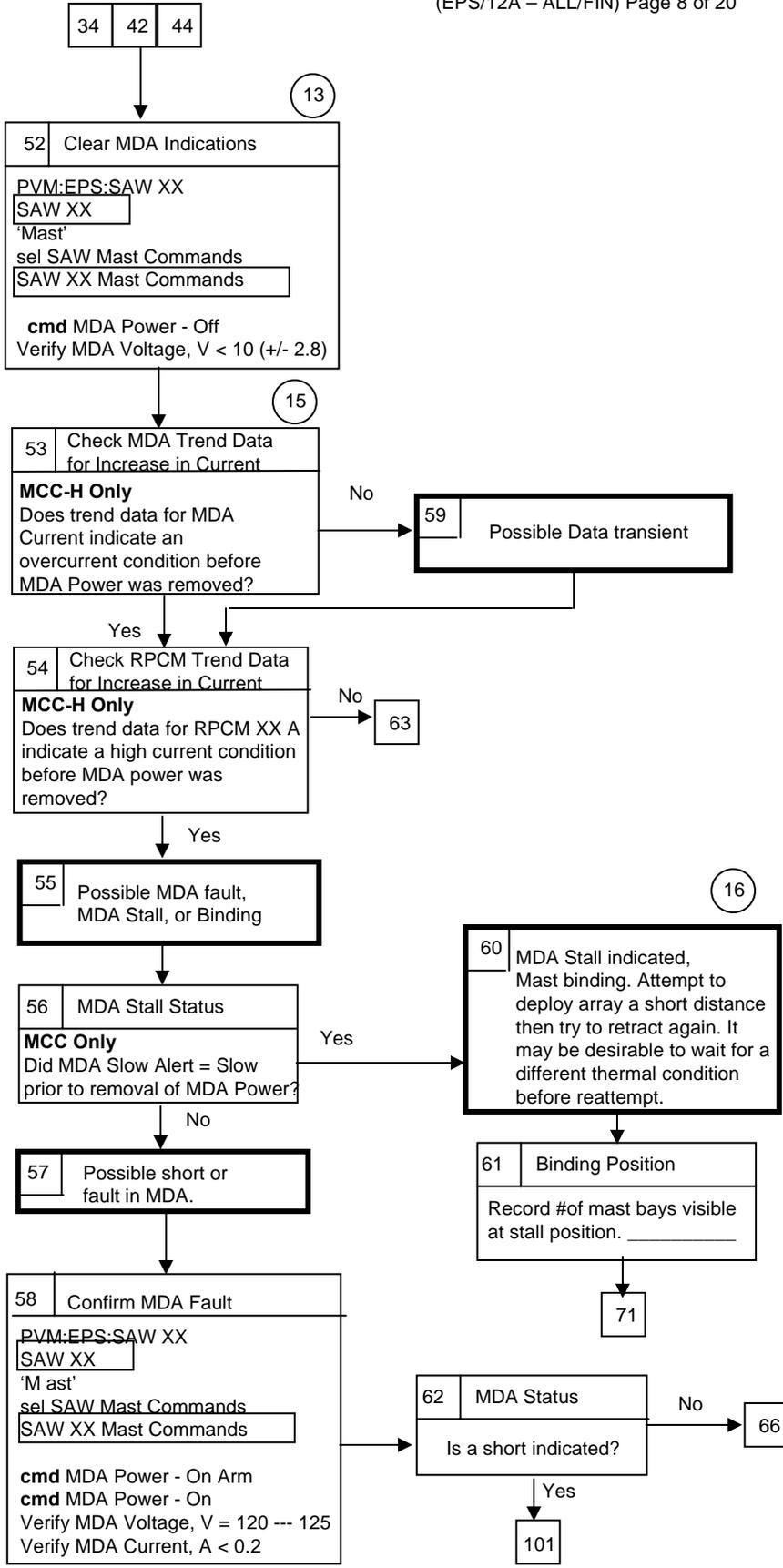


14

SAW Caution and Warning Flags are available for downlink only during missions that scheduled SAW activities. (e.g 12A) Flags are not available on PCS displays.

3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY

(EPS/12A – ALL/FIN) Page 8 of 20



13

MDA Power off is a one step command.

15

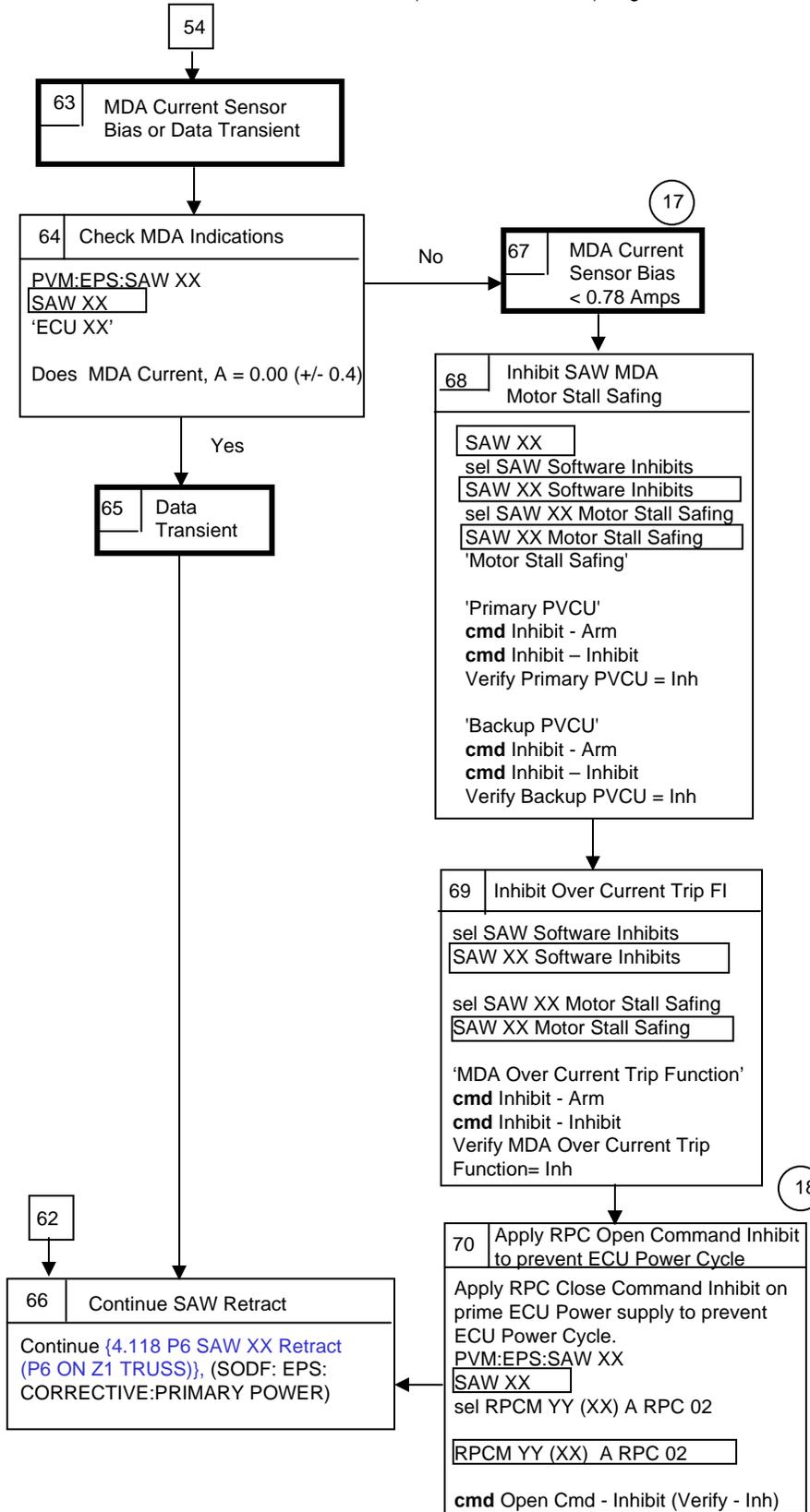
PVCU Software MDA Over Current Trip occurs at 0.78 Amps.

16

If a Stall Condition is indicated, Current > 0.78 A and motor speed is < 25 RPM, power is removed from the MDA

3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY

(EPS/12A – ALL/FIN) Page 9 of 20



17

If Current sensor fails high > 0.78 A RPCs providing power to ECU will be opened. A new PPL with a higher current limit must be uploaded before the ECU can be recovered. There is no inhibit for SAW MDA Motor Stall Persistent Current Safing. Refer to block 3.

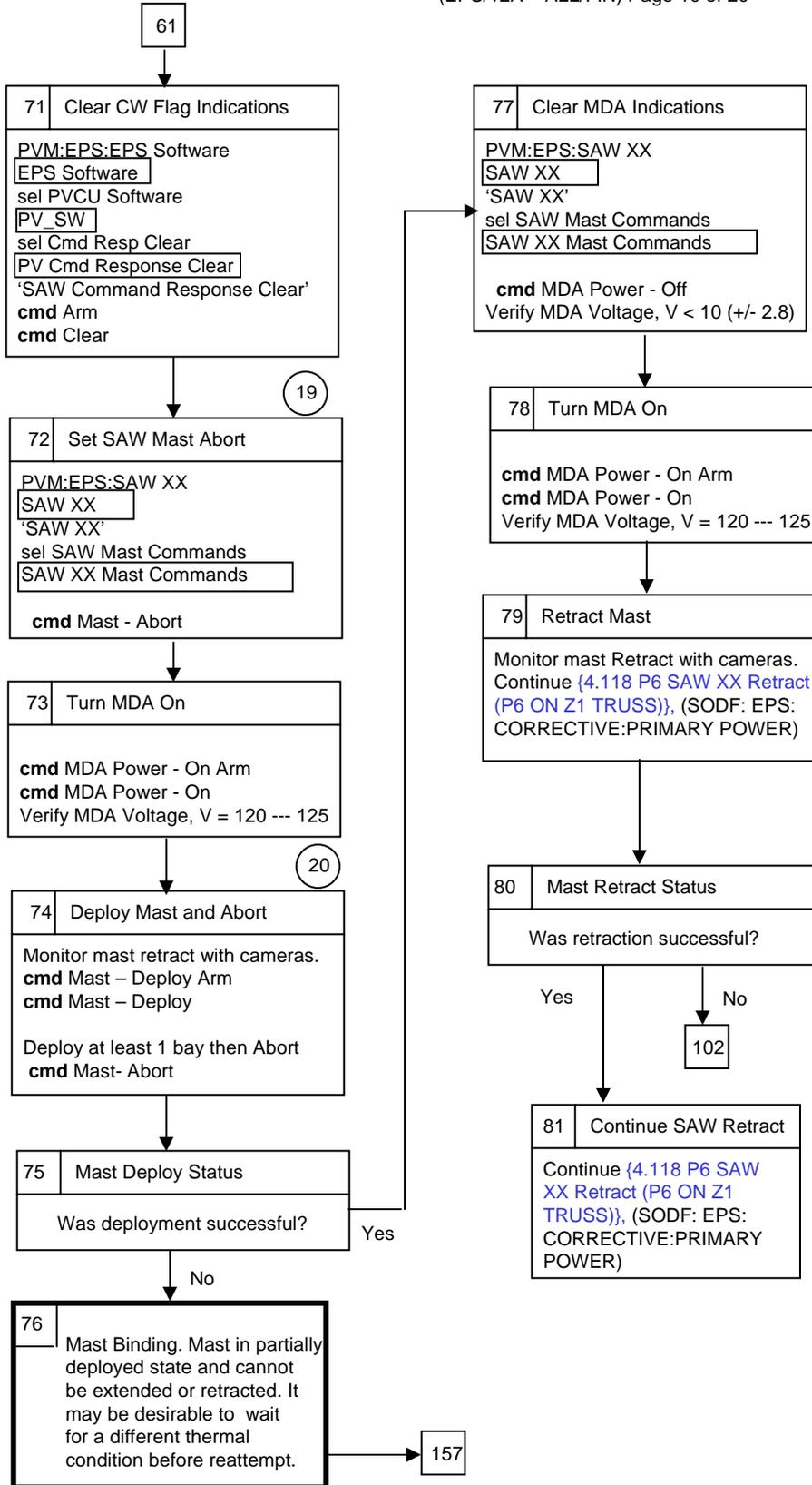
18

However, all MDAs use the same current sensor. A new PPL 69 must be unlinked prior to SAW operations or Inhibit the RPC Open Command to avoid power cycling the ECU.

18

3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY

(EPS/12A – ALL/FIN) Page 10 of 20



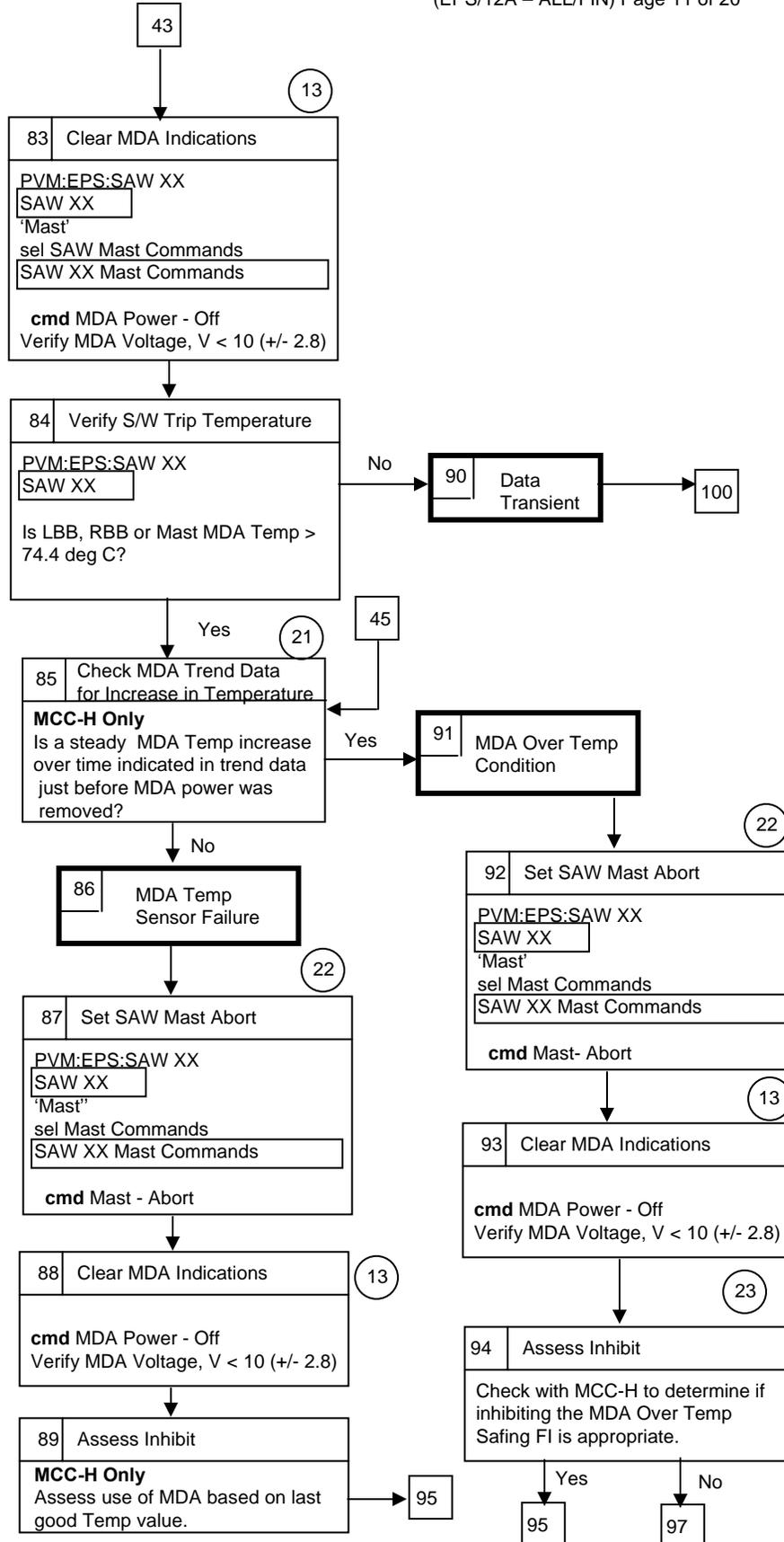
19 MDA Abort must be sent to prevent MDA from driving once power is re-applied. This is a single step cmd.

20 Confirm that ISS Thrusters are inhibited or ISS/Orbiter in Free Drift and no crew un-isolated exercise or max EVA loads prior to sending the Deploy or Retract command. If at any time mechanical movement is stopped or aborted, attitude control may be resumed.

Step 82 Deleted

3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY

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13

MDA Power off is a one step command.

21

Disconnects are present in the MDA Over Temp FDIR. S/W Trip level = 77.7 deg C. F/W Trip level = 140 deg C. H/W damage occurs at 120 deg C. At a minimum a 30 deg C Mast MDA Temp increase should be protected for during mast deploy/retract

22

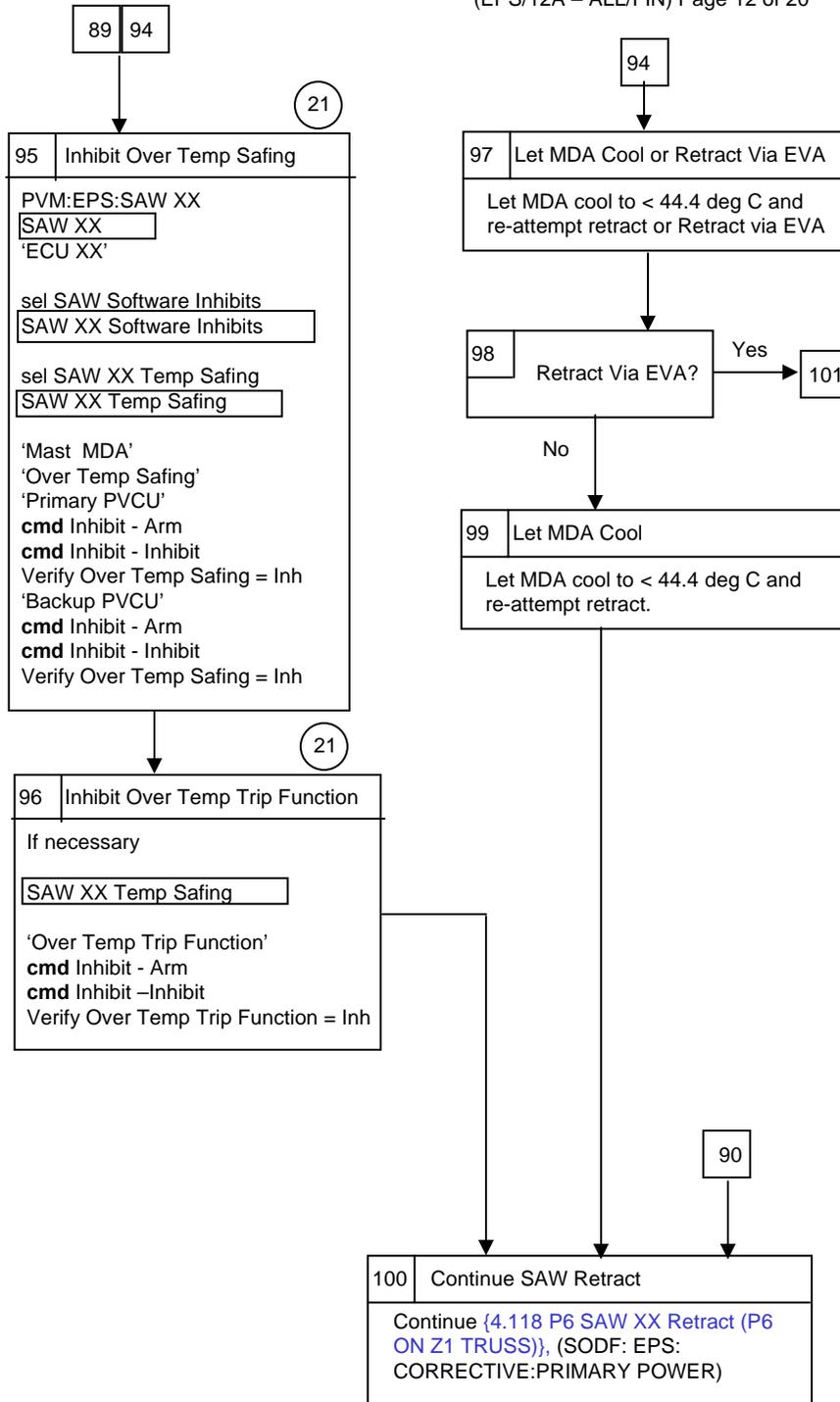
Since S/W Temp limit is reached first and it does not set the MDA Over Temp Trip flag, a MDA Abort must sent to prevent MDA from driving, once power is re-applied. This is a single step cmd.

23

Per Flight Rule B9-207, MDA operations can proceed even if MDA temp is high in order to meet critical mission objectives. Measurement Out of Range will be indicated if MDA temp >72.2 deg C.

3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY

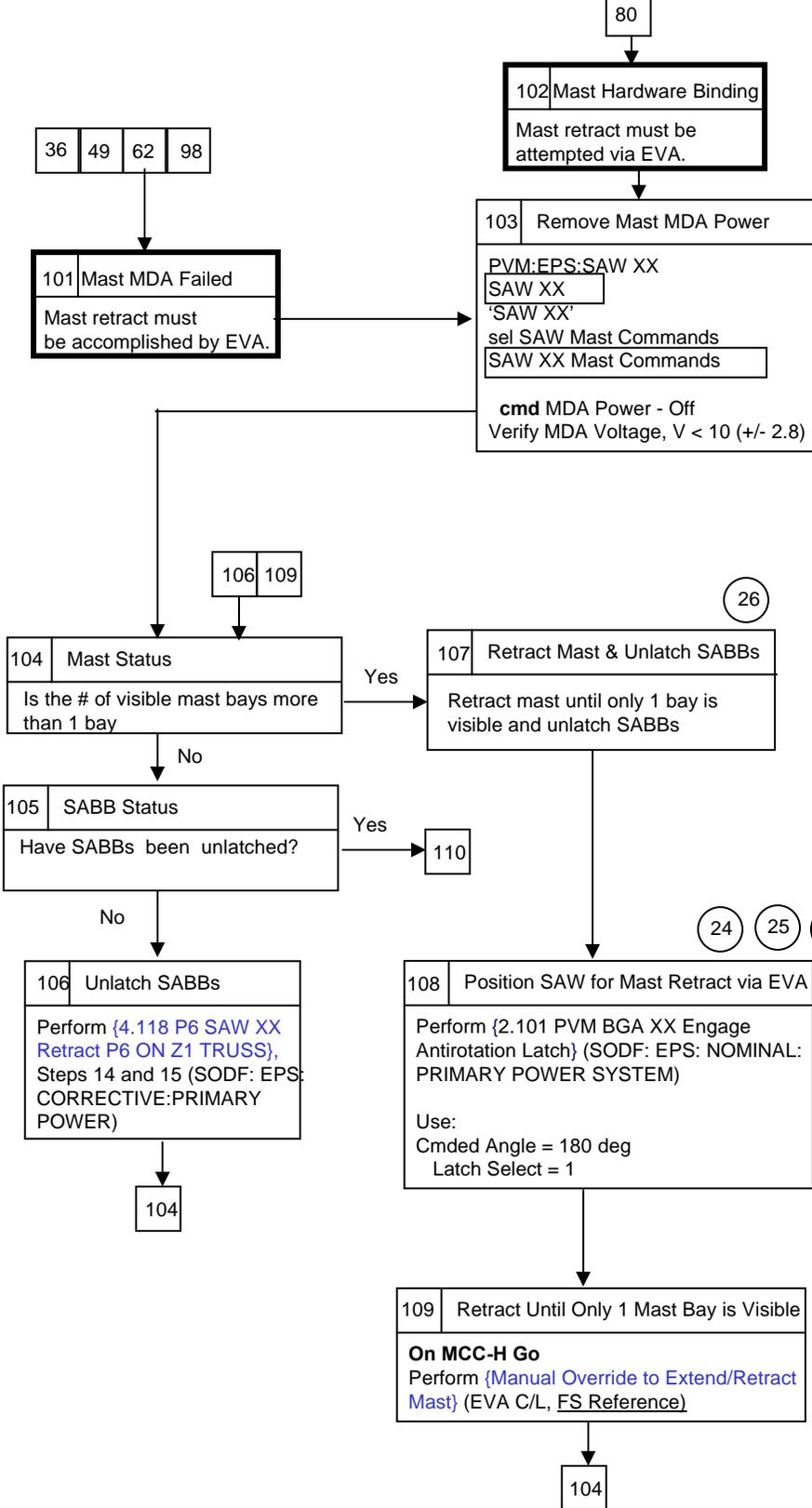
(EPS/12A – ALL/FIN) Page 12 of 20



(21)
 Disconnects are present in the MDA Over Temp FDIR. S/W Trip level = 77.7 deg C. F/W Trip level = 140 deg C. H/W damage occurs at 120 deg C. At a minimum a 30 deg C Mast MDA Temp increase should be protected for during mast deploy/retract

3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY

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24 This step can take up to 1 hr to complete. The latch cmd can be sent when the BGA Actual Angle is within 1 deg of the commanded value in order to save time.

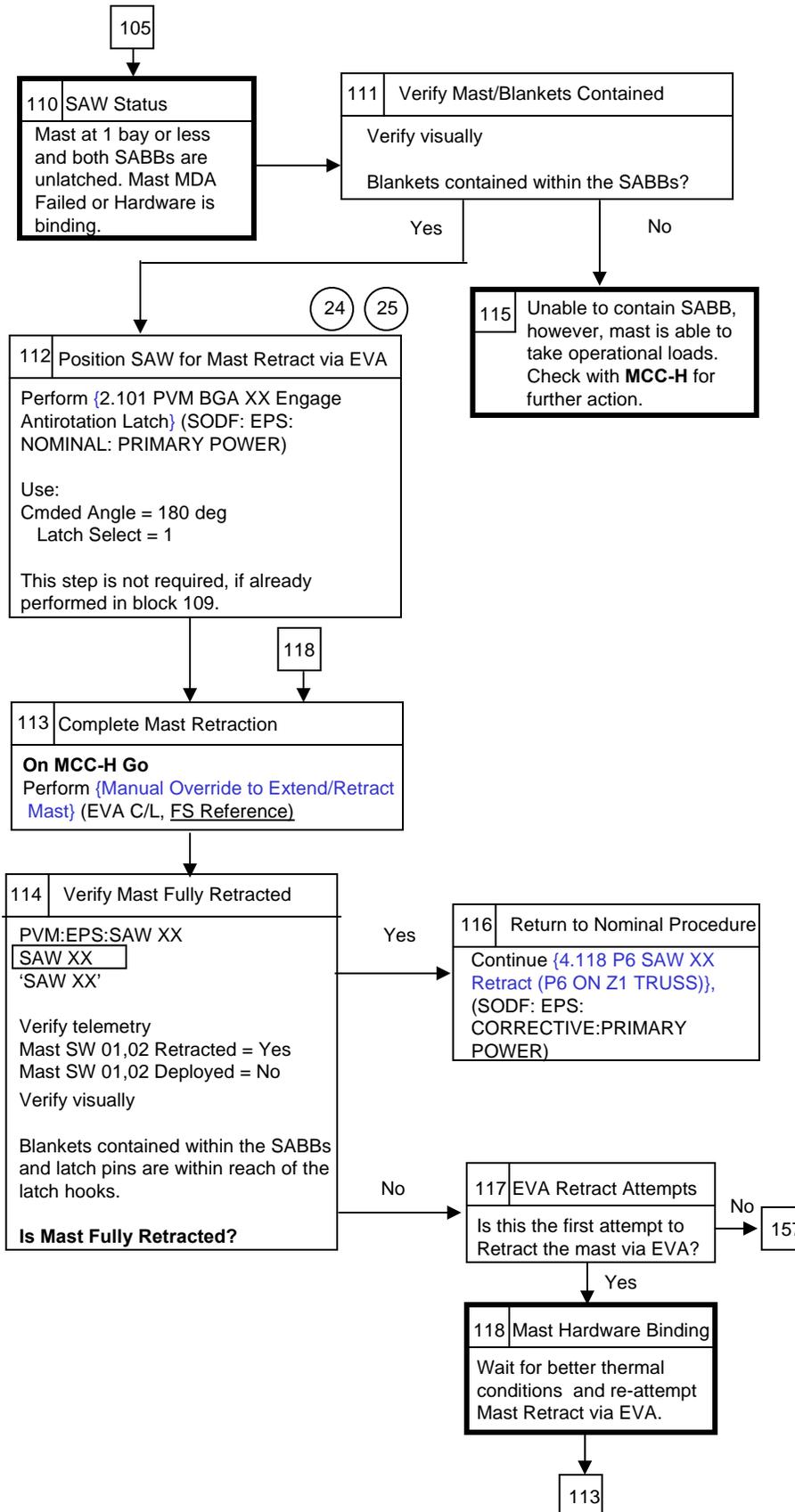
25 This step may be omitted if EVA crew can free float and drive the Mast MDA.

26 SABBs can be unlatched anytime the Mast is less than 13.5 or greater than 1 bay. May consider unlatching prior to BGA positioning to support EVA, if there will be no attempt to redeploy. Camera config. is still available to view unlatch, prior to BGA rotation, and unlatching early will reduce EVA time.

27 When the BGA is repositioned, the thermal environment of the Mast is changed. Consider another attempt to retract if binding was the problem.

3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY

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24

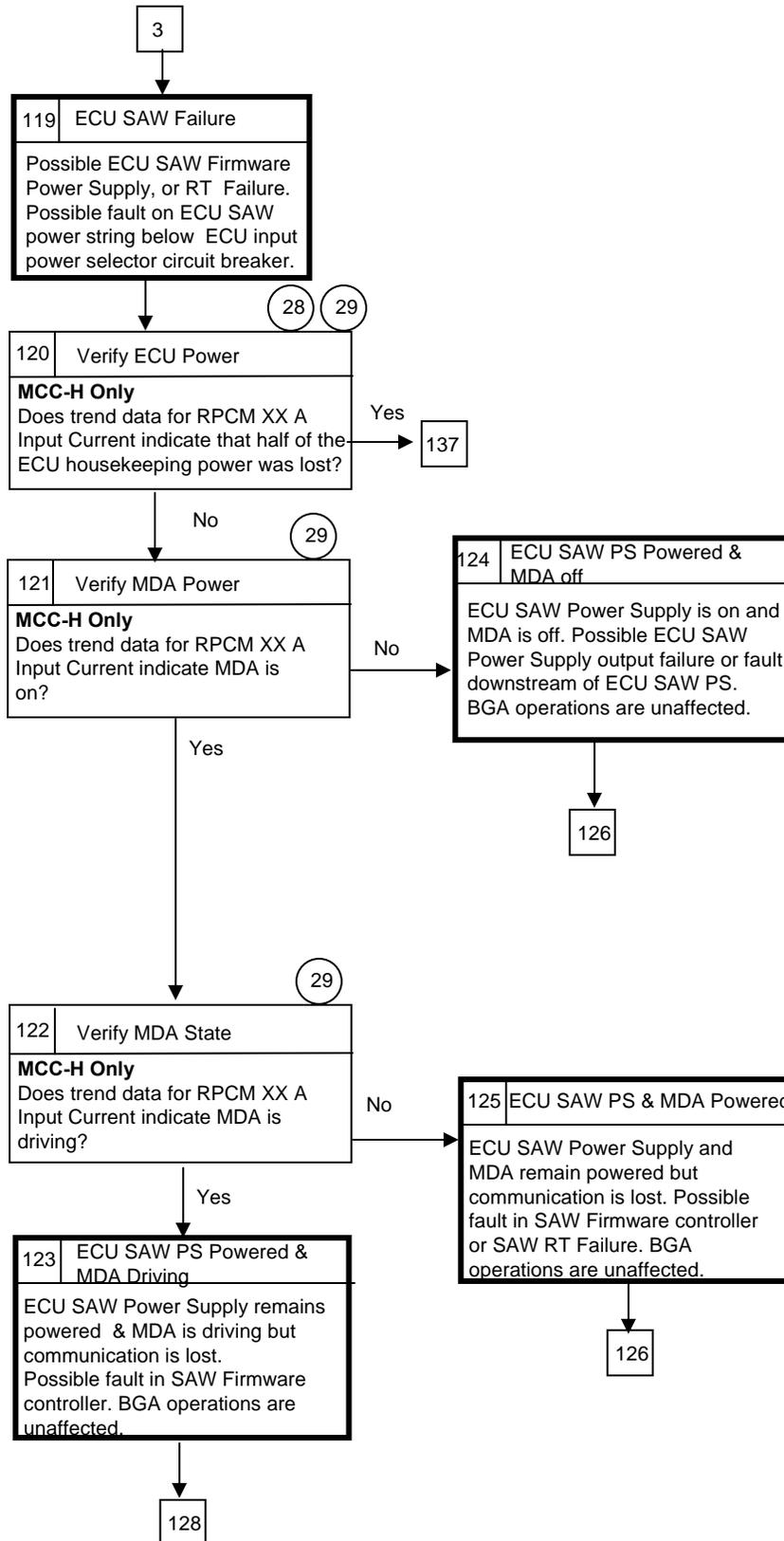
This step can take up to 1 hr to complete. The latch cmd can be sent when the BGA Actual Angle is within 1 deg of the commanded value in order to save time.

25

This step may be omitted if EVA crew can free float and drive the Mast MDA.

3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY

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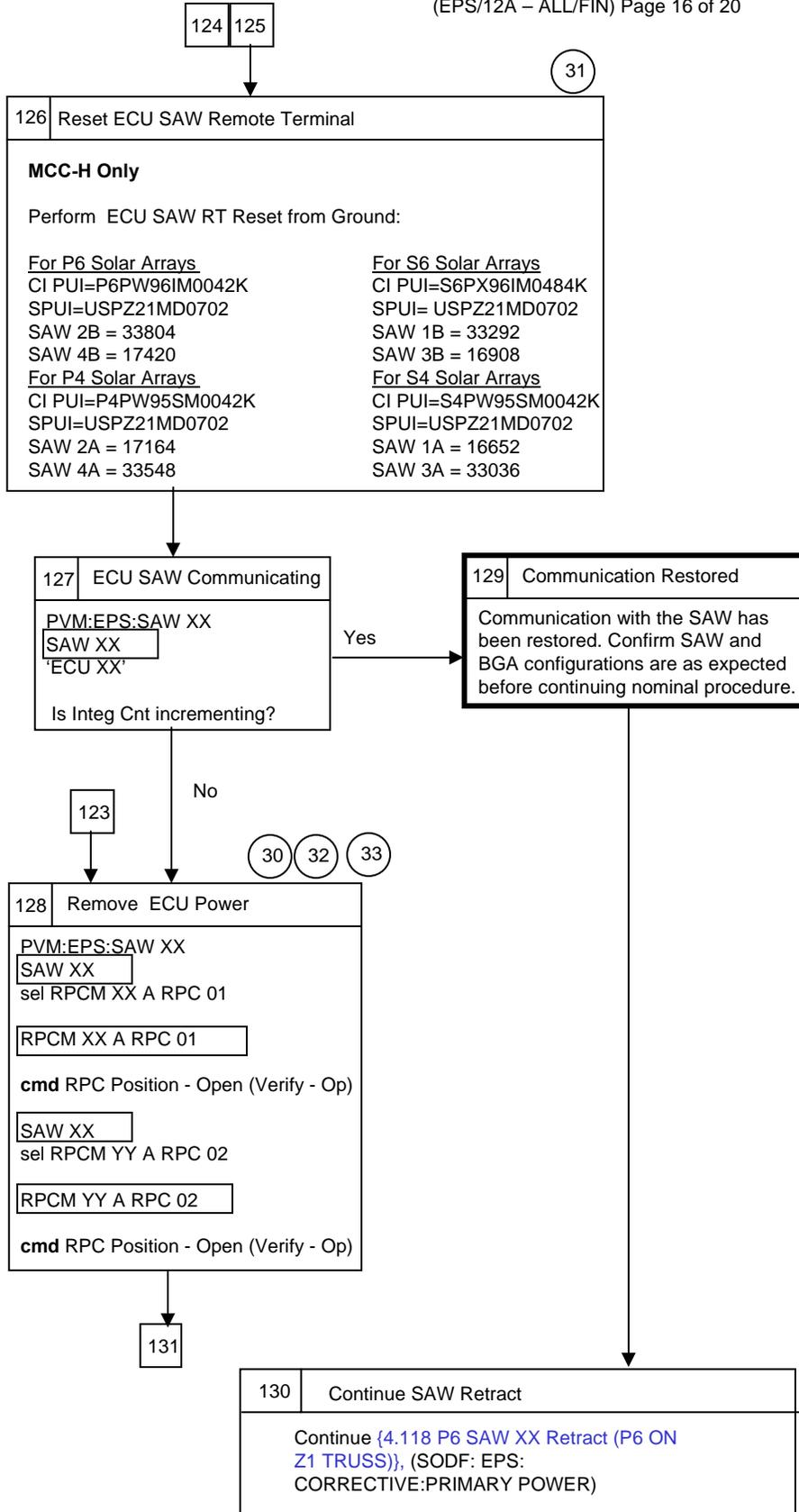


28
Total ECU housekeeping power is 115W (0.93A) at initialization and before BGA mtr or MDAs are turned on. Half of the ECU housekeeping power is 57.5W (0.47A)

29
When the MDA is on it draws about 0.22A. When the MDA is driving it can draw as high as 3.0A. MDA over current trip occurs at 0.78A. The MDA will stop driving but will remain on if one of the two "Retracted" limit switches have contacted.

3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY

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30 Removes Power from MDA. When power is re-applied to the ECU the MDA will be off.

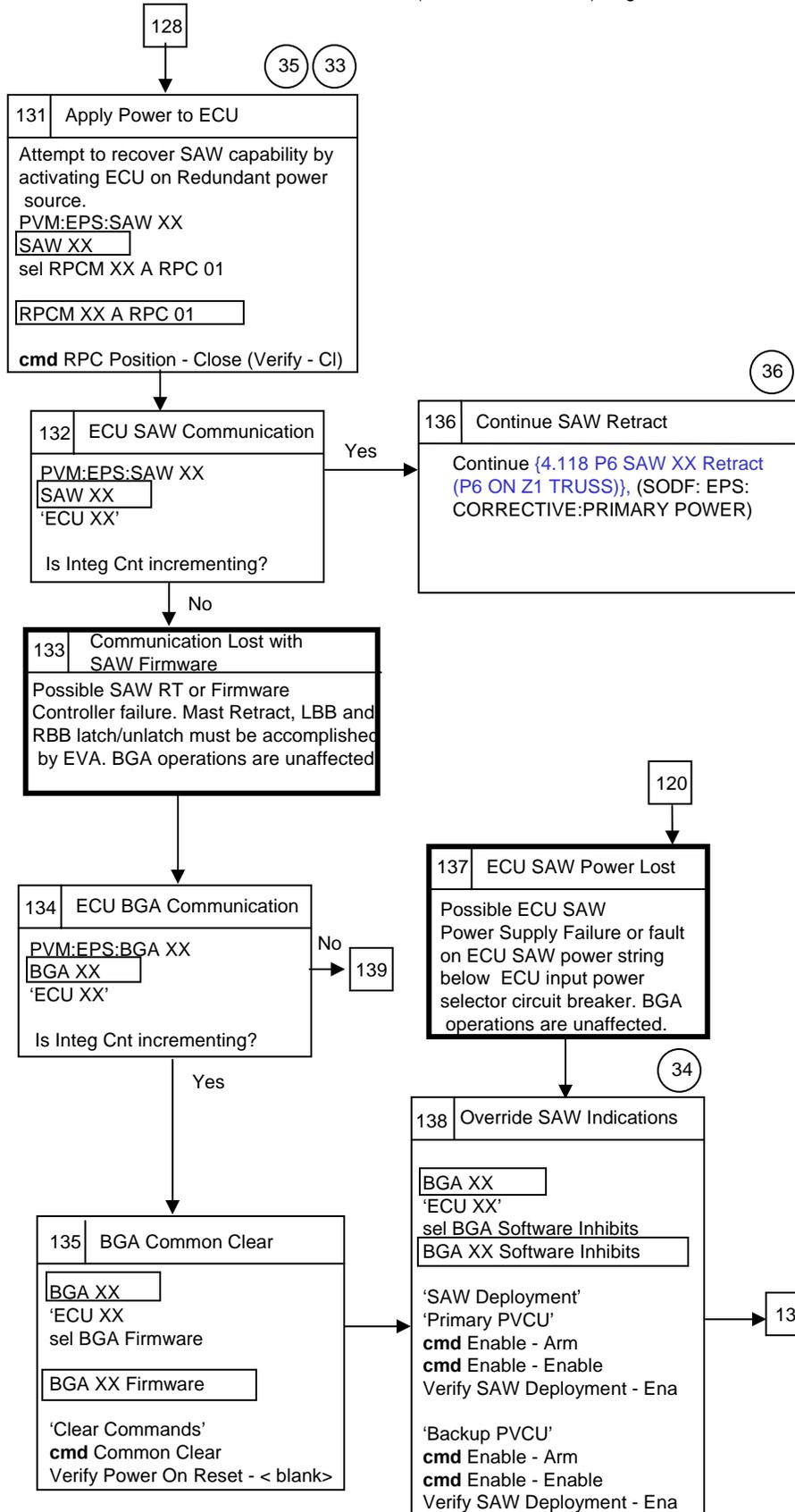
31 MCC-H must build and perform this step from command inventory.

32 Expect Caution message BGA XX Loss of Comm - PVM when RPC 01 is cmded open.

33 ECU power is supplied by the opposite deck channel (YY) for SAW Retraction operations.

3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY

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33 ECU power is supplied by the opposite deck channel (YY) for SAW Retraction operations.

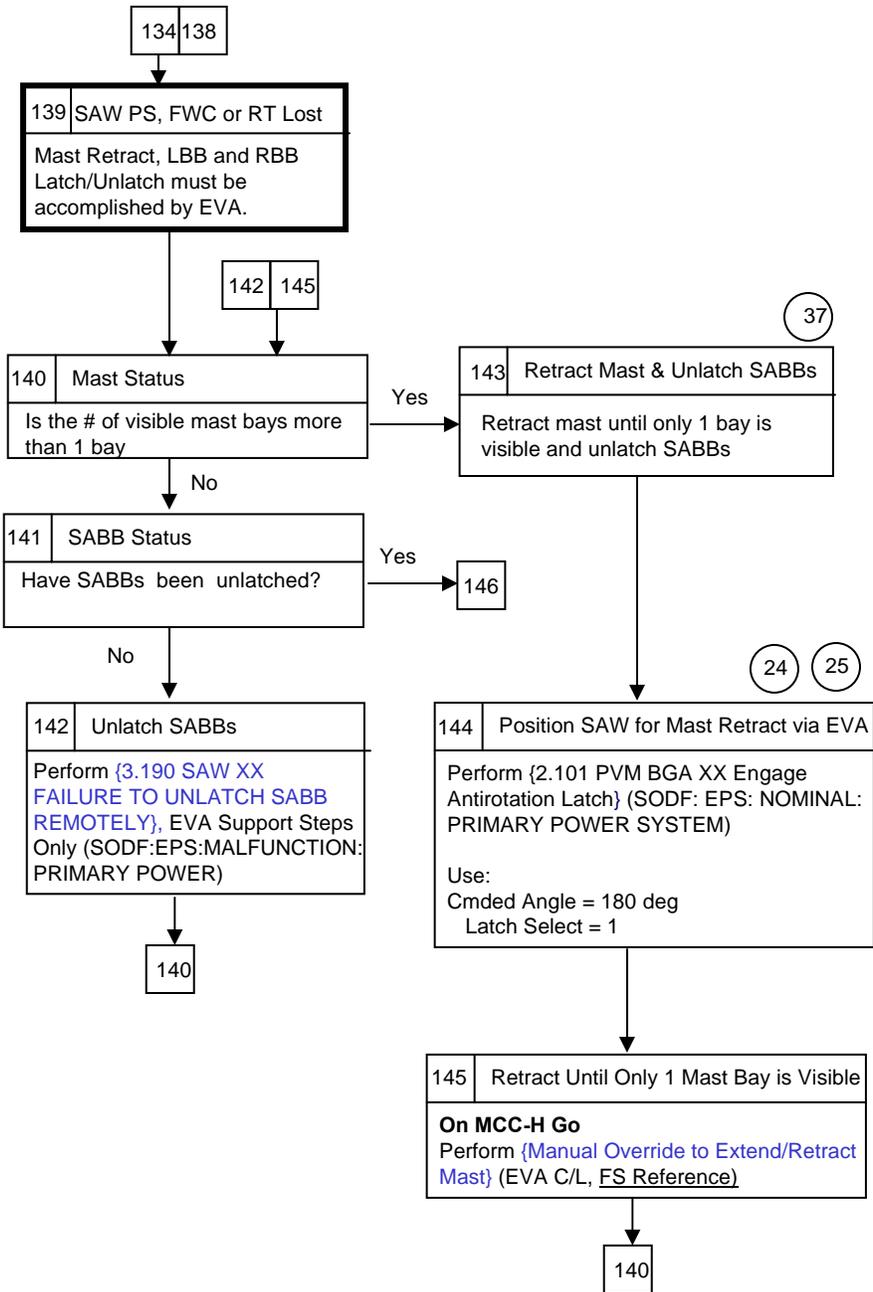
34 Allows BGA to be operated when SAW Mast is in an undetermined state, or comm is lost with SAW FWC

35 Caution message BGA XX 1553/ FWC Errors- PVM may be received after RPC 01 is closed.

36 If power was removed from the ECU you must begin again with step 1 of the Deploy/Retract procedure, to reset the F/W inhibits.

3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY

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24

This step can take up to 1 hr to complete. The latch cmd can be sent when the BGA Actual Angle is within 1 deg of the commanded value in order to save time.

25

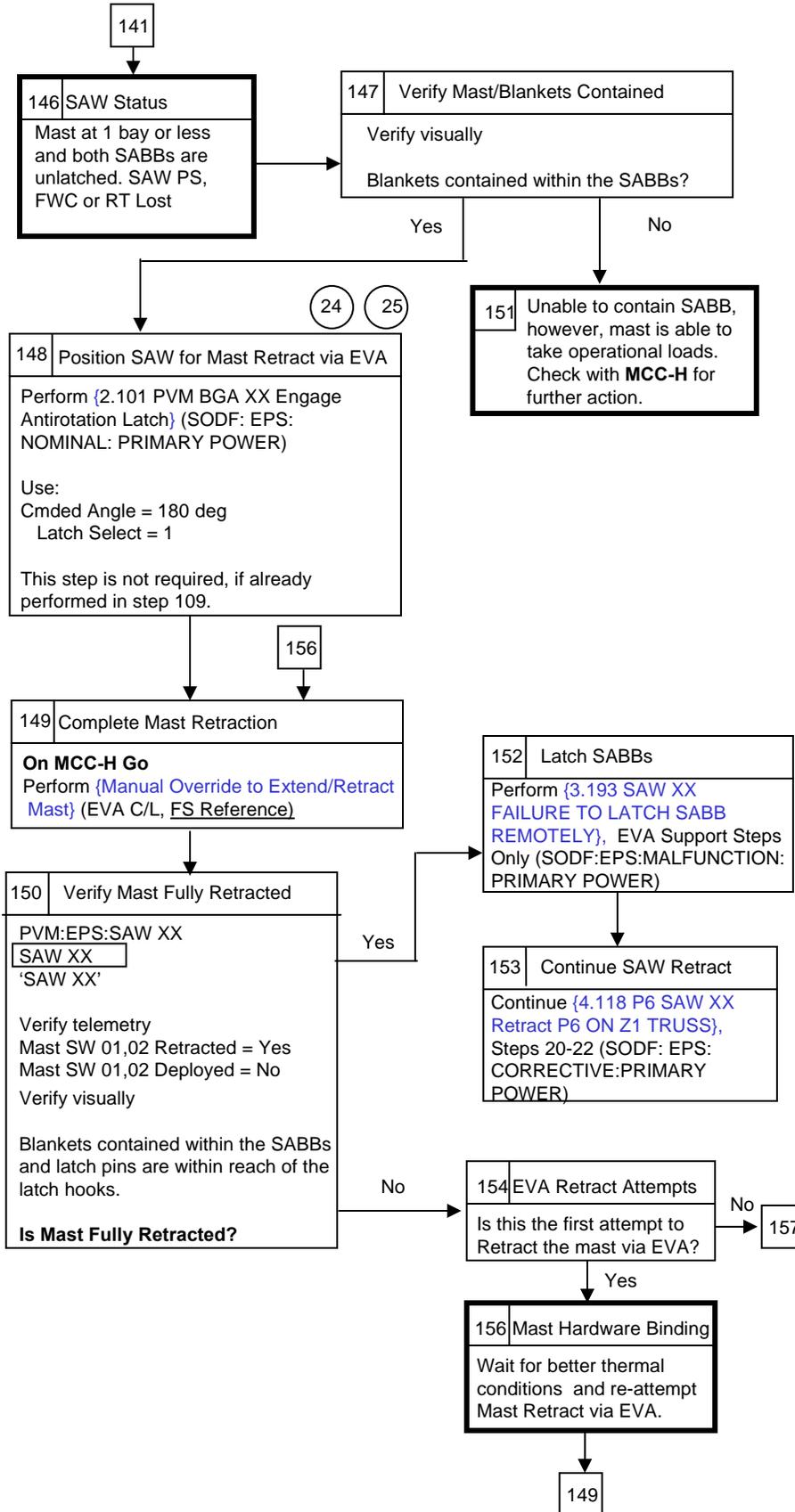
This step may be omitted if EVA crew can free float and drive the Mast MDA.

37

Retracting while still latched, allows for early SARJ positioning, or improved power generation, while the crew is still working on the rest of the SAW EVA tasks

3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY

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24

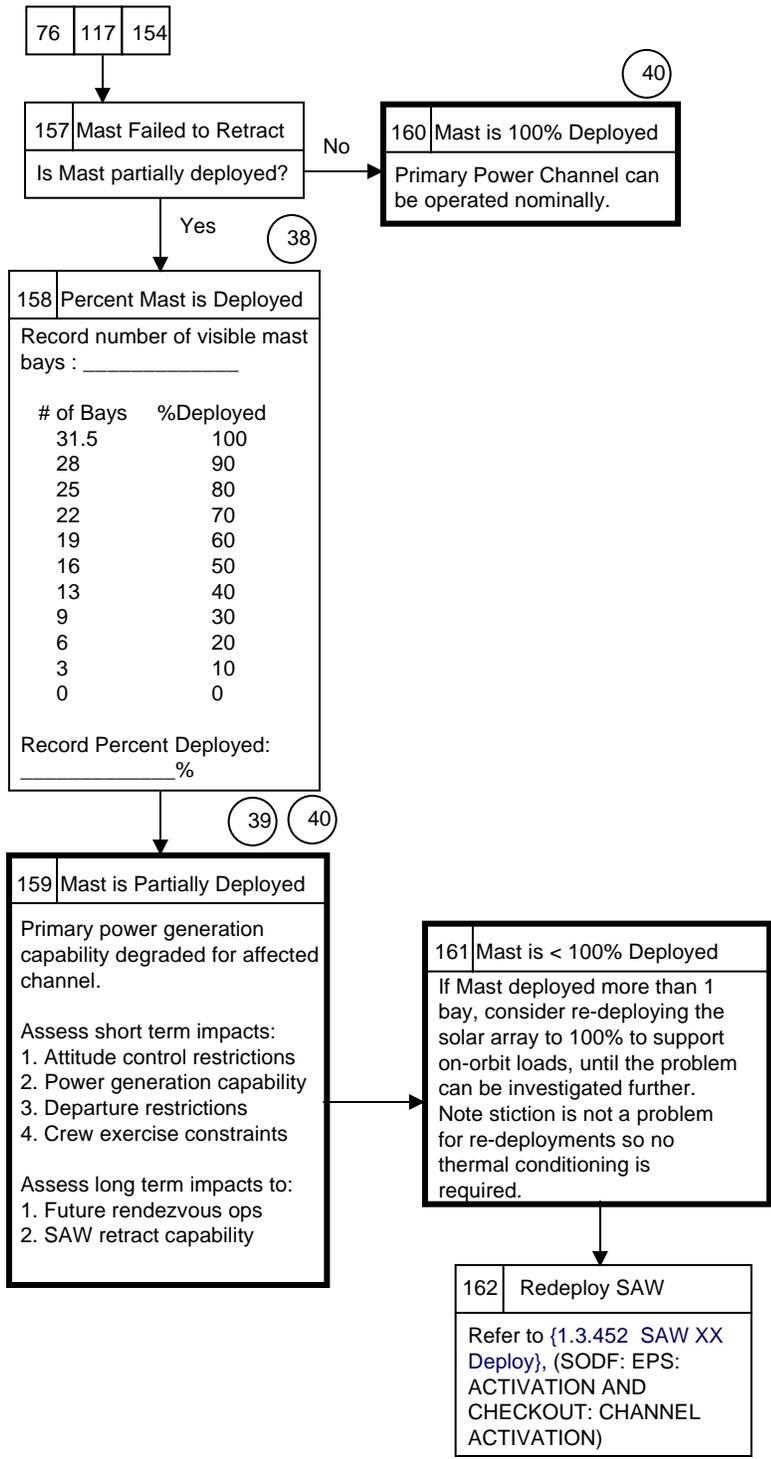
25

This step can take up to 1 hr to complete. The latch cmd can be sent when the BGA Actual Angle is within 1 deg of the commanded value in order to save time.

This step may be omitted if EVA crew can free float and drive the Mast MDA.

3.192 SAW XX FAILURE TO RETRACT MAST REMOTELY

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38
SAW is un-tensioned if < 31.5 bays are visible.

39
Analysis indicates that the Mast must be deployed > 60% before adequate power generation can be achieved.

40
Remove MDA Power (Mast MDA-Off) if you have not already done so.

EPS

3.193 SAW XX FAILURE TO LATCH (TENSION) SABB REMOTELY

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LBB(RBB) Failed to Latch
LBB(RBB) Partially Latched

CAUTION ALARM

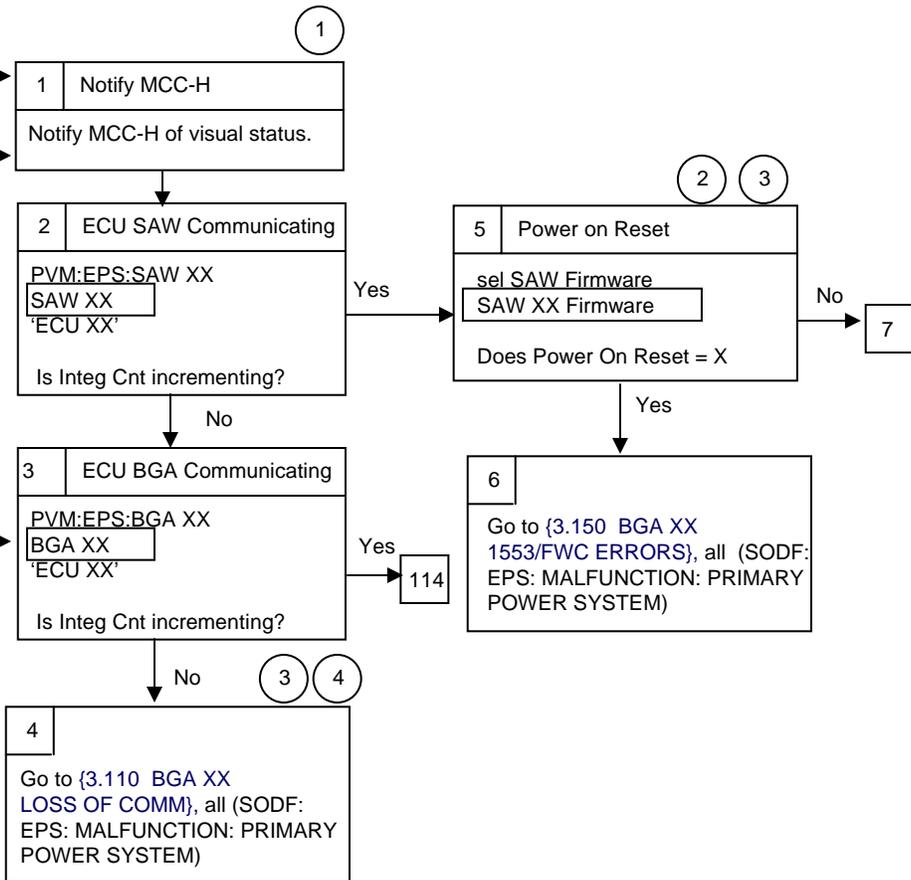
BGA XX Loss of Comm - PVM

No C&W messages are available for SAW hardware

Power Channel Connectivity

PVM	XX	YY
S4	1A	3A
S4	3A	1A
S6	1B	3B
S6	3B	1B
P4	2A	4A
P4	4A	2A
P6	2B	4B
P6	4B	2B

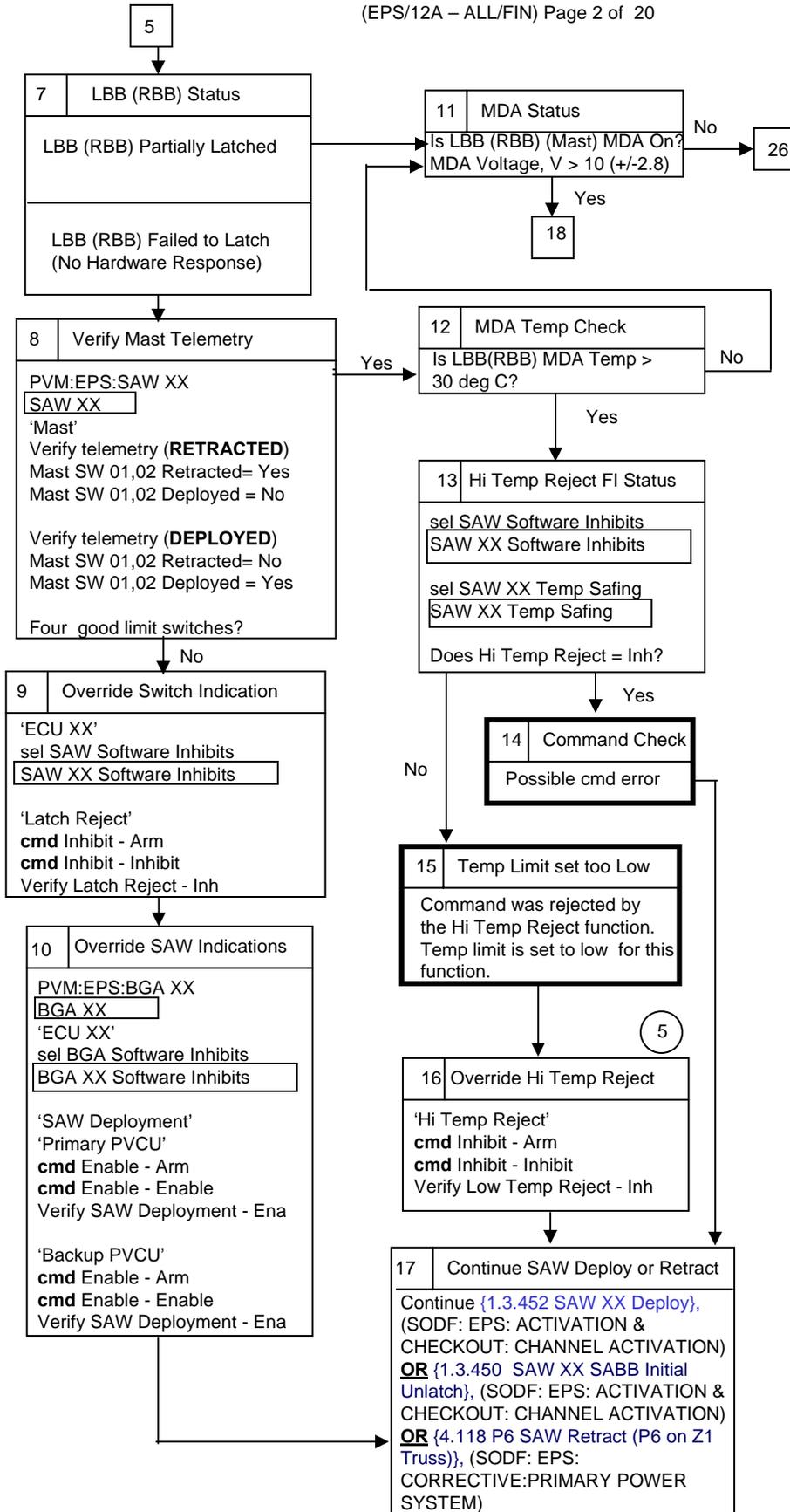
Nominal Config:
ECU SAW XX:
RPCM XX A
RPC 1 - CI
RPCM YY A
RPC 2 - CI



- 1 This procedure assumes the SABBs will be latched at specific times during the mission. For Deployments: 1) Re-latch after Initial SABB Unlatch, 2) Re-latch SABBs when Mast at 1 Bay. For Retractions: 1) Latch when 100% retracted.
- 2 Caution message BGA XX 1553/FWC Errors- PVM may also be received if a Power on Reset has occurred.
- 3 If power was removed from the ECU you must begin again with step 1 of the Deploy/Retract procedure, to reset the F/W inhibits.
- 4 If Current sensor fails high > 0.78 A RPCs providing power to ECU will be opened. A new PPL with a higher Current limit must be uploaded before the ECU can be recovered. There is no inhibit for SAW MDA Config Complete Persistent Current Safing.

3.193 SAW XX FAILURE TO LATCH (TENSION) SABB REMOTELY

(EPS/12A – ALL/FIN) Page 2 of 20



5

MDA operating temperature range is -54 to 48 deg C.

3.193 SAW XX FAILURE TO LATCH (TENSION) SABB REMOTELY

(EPS/12A – ALL/FIN) Page 3 of 20

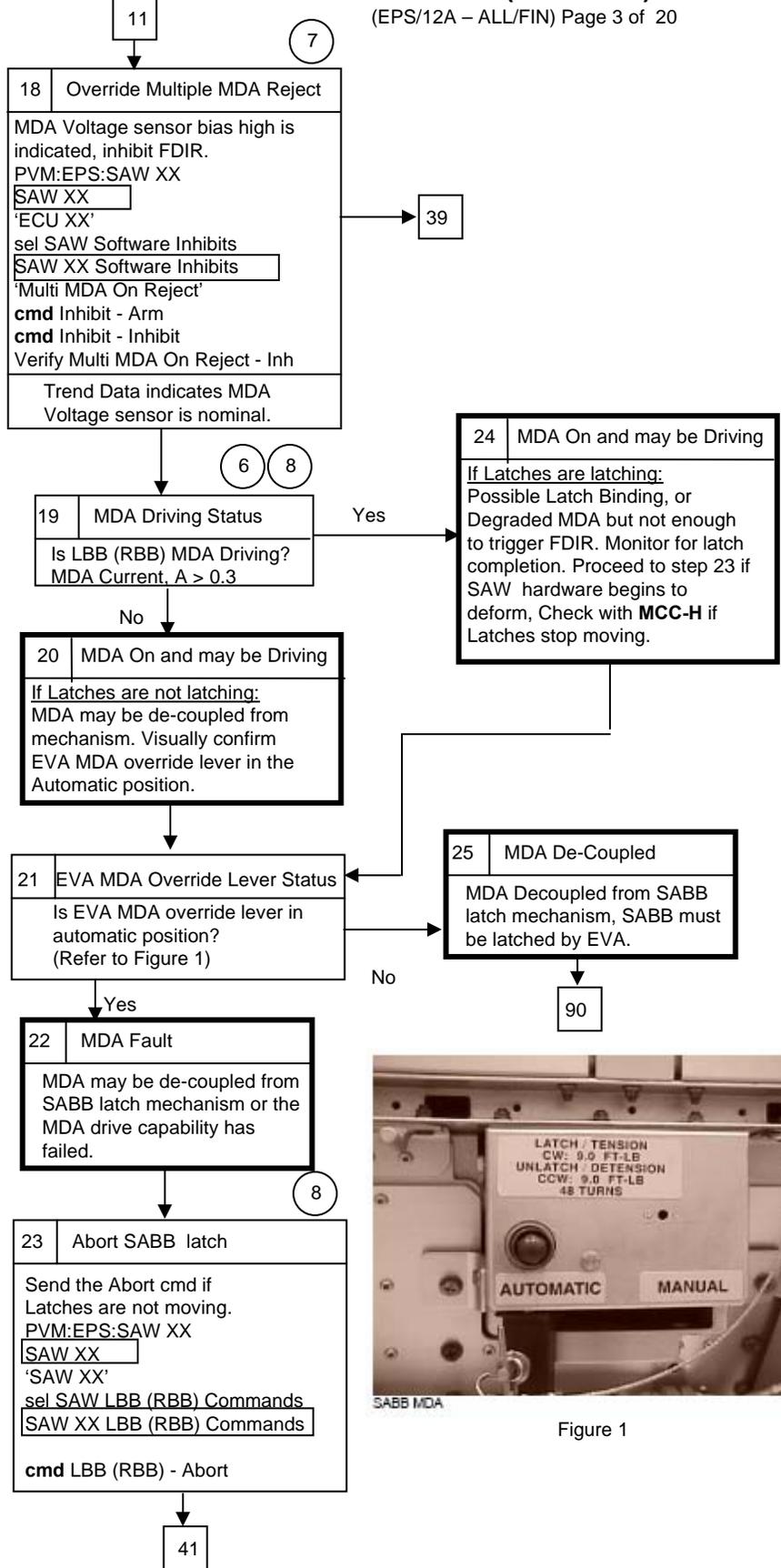


Figure 1

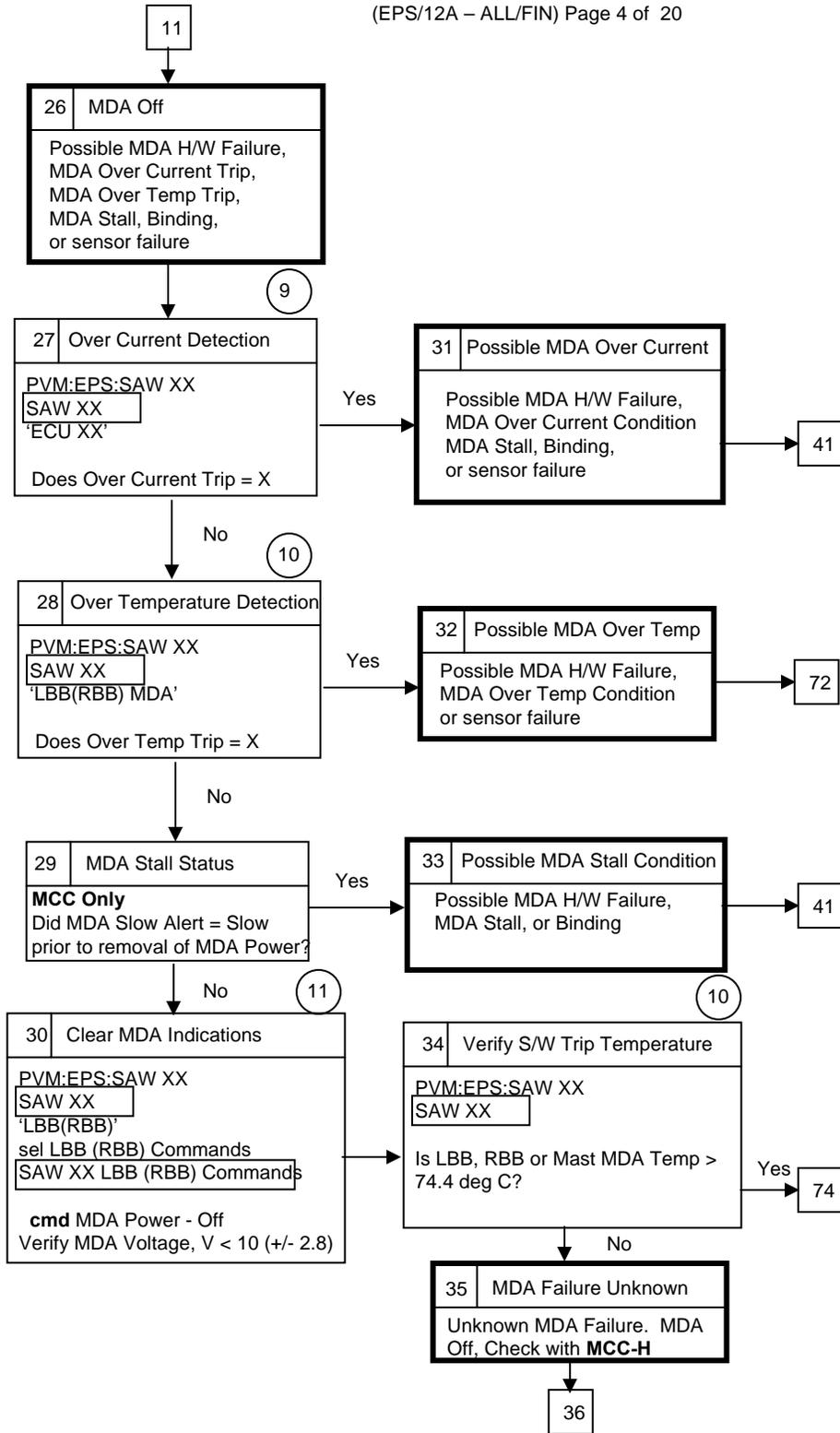
6 The manual MDA override lever is located on the back (inactive side) of the SABB base. (MDA current with no load = 0.3A)

7 There is no overvoltage FDIR for the MDA. The MDA will continue to operate if a Voltage sensor has failed high. Check voltages of all MDAs. The multiple MDA On Reject FDIR will reject an MDA on command if another MDA is already on.

8 If MDA de-coupled you may not be able to tell if the MDA is driving based on the current.

3.193 SAW XX FAILURE TO LATCH (TENSION) SABB REMOTELY

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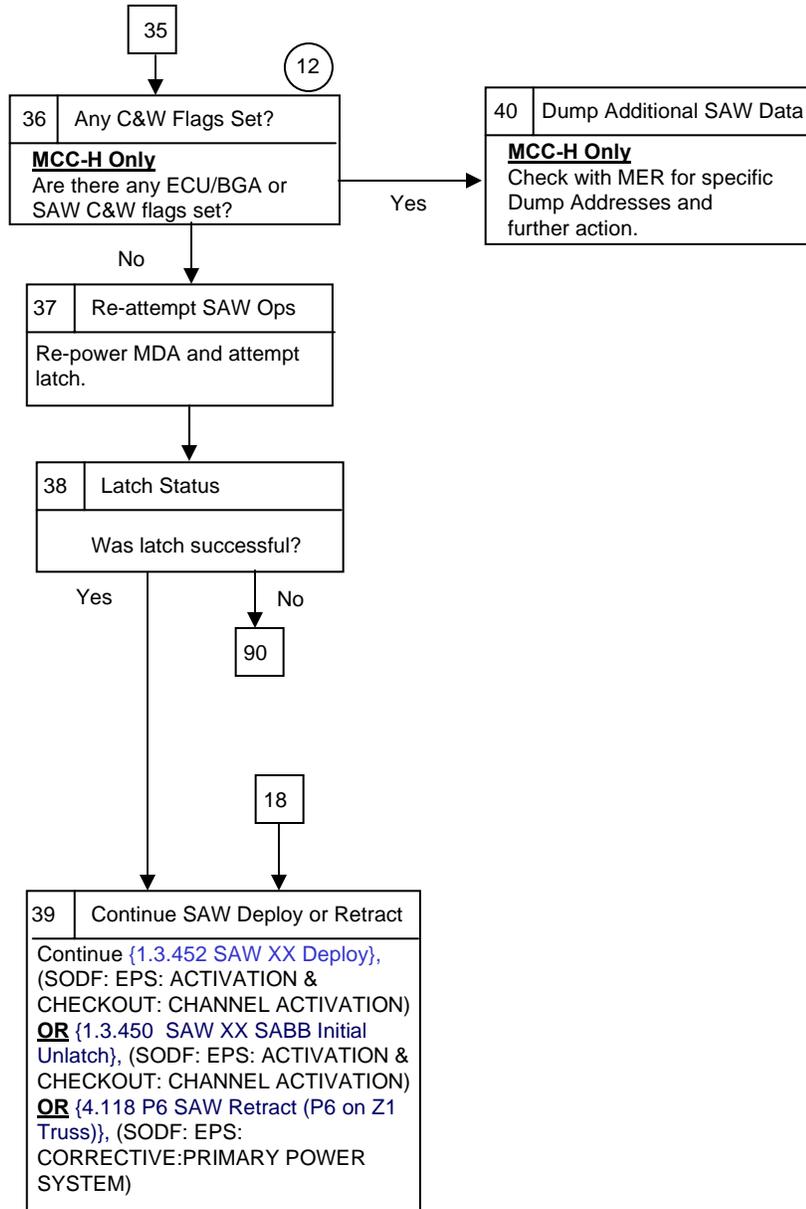
9
ECU Firmware
MDA Over
Current Trip
occurs at
6.2 Amps. S/W
Limit (0.78 A) is
reached
first and it does
not set the MDA
Over Current Trip
Flag.

10
Disconnects are
present in the MDA
Over Temp FDIR.
S/W Trip level =
77.7 deg C. F/W
Trip level = 140
deg C. H/W
damage occurs
at 120 deg C.
S/W Temp
limit is reached
first and it does
not set the MDA
Over Temp Trip
Flag.

11
MDA Power off
is a one step
command.

3.193 SAW XX FAILURE TO LATCH (TENSION) SABB REMOTELY

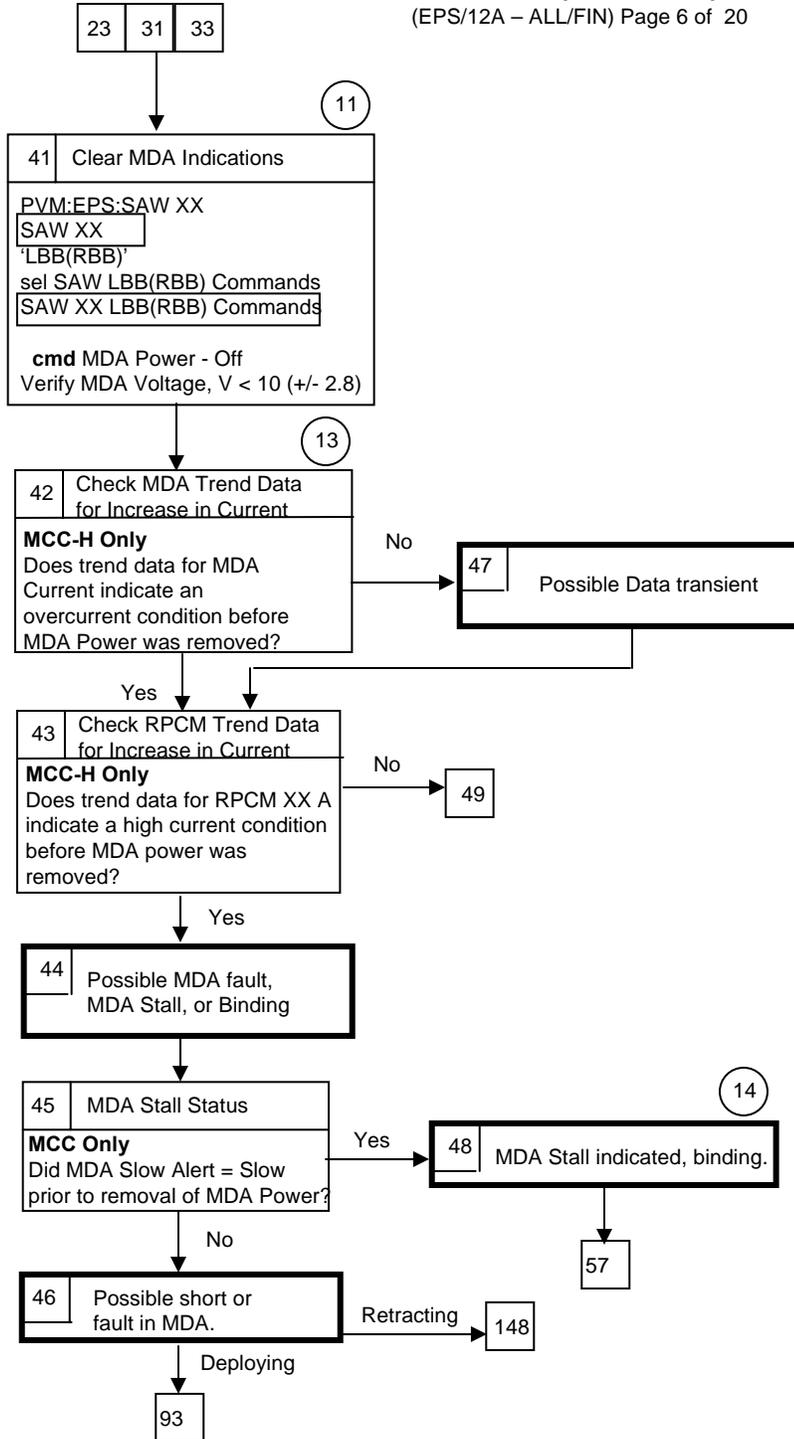
(EPS/12A – ALL/FIN) Page 5 of 20



12
 SAW Caution and Warning Flags are available for downlink only during missions that scheduled SAW activities. (e.g 12A) Flags are not available on PCS displays.

3.193 SAW XX FAILURE TO LATCH (TENSION) SABB REMOTELY

(EPS/12A – ALL/FIN) Page 6 of 20



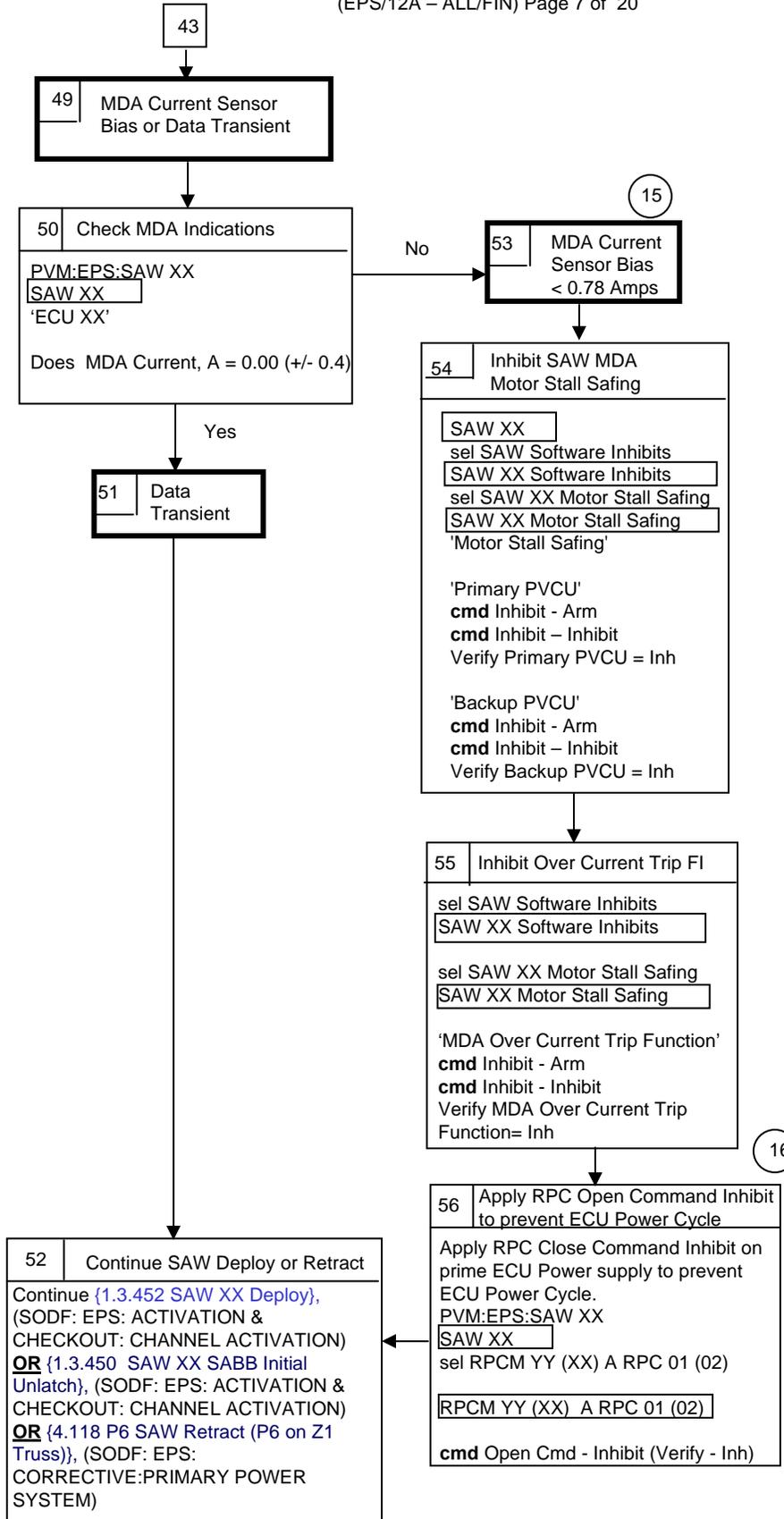
11 MDA Power off is a one step command.

13 PVCU Software MDA Over Current Trip occurs at 0.78 Amps.

14 If a Stall Condition is indicated, Current > 0.78 A and motor speed is < 25 RPM, power is removed from the MDA

3.193 SAW XX FAILURE TO LATCH (TENSION) SABB REMOTELY

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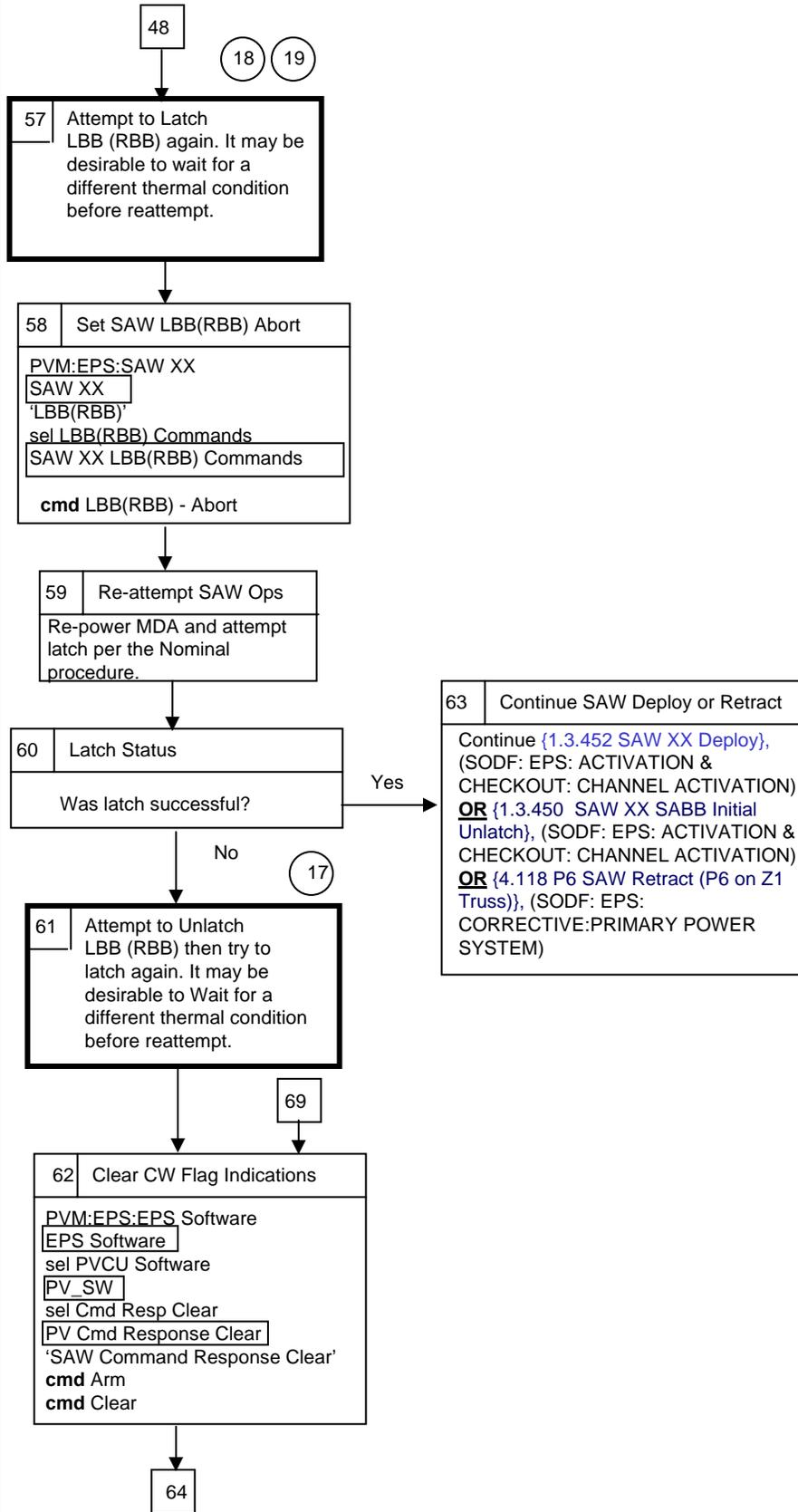


15
 If Current sensor fails high > 0.78 A RPCs providing power to ECU will be opened. A new PPL with a higher current limit must be uploaded before the ECU can be recovered. There is no inhibit for SAW MDA Motor Stall Persistent Current Safing. Refer to block 3.

16
 Nominal SABB latch, takes approximately 14 seconds to complete. However, all MDAs use the same current sensor. A new PPL 69 must be uplinked prior to SAW operations or Inhibit the RPC Open Command to avoid power cycling the ECU.

3.193 SAW XX FAILURE TO LATCH (TENSION) SABB REMOTELY

(EPS/12A – ALL/FIN) Page 8 of 20



17

There is a very limited partially unlatched range in which a unlatch can be attempted without damaging the hardware. This must be confirmed visually by MCC-H.

18

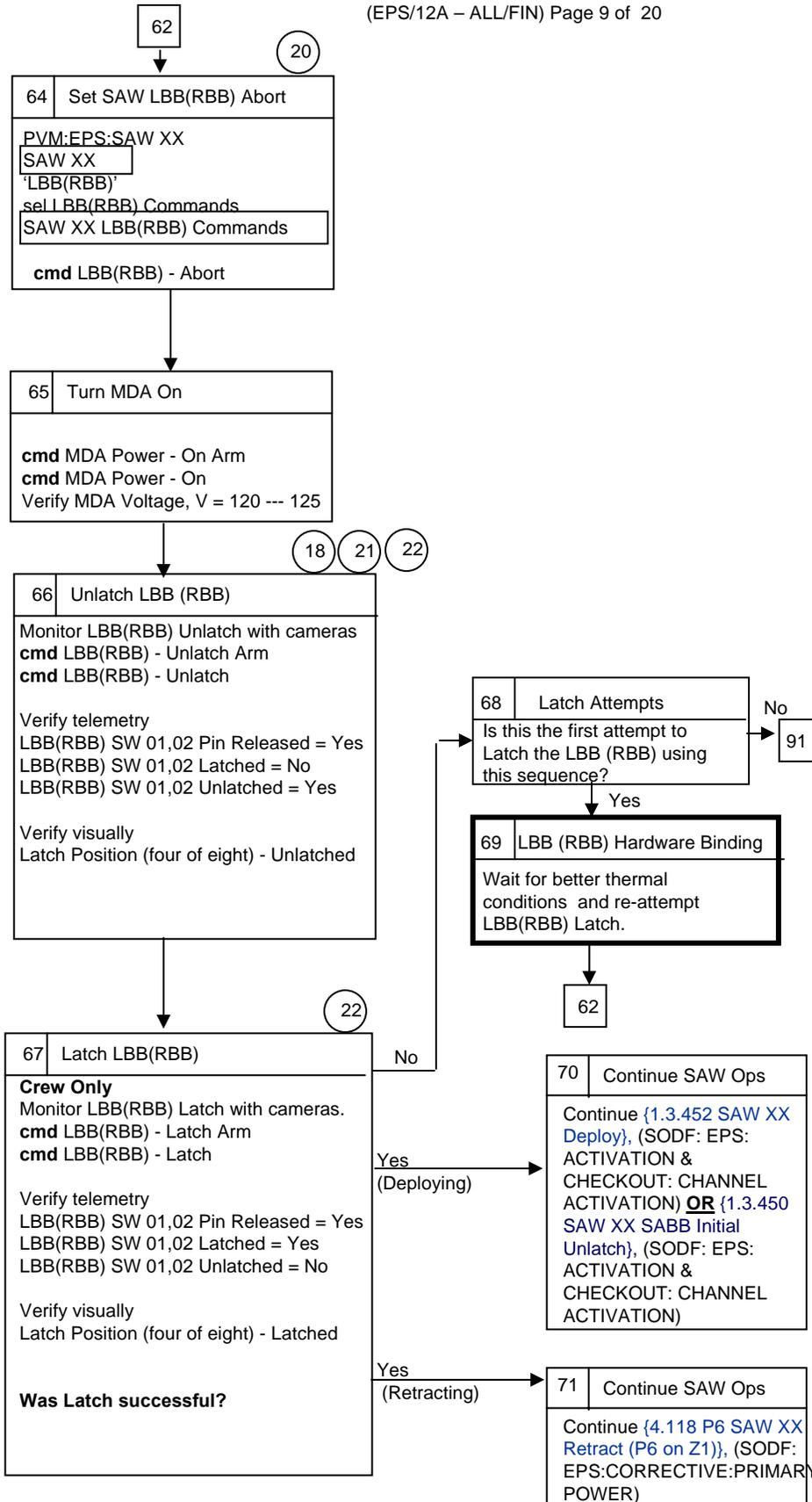
Damage to SABB hardware when driving a MDA in the opposite direction from the initial cmded direction.

19

Re-attempt will be made at the end of insolation or end of eclipse, which ever case is opposite initial attempt.

3.193 SAW XX FAILURE TO LATCH (TENSION) SABB REMOTELY

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18 Damage to SABB hardware when driving a MDA in the opposite direction from the initial cmded direction.

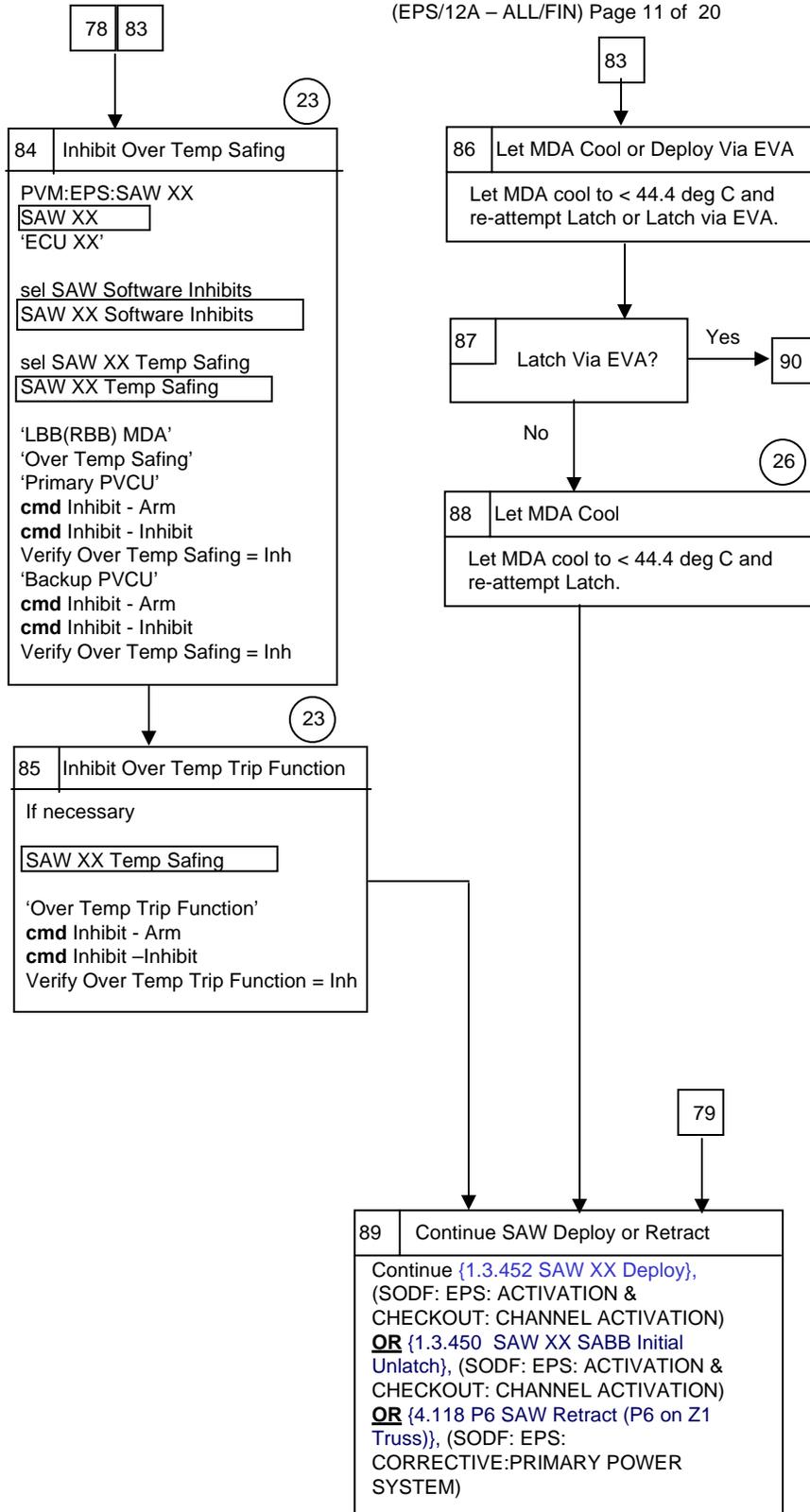
20 MDA Abort must sent to prevent MDA from driving once power is re-applied. This is a single step cmd.

21 There is a very limited partially unlatched range in which a unlatch can be attempted without damaging the hardware. This must be confirmed visually by MCC-H before step 66 can be executed. If step 66 cannot be performed continue in step 67

22 Confirm that ISS Thrusters are inhibited or ISS/Orbiter in Free Drift and no crew un-isolated exercise or max EVA loads prior to sending the Unlatch or Latch command. If at any time the array mechanical movement is stopped or aborted, attitude control may be resumed.

3.193 SAW XX FAILURE TO LATCH (TENSION) SABB REMOTELY

(EPS/12A – ALL/FIN) Page 11 of 20

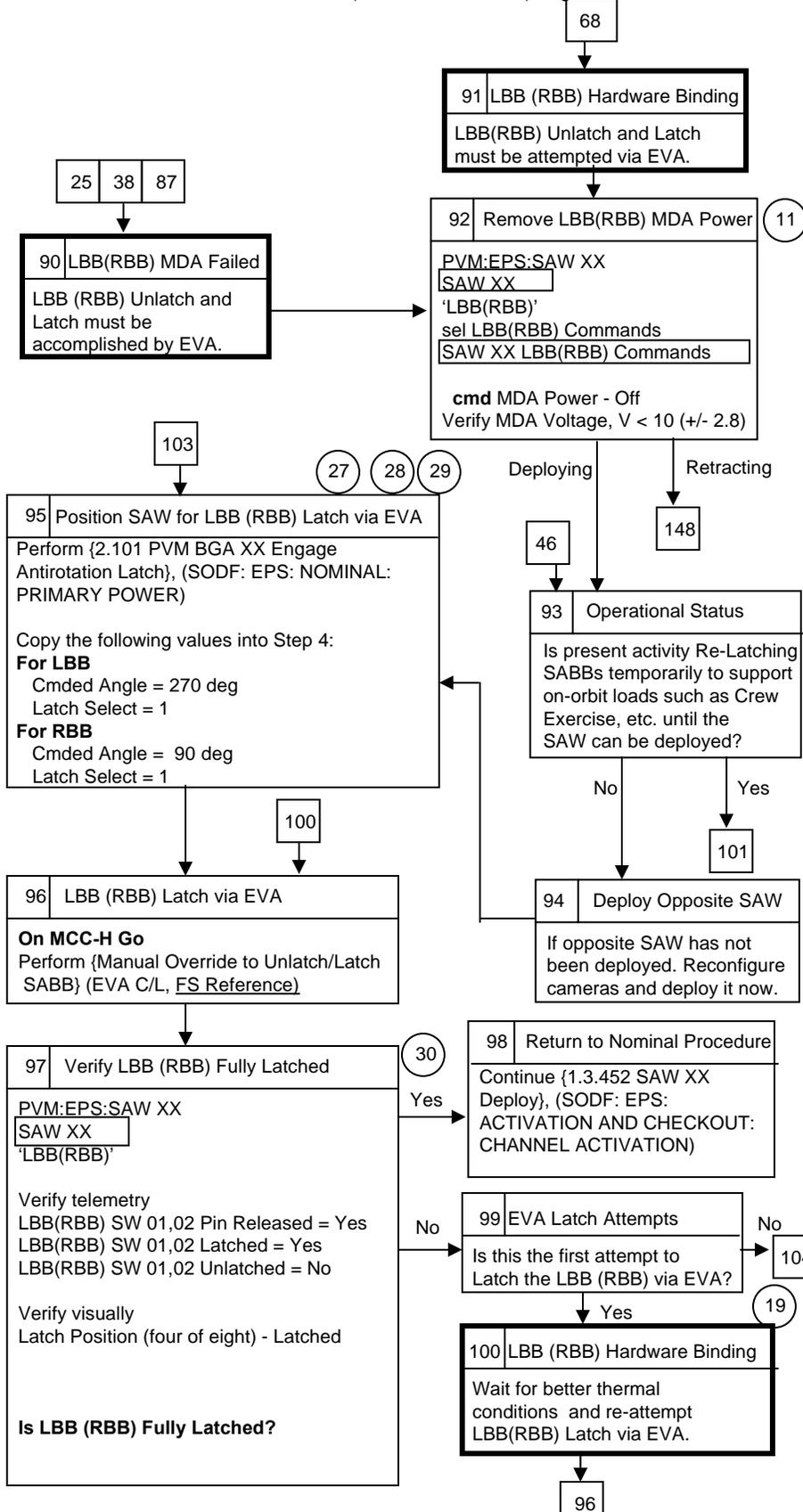


23
 Disconnects are present in the MDA Over Temp FDIR. S/W Trip level = 77.7 deg C. F/W Trip level = 140 deg C. H/W damage occurs at 120 deg C.

26
 Retry temperatures can be higher for SABBs since they are only operated a few seconds.

3.193 SAW XX FAILURE TO LATCH (TENSION) SABB REMOTELY

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(11) MDA Power off is a one step command.

(19) Re-attempt will be made at the end of insolation or end of eclipse, which ever case is opposite initial attempt.

(27) This step can take up to 1 hr to complete. The latch cmd can be sent when the BGA Actual Angle is within 1 deg of the commanded value in order to save time.

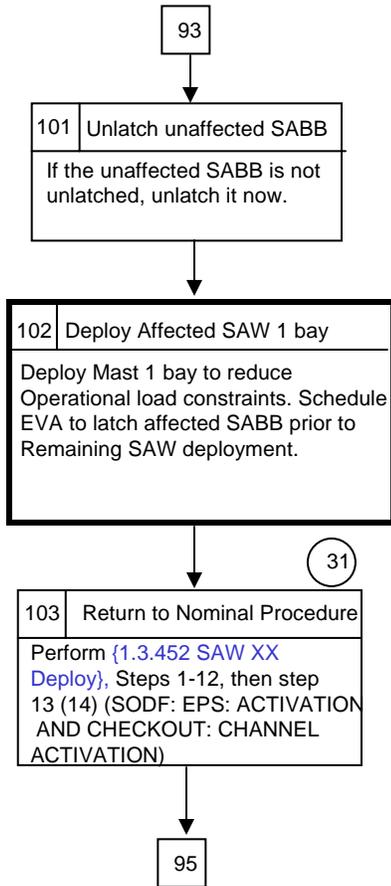
(28) This step may be omitted if EVA crew can free float and drive the MDA.

(29) Assumes that one or more mast bays have already been deployed, to allow latches to clear SABB Structure

(30) Both SABBs must be Latched (Hi Tension Mode) before the SAW can be deployed, to protect H/W against damage due to high stiction forces.

3.193 SAW XX FAILURE TO LATCH (TENSION) SABB REMOTELY

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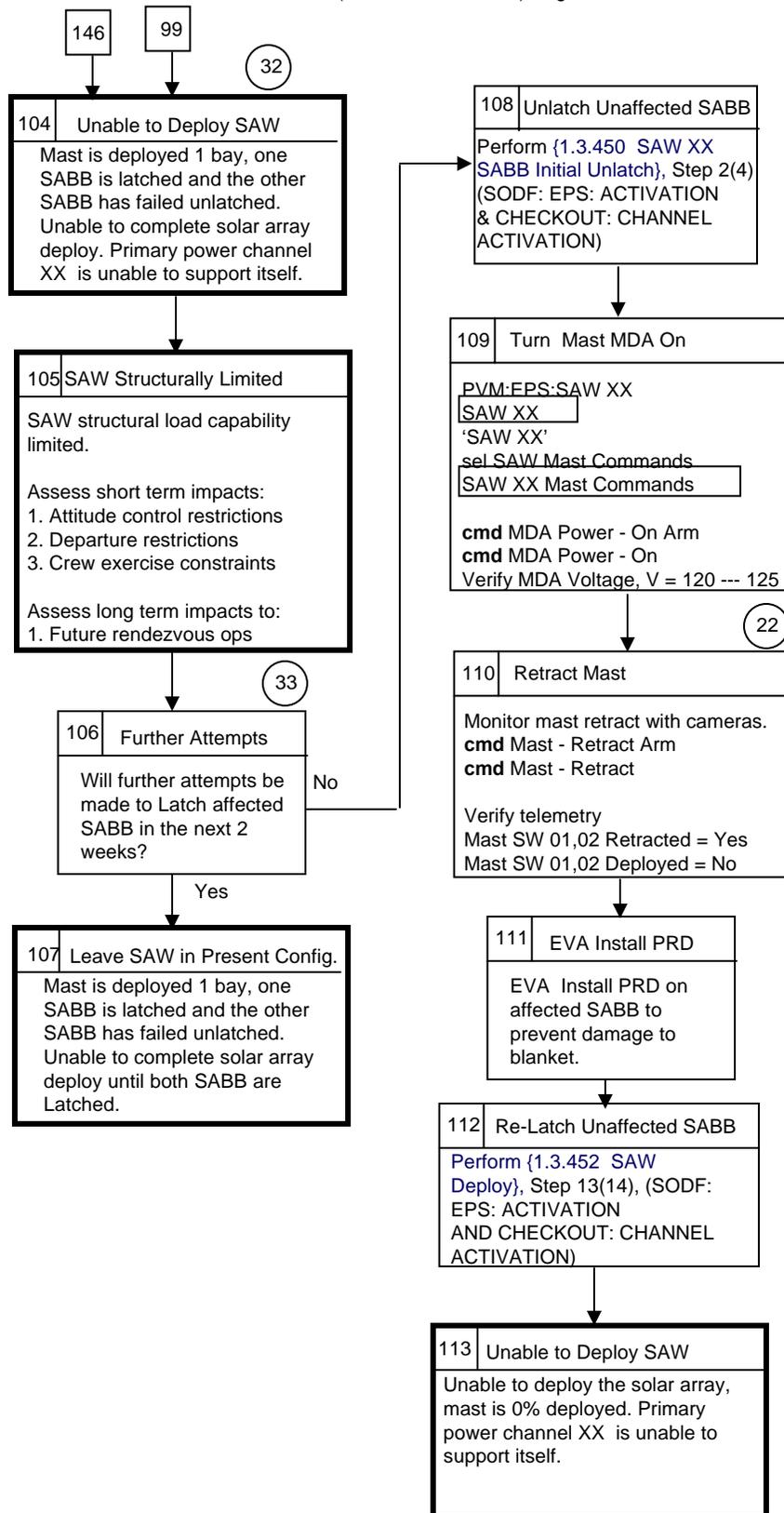


31

Operational load constraints apply for a partially deployed array

3.193 SAW XX FAILURE TO LATCH (TENSION) SABB REMOTELY

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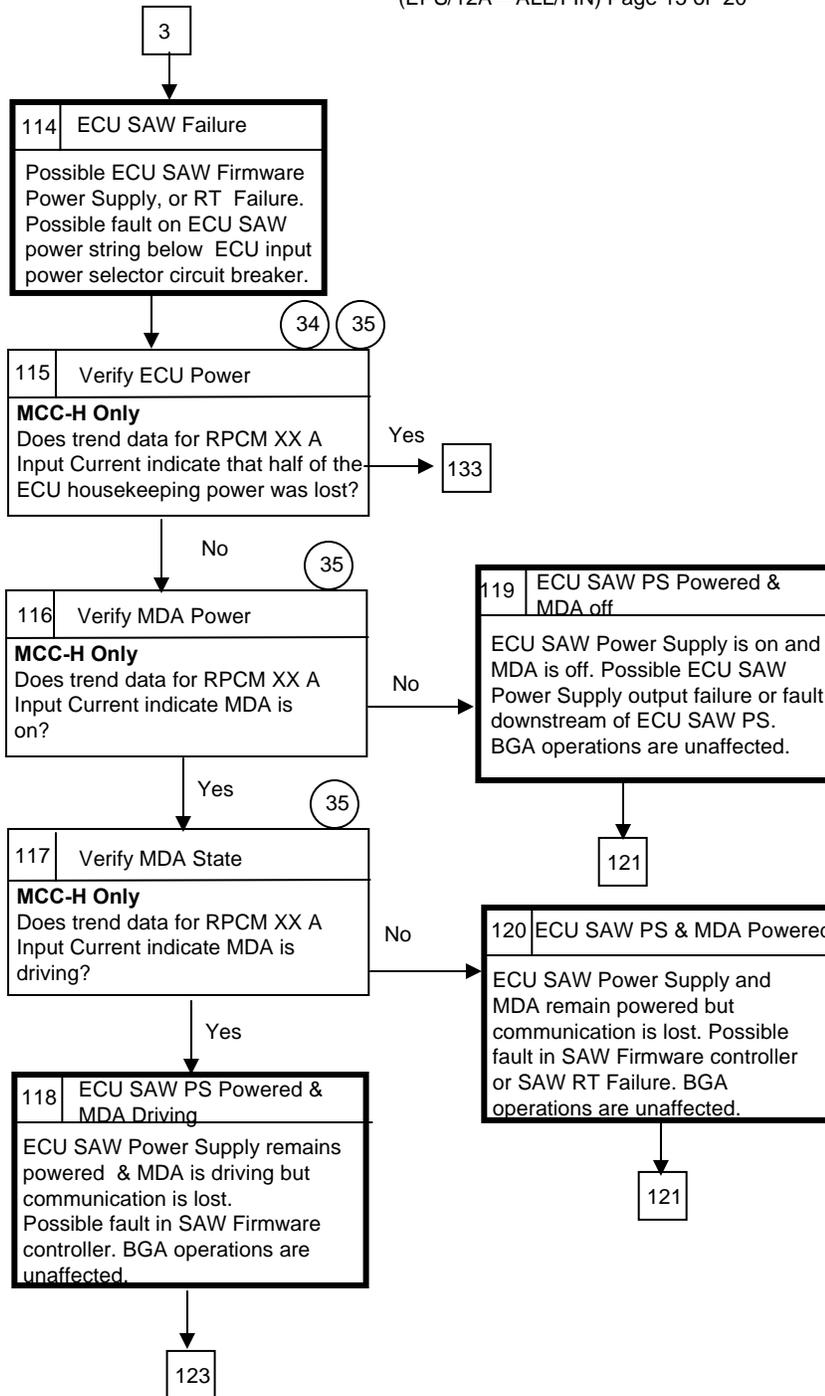
22 Confirm that ISS Thrusters are inhibited or ISS/Orbiter in Free Drift and no crew un-isolated exercise or max EVA loads prior to sending the Deploy or Retract command. If at any time mechanical movement is stopped or aborted, attitude control may be resumed.

32 Both SABBs must be latched before deployment can continue. If the SABB is not latched, the blanket will not be tensioned when the array is at 100% deployed, and subject to damage from thrusters and external loads. The array can handle most loads in the 1 bay deployed configuration.

33 If unable to latch one of the SABBs, and PRD is not available, it is better to remain deployed to 1 mast bay than retract. Blanket is subject to damage when mast is fully retracted and the SABB is unlatched.

3.193 SAW XX FAILURE TO LATCH (TENSION) SABB REMOTELY

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34

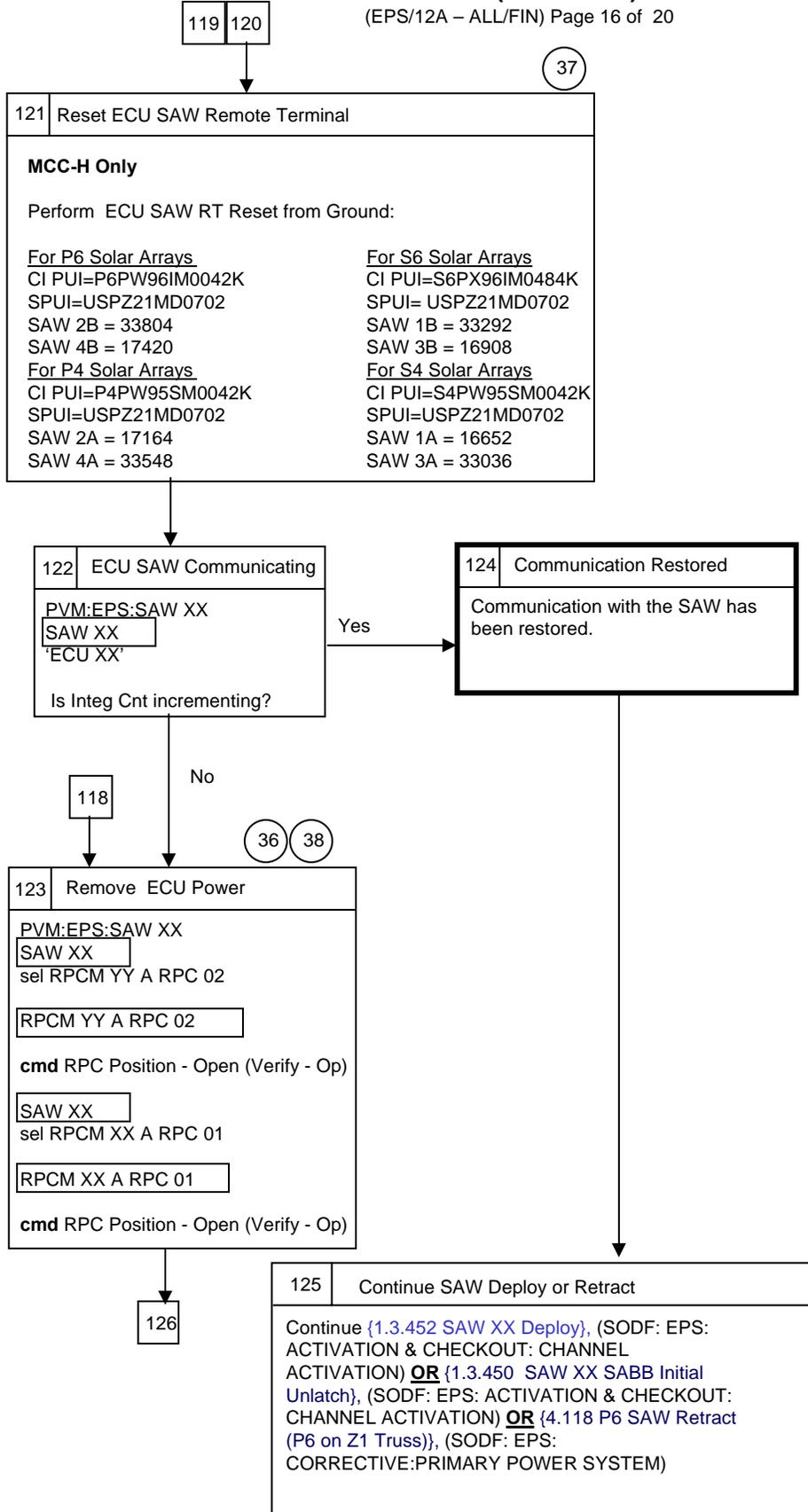
Total ECU housekeeping power is 115W (0.93A) at initialization and before BGA mtr or MDAs are turned on. Half of the ECU housekeeping power is 57.5W (0.47A)

35

It only takes 14 sec to latch SABBs. When the MDA is on it draws about 0.22A. When the MDA is driving it can draw as high as 3.0A. MDA over current trip occurs at 0.78A. The MDA will stop driving but will remain on if one of the two "Latched" limit switches have contacted.

3.193 SAW XX FAILURE TO LATCH (TENSION) SABB REMOTELY

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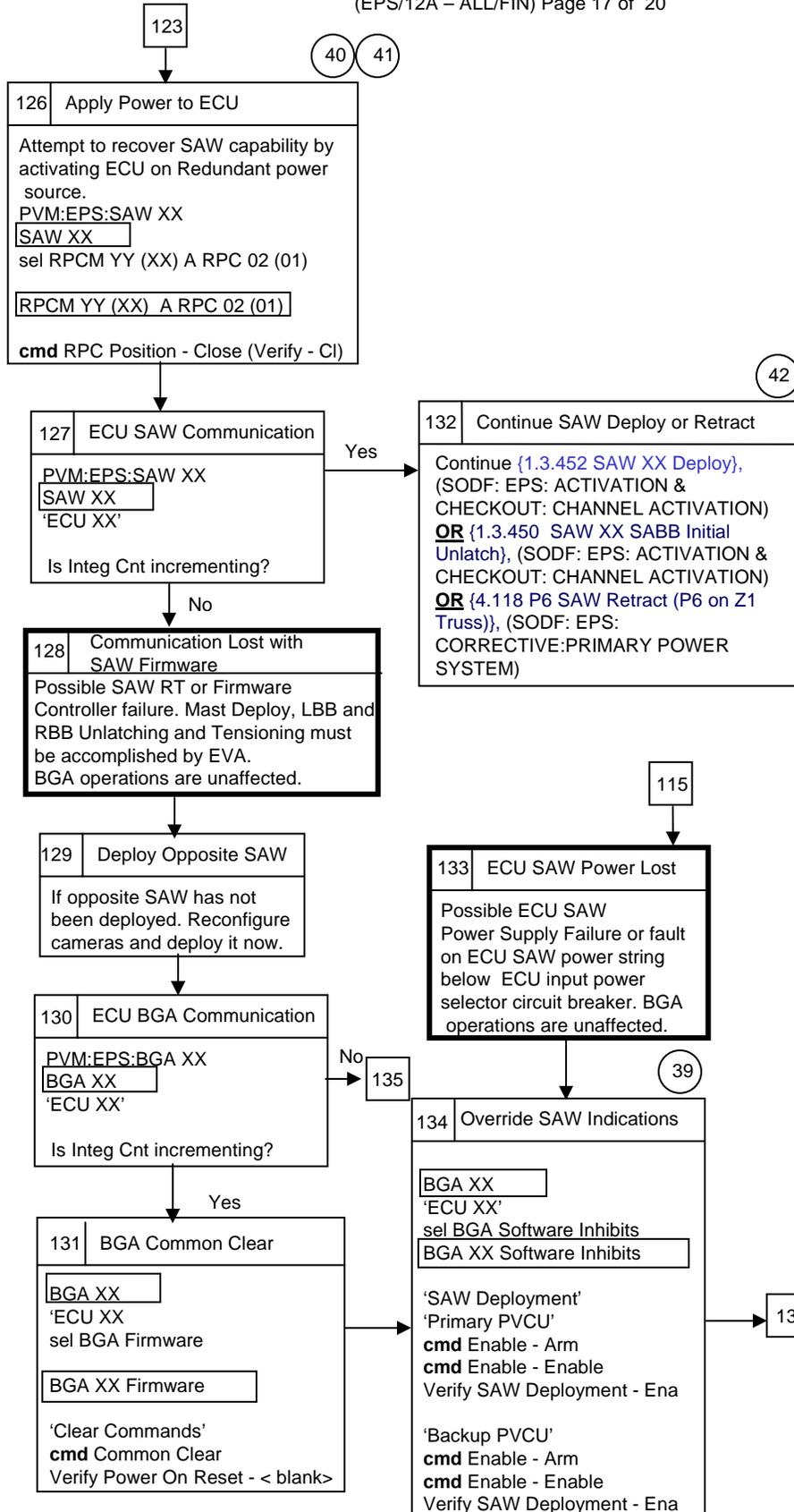
36 Removes Power from MDA. When power is re-applied to the ECU the MDA will be off.

37 MCC-H must build and perform this step from command inventory.

38 Expect Caution message BGA XX Loss of Comm - PVM when RPC 01 is cmded open.

3.193 SAW XX FAILURE TO LATCH (TENSION) SABB REMOTELY

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39
Allows BGA to be operated when SAW Mast is in an undetermined state, or comm is lost with SAW FWC

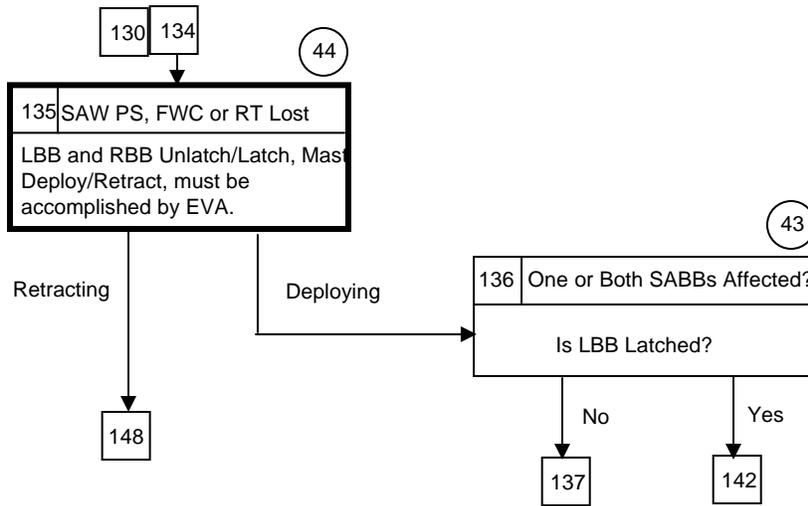
40
Caution message BGA XX 1553/ FWC Errors- PVM may be received after RPC 01 is closed.

41
ECU power is supplied by the opposite deck channel (YY) for SAW Retraction Operations and Channel (XX) for Deploy Operations

42
If power was removed from the ECU you must begin again with step 1 of the Deploy/Retract procedure, to reset the F/W inhibits.

3.193 SAW XX FAILURE TO LATCH (TENSION) SABB REMOTELY

(EPS/12A – ALL/FIN) Page 18 of 20

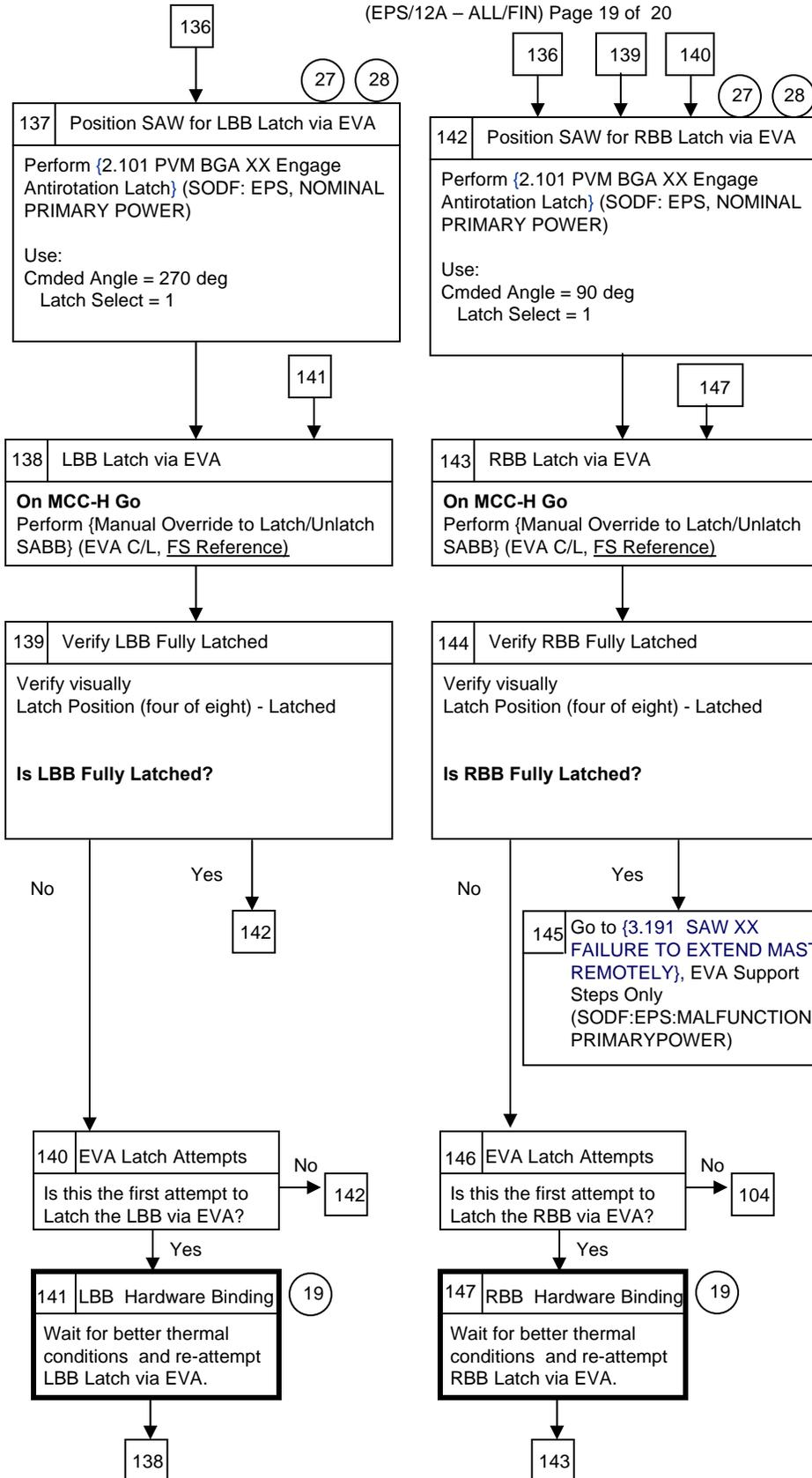


43
Assumes 1 bay has been deployed and one (both) SABBs are unlatched.

44
No thermal conditioning of the SAW is required if manually deploying, due to fact that it takes longer to deploy and it is warming throughout the manual deploy, also the crew can respond faster to stop the deploy.

3.193 SAW XX FAILURE TO LATCH (TENSION) SABB REMOTELY

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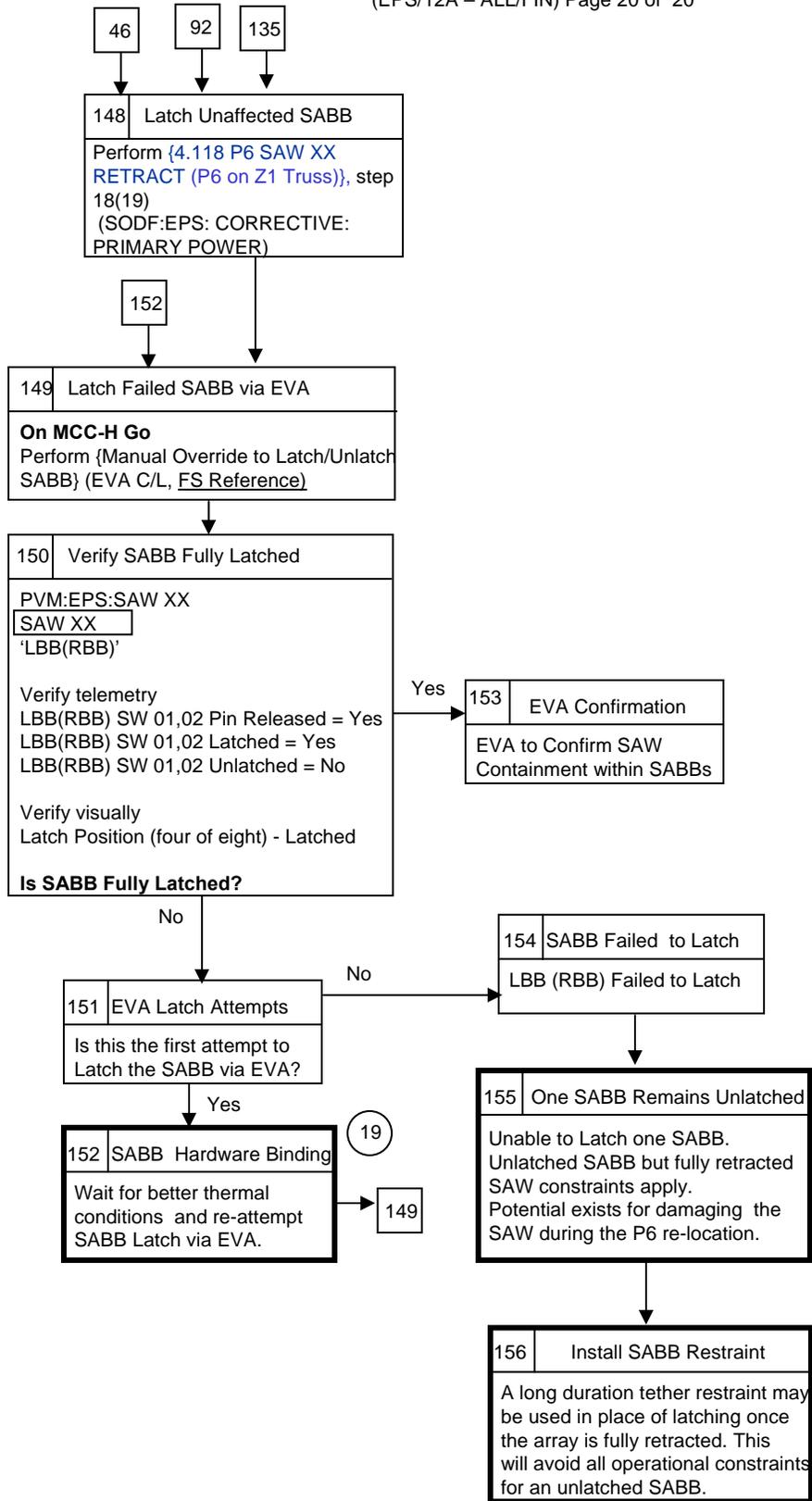
(19) Re-attempt will be made at the end of insolation or end of eclipse, whichever case is opposite initial attempt.

(27) This step can take up to 1 hr to complete. The latch cmd can be sent when the BGA Actual Angle is within 1 deg of the commanded value in order to save time.

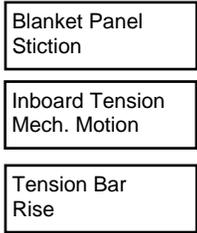
(28) This step may be omitted if EVA crew can free float and drive the MDA.

3.193 SAW XX FAILURE TO LATCH (TENSION) SABB REMOTELY

(EPS/12A – ALL/FIN) Page 20 of 20



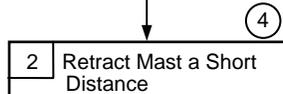
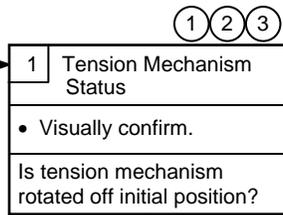
19
 Re-attempt will be made at the end of insolation or end of eclipse, whichever case is opposite initial attempt.



No C&W messages are available for SAW hardware.

Nominal Config:
 Nominal Config:
 ECU SAW [XX];
 RPCM [XX] A
 RPCM [YY] A
 RPC 2 - CI

SABBs in High Tension Mode



CAUTION

Confirm that ISS Thrusters are inhibited or ISS/Orbiter in Free Drift and no crew exercise prior to sending the Deploy or Retract command. If at any time the array deployment or retraction is stopped or aborted, attitude control may be resumed.

- PVM: EPS: SAW [XX]
SAW [XX]
 'Mast'
- sel Mast Commands
SAW XX Mast Commands
 'MDA'
 'Power'
 - **cmd** On - On Arm
 - **cmd** On - On
 - Verify MDA Voltage, V = 120 to 125
 - Monitor mast retract with cameras.
 'Mast'
 - **cmd** Retract - Arm
 - **cmd** Retract - Retract
 - Retract the mast until the tension mechanism returns to the initial position, then Abort
 'Mast'
 - **cmd** Abort - Abort
 - Verify MDA Voltage, V < 10 (± 2.8)

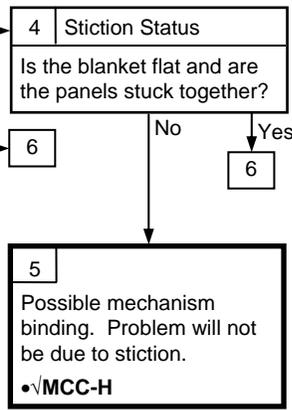
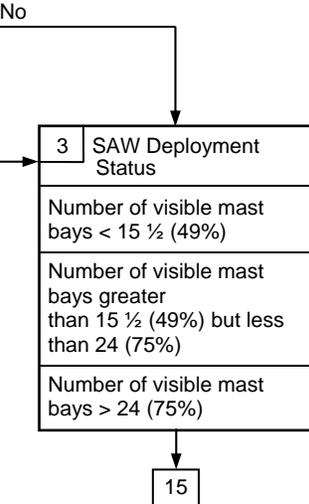
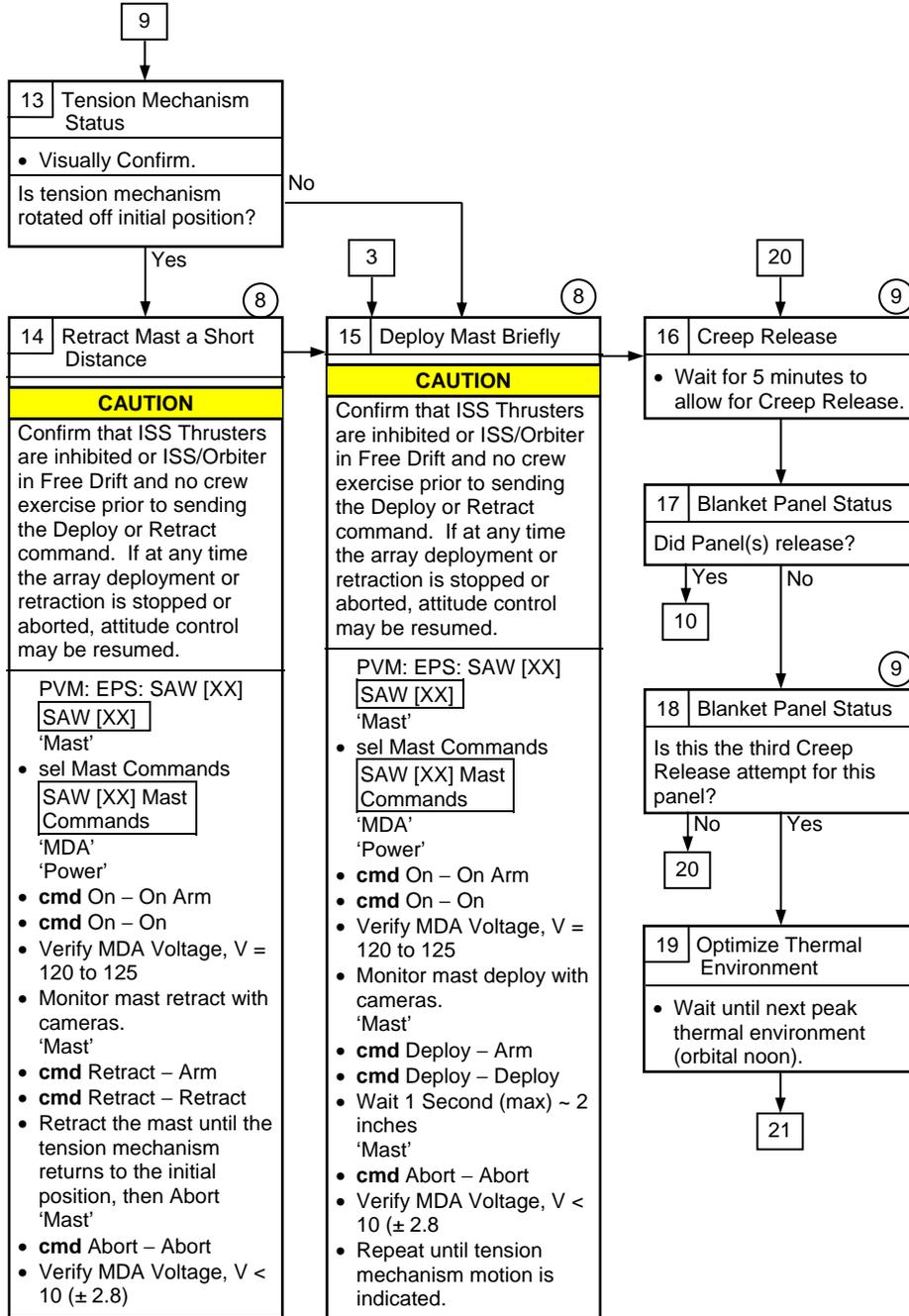


Table 1. Power Channel Connectivity

PVM	XX	YY
S4	1A	3A
S4	3A	1A
S6	1B	3B
S6	3B	1B
P4	2A	4A
P4	4A	2A
P6	2B	4B
P6	4B	2B

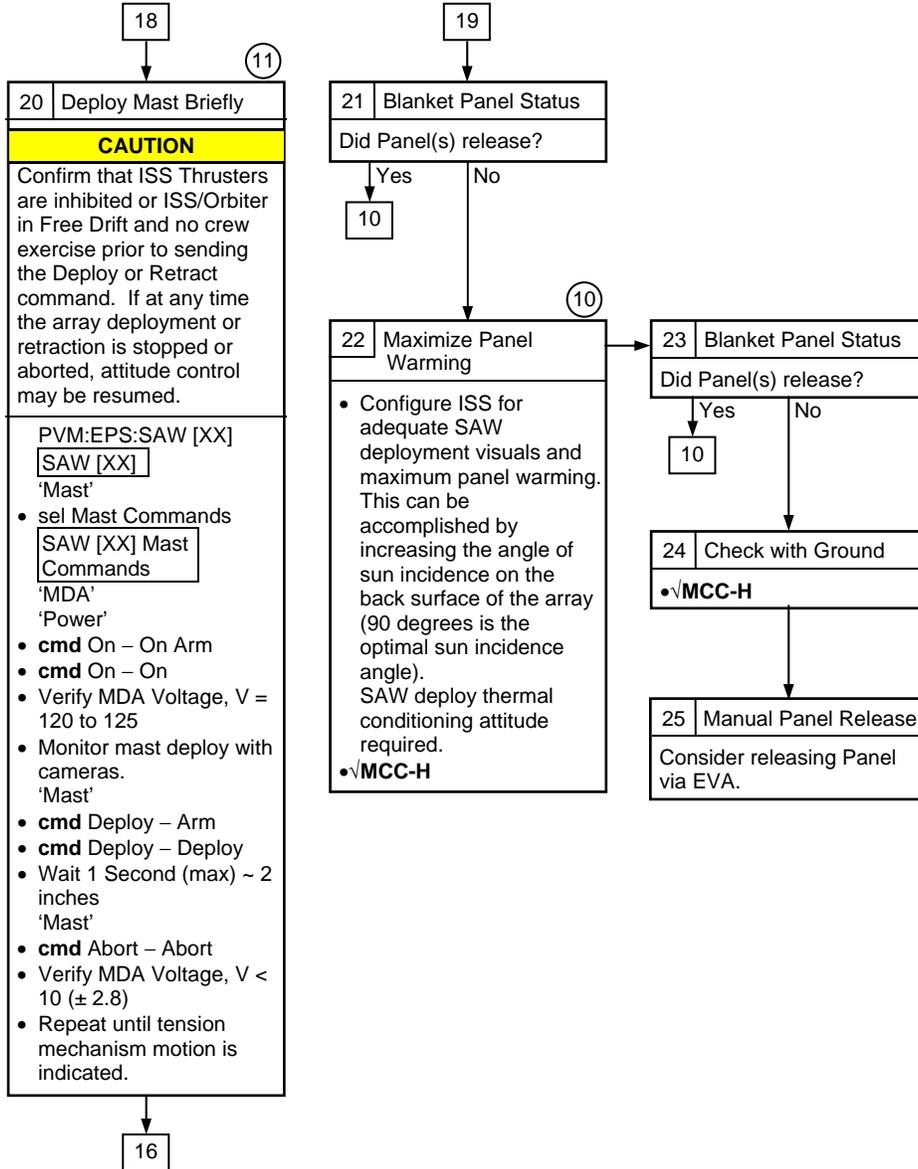
- ① All displays in this procedure are on the PCS.
- ② This procedure assumes that the abort cmd has already been issued to stop the deploy.
- ③ Visual confirmation of hardware status is required throughout this procedure. Do not attempt to perform this procedure during eclipse. Stiction forces increase as the blanket cools during eclipse.
- ④ MDA Abort must be sent to prevent MDA from driving once power is re-applied. This is a single step cmd.



8 If unable to complete array deployment in a single insolation pass, deploy the mast until the array is flat and tension mechanism motion is indicated. Leave the array in this configuration during the eclipse period. Continue deploy attempts at sunrise + 5 minutes. If a panel pair released during eclipse, deploy attempts can resume at sunrise.

9 "Creep Release" attempts to reduce stiction by placing the problematic panel under tension, (blanket should be flat) then warming the array for 5 minutes. The warmer the array, the lower the stiction force.

3.194 SAW XX BLANKET PANEL STICTION DURING DEPLOY



10 Avoid pluming a partially deployed array with ISS or Orbiter thrusters. Refer to Flight Rule B9-207 Section B paragraph 5. For the stiction case, you must complete the deployment of this array first before attempting to deploy another array.

11 If unable to complete array deployment in a single insolation pass, then deploy the mast until the array is flat and tension mechanism motion is indicated. Leave the array in this configuration during the eclipse period. Continue deploy attempts at sunrise + 5 minutes. If a panel pair released during eclipse, deploy attempts can resume at sunrise.

ASSEMBLY

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PAS HEATER CHECKOUT

(ASSY OPS/13A/FIN)

Page 1 of 6 pages

OBJECTIVE:

Verify correct activation of Capture Latch Assembly (CLA) heaters and Umbilical Mating Assembly (UMA) heaters on the four S3 Payload Attach Systems (PAS).

LOCATION:

S3 Truss

DURATION:

45 minutes

REFERENCED PROCEDURE(S):

None

NOTE

All of the PAS heaters are Resistive Temperature Device (RTD) controlled and should be enabled automatically upon activation of control software in the S3 MDMs. The following steps verify correct heater activation required to keep the PAS hardware above the operational limit of -42.8° C (-45° F) post S3-1 and S3-2 MDM activation.

PCS

1. VERIFYING PAS 1 HEATER ACTIVATION

S3: SNM

S3 SNM Overlay

'PAS 1'

sel Latch Htr

PAS 1 Latch Htr

'Htr Availability'

√Availability – Ena

√Control Mode State – Closed Loop

'Temperature'

Verify Temp: -26.1 to 50 deg C

Verify Invalid – no X

'RPC Status'

Verify RPC Trip – no X

sel RPCM S31A A RPC 14

RPCM S31A A RPC 14

Verify Integration Counter – incrementing

Verify Tripped – no X

PAS HEATER CHECKOUT

(ASSY OPS/13A/FIN)

Page 2 of 6 pages

√Close Cmd – Ena

S3 SNM Overlay

'PAS 1'

sel UMA Htr

PAS 1 UMA Htr

'Htr Availability'

√Htr Availability – Ena

√Control Mode State – Closed Loop

'Temperature'

Verify Temp: -36.7 to 52.8 deg C

Verify Invalid – no X

'RPC Status'

Verify RPC Trip – no X

sel RPCM S31A A RPC 9

RPCM S31A A RPC 9

Verify Integration Counter – incrementing

Verify Tripped – no X

√Close Cmd – Ena

2. VERIFYING PAS 2 HEATER ACTIVATION

S3 SNM Overlay

'PAS 2'

sel Latch Htr

PAS 2 Latch Htr

'Htr Availability'

√Availability – Ena

√Control Mode State – Closed Loop

'Temperature'

Verify Temp: -22.2 to 50 deg C

Verify Invalid – no X

'RPC Status'

PAS HEATER CHECKOUT

(ASSY OPS/13A/FIN)

Page 3 of 6 pages

Verify RPC Trip – no X

sel RPCM S32B A RPC 14

RPCM S32B A RPC 14

Verify Integration Counter – incrementing

Verify Tripped – no X

√Close Cmd – Ena

S3 SNM Overlay

'PAS 2'

sel UMA Htr

PAS 2 UMA Htr

'Htr Availability'

√Htr Availability – Ena

√Control Mode State – Closed Loop

'Temperature'

Verify Temp: -36.7 to 52.8 deg C

Verify Invalid – no X

'RPC Status'

Verify RPC Trip – no X

sel RPCM S32B A RPC 9

RPCM S32B A RPC 9

Verify Integration Counter – incrementing

Verify Tripped – no X

√Close Cmd – Ena

3. VERIFYING PAS 3 HEATER ACTIVATION

S3 SNM Overlay

'PAS 3'

sel Latch Htr

PAS 3 Latch Htr

'Htr Availability'

PAS HEATER CHECKOUT

(ASSY OPS/13A/FIN)

Page 4 of 6 pages

- √Availability – Ena
- √Control Mode State – Closed Loop

'Temperature'

Verify Temp: -22.2 to 50 deg C
Verify Invalid – no X

'RPC Status'

Verify RPC Trip – no X

sel RPCM S32B A RPC 05

RPCM S32B A RPC 05

Verify Integration Counter – incrementing
Verify Tripped – no X

- √Close Cmd – Ena

S3 SNM Overlay

'PAS 3'

sel UMA Htr

PAS 3 UMA Htr

'Htr Availability'

- √Htr Availability – Ena
- √Control Mode State – Closed Loop

'Temperature'

Verify Temp: -36.7 to 52.8 deg C
Verify Invalid – no X

'RPC Status'

Verify RPC Trip – no X

sel RPCM S32B A RPC 07

RPCM S32B A RPC 07

Verify Integration Counter – incrementing
Verify Tripped – no X

- √Close Cmd – Ena

PAS HEATER CHECKOUT

(ASSY OPS/13A/FIN)

Page 5 of 6 pages

4. VERIFYING PAS 4 HEATER ACTIVATION

'PAS 4'

sel Latch Htr

'Htr Availability'

√Availability – Ena

√Control Mode State – Closed Loop

'Temperature'

Verify Temp: -26.1 to 50 deg C

Verify Invalid – no X

'RPC Status'

Verify RPC Trip – no X

sel RPCM S31A A RPC 05

Verify Integration Counter – incrementing

Verify Tripped – no X

√Close Cmd – Ena

'PAS 4'

sel UMA Htr

'Htr Availability'

√Htr Availability – Ena

√Control Mode State – Closed Loop

'Temperature'

Verify Temp: -36.7 to 52.8 deg C

Verify Invalid – no X

'RPC Status'

Verify RPC Trip – no X

PAS HEATER CHECKOUT

(ASSY OPS/13A/FIN)

Page 6 of 6 pages

sel RPCM S31A A RPC 07

RPCM S31A A RPC 07

Verify Integration Counter – incrementing

Verify Tripped – no X

√Close Cmd – Ena

S1S3 SSAS PREP FOR MATE

(ASSY OPS/13A/FIN 1/HC) Page 1 of 30 pages

OBJECTIVE:

Activate the S1S3 Segment to Segment Attachment System (SSAS) by powering on and checking communication with both Integrated Motor Controller Actuators (IMCAs) and by powering each Bolt Bus Controller (BBC), one at a time, which will then be used to checkout the Motorized Bolt Assemblies (MBAs) in preparation for the mating event.

LOCATION:

Starboard side of S1 Truss

DURATION:

2 hours

REFERENCED PROCEDURE(S):

1.231 CCS BUILD DATA LOAD COMMAND

1.232 CCS BUILD FILE UPLINK COMMAND

NOTE

1. Step titles followed by the notation "(AOS/M)" indicate that AOS during the execution of that step is mandatory. If current LOS or expecting LOS prior to completion of an AOS/M step, wait for the next AOS to perform.
2. Step titles followed by the notation "(AOS/HD)" indicate that AOS during the execution of that step is highly desired. If communication will be regained within 10 minutes of reaching such a step, wait for AOS to perform.
3. For any off-nominal steps or any attention symbols that appear, refer to [{2.903 SSAS MALFUNCTION}](#) (SODF: S&M: MALFUNCTION: TRUSS SYSTEMS).
4. Ignore all attention symbols, switch indications, cautions and advisories prior to activation of SSAS software, path selection and devices being powered.
5. To stop mechanism actuation the following commands may be sent:
in Manual State: **cmd Stop Execute**
in Normal State: **cmd Pause Execute**
in any SSAS state: **cmd Abort Execute** (device power will be cut with Abort command)
6. In order to prevent erroneous autosafing, the IMCA Inadvertent Motion and BBC Inadvertent Power autosafing capabilities will be inhibited during use of IMCAs and BBC.
7. Caution events for the IMCA Inadvertent Motion and BBC Inadvertent Power should be inhibited (event codes: 10331, 10332, 10315, and 10316).
8. If crew performing procedure steps, Advisories on PCS should be turned on.
9. IMCA and BBC activation/deactivation and bolt drive tests will be performed by **MCC-H** using command scripts, with script information contained in Table 1.

S1S3 SSAS PREP FOR MATE

(ASSY OPS/13A/FIN 1/HC) Page 2 of 30 pages

Table 1. S1S3 SSAS Command Script Information

Command Script	Script Function	Procedure Step(s)
S1S3_SSAS_IMCA_1_Activate	Activate S1S3 SSAS IMCA 1	6
S1S3_SSAS_IMCA_2_Activate	Activate S1S3 SSAS IMCA 2	7
S1S3_SSAS_BBC_2_Activate	Activate S1S3 SSAS BBC 2	8
SSAS_Bolt_1_Forward_Drive_Test	Drive MBA 1 forward 35 seconds	13
SSAS_Bolt_2_Forward_Drive_Test	Drive MBA 2 forward 35 seconds	13
SSAS_Bolt_3_Forward_Drive_Test	Drive MBA 3 forward 35 seconds	13
SSAS_Bolt_4_Forward_Drive_Test	Drive MBA 4 forward 35 seconds	13
S1S3_SSAS_BBC_2_Deactivate	Deactivate S1S3 SSAS BBC 2	16
S1S3_SSAS_BBC_1_Activate	Activate S1S3 SSAS BBC 1	18
SSAS_Bolt_1_Reverse_Drive_Test	Drive MBA 1 reverse 38 seconds	23
SSAS_Bolt_2_Reverse_Drive_Test	Drive MBA 2 reverse 38 seconds	23
SSAS_Bolt_3_Reverse_Drive_Test	Drive MBA 3 reverse 38 seconds	23
SSAS_Bolt_4_Reverse_Drive_Test	Drive MBA 4 reverse 38 seconds	23

1. VERIFYING RPCM STATUS

PCS

S1: S&M: SSAS S1/S3

S1S3 SSAS Overview

'BBC-1 Pwr'

sel S14B G RPC 01

RPCM S14B G RPC 01

√Integration Counter – incrementing

S1S3 SSAS Overview

'BBC-2 Pwr'

sel S13A G RPC 01

RPCM S13A G RPC 01

√Integration Counter – incrementing

S1S3 SSAS Overview

'IMCA-1 Pwr'

sel S14B G RPC 15

RPCM S14B G RPC 15

√Integration Counter – incrementing

S1S3 SSAS Overview

'IMCA-2 Pwr'

S1S3 SSAS PREP FOR MATE

(ASSY OPS/13A/FIN 1/HC) Page 3 of 30 pages

sel S13A G RPC 15

√Integration Counter – incrementing

2. RECORDING CDH CONFIGURATION

Record Primary MDM: EXT: _____

Record Backup MDM: EXT: _____

√LB MECH S1 Ch – A

√LB MECH S2 Ch – A

sel Primary EXT MDM

sel LB Mech S 1

sel RT Status

'12 SSAS S1/S3 L1'

√RT Status – Inh

√RT FDIR Status – Inh

Verify RT Comm Failed Status – blank

'13 SSAS S1/S3 B1'

√RT Status – Inh

√RT FDIR Status – Inh

Verify RT Comm Failed Status – blank

sel LB Mech S 2

sel RT Status

S1S3 SSAS PREP FOR MATE

(ASSY OPS/13A/FIN 1/HC) Page 4 of 30 pages

LB MECH S2 RT Status

'12 SSAS S1/S3 L2'

√RT Status – Inh

√RT FDIR Status – Inh

Verify RT Comm Failed Status – blank

'13 SSAS S1/S3 B2'

√RT Status – Inh

√RT FDIR Status – Inh

Verify RT Comm Failed Status – blank

3. ACTIVATING SSAS SOFTWARE APPLICATION

NOTE

Before SSAS software activation, a nominal SSAS State indication of '**idle**' will be displayed.

S1S3 SSAS Overview

'SSAS Application'

sel Application Commands

SSAS Application

cmd SSAS Application S/W Status – Activate **Execute**

Verify SSAS Application S/W Status – Activated

√SSAS IMCA S/W Status – Activated

√SSAS BBC S/W Status – Activated

4. TRANSITIONING SSAS STATE TO STANDBY

S1S3 SSAS Overview

'SSAS State'

sel State Commands

SSAS State Commands

cmd Standby **Execute**

Verify SSAS State – Standby

S1S3 SSAS PREP FOR MATE

(ASSY OPS/13A/FIN 1/HC) Page 5 of 30 pages

5. SELECTING SSAS PATH

S1S3 SSAS Overview

'S1S3 Path Selection'

sel Path Commands

S1S3 SSAS Path Commands

'Nominal Commands'

cmd IMCA 2 and BBC 2 Execute

S1S3 SSAS Overview

'S1S3 Path Selection'

Verify SSAS Selected – S1S3
Verify IMCA Selected – IMCA 2
Verify BBC Selected – BBC 2
Verify SSAS Path – S1S3 IMCA 2 BBC 2

NOTE

1. IMCA-1 and IMCA-2 telemetry fields on Latching graphical display update at 0.1 Hz rate. Data on Latching command displays update at 1.0 Hz rate and should be used first for data verification.
2. Each IMCA will take 6 seconds to complete Power On Self Test (POST) and mode to Standby after power has been applied.

6. ACTIVATING S1S3 SSAS IMCA-1

NOTE

The following commands to Inhibit Inadvertent Motion Autosafing and their associated telemetry do not exist on PCS and, thus, can only be sent and verified by **MCC-H**.

MCC-H

6.1 Inhibiting IMCA-1 Inadvertent Motion Autosafing

cmd Prim_EXT_Arm_Inh_ECZ_Function_Tmplt Execute

<Cmd PUI: S0DD96IM1665K>
<Template IMCA_SAS_S1S3_L1_INADVERT_MOTION
_AUTOSAFING_9A>

input – 3 9

S1S3 SSAS Latching MSKVIEW

'Latching Cautions & Advisories'

Verify IMCA-1 Inadvertent Motion – Arm

cmd Prim_EXT_Inh_ECZ_Function_Tmplt Execute

S1S3 SSAS PREP FOR MATE

(ASSY OPS/13A/FIN 1/HC) Page 6 of 30 pages

<Cmd PUI: S0DD96IM1672K>
<Template IMCA_SAS_S1S3_L1_INADVERT_MOTION
_AUTOSAFING_9A>

input – 3 9

S1S3 SSAS Latching MSKVIEW
'Latching Cautions & Advisories'

Verify IMCA-1 Inadvertent Motion – Inh

6.2 Opening IMCA-1 RPC

NOTE

The RPC powering IMCA-1 was closed to allow IMCA to be continuously powered in order to prevent loss of heating should the Capture Latch heaters fail similar to the P1P3 SSAS. Thus in order to clear the IMCA Watchdog Timer, the IMCA RPC is opened prior to its reactivation and Enabling of the Remote Terminal communication.

S1S3 SSAS Overview
'IMCA-1 Pwr'

sel S14B G RPC 15

RPCM S14B G RPC 15

cmd RPC Position – Open (Verify – Op)

6.3 Enabling IMCA-1 RT I/O

S1S3 SSAS Overview

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 1

LB MECH S1

sel RT Status

LB MECH S1 RT Status

'12 SSAS S1/S3 L1'

√RT FDIR Status – Inh

cmd RT Status – Enable **Execute**

Verify RT Status – Ena

S1S3 SSAS PREP FOR MATE

(ASSY OPS/13A/FIN 1/HC) Page 7 of 30 pages

6.4 Activating IMCA-1

S1S3 SSAS Overview

'Operations'

sel Latching

S1S3 SSAS Latching

'Latching Graphical Representation'

'IMCA-1 Pwr'

sel S14B G RPC 15

RPCM S14B G RPC 15

cmd RPC Position – Close (Verify – Cl)

Verify Open Cmd – Ena

S1S3 SSAS Latching

'IMCA-1'

Verify Built In Test Errors – no attention symbol

'Mode'

Verify Standby – green

'Motor Status'

Verify RTD Voltage $\leq 1251\text{mV}$

Verify RTD Voltage – changed at least once over a 30 second period

'Latch Status'

Verify Latch Status – Stopped

'Latching Graphical Representation'

Verify IMCA-1 icon – no attention symbol

Verify Closed – gray

Verify Open – green

Verify RTL 1 – gray

Verify RTL 2 – gray

Verify RTL 3 – gray

S1S3 SSAS PREP FOR MATE

(ASSY OPS/13A/FIN 1/HC) Page 8 of 30 pages

6.5 Enabling IMCA-1 RT FDIR

S1S3 SSAS Latching

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 1

LB MECH S1

sel RT Status

LB MECH S1 RT Status

'12 SSAS S1/S3 L1'

√RT Status – Ena

cmd RT FDIR Status – Enable FDIR Execute

Verify RT FDIR Status – Ena

Verify RT Comm Failed Status – blank

7. ACTIVATING S1S3 SSAS IMCA-2

NOTE

The following commands to Inhibit Inadvertent Motion Autosafing and their associated telemetry do not exist on PCS and, thus, can only be sent and verified by **MCC-H**.

MCC-H

7.1 Inhibiting IMCA-2 Inadvertent Motion Autosafing

cmd Prim_EXT_Arm_Inh_ECZ_Function_Tmpl Executive

<Cmd PUI: S0DD96IM1665K>

<Template IMCA_SAS_S1S3_L2_INADVERT_MOTION
_AUTOSAFING_9A>

input – 4 0

S1S3 SSAS Latching MSKVIEW

'Latching Cautions & Advisories'

Verify IMCA-2 Inadvertent Motion – Arm

cmd Prim_EXT_Inh_ECZ_Function_Tmpl Executive

<Cmd PUI: S0DD96IM1672K>

<Template IMCA_SAS_S1S3_L2_INADVERT_MOTION
_AUTOSAFING_9A>

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input – 4 0

S1S3 SSAS Latching MSKVIEW

'Latching Cautions & Advisories'

Verify IMCA-2 Inadvertent Motion – Inh

7.2 Opening IMCA-2 RPC

NOTE

The RPC powering IMCA-2 was closed to allow IMCA to be continuously powered in order to prevent loss of heating should the Capture Latch heaters fail similar to the P1P3 SSAS. Thus in order to clear the IMCA Watchdog Timer, the IMCA RPC is opened prior to its reactivation and Enabling of the Remote Terminal communication.

S1S3 SSAS Overview

'IMCA-2 Pwr'

sel S13A G RPC 15

RPCM S13A G RPC 15

cmd RPC Position – Open (Verify – Op)

7.3 Enabling IMCA-2 RT I/O

S1S3 SSAS Latching

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 2

LB MECH S2

sel RT Status

LB MECH S2 RT Status

'12 SSAS S1/S3 L2'

√RT FDIR Status – Inh

cmd RT Status – Enable **Execute**

Verify RT Status – Ena

S1S3 SSAS PREP FOR MATE

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7.4 Activating IMCA-2

S1S3 SSAS Latching

'Latching Graphical Representation'
'IMCA-2 Pwr'

sel S13A G RPC 15

RPCM S13A G RPC 15

cmd RPC Position – Close (Verify – Cl)

Verify Open Cmd – Ena

S1S3 SSAS Latching

'IMCA-2'

Verify Built In Test Errors – no attention symbol

'Mode'

Verify Standby – green

'Motor Status'

Verify RTD Voltage ≤ 1251 mV

Verify RTD Voltage – changed at least once over a 30 second period

'Latch Status'

Verify Latch Status – Stopped

'Latching Graphical Representation'

Verify IMCA-2 icon – no attention symbol

Verify Closed – gray

Verify Open – green

Verify RTL 1 – gray

Verify RTL 2 – gray

Verify RTL 3 – gray

'Command Validation'

Verify IMCA Cmd and Data Status – no attention symbol

S1S3 SSAS PREP FOR MATE

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7.5 Enabling IMCA-2 RT FDIR

S1S3 SSAS Latching

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 2

LB MECH S2

sel RT Status

LB MECH S2 RT Status

'12 SSAS S1/S3 L2'

√RT Status – Ena

cmd RT FDIR Status – Enable FDIR Execute

Verify RT FDIR Status – Ena

Verify RT Comm Failed Status – blank

8. ACTIVATING S1S3 SSAS BBC-2

NOTE

The following commands to Inhibit Inadvertent Power Autosafing and their associated telemetry do not exist on PCS and, thus, can only be sent and verified by **MCC-H**.

MCC-H

8.1 Inhibiting BBC-2 Inadvertent Power Autosafing

cmd Prim_EXT_Arm_Inh_ECZ_Function_Tmplt Execute

<Cmd PUI: S0DD96IM1665K>

<Template BBC_SAS_S1S3_B2_INADVERT_POWER
_AUTOSAFING_9A>

input – 6 4

S1S3 SSAS Bolting MSKVIEW

'Bolting Cautions & Advisories'

Verify BBC-2 Inadvertent Power – Arm

cmd Prim_EXT_Inh_ECZ_Function_Tmplt Execute

<Cmd PUI: S0DD96IM1672K>

<Template BBC_SAS_S1S3_B2_INADVERT_POWER
_AUTOSAFING_9A>

input – 6 4

S1S3 SSAS PREP FOR MATE

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S1S3 SSAS Bolting MSKVIEW

'Bolting Cautions & Advisories'

Verify BBC-2 Inadvertent Power – Inh

8.2 Activating BBC-2

CAUTION

Only one Bolt Bus Controller (BBC) may be powered at a given time to avoid short circuits between BBC-1 and BBC-2.

S1S3 SSAS Overview

'Operations'

sel Bolting

S1S3 SSAS Bolting

'Bolting Graphical Representation'
'BBC-2 Pwr'

sel S13A G RPC 01

RPCM S13A G RPC 01

cmd Close Cmd – Enable (Verify – Ena)

cmd RPC Position – Close (Verify – Cl)

8.3 Enabling BBC-2 RT I/O

S1S3 SSAS Bolting

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 2

LB MECH S2

sel RT Status

LB MECH S2 RT Status

'13 SSAS S1/S3 B2'

√RT FDIR Status – Inh

cmd RT Status – Enable **Execute**

Verify RT Status – Ena

S1S3 SSAS Bolting

'Command Validation'

S1S3 SSAS PREP FOR MATE

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Verify BBC Cmd and Data Status – no attention symbol

'BBC Status'

Verify BBC Selected – BBC 2

Verify MBA Current: 0 to 16 mA

Verify Bolt Direction – FWD

Verify Limit Sw Cutoff Flag – gray

Verify Current Cutoff Flag – gray

Verify Limit Sw Cutoff Override – gray

'Bolting Graphical Representation'

Verify Limit Switch Return Num 2 – Closed

Verify BBS (all) – green

Verify BTS (all) – gray

Verify BBC-1 icon – gray

Verify BBC-1 & BBC-2 icon – no attention symbol

8.4 Enabling BBC-2 RT FDIR

sel Primary EXT MDM

sel LB MECH S 2

sel RT Status

'13 SSAS S1/S3 B2'

√RT Status – Ena

cmd RT FDIR Status – Enable FDIR **Execute**

Verify RT FDIR Status – Ena

Verify RT Comm Failed Status – blank

9. TRANSITIONING SSAS STATE TO MANUAL

'SSAS State'

sel State Commands

S1S3 SSAS PREP FOR MATE

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cmd Manual **Execute**

Verify SSAS State – Manual

10. PERFORMING ACTIVE BIT TEST ON IMCA-2 (AOS/HD)

NOTE

1. The IMCA will stop communicating with the MDM momentarily during performance of the Active Built In Test (BIT), which should cause a single 1553 channel swap to the alternate channel for the affected IMCA.
2. Likewise, during performance of the Active BIT the attention symbol next to the IMCA Cmd and Data Status nav button may momentarily appear for approximately 4 to 5 seconds. This is caused by the IMCA Status Measurement Data Stale indication being set during performance of the BIT, which is a known software feature.

S1S3 SSAS Latching

sel Contingency Latching

SSAS Contingency Latching Commands

'Contingency Commands'

cmd Active BIT **Execute**

S1S3 SSAS Latching

'IMCA-2'

Verify Built-In Test Errors – no attention symbol

'Latching Graphical Representation'

Verify LB MECH S2 Ch – B

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 2

LB MECH S2

sel RT Status

LB MECH S2 RT Status

'12 SSAS S1/S3 L2'

S1S3 SSAS PREP FOR MATE

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Verify RT Status – Ena
Verify RT FDIR Status – Ena
Verify RT Comm Failed Status – blank

'13 SSAS S1/S3 B2'

Verify RT Status – Ena
Verify RT FDIR Status – Ena
Verify RT Comm Failed Status – blank

```
*****  
* If LB MECH S2 bus is not on channel B  
* |  
* | LB MECH S2  
* |  
* | sel Bus Status  
* |  
* | LB MECH S2 Bus Status  
* |  
* | cmd Select Ch B Execute  
* |  
* | Verify Channel Selected – B  
*****
```

11. VERIFYING IMCA-2, BBC-2 COMMUNICATION ON ALTERNATE 1553 CHANNEL

S1S3 SSAS Overview

'Operations'

sel Latching

S1S3 SSAS Latching

'Command Validation'

Verify IMCA Cmd and Data Status – no attention symbol

'Latching Graphical Representation'

Verify IMCA-1 & IMCA-2 icons – no attention symbols

Verify IMCA-1 Closed – gray

Verify IMCA-2 Closed – gray

Verify IMCA-1 Open – green

Verify IMCA-2 Open – green

Verify RTL 1 (two) – gray

Verify RTL 2 (two) – gray

Verify RTL 3 (two) – gray

S1S3 SSAS Overview

'Operations'

sel Bolting

S1S3 SSAS PREP FOR MATE

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S1S3 SSAS Bolting

'Command Validation'

Verify BBC Cmd and Data Status – no attention symbol

'BBC Status'

Verify Bolt Direction – FWD

'Bolting Graphical Representation'

Verify BBC-1 & BBC-2 icons – no attention symbols

Verify Limit Switch Return Num 2 – Closed

Verify BBS (all) – green

Verify BTS (all) – gray

Verify BBC-1 icon – gray

12. SETUP CONFIGURATION FOR S1S3 SSAS BOLT DRIVE TEST

(AOS/M)

S1S3 SSAS Overview

'Operations'

sel Bolting

S1S3 SSAS Bolting

sel Common Power Relay Cmds

SSAS BBC Common Power Relay

'SSAS MANUAL MODE - Relay Position'

cmd Close Execute

Verify Commanded Relay Position – CI

Verify Actual Relay Position – CI

S1S3 SSAS Bolting

sel Manual Bolting Commands

SSAS Manual Bolting Commands

Verify Bolt Direction – Forward

Verify Common Power Relay – Closed

Verify Limit Switch Return – Closed

S1S3 SSAS PREP FOR MATE

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CAUTION

To prevent Bolt from extending beyond the fine alignment cone, MBA on time should not exceed 35 seconds.

NOTE

1. This Bolt Drive test will use BBC-2 to drive each SSAS Bolt forward in Manual State (one at a time) to open the Bolt Back Switch (BBS), and then power will be cut to the MBA. Upon completion of driving all four Bolts forward, BBC-2 will be deactivated and BBC-1 will be activated and used to drive all four Bolts in reverse in Manual State (one at a time), until the BBS closes.
2. When sending bolting commands, SSAS command validation S/W will momentarily cause an attention symbol next to the BBC Command and Data Status, but will self-clear.
3. When performing the bolt forward drive test from Ground, **MCC-H** will build time tag commands to drive the Bolts forward one at a time for a total of 35 seconds. This is done by sending Bolt [Z] power on command, followed by the Bolt power-off command sent 35 seconds later.

13. S1S3 SSAS BOLT [Z] FORWARD DRIVE TEST (AOS/M)

SSAS Manual Bolting Commands

'Drive Bolt'

cmd Bolt [Z] Execute where [Z] =

* If MBA Current exceeds 300 mA just after Drive
* Bolt command is sent, immediately
* **cmd Stop Execute**

Verify Bolt Selected – Bolt [Z]

Verify MBA Current: 100 to 175 mA

Verify Pwr On – X
Verify MBA Posn, On – incrementing

* If MBA Current exceeds 175 mA at anytime
* before MBA On of 480 seconds, immediately
* **cmd Stop Execute**

When BBS – blank or MBA On: 35 seconds
cmd Bolt Power – Off Execute

Verify Bolt Selected – None
Verify MBA Current – Current < 16 mA
Verify Pwr On – blank
Verify MBA Posn, On – not incrementing

Repeat

14. OPENING COMMON POWER RELAY

S1S3 SSAS Bolting

sel Common Power Relay Cmds

SSAS BBC Common Power Relay

'SSAS MANUAL MODE - Relay Position'

cmd Open Execute

Verify Commanded Relay Position – Op
Verify Actual Relay Position – Op

S1S3 SSAS PREP FOR MATE

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15. TRANSITIONING SSAS STATE TO STANDBY

S1S3 SSAS Overview

'SSAS State'

sel State Commands

SSAS State Commands

cmd Standby Execute

Verify SSAS State – Standby

16. DEACTIVATING S1S3 SSAS BBC-2

16.1 Inhibiting BBC-2 RT FDIR

S1S3 SSAS Overview

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 2

LB MECH S2

sel RT Status

LB MECH S2 RT Status

'13 SSAS S1/S3 B2'

√RT Status – Ena

cmd RT FDIR Status – Inhibit FDIR Execute

Verify RT FDIR Status – Inh

16.2 Inhibiting BBC-2 RT I/O

LB MECH S2 RT Status

'13 SSAS S1/S3 B2'

cmd RT Status – Inhibit Execute

Verify RT Status – Inh

16.3 Deactivating BBC-2

S1S3 SSAS Overview

'BBC-2 Pwr'

sel S13A G RPC 01

S1S3 SSAS PREP FOR MATE

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RPCM S13A G RPC 01

cmd RPC Position – Open (Verify – Op)

cmd Close Cmd – Inhibit (Verify – Inh)

16.4 Enabling BBC-2 Inadvertent Power Autosafing

NOTE

The following command to Enable Inadvertent Power Autosafing and its associated telemetry does not exist on PCS and, thus, can only be sent by **MCC-H**.

MCC-H

cmd Prim_EXT_Ena_ECZ_Function_Tmplt **Execute**

<Cmd PUI: S0DD96IM1658K>

<Template BBC_SAS_S1S3_B1_INADVERT_POWER
_AUTOSAFING_9A>

input – 6 4

S1S3 SSAS Bolting MSKVIEW

'Bolting Cautions & Advisories'

Verify BBC-2 Inadvertent Power – Ena

17. SELECTING SSAS PATH

S1S3 SSAS Overview

'S1S3 Path Selection'

sel Path Commands

S1S3 SSAS Path Commands

'Nominal Commands'

cmd IMCA 1 and BBC 1 **Execute**

S1S3 SSAS Overview

'S1S3 Path Selection'

Verify SSAS Selected – S1S3

Verify IMCA Selected – IMCA 1

Verify BBC Selected – BBC 1

Verify SSAS Path – S1S3 IMCA 1 BBC 1

18. ACTIVATING S1S3 SSAS BBC-1

NOTE

The following commands to Inhibit Inadvertent Power Autosafing and their associated telemetry do not exist on PCS and, thus, can only be sent by **MCC-H**.

S1S3 SSAS PREP FOR MATE

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MCC-H 18.1 Inhibiting BBC-1 Inadvertent Power Autosafing
cmd Prim_EXT_Arm_Inh_Ena_ECZ_Function_Tmplt **Execute**

<Cmd PUI: S0DD96IM1665K>
<Template BBC_SAS_S1S3_B1_INADVERT_POWER
_AUTOSAFING_9A>

input – 6 3

S1S3 SSAS Bolting MSKVIEW

'Bolting Cautions & Advisories'

Verify BBC-1 Inadvertent Power – Arm

cmd Prim_EXT_Inh_ECZ_Function_Tmplt **Execute**

<Cmd PUI: S0DD96IM1672K>
<Template BBC_SAS_S1S3_B1_INADVERT_POWER
_AUTOSAFING_9A>

input – 6 3

S1S3 SSAS Bolting MSKVIEW

'Bolting Cautions & Advisories'

Verify BBC-1 Inadvertent Power – Inh

18.2 Activating BBC-1

CAUTION

Only one Bolt Bus Controller (BBC) may be powered at a given time to avoid short circuits between BBC-1 and BBC-2.

S1S3 SSAS Overview

'Operations'

sel Bolting

S1S3 SSAS Bolting

'Bolting Graphical Representation'
'BBC-1 Pwr'

sel S14B G RPC 01

RPCM S14B G RPC 01

cmd Close Cmd – Enable (Verify – Ena)

cmd RPC Position – Close (Verify – Cl)

S1S3 SSAS PREP FOR MATE

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18.3 Enabling BBC-1 RT I/O

S1S3 SSAS Bolting

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 1

LB MECH S1

sel RT Status

LB MECH S1 RT Status

'13 SSAS S1/S3 B1'

√RT FDIR Status – Inh

cmd RT Status – Enable **Execute**

Verify RT Status – Ena

S1S3 SSAS Bolting

'Command Validation'

Verify BBC Cmd and Data Status – no attention symbol

'BBC Status'

Verify BBC Selected – BBC 1

Verify MBA Current: 0 to16 mA

Verify Bolt Direction – FWD

Verify Limit Sw Cutoff Flag – gray

Verify Current Cutoff Flag – gray

Verify Limit Sw Cutoff Override – gray

'Bolting Graphical Representation'

Verify Limit Switch Return Num 1 – Closed

Verify BBS (all) – gray

Verify BTS (all) – gray

Verify BBC-2 icon – gray

Verify BBC-1 & BBC-2 icon – no attention symbol

18.4 Enabling BBC-1 RT FDIR

S1S3 SSAS Bolting

S1S3 SSAS PREP FOR MATE

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sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 1

LB MECH S1

sel RT Status

LB MECH S1 RT Status

'13 SSAS S1/S3 B1'

√RT Status – Ena

cmd RT FDIR Status – Enable FDIR Execute

Verify RT FDIR Status – Ena

19. TRANSITIONING SSAS STATE TO MANUAL

S1S3 SSAS Overview

'SSAS State'

sel State Commands

SSAS State Commands

cmd Manual Execute

Verify SSAS State – Manual

20. PERFORMING ACTIVE BIT TEST ON IMCA-1 (AOS/HD)

NOTE

1. The IMCA will stop communicating with the MDM momentarily during performance of the Active Built In Test (BIT), which should cause a single 1553 channel swap to the alternate channel for the affected IMCA.
2. Likewise, during performance of the Active BIT the attention symbol next to the IMCA Cmd and Data Status nav button may momentarily appear for approximately 4 to 5 seconds. This is caused by the IMCA Status Measurement Data State indication being set during performance of the BIT, which is a known software feature.

S1S3 SSAS Latching

sel Contingency Latching

SSAS Contingency Latching Commands

'Contingency Commands'

cmd Active BIT Execute

S1S3 SSAS Latching

'IMCA-1'

Verify Built-In Test Errors – no attention symbol

'Latching Graphical Representation'

Verify LB MECH S1 Ch – B

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 1

LB MECH S1

sel RT Status

LB MECH S1 RT Status

'12 SSAS S1/S3 L1'

Verify RT Status – Ena
Verify RT FDIR Status – Ena
Verify RT Comm Failed Status – blank

'13 SSAS S1/S3 B1'

Verify RT Status – Ena
Verify RT FDIR Status – Ena
Verify RT Comm Failed Status – blank

* If LB MECH S1 bus is not on channel B

*
*
*
*
*
*
*
*
*
*
*

LB MECH S1

sel Bus Status

LB MECH S1 Bus Status

cmd Select Ch B Execute

Verify Channel Selected – B

S1S3 SSAS PREP FOR MATE

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21. VERIFYING IMCA-1, BBC-1 COMMUNICATION ON ALTERNATE 1553 CHANNELS

S1S3 SSAS Overview

'Operations'

sel Latching

S1S3 SSAS Latching

'Command Validation'

Verify IMCA Cmd and Data Status – no attention symbol

'Latching Graphical Representation'

Verify IMCA-1 & IMCA-2 icons – no attention symbols

Verify IMCA-1 Closed – gray

Verify IMCA-2 Closed – gray

Verify IMCA-1 Open – green

Verify IMCA-2 Open – green

Verify RTL 1 (two) – gray

Verify RTL 2 (two) – gray

Verify RTL 3 (two) – gray

S1S3 SSAS Overview

'Operations'

sel Bolting

S1S3 SSAS Bolting

'Command Validation'

Verify BBC Cmd and Data Status – no attention symbol

'BBC Status'

Verify Bolt Direction – FWD

'Bolting Graphical Representation'

Verify BBC-1 & BBC-2 icons – no attention symbols

Verify Limit Switch Return Num 1 – Closed

Verify BBS (all) – gray

Verify BTS (all) – gray

Verify BBC-2 icon – gray

S1S3 SSAS PREP FOR MATE

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22. SETUP CONFIGURATION FOR S1S3 SSAS BOLT REVERSE DRIVE TEST (AOS/M)

NOTE

The following step will use BBC-1 to drive each Bolt in reverse (one at a time) in manual state until the BBS closes and MBA Position and On Time equal zero. At this time, the Bolt is powered off.

S1S3 SSAS Overview

'Operations'

sel Bolting

S1S3 SSAS Bolting

sel Common Power Relay Cmds

SSAS BBC Common Power Relay

'SSAS MANUAL MODE - Relay Position'

cmd Close Execute

Verify Commanded Relay Position – CI

Verify Actual Relay Position – CI

S1S3 SSAS Bolting

sel Bolt Direction Commands

SSAS BBC Set Bolt Direction

'Select Bolt Direction (Manual Mode)'

cmd Reverse Execute

Verify Commanded Bolt Direction – Reverse

Verify Actual Bolt Direction – Reverse

NOTE

1. When sending bolting commands, SSAS command validation S/W will momentarily cause an attention symbol next to the BBC Command and Data Status but will self-clear.
2. When performing the bolt reverse drive test from Ground, **MCC-H** will build time tag commands to drive the Bolts in reverse one at a time for a total of 38 seconds. This is done by sending Bolt [Z] power on command, followed by the Bolt power-off command sent 38 seconds later.
3. Bolts are driven for 38 seconds to ensure that MBA Posn and MBA On telemetry is reset back to zero for each bolt prior to the mating event.

23. S1S3 SSAS BOLT [Z] REVERSE DRIVE TEST (AOS/M)

S1S3 SSAS Bolting

sel Manual Bolting Commands

SSAS Manual Bolting Commands

'Drive Bolt'

cmd Bolt [Z] Execute where [Z] =

```
*****  
* If MBA Current exceeds 300 mA just after Drive  
* | Bolt command is sent, immediately  
* | cmd Stop Execute  
*****
```

Verify Bolt Selected – Bolt [Z]

Verify MBA Current: 100 to 175 mA

Verify Pwr On – X

Verify MBA Posn, On – decrementing

```
*****  
* If MBA Current exceeds 175 mA at anytime  
* | before MBA On of 480 seconds, immediately  
* | cmd Stop Execute  
*****
```

When BBS – X and MBA Posn, On: 0
'Bolt Power'

cmd Bolt Power – Off Execute

Verify Bolt Selected – None

Verify MBA Current – Current < 16 mA

Verify Pwr On – blank

Verify MBA Posn: 0.0

Verify MBA On: 0

Repeat

sel Bolt Direction Commands

SSAS BBC Set Bolt Direction

'Select Bolt Direction (Manual Mode)'

cmd Forward Execute

Verify Commanded Bolt Direction – Forward

Verify Actual Bolt Direction – Forward

S1S3 SSAS PREP FOR MATE

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24. OPENING COMMON POWER RELAY

S1S3 SSAS Bolting

sel Common Power Relay Cmds

SSAS BBC Common Power Relay

'SSAS MANUAL MODE - Relay Position'

cmd Open **Execute**

Verify Commanded Relay Position – Op

Verify Actual Relay Position – Op

25. TRANSITIONING SSAS STATE TO STANDBY AND VERIFYING LB MECH BUS ON CHANNEL A

S1S3 SSAS OVERVIEW

'SSAS State'

sel State Commands

SSAS State Commands

cmd Standby **Execute**

Verify SSAS State – Standby

NOTE

The S3 Activation procedure requires the LB Mech S1 and S2 busses to be on channel A in preparation for the EVA Nadir tray connections.

S1S3 SSAS OVERVIEW

'Overview Graphical Representation'

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 1

LB MECH S1

sel Bus Status

LB MECH S1 Bus Status

cmd Select Ch A **Execute**

Verify Channel Selected – A

S1S3 SSAS PREP FOR MATE

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Primary Ext MDM

sel LB Mech S 2

LB MECH S2

sel Bus Status

LB MECH S2 Bus Status

cmd Select Ch A **Execute**

Verify Channel Selected – A

MCC-H 26. PERFORMING FILE UPLINK AND DATA LOAD COMMANDS FOR MECHANISM AUTOSAFING PPLs

- 26.1 Building RDF 207 PPL Uplink to Primary C&C MDM (OSO)
Using the following, perform {1.232 **CCS BUILD FILE UPLINK COMMAND**}, all (SODF: GND AVIONICS: C&DH: NOMINAL), then:

Ops Name = YYYY_DDD_HH_CC_Hot_Mech_Safing_207_PPL_1
Source Device = Ground
Storage Type = RAM
Select Destination Filename = /mcc/fsw/{ISS Flight ID}/ppl/ccsr4_460/
ccs_ppl_0207_4_a_04012.lif
Verify Source Filename = /mcc/fsw/{ISS Flight ID}/ppl/ccsr4_460/
ccs_ppl_0207_4_a_04012.lif
Destination Device = C&C HOT
Priority = High
Uplink after = S1S3 SSAS Prep for Mate procedure
Uplink by = prior to S1S3 SSAS Nominal Mate procedure
Remarks = uplink required by OCAD #s 19418, and 19427

- 26.2 Building RDF 207 PPL Uplink to Backup C&C MDM (OSO)
Using the following, perform {1.231 **CCS BUILD DATA LOAD COMMAND**}, all (SODF: GND AVIONICS: C&DH: NOMINAL), then:

Ops Name = YYYY_DDD_HH_CC_Warm_Mech_Safing_207_PPL_1
Select Load File = /mcc/fsw/{ISS Flight ID}/ppl/ccsr4_460/
ccs_ppl_0207_4_a_04012.lif
Memory Type = RAM
Destination Device = C&C WARM
Priority = High
Uplink after = S1S3 SSAS Prep for Mate procedure
Uplink by = prior to S1S3 SSAS Nominal Mate procedure
Remarks = uplink required by OCAD #s 19418, and 19427

S1S3 SSAS PREP FOR MATE

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- 26.3 Building RDF 243 PPL Uplink to Backup C&C MDM (OSO)
Using the following, perform {1.231 [CCS BUILD DATA LOAD COMMAND](#)}, all (SODF: GND AVIONICS: C&DH: NOMINAL), then:

Ops Name = YYYY_DDD_HH_CC_Warm_Mech_Safing_243_PPL_2
Select Load File = /mcc/fsw/{ISS Flight ID}/ppl/ccsr4_460/
ccs_ppl_0243_4_a_04002.lif
Memory Type = RAM
Destination Device = C&C WARM
Priority = High
Uplink after = S1S3 SSAS Prep for Mate procedure
Uplink by = prior to S1S3 SSAS Nominal Mate procedure

- 26.4 Performing PPL FILE Uplink and Data Loads (ODIN)
To uplink RDF 207 PPL to the Primary C&C MDM, perform {1.232 [CCS BUILD FILE UPLINK COMMAND](#)}, all (SODF: GND AVIONICS: C&DH: NOMINAL), then:

To uplink RDF 207 PPL to the Backup C&C MDM, perform {1.231 [CCS BUILD DATA LOAD COMMAND](#)}, all (SODF: GND AVIONICS: C&DH: NOMINAL), then:

To uplink RDF 243 PPL to the Backup C&C MDM, perform {1.231 [CCS BUILD DATA LOAD COMMAND](#)}, all (SODF: GND AVIONICS: C&DH: NOMINAL), then:

- 26.5 Verifying PPL Version IDs (OSO)

[S1S3 SSAS Overview](#)

'Operations'

sel Latching

[S1S3 SSAS Latching](#)

sel Manual Latching

[SSAS Manual Latching Commands](#)

'Capture Autosafing'

sel Mechanism Autosafing

[Mechanism Autosafing](#)

'Autosafing PPL Version IDs - Safing Cmds'

Verify Primary C&C: 04012

Verify Backup C&C: 04012

'Autosafing PPL Version IDs - Safing Default'

Verify Backup C&C: 04002

S1S3 SSAS NOMINAL MATE

(ASSY OPS/13A/FIN/HC)

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OBJECTIVE:

In Manual State operation, capture the S3 Integrated Truss Segments (ITS) using S1S3 Segment to Segment Attachment System (SSAS) Capture Latch driven by Integrated Motor Controller Actuators (IMCAs). Switch to Normal State to permanently attach the S1 and S3 Trusses together using Bolt Bus Controllers (BBCs) and Motorized Bolt Assemblies (MBAs).

LOCATION:

Starboard side of S1 Truss

DURATION:

1 hour, 40 minutes

REFERENCED PROCEDURE(S):

1.231 CCS BUILD DATA LOAD COMMAND

1.232 CCS BUILD FILE UPLINK COMMAND

NOTE

1. Step titles followed by the notation "(AOS/M)" indicate that AOS during the execution of that step is mandatory. If current LOS or expecting LOS prior to completion of an AOS/M step, wait for the next AOS to perform.
2. Step titles followed by the notation "(AOS/HD)" indicate that AOS during the execution of that step is highly desired. If communication will be regained within 10 minutes of reaching such a step, wait for AOS to perform.
3. For any off-nominal steps or any attention symbols that appear, refer to [{2.903 SSAS MALFUNCTION}](#) (SODF: S&M: MALFUNCTION: TRUSS SYSTEMS).
4. To stop mechanism actuation, the following commands may be sent:
in Manual State: **cmd Stop Execute**
in Normal State: **cmd Pause Execute**
in any SSAS State: **cmd Abort Execute** (device power will be cut with Abort command)
5. In order to prevent erroneous autosafing, the IMCA Inadvertent Motion and BBC Inadvertent Power autosafing capabilities are inhibited during the mating event and reenabled once mating is complete.
6. If crew performing procedure steps, then Advisories on PCS should be turned ON.
7. Upon completion of mating event, IMCAs are permanently unpowered and, as such, will no longer serve function as contingency survival heater replacement, since the Capture Latch has fulfilled its expected usage.
8. IMCA and BBC deactivation will nominally be performed by **MCC-H** using command scripts, with script information contained in Table 1.

S1S3 SSAS NOMINAL MATE

(ASSY OPS/13A/FIN/HC)

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Table 1. S1S3 SSAS Command Script Information

Command Script	Script Function	Procedure Step(s)
S1S3_SSAS_IMCA_2_Deactivate	Deactivates S1S3 SSAS IMCA 2	20
S1S3_SSAS_IMCA_1_Deactivate	Deactivates S1S3 SSAS IMCA 1	26
S1S3_SSAS_BBC_1_Deactivate	Deactivates S1S3 SSAS BBC 1	27

- PCS
1. VERIFYING RPCM STATUS
S1: S&M: SSAS S1/S3
S1S3 SSAS Overview
'SSAS Graphical Representation'
'BBC-1 Pwr'

√S14B G RPC 01 Icon – blue with green corners

'BBC-2 Pwr'

√S13A G RPC 01 Icon – gray with black corners

'IMCA-1 Pwr'

√S14B G RPC 15 Icon – blue with green corners

'IMCA-2 Pwr'

√S13A G RPC 15 Icon – blue with green corners
 2. SSAS STATUS VERIFICATION
S1S3 SSAS Overview
'SSAS Application'

√SSAS App On – green

'SSAS State'

√SSAS State – Standby

'S1S3 Path Selection'

√SSAS Path – S1S3 IMCA 1 BBC 1

'SSAS Graphical Representation'

Record Primary MDM: EXT: _____
Record Backup MDM: EXT: _____
Record LB MECH S1 Ch: _____
Record LB MECH S2 Ch: _____

S1S3 SSAS NOMINAL MATE

(ASSY OPS/13A/FIN/HC)

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'Operations'

sel Latching

S1S3 SSAS Latching

sel Manual Latching

SSAS Manual Latching Commands

'Capture Autosafing'

sel Mechanism Autosafing

Mechanism Autosafing

'Autosafing PPL Version IDs - Safing Cmds'

Verify Primary C&C: 04012

Verify Backup C&C: 04012

'Autosafing PPL Version IDs - Safing Default'

Verify Backup C&C: 04002

3. TRANSITIONING SSAS TO MANUAL STATE

S1S3 SSAS Overview

'SSAS State'

sel State Commands

SSAS State Commands

cmd Manual Execute

Verify SSAS State – Manual

S1S3 SSAS Overview

'SSAS Graphical Representation'

Verify IMCA-1 Open – green

Verify IMCA-2 Open – green

Verify RTL 1 (two) – gray

Verify RTL 2 (two) – gray

Verify RTL 3 (two) – gray

4. INITIALIZING IMCA-1 WITH SAFING INITFRAME AND MODING TO ON (AOS/HD)

S1S3 SSAS Overview

'Operations'

sel Latching

S1S3 SSAS Latching

sel Manual Latching

SSAS Manual Latching Commands

'Select IMCA Initframe'

cmd Safing Execute

Verify Initframe Selected – Safing

CAUTION
From preinstall until RTLs are acquired, in the very unlikely event of IMCA inadvertent actuation (uncommanded motion), the operator should stop or abort latch actuation.

* Upon detection of inadvertent IMCA motion, SSAS operator

* should immediately send the following commands

*

* **cmd Latch Operations – Stop Execute**

* or

* **cmd Latch Operations – Abort Execute** (device power

* will be cut with this command)

'IMCA Mode'

Verify Standby – √

'Mode Cmds'

cmd On Execute

'IMCA Mode'

Verify On – √

Verify IMCA Turns: 0 ± 2 Rev

Verify Accum IMCA Turns: 0 ± 2 Rev

S1S3 SSAS NOMINAL MATE

(ASSY OPS/13A/FIN/HC)

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5. BUILDING AND UPLINKING MODIFIED FIRST STAGE CAPTURE INITFRAME (AOS/HD)

S1S3 SSAS Latching

sel Contingency Latching

SSAS Contingency Latching Commands

'Contingency Commands'

sel Modify Previous Initframe Template

SSAS Modify Previous Initframe Template

input parameters into template window shown in Figure 1

NOTE
When selecting Yes/No values in the template, right-click on the data input field to open the picklist and allow selection.

SSAS Modify Previous Initframe Template				
Stop On		Limits		
Latch Closed	<input type="text" value="No"/>	Torque	<input type="text" value="0.757"/>	N-m
Latch Open	<input type="text" value="No"/>	Shaft Speed	<input type="text" value="450"/>	rpm
RTL 1 Closed	<input type="text" value="No"/>	Accel/Decel Time	<input type="text" value="2"/>	s
RTL 2 Closed	<input type="text" value="No"/>	Position Change High	<input type="text" value="1034"/>	Rev
RTL 3 Closed	<input type="text" value="No"/>	Position Change Low	<input type="text" value="0"/>	Rev
Torque Limit	<input type="text" value="No"/>	RTD Voltage	<input type="text" value="1500"/>	mv
Rate Error Limit	<input type="text" value="No"/>			
Position Change	<input type="text" value="Yes"/>			
Inverter Temp	<input type="text" value="Yes"/>			
Card Temp	<input type="text" value="Yes"/>			
Monitor Limit Switches	<input type="text" value="No"/>			
Enable Clutch	<input type="text" value="Yes"/>			
Perform Overspeed Reverse Test	<input type="text" value="Yes"/>			

Figure 1.- SSAS IMCA Initframe Template Modified First Stage Capture Parameters.

cmd Set Execute

NOTE
At this point the SSAS is ready for the SSRMS to maneuver to the Ready to Latch position.

S1S3 SSAS NOMINAL MATE

(ASSY OPS/13A/FIN/HC)

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6. GIVING A GO FOR MODIFIED FIRST STAGE CAPTURE POST MANEUVER TO RTL

Robotics operator \Rightarrow SSAS operator, "Maneuver to RTL complete - go for Modified First Stage Capture."

7. VERIFYING POSITIVE READY-TO-LATCH (RTL) INDICATIONS AND LOADING FIRST STAGE CAPTURE INITFRAME INTO IMCA (AOS/HD)

S1: S&M: SSAS S1/S3

S1S3 SSAS Overview

sel Latching

S1S3 SSAS Latching

'Latching Graphical Representation'

Verify RTL 1 (at least one of two) – green

Verify RTL 2 (at least one of two) – green

Verify RTL 3 (at least one of two) – green

sel Contingency Latching

SSAS Contingency Latching Commands

'Contingency Commands'

cmd Select Mod Previous Initframe **Execute**

Verify Initframe Selected – Wildcard Initframe

S1S3 SSAS Latching

'IMCA-1'

sel Initframe Details

S1S3 SSAS IMCA 1 Initframe Details

'Limits'

Verify Position Change: 1033.92 ± 1 Rev

Verify Shaft Speed: 449.99 ± 1 rpm

Verify RTD Voltage: 1500.00 mV

Verify Torque: 0.76 ± 0.04 N-m

Verify Power: 472.97 ± 1.0 N-m Rad/s (Watts)

Verify Accel/Decel Time: 1.98 ± 0.5 s

'Stop On'

S1S3 SSAS NOMINAL MATE

(ASSY OPS/13A/FIN/HC)

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Verify Position Change – X
Verify RTD Voltage – X
Verify Torque – blank
Verify Latch Closed – blank
Verify Latch Open – blank
Verify RTL 1 Closed – blank
Verify RTL 2 Closed – blank
Verify RTL 3 Closed – blank
Verify Inverter Temp – X
Verify Rate Error – blank

'Clutch and Switch Settings'

Verify Monitor Limit Switches – blank
Verify Enable Clutch – X
Verify Perform Overspeed Reverse Speed Test – X

8. PERFORMING MODIFIED FIRST STAGE CAPTURE LATCH CLOSURE (AOS/HD)

CAUTION

1. To prevent damage to active SSAS, CMG TA (with Desat Request inhibited), or Free Drift (DAP: FREE if shuttle in control of attitude) is required from initiation of SSAS Capture Latch operation until a minimum of two bolts (with one being bolt three); have completed loading (both Bolt Tight Switches closed). SSRMS shall nominally remain grappled to truss until any three Bolts have completed loading.
2. To prevent potential damage to SSRMS or element grapple fixture due to overloading by SSAS mechanism if SSRMS safes during capture, the Mechanism Autosafing software must be Enabled prior to initiation of Capture Latch actuation.

NOTE

Desat Request will nominally be Inhibited prior to SSRMS maneuvering element to within 5 feet and remain inhibited until minimum structural integrity is achieved for the SSAS (two bolts with one bolt being three). Desat Request Enable may be performed as early as Capture Latch fully closed as long as Progress jets are inhibited from firing.

S1S3 SSAS Latching

sel Manual Latching

SSAS Manual Latching Commands

'Capture Autosafing'

sel Mechanism Autosafing

S1S3 SSAS NOMINAL MATE

(ASSY OPS/13A/FIN/HC)

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Mechanism Autosafing

'Enable'

cmd Enable Execute

Verify Mechanism Autosafing – Enabled

SSAS Manual Latching Commands

'Mode Cmds'

cmd Enabled Execute

'IMCA Mode'

Verify Enabled – √

Verify IMCA Turns – incrementing

Verify Accum IMCA Turns – incrementing

Wait approximately 3 minutes for completion of Modified First Stage Capture.

* If SSAS powered off due to SSRMS Safing Event

* | √MCC-H for SSAS and SSRMS reconfiguration
* | per Flight rule 13A_C10-7

9. VERIFYING IMCA-1 STOP CONDITIONS AT END OF MODIFIED FIRST STAGE CAPTURE (AOS/HD)

SSAS Manual Latching Commands

'IMCA Mode'

Verify On – √

'IMCA Data'

Verify IMCA Turns: 1034 ± 2 Rev

Verify Accum IMCA Turns: 1034 ± 2 Rev

S1S3 SSAS Latching

'IMCA-1'

Verify Latch Status – Stopped

'Latching Graphical Representation'

Verify IMCA-1 Open – gray

Verify IMCA-2 Open – gray

S1S3 SSAS NOMINAL MATE

(ASSY OPS/13A/FIN/HC)

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10. GIVING A GO FOR SSRMS LIMP POST FIRST STAGE CAPTURE

SSAS operator ⇒ Robotics operator, “Modified First Stage Capture complete – go to limp SSRMS.”

11. BUILDING AND UPLINKING MODIFIED THIRD STAGE CAPTURE INITFRAME (AOS/HD)

11.1 Building and Uplinking Template

Wait for Robotics Operator message, “Go for Modified Third Stage Capture - All joints limped.”

NOTE

1. The latch will be driven fully closed from the topological capture position in one stage, called the Modified Third Stage Capture, since the speed of the IMCA needs to be lowered in order to prevent potential loads buildup in SSRMS.
2. When selecting Yes/No values in the template, right click on the data input field to open the picklist and allow selection

S1S3 SSAS Latching

sel Contingency Latching

SSAS Contingency Latching Commands

'Contingency Commands'

sel Modify Previous Initframe Template

SSAS Modify Previous Initframe Template

input parameters into template window shown in Figure 2

S1S3 SSAS NOMINAL MATE

(ASSY OPS/13A/FIN/HC)

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SSAS Modify Previous Initframe Template				
Stop On		Limits		
Latch Closed	<input type="checkbox"/> No	Torque	<input type="text" value="0.757"/>	N-m
Latch Open	<input type="checkbox"/> No	Shaft Speed	<input type="text" value="350"/>	rpm
RTL 1 Closed	<input type="checkbox"/> No	Accel/Decel Time	<input type="text" value="2"/>	s
RTL 2 Closed	<input type="checkbox"/> No	Position Change High	<input type="text" value="3110"/>	Rev
RTL 3 Closed	<input type="checkbox"/> No	Position Change Low	<input type="text" value="0"/>	Rev
Torque Limit	<input type="checkbox"/> No	RTD Voltage	<input type="text" value="1500"/>	mv
Rate Error Limit	<input type="checkbox"/> No			
Position Change	<input type="checkbox"/> Yes			
Inverter Temp	<input type="checkbox"/> Yes			
Card Temp	<input type="checkbox"/> Yes			
Monitor Limit Switches	<input type="checkbox"/> No			
Enable Clutch	<input type="checkbox"/> Yes			
Perform Overspeed Reverse Test	<input type="checkbox"/> Yes			

Figure 2.- SSAS IMCA Initframe Template Modified Third Stage Capture Parameters.

cmd Set **Execute**

'Contingency Commands'

cmd Select Mod Previous Initframe **Execute**

Verify Initframe Selected – Wildcard Initframe

11.2 Verifying Template Parameters

'IMCA-1'

sel Initframe Details

'Limits'

S1S3 SSAS NOMINAL MATE

(ASSY OPS/13A/FIN/HC)

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Verify Position Change: 3110.02 ± 1 Rev
Verify Shaft Speed: 350.00 ± 1 rpm
Verify RTD Voltage: 1500.00 mV
Verify Torque: 0.76 ± 0.04 N-m
Verify Power: 472.97 ± 1.0 N-m Rad/s (Watts)
Verify Accel/Decel Time: 1.98 ± 0.5 s

'Stop On'

Verify Position Change – X
Verify RTD Voltage – X
Verify Torque – blank
Verify Latch Closed – blank
Verify Latch Open – blank
Verify RTL 1 Closed – blank
Verify RTL 2 Closed – blank
Verify RTL 3 Closed – blank
Verify Inverter Temp – X
Verify Rate Error – blank

'Clutch and Switch Settings'

Verify Monitor Limit Switches – blank
Verify Enable Clutch – X
Verify Perform Overspeed Reverse Speed Test – X

12. PERFORMING MODIFIED THIRD STAGE CAPTURE (AOS/HD)

SSAS Manual Latching Commands

'IMCA Mode'

Verify On – \checkmark

'Mode Cmds'

cmd Enabled Execute

'IMCA Mode'

Verify Enabled – \checkmark
Verify IMCA Turns – incrementing
Verify Accum IMCA Turns – incrementing

Wait approximately 6 minutes for completion of Modified Third Stage Capture.

* If SSAS powered off due to SSRMS Safing Event
* | \checkmark MCC-H for SSAS and SSRMS reconfiguration
* | per Flight rule 13A_C10-7

13. VERIFYING IMCA-1 STOP CONDITIONS AT END OF MODIFIED THIRD STAGE CAPTURE (AOS/HD)

SSAS Manual Latching Commands

'IMCA Mode'

Verify On – ✓

Verify IMCA Turns: 3110 ± 2 Rev

Verify Accum IMCA Turns: 3110 ± 2 Rev

S1S3 SSAS Latching

'IMCA-1'

Verify Latch Status – Stopped

'Latching Graphical Representation'

Verify IMCA-1 Closed – green

Verify IMCA-2 Closed – green

SSAS Manual Latching Commands

'Mode Cmds'

cmd Standby Execute

'IMCA Mode'

Verify Standby – ✓

14. INHIBITING MECHANISM AUTOSAFING SOFTWARE

NOTE

To prevent undesirable removal of power from the SSAS IMCAs when SSRMS transitions to Safed, the Mechanism Autosafing software is Inhibited.

SSAS Manual Latching Command

'Capture Autosafing'

sel Mechanism Autosafing

Mechanism Autosafing

'Inhibit'

cmd Arm Execute

Verify Arm – ✓

cmd Inhibit Execute

Verify Mechanism Autosafing – Inhibited

S1S3 SSAS NOMINAL MATE

(ASSY OPS/13A/FIN/HC)

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15. GIVING A GO FOR SSRMS SAFING POST CAPTURE COMPLETE
SSAS operator ⇒ Robotics operator, “Third Stage Capture complete – go for SSRMS Safing.”

16. VERIFYING CONFIGURATION TO BEGIN BOLTING OPERATIONS

S1S3 SSAS Overview

‘SSAS State’

sel State Commands

SSAS State Commands

cmd Standby Execute

Verify SSAS State – Standby

cmd Normal Execute

Verify SSAS State – Normal

S1S3 SSAS Overview

‘SSAS Graphical Representation’

‘BBC-1 Pwr’

√S14B G RPC 01 icon – blue with green corners

‘BBC-2 Pwr’

√S13A G RPC 01 icon – gray with black corners

‘Operations’

sel Bolting

S1S3 SSAS Bolting

‘BBC Status’

Verify Bolt Direction – FWD

17. CLOSING BBC COMMON POWER RELAY (AOS/HD)

S1S3 SSAS Bolting

sel Common Power Relay Cmds

SSAS BBC Common Power Relay

‘SSAS NORMAL MODE - Relay Position’

cmd Close Execute

S1S3 SSAS NOMINAL MATE

(ASSY OPS/13A/FIN/HC)

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Verify Commanded Relay Position – CI
Verify Actual Relay Position – CI

S1S3 SSAS Bolting

sel Normal Bolting Commands

SSAS Normal Bolting Commands

'Common Power Relay and Limit Switch Return Status'

Verify Limit Switch Return – Closed

CAUTION

To prevent damage to bolt hardware, operator should be prepared to send **cmd** Pause **Execute** if the MBA Current exceeds the specified limits during Bolt tightening.

NOTE

1. Each SSAS Bolt takes approximately 8.5 minutes to complete its tightening. During the tightening of each Bolt, when both Bolt Tight Switches (BTS) close, the Limit Sw Cutoff Flag will momentarily turn green for approximately 1 second. This is an indication that the Bolt tightened nominally.
2. If unexpected LOS with **MCC-H** during bolt actuation and bolt current > 175 mA and MBA On Time > 480 seconds, do not stop bolt motion. Continue to let bolt drive until fully tight. Wait for AOS before driving next bolt.

S1S3 SSAS NOMINAL MATE

(ASSY OPS/13A/FIN/HC)

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18. TIGHTENING S1S3 SSAS BOLT - BOLTS 3,1,2 (AOS/M)

SSAS Normal Bolting Commands

'Select'

cmd Bolt [Z] Execute where [Z] =

Verify Bolt Selected – Bolt [Z]

Verify BBS – X

cmd Bolt Actuation – Drive Bolt Execute

* If MBA Current exceeds 300 mA just after Drive

* | Bolt command is sent, immediately

* | **cmd Pause Execute**

Verify MBA Current (steady state): 100 to 175 mA

Verify Pwr On – X

Verify MBA Posn, Rev – incrementing

Verify MBA On, s – incrementing

Verify Bolt Controller Sequence Step: Bolt Motion – In Progress

* If MBA Current exceeds 175 mA at anytime

* | before MBA On of 480 seconds, immediately

* | **cmd Pause Execute**

Wait approximately 8.5 minutes for Bolt to tighten.

Verify BBS – blank

Verify BTS 1 – X

Verify BTS 2 – X

Verify Bolt Controller Sequence Step – No Motion

Verify Common Power Relay – Closed

Verify Limit Switch Return – Closed

Verify Bolt Direction – Forward

S1S3 SSAS Bolting

'BBC Status'

Limit Sw Cutoff Flag – green (momentary)

Repeat

S1S3 SSAS NOMINAL MATE

(ASSY OPS/13A/FIN/HC)

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19. CONFIGURING ATTITUDE CONTROL

√**MCC-H** for required MCS Configuration

NOTE

At this point in the operation, **MCC-H** is nominally expected to take over control and complete remaining steps of SSAS mate to allow crew to support SSRMS ungrapple and subsequent EVA RMS support.

20. DEACTIVATING S1S3 SSAS IMCA-2

20.1 Inhibiting IMCA-2 RT FDIR

S1S3 SSAS Overview

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 2

LB MECH S2

sel RT Status

LB MECH S2 RT Status

'12 SSAS S1/S3 L2'

√RT Status – Ena

cmd RT FDIR Status – Inhibit FDIR **Execute**

√RT FDIR Status – Inh

20.2 Deactivating IMCA-2

S1S3 SSAS Overview

'SSAS Graphical Representation'

'IMCA-2 Pwr'

sel S13A G RPC 15

RPCM S13A G RPC 15

cmd RPC Position – Open (Verify – Op)

cmd Close Cmd – Inhibit (Verify – Inh)

20.3 Inhibiting IMCA-2 RT I/O

S1S3 SSAS Overview

sel Primary EXT MDM

S1S3 SSAS NOMINAL MATE

(ASSY OPS/13A/FIN/HC)

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Primary Ext MDM

sel LB Mech S 2

LB MECH S2

sel RT Status

LB MECH S2 RT Status

'12 SSAS S1/S3 L2'

√RT FDIR Status – Inh

cmd RT Status – Inhibit **Execute**

√RT Status – Inh

20.4 Enabling IMCA-2 Inadvertent Motion Autosafing

NOTE

The following command to Enable Inadvertent Motion Autosafing and its associated telemetry does not exist on PCS and, thus, can only be sent and verified by **MCC-H**.

MCC-H

cmd Prim_EXT_Ena_ECZ_Function_Tmplt **Execute**

<Cmd PUI: S0DD96IM1658K>

<Template IMCA_SAS_S1S3_L2_INADVERT_MOTION
_AUTOSAFING_9A>

input – 4 0

S1S3 SSAS Latching MSKVIEW

'Latching Cautions & Advisories'

Verify IMCA-2 Inadvertent Motion – Ena

CAUTION

To prevent damage to bolt hardware, operator should be prepared to send **cmd** Pause **Execute** if the MBA Current exceeds the specified limits during Bolt tightening.

NOTE

Each SSAS Bolt takes approximately 8.5 minutes to complete its tightening. During the tightening of each Bolt, when both Bolt Tight Switches (BTS) close, the Limit Sw Cutoff Flag will momentarily turn green for approximately 1 second. This is an indication that the Bolt tightened nominally.

S1S3 SSAS NOMINAL MATE

(ASSY OPS/13A/FIN/HC)

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21. TIGHTENING S1S3 SSAS BOLT - BOLT 4 (AOS/M)

S1S3 SSAS Bolting

'Select'

cmd Bolt 4 Execute

Verify Bolt Selected – Bolt 4
Verify BBS – X

cmd Bolt Actuation – Drive Bolt Execute

* If MBA Current exceeds 300 mA just after Drive
* Bolt command is sent, immediately
* **cmd Pause Execute**

Verify MBA Current (steady state): 100 to 175 mA

Verify Pwr On – X
Verify MBA Posn, Rev – incrementing
Verify MBA On, s – incrementing
Verify Bolt Controller Sequence Step: Bolt Motion – In Progress

* If MBA Current exceeds 175 mA at anytime
* before MBA On of 480 seconds, immediately
* **cmd Pause Execute**

Wait approximately 8.5 minutes for Bolt to tighten.

Verify BBS – blank
Verify BTS 1 – X
Verify BTS 2 – X
Verify Bolt Controller Sequence Step – No Motion
Verify Common Power Relay – Closed
Verify Limit Switch Return – Closed
Verify Bolt Direction – Forward

S1S3 SSAS Bolting

'BBC Status'

Limit Sw Cutoff Flag – green (momentary)

22. OPENING COMMON POWER RELAY (AOS/HD)

S1S3 SSAS Bolting

sel Common Power Relay Cmds

S1S3 SSAS NOMINAL MATE

(ASSY OPS/13A/FIN/HC)

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SSAS BBC Common Power Relay

'SSAS NORMAL MODE - Relay Position'

cmd Open Execute

Verify Commanded Relay Position – Op

Verify Actual Relay Position – Op

23. TRANSITIONING SSAS TO STANDBY STATE

S1S3 SSAS Overview

'SSAS State'

sel State Commands

SSAS State Commands

cmd Standby Execute

Verify SSAS State – Standby

24. DEACTIVATING S1S3 SSAS IMCA-1

24.1 Inhibiting IMCA-1 RT FDIR

S1S3 SSAS Overview

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 1

LB MECH S1

sel RT Status

LB MECH S1 RT Status

'12 SSAS S1/S3 L1'

√RT Status – Ena

cmd RT FDIR Status – Inhibit FDIR Execute

√RT FDIR Status – Inh

24.2 Deactivating IMCA-1

S1S3 SSAS Overview

'SSAS Graphical Representation'

'IMCA-1 Pwr'

S1S3 SSAS NOMINAL MATE

(ASSY OPS/13A/FIN/HC)

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sel S14B G RPC 15

RPCM S14B G RPC 15

cmd RPC Position – Open (Verify – Op)

cmd Close Cmd – Inhibit (Verify – Inh)

24.3 Inhibiting IMCA-1 RT I/O

S1S3 SSAS Overview

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 1

LB MECH S1

sel RT Status

LB MECH S1 RT Status

'12 SSAS S1/S3 L1'

√RT FDIR Status – Inh

cmd RT Status – Inhibit **Execute**

√RT Status – Inh

24.4 Enabling IMCA-1 Inadvertent Motion Autosafing

NOTE

The following command to Enable Inadvertent Motion Autosafing and its associated telemetry does not exist on PCS and, thus, can only be sent and verified by **MCC-H**.

cmd Prim_EXT_Ena_ECZ_Function_Tmplt **Execute**

<Cmd PUI: S0DD96IM1658K>

<Template IMCA_SAS_S1S3_L1_INADVERT_MOTION
_AUTOSAFING_9A>

input – 3 9

S1S3 SSAS Latching MSKVIEW

'Latching Cautions & Advisories'

Verify IMCA-1 Inadvertent Motion – Ena

S1S3 SSAS NOMINAL MATE

(ASSY OPS/13A/FIN/HC)

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25. DEACTIVATING S1S3 SSAS BBC-1

25.1 Inhibiting BBC-1 RT FDIR

sel Primary EXT MDM

sel LB Mech S 1

sel RT Status

'13 SSAS S1/S3 B1'

√RT Status – Ena

cmd RT FDIR Status – Inhibit FDIR **Execute**

√RT FDIR Status – Inh

25.2 Inhibiting BBC-1 RT I/O

'13 SSAS S1/S3 B1'

cmd RT Status – Inhibit **Execute**

√RT Status – Inh

25.3 Deactivating BBC-1

'BBC-1 Pwr'

sel S14B G RPC 01

cmd RPC Position – Open (Verify – Op)

cmd Close Cmd – Inhibit (Verify – Inh)

25.4 Enabling BBC-1 Inadvertent Power Autosafing

NOTE

The following command to Enable Inadvertent Power Autosafing and its associated telemetry does not exist on PCS and, thus, can only be sent and verified by **MCC-H**.

S1S3 SSAS NOMINAL MATE

(ASSY OPS/13A/FIN/HC)

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cmd Prim_EXT_Ena_ECZ_Function_Tmplt **Execute**

<Cmd PUI: S0DD96IM1658K>

<Template BBC_SAS_S1S3_B1_INADVERT_POWER
_AUTOSAFING_9A>

input – 6 3

S1S3 SSAS Bolting MSKVIEW

'Bolting Cautions & Advisories'

Verify BBC-1 Inadvertent Power – Ena

26. TRANSITIONING SSAS TO IDLE STATE AND DEACTIVATING SSAS APPLICATION

S1S3 SSAS Overview

'SSAS State'

sel State Commands

SSAS State Commands

cmd Idle **Execute**

Verify SSAS State – Idle

S1S3 SSAS Overview

'SSAS Application'

sel Application Commands

SSAS Application

cmd SSAS Application S/W Status – Deactivate **Execute**

√SSAS Application S/W Status – Deactivated

√SSAS IMCA S/W Status – Activated

√SSAS BBC S/W Status – Activated

NOTE

As a non-time critical clean-up step after completion of the mating event, the default Mechanism Autosafing PPLs are reloaded into the Primary and Backup C&C MDMs to return to the default configuration.

27. PERFORMING FILE UPLINK AND DATA LOAD COMMANDS FOR MECHANISM AUTOSAFING PPLs

- 27.1 Building RDF 207 PPL Uplink to Primary C&C MDM (OSO)
Using the following, perform {1.232 **CCS BUILD FILE UPLINK COMMAND**}, all (SODF: GND AVIONICS: C&DH: NOMINAL), then:

Ops Name = YYYY_DDD_HH_CC_Hot_Mech_Safing_207_PPL_1
Source Device = Ground
Storage Type = RAM
Select Destination Filename = /mcc/fsw/{ISS Flight ID}/ppl/ccsr4_460/ccs_ppl_0207_4_a_04001.lif
Verify Source Filename = /mcc/fsw/{ISS Flight ID}/ppl/ccsr4_460/ccs_ppl_0207_4_a_04001.lif
Destination Device = C&C HOT
Priority = High
Uplink after = completion of S1S3 SSAS Nominal Mate
Remarks = re-engages default PPL after mate is completed

- 27.2 Building RDF 207 PPL Uplink to Backup C&C MDM (OSO)
Using the following, perform {1.231 **CCS BUILD DATA LOAD COMMAND**}, all (SODF: GND AVIONICS: C&DH: NOMINAL), then:

Ops Name = YYYY_DDD_HH_CC_Warm_Mech_Safing_207_PPL_1
Select Load File = /mcc/fsw/{ISS Flight ID}/ppl/ccsr4_460/ccs_ppl_0207_4_a_04001.lif
Memory Type = RAM
Select Destination Filename = /mcc/fsw/{ISS Flight ID}/ppl/ccsr4_460/ccs_ppl_0207_4_a_04001.lif
Destination Device = C&C WARM
Priority = High
Uplink after = completion of S1S3 SSAS Nominal Mate
Remarks = re-engages default PPL after mate is completed

- 27.3 Building RDF 243 PPL Uplink to Backup C&C MDM (OSO)
Using the following, perform {1.231 **CCS BUILD DATA LOAD COMMAND**}, all (SODF: GND AVIONICS: C&DH: NOMINAL), then:

Ops Name = YYYY_DDD_HH_CC_Warm_Mech_Safing_243_PPL_2
Select Load File = /mcc/fsw/{ISS Flight ID}/ppl/ccsr4_460/ccs_ppl_0243_4_a_04001.lif
Memory Type = RAM
Destination Device = C&C WARM
Priority = High
Uplink after = completion of S1S3 SSAS Nominal Mate
Remarks = re-engages default PPL after mate is completed

27.4 Performing PPL File Uplink and Data Loads (ODIN)

To uplink RDF 207 PPL to the Primary C&C MDM, perform {1.232
[CCS BUILD FILE UPLINK COMMAND](#)}, all (SODF: GND
AVIONICS: C&DH: NOMINAL), then:

To uplink RDF 207 PPL to the Backup C&C MDM, perform {1.231
[CCS BUILD DATA LOAD COMMAND](#)}, all (SODF: GND
AVIONICS: C&DH: NOMINAL), then:

To uplink RDF 243 PPL to the Backup C&C MDM, perform {1.231
[CCS BUILD DATA LOAD COMMAND](#)}, all (SODF: GND
AVIONICS: C&DH: NOMINAL), then:

27.5 Verifying PPL Version IDs (OSO)

[S1S3 SSAS Overview](#)

'Operations'

sel Latching

[S1S3 SSAS Latching](#)

sel Manual Latching

[SSAS Manual Latching Commands](#)

'Capture Autosafing'

sel Mechanism Autosafing

[Mechanism Autosafing](#)

'Autosafing PPL Version IDs - Safing Cmds'

Verify Primary C&C: 04001

Verify Backup C&C: 04001

'Autosafing PPL Version IDs - Safing Default'

Verify Backup C&C: 04001

S1S3 SSAS MANUAL MATE

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OBJECTIVE:

In Manual State operation, capture the S3 Integrated Truss Segments (ITS) using S1S3 Segment to Segment Attachment System (SSAS) Capture Latch driven by Integrated Motor Controller Actuators (IMCAs). Bolting is then performed in Manual State to permanently attach the S1 and S3 Trusses together using Bolt Bus Controllers (BBCs) and Motorized Bolt Assemblies (MBAs). This procedure is for contingency purposes since bolting will nominally be performed utilizing the Nominal Mate procedure.

LOCATION:

Starboard side of S1 Truss

DURATION:

1 hour, 40 minutes

REFERENCED PROCEDURE(S):

1.231 CCS BUILD DATA LOAD COMMAND

1.232 CCS BUILD FILE UPLINK COMMAND

NOTE

1. Step titles followed by the notation "(AOS/M)" indicate that AOS during the execution of that step is mandatory. If current LOS or expecting LOS prior to completion of an AOS/M step, wait for the next AOS to perform.
2. Step titles followed by the notation "(AOS/HD)" indicate that AOS during the execution of that step is highly desired. If communication will be regained within 10 minutes of reaching such a step, wait for AOS to perform.
3. For any off-nominal steps or any attention symbols that appear, refer to {2.903 SSAS MALFUNCTION} (SODF: S&M: MALFUNCTION: TRUSS SYSTEMS).
4. To stop mechanism actuation, the following commands may be sent:
in Manual State: **cmd Stop Execute**
in Normal State: **cmd Pause Execute**
in any SSAS State: **cmd Abort Execute** (device power will be cut with Abort command)
5. In order to prevent erroneous autosafing, the IMCA Inadvertent Motion and BBC Inadvertent Power autosafing capabilities are inhibited during the mating event and reenabled once mating is complete.
6. If crew performing procedure steps, then Advisories on PCS should be turned ON.
7. Upon completion of mating event, IMCAs are permanently unpowered and, as such, will no longer serve function as contingency survival heater replacement because the Capture Latch has fulfilled its expected usage.
8. IMCA and BBC deactivation will nominally be performed by **MCC-H** using command scripts, with script information contained in Table 1.

S1S3 SSAS MANUAL MATE

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Table 1. S1S3 SSAS Command Script Information

Command Script	Script Function	Procedure Step(s)
S1S3_SSAS_IMCA_2_Deactivate	Deactivates S1S3 SSAS IMCA 2	20
S1S3_SSAS_IMCA_1_Deactivate	Deactivates S1S3 SSAS IMCA 1	27
S1S3_SSAS_BBC_1_Deactivate	Deactivates S1S3 SSAS BBC 1	28

1. VERIFYING RPCM STATUS

S1: S&M: SSAS S1/S3

S1S3 SSAS Overview

'SSAS Graphical Representation'

'BBC-1 Pwr'

√S14B G RPC 01 Icon – blue with green corners

'BBC-2 Pwr'

√S13A G RPC 01 Icon – gray with black corners

'IMCA-1 Pwr'

√S14B G RPC 15 Icon – blue with green corners

'IMCA-2 Pwr'

√S13A G RPC 15 Icon – blue with green corners

2. SSAS STATUS VERIFICATION

S1S3 SSAS Overview

'SSAS Application'

√SSAS App On – green

'SSAS State'

√SSAS State – Standby

'S1S3 Path Selection'

√SSAS Path – S1S3 IMCA 1 BBC 1

'SSAS Graphical Representation'

Record Primary MDM: EXT _____

Record Backup MDM: EXT _____

Record Active LB MECH S1 Ch _____

Record Active LB MECH S2 Ch _____

S1S3 SSAS MANUAL MATE

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'Operations'

sel Latching

S1S3 SSAS Latching

sel Manual Latching

SSAS Manual Latching Commands

'Capture Autosafing'

sel Mechanism Autosafing

Mechanism Autosafing

'Autosafing PPL Version IDs - Safing Cmds'

Verify Primary C&C: 04012

Verify Backup C&C: 04012

'Autosafing PPL Version IDs - Safing Default'

Verify Backup C&C: 04002

3. TRANSITIONING SSAS TO MANUAL STATE

S1S3 SSAS Overview

'SSAS State'

sel State Commands

SSAS State Commands

cmd Manual Execute

Verify SSAS State – Manual

S1S3 SSAS Overview

'SSAS Graphical Representation'

Verify IMCA-1 Open – green

Verify IMCA-2 Open – green

Verify RTL 1 (two) – gray

Verify RTL 2 (two) – gray

Verify RTL 3 (two) – gray

4. INITIALIZING IMCA-1 WITH SAFING INITFRAME AND MODING TO ON (AOS/HD)

S1S3 SSAS Overview
'Operations'

sel Latching

S1S3 SSAS Latching

sel Manual Latching

SSAS Manual Latching Commands
'Select IMCA Initframe'

cmd Safing Execute

Verify Initframe Selected – Safing

CAUTION
From preinstall until RTLs are acquired, in the very unlikely event of IMCA inadvertent actuation (uncommanded motion), the operator should stop or abort latch actuation.

* Upon detection of inadvertent IMCA motion, SSAS operator
* should immediately send the following commands
*
* **cmd Latch Operations – Stop Execute**
* or
* **cmd Latch Operations – Abort Execute** (device power
* will be cut with this command)

'IMCA Mode'

Verify Standby – √

'Mode Cmds'

cmd On Execute

'IMCA Mode'

Verify On – √

Verify IMCA Turns: 0 ± 2 Rev

Verify Accum IMCA Turns: 0 ± 2 Rev

5. BUILDING AND UPLINKING MODIFIED FIRST STAGE CAPTURE INITFRAME (AOS/HD)

S1S3 SSAS Latching

sel Contingency Latching

SSAS Contingency Latching Commands
'Contingency Commands'

sel Modify Previous Initframe Template

SSAS Modify Previous Initframe Template

input parameters into template window shown in Figure 1

NOTE
When selecting Yes/No values in the template, right-click on the data input field to open the picklist and allow selection.

SSAS Modify Previous Initframe Template				
Stop On		Limits		
Latch Closed	<input type="text" value="No"/>	Torque	<input type="text" value="0.757"/>	N-m
Latch Open	<input type="text" value="No"/>	Shaft Speed	<input type="text" value="450"/>	rpm
RTL 1 Closed	<input type="text" value="No"/>	Accel/Decel Time	<input type="text" value="2"/>	s
RTL 2 Closed	<input type="text" value="No"/>	Position Change High	<input type="text" value="1034"/>	Rev
RTL 3 Closed	<input type="text" value="No"/>	Position Change Low	<input type="text" value="0"/>	Rev
Torque Limit	<input type="text" value="No"/>	RTD Voltage	<input type="text" value="1500"/>	mv
Rate Error Limit	<input type="text" value="No"/>			
Position Change	<input type="text" value="Yes"/>			
Inverter Temp	<input type="text" value="Yes"/>			
Card Temp	<input type="text" value="Yes"/>			
Monitor Limit Switches	<input type="text" value="No"/>			
Enable Clutch	<input type="text" value="Yes"/>			
Perform Overspeed Reverse Test	<input type="text" value="Yes"/>			

Figure 1.- SSAS IMCA Initframe Template Modified First Stage Capture Parameters.

cmd Set Execute

S1S3 SSAS MANUAL MATE

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NOTE

At this point the SSAS is ready for the SSRMS to maneuver to the Ready to Latch position.

6. GIVING A GO FOR MODIFIED FIRST STAGE CAPTURE POST MANEUVER TO RTL

Robotics operator \Rightarrow SSAS operator, "Maneuver to RTL complete - go for Modified First Stage Capture."

7. VERIFYING POSITIVE READY-TO-LATCH (RTL) INDICATIONS AND LOADING FIRST STAGE CAPTURE INITFRAME INTO IMCA (AOS/HD)

S1: S&M: SSAS S1/S3

S1S3 SSAS Overview

sel Latching

S1S3 SSAS Latching

'Latching Graphical Representation'

Verify RTL 1 (at least one of two) – green

Verify RTL 2 (at least one of two) – green

Verify RTL 3 (at least one of two) – green

sel Contingency Latching

SSAS Contingency Latching Commands

'Contingency Commands'

cmd Select Mod Previous Initframe **Execute**

Verify Initframe Selected – Wildcard Initframe

S1S3 SSAS Latching

'IMCA-1'

sel Initframe Details

S1S3 SSAS IMCA 1 Initframe Details

'Limits'

Verify Position Change: 1033.92 ± 1 Rev

Verify Shaft Speed: 449.99 ± 1 rpm

Verify RTD Voltage: 1500.00mV

Verify Torque: 0.76 ± 0.04 N-m

Verify Power: 472.97 ± 1.0 N-m Rad/s (Watts)

Verify Accel/Decel Time: 1.98 ± 0.5 s

'Stop On'

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Verify Position Change – X
Verify RTD Voltage – X
Verify Torque – blank
Verify Latch Closed – blank
Verify Latch Open – blank
Verify RTL 1 Closed – blank
Verify RTL 2 Closed – blank
Verify RTL 3 Closed – blank
Verify Inverter Temp – X
Verify Rate Error – blank

'Clutch and Switch Settings'

Verify Monitor Limit Switches – blank
Verify Enable Clutch – X
Verify Perform Overspeed Reverse Speed Test – X

8. PERFORMING MODIFIED FIRST STAGE CAPTURE LATCH CLOSURE (AOS/HD)

CAUTION

1. To prevent damage to active SSAS, CMG TA (with Desat Request inhibited), or Free Drift (DAP: FREE for shuttle control) is required from initiation of SSAS Capture Latch operation until a minimum of two bolts (with one being bolt three); have completed loading (both Bolt Tight Switches closed). SSRMS shall nominally remain grappled to truss until any three Bolts have completed loading.
2. To prevent potential damage to SSRMS or element grapple fixture due to overloading by SSAS mechanism if SSRMS safes during capture, the Mechanism Autosafing software must be Enabled prior to initiation of Capture Latch actuation.

NOTE

Desat Request will nominally be Inhibited prior to SSRMS maneuvering element to within 5 feet and remain inhibited until minimum structural integrity is achieved for the SSAS (two bolts with one bolt being three). Desat Request Enable may be performed as early as Capture Latch fully closed as long as Progress jets are inhibited from firing.

S1S3 SSAS Latching

sel Manual Latching

SSAS Manual Latching Commands

'Capture Autosafing'

sel Mechanism Autosafing

Mechanism Autosafing
'Enable'

cmd Enable Execute

Verify Mechanism Autosafing – Enabled

SSAS Manual Latching Commands
'Mode Cmds'

cmd Enabled Execute

'IMCA Mode'

Verify Enabled – √
Verify IMCA Turns – incrementing
Verify Accum IMCA Turns – incrementing

Wait approximately 3 minutes for completion of Modified First Stage Capture.

* If SSAS powered off due to SSRMS Safing Event
* | √**MCC-H** for SSAS and SSRMS reconfiguration
* | per Flight rule 13A_C10-7

9. [VERIFYING IMCA-1 STOP CONDITIONS AT END OF MODIFIED FIRST STAGE CAPTURE \(AOS/HD\)](#)

SSAS Manual Latching Commands
'IMCA Mode'

Verify On – √

Verify IMCA Turns: 1034 ± 2 Rev
Verify Accum IMCA Turns: 1034 ± 2 Rev

S1S3 SSAS Latching
'IMCA-1'

Verify Latch Status – Stopped

'Latching Graphical Representation'

Verify IMCA-1 Open – gray
Verify IMCA-2 Open – gray

10. [GIVING A GO FOR SSRMS LIMP POST FIRST STAGE CAPTURE](#)

SSAS operator ⇒ Robotics operator, "Modified First Stage Capture complete – go to limp SSRMS."

11. BUILDING AND UPLINKING MODIFIED THIRD STAGE CAPTURE INITFRAME (AOS/HD)

11.1 Building and Uplinking Template

Wait for Robotics Operator message, "Go for Modified Third Stage Capture - All joints limped."

NOTE

1. The latch will be driven fully closed from the topological capture position in one stage, called the Modified Third Stage Capture, since the speed of the IMCA needs to be lowered in order to prevent potential loads buildup in SSRMS.
2. When selecting Yes/No values in the template, right-click on the data input field to open the picklist and allow selection.

S1S3 SSAS Latching

sel Contingency Latching

SSAS Contingency Latching Commands

'Contingency Commands'

sel Modify Previous Initframe Template

SSAS Modify Previous Initframe Template

input parameters into template window shown in Figure 2

SSAS Modify Previous Initframe Template				
Stop On		Limits		
Latch Closed	<input type="checkbox"/> No	Torque	<input type="text" value="0.757"/>	N-m
Latch Open	<input type="checkbox"/> No	Shaft Speed	<input type="text" value="350"/>	rpm
RTL 1 Closed	<input type="checkbox"/> No	Accel/Decel Time	<input type="text" value="2"/>	s
RTL 2 Closed	<input type="checkbox"/> No	Position Change High	<input type="text" value="3110"/>	Rev
RTL 3 Closed	<input type="checkbox"/> No	Position Change Low	<input type="text" value="0"/>	Rev
Torque Limit	<input type="checkbox"/> No	RTD Voltage	<input type="text" value="1500"/>	mv
Rate Error Limit	<input type="checkbox"/> No			
Position Change	<input type="checkbox"/> Yes			
Inverter Temp	<input type="checkbox"/> Yes			
Card Temp	<input type="checkbox"/> Yes			
Monitor Limit Switches	<input type="checkbox"/> No			
Enable Clutch	<input type="checkbox"/> Yes			
Perform Overspeed Reverse Test	<input type="checkbox"/> Yes			

Figure 2.- SSAS IMCA Initframe Template Modified Third Stage Capture Parameters.

cmd Set Execute

'Contingency Commands'

cmd Select Mod Previous Initframe Execute

Verify Initframe Selected – Wildcard Initframe

11.2 Verifying Template Parameters

'IMCA-1'

sel Initframe Details

'Limits'

S1S3 SSAS MANUAL MATE

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Verify Position Change: 3109.92 ± 1 Rev
Verify Shaft Speed: 349.99 ± 1 rpm
Verify RTD Voltage: 1500.00mV
Verify Torque: 0.76 ± 0.04 N-m
Verify Power: 472.97 ± 1.0 N-m Rad/s (Watts)
Verify Accel/Decel Time: 1.98 ± 0.5 s

'Stop On'

Verify Position Change – X
Verify RTD Voltage – X
Verify Torque – blank
Verify Latch Closed – blank
Verify Latch Open – blank
Verify RTL 1 Closed – blank
Verify RTL 2 Closed – blank
Verify RTL 3 Closed – blank
Verify Inverter Temp – X
Verify Rate Error – blank

'Clutch and Switch Settings'

Verify Monitor Limit Switches – blank
Verify Enable Clutch – X
Verify Perform Overspeed Reverse Speed Test – X

12. PERFORMING MODIFIED THIRD STAGE CAPTURE (AOS/HD)

SSAS Manual Latching Commands

'IMCA Mode'

Verify On – \checkmark

'Mode Cmds'

cmd Enabled Execute

'IMCA Mode'

Verify Enabled – \checkmark
Verify IMCA Turns – incrementing
Verify Accum IMCA Turns – incrementing

Wait approximately 6 minutes for completion of Modified Third Stage Capture.

* If SSAS powered off due to SSRMS Safing Event
* | \checkmark **MCC-H** for SSAS and SSRMS reconfiguration
* | per Flight rule 13A_C10-7

S1S3 SSAS MANUAL MATE

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13. VERIFYING IMCA-1 STOP CONDITIONS AT END OF MODIFIED THIRD STAGE CAPTURE (AOS/HD)

SSAS Manual Latching Commands

'IMCA Mode'

Verify On – ✓

Verify IMCA Turns: 3110 ± 2 Rev

Verify Accum IMCA Turns: 3110 ± 2 Rev

S1S3 SSAS Latching

'IMCA-1'

Verify Latch Status – Stopped

'Latching Graphical Representation'

Verify IMCA-1 Closed – green

Verify IMCA-2 Closed – green

SSAS Manual Latching Commands

'Mode Cmds'

cmd Standby Execute

'IMCA Mode'

Verify Standby – ✓

14. INHIBITING MECHANISM AUTOSAFING SOFTWARE

NOTE

To prevent undesirable removal of power from the SSAS IMCAs when SSRMS transitions to Safed, the Mechanism Autosafing software is Inhibited.

SSAS Manual Latching Command

'Capture Autosafing'

sel Mechanism Autosafing

Mechanism Autosafing

'Inhibit'

cmd Arm Execute

Verify Arm – ✓

cmd Inhibit Execute

Verify Mechanism Autosafing – Inhibited

S1S3 SSAS MANUAL MATE

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15. GIVING A GO FOR SSRMS SAFING POST CAPTURE COMPLETE
SSAS operator ⇒ Robotics operator, "Third Stage Capture complete – go for SSRMS Safing."

16. VERIFYING CONFIGURATION TO BEGIN BOLTING OPERATIONS

S1S3 SSAS Overview

'SSAS Graphical Representation'

'BBC-1 Pwr'

√S14B G RPC 01 icon – blue with green corners

'BBC-2 Pwr'

√S13A G RPC 01 icon – gray with black corners

'Operations'

sel Bolting

S1S3 SSAS Bolting

'BBC Status'

Verify Bolt Direction – FWD

17. CLOSING BBC COMMON POWER RELAY (AOS/HD)

S1S3 SSAS Bolting

sel Common Power Relay Cmds

SSAS BBC Common Power Relay

'SSAS MANUAL MODE - Relay Position'

cmd Close Execute

Verify Commanded Relay Position – CI

Verify Actual Relay Position – CI

S1S3 SSAS Bolting

sel Manual Bolting Commands

SSAS Manual Bolting Commands

'Common Power Relay and Limit Switch Return Status'

Verify Limit Switch Return – Closed

CAUTION
1. To prevent overtightening of Bolts and possible hardware damage in Manual State, it is imperative that the operator send the Bolt Power Off command immediately upon detection of the first Bolt Tight Switch (BTS) closing, which is represented by an "X" on command displays and a green status light on the bolting graphical display.
2. To prevent damage to bolt hardware, operator should be prepared to send a cmd Bolt Power – Off Execute if the MBA Current exceeds the specified limits during Bolt tightening.

<u>NOTE</u>
1. Each SSAS Bolt takes approximately 8.5 minutes to complete its tightening. During the tightening of each Bolt, when both Bolt Tight Switches (BTS) close, the Limit Sw Cutoff Flag will turn green and will go gray when the Bolt Power – Off or Reset Stop Flags – step 1 command is sent. This is an indication that the Bolt tightened nominally.
2. If unexpected LOS with MCC-H during bolt actuation and bolt current > 175mA AND MBA On Time > 480 seconds, do not stop bolt motion. Continue to let bolt drive until fully tight. Wait for AOS before driving next bolt.

* If a Latching malfunction led to performance of Manual
* Latching steps (refer to previous Caution box), then
* Do not perform the following manual bolting steps.
* Perform bolting steps from nominal mate procedure.

18. TIGHTENING S1S3 SSAS BOLT - BOLTS 3,1,2 (AOS/M)

SSAS Manual Bolting Commands

'Drive Bolt'

cmd Bolt [Z] Execute where [Z] =

* If MBA Current exceeds 300 mA just after Drive
* | Bolt command is sent, immediately
* | **cmd Stop Execute**

Verify Bolt Selected – Bolt [Z]

Verify MBA Current (steady state): 100 to 175 mA

Verify Pwr On – X
Verify BBS – blank
Verify MBA Posn, Rev – incrementing
Verify MBA On, s – incrementing

* If MBA Current exceeds 175 mA at anytime
* | before MBA On of 480 seconds, immediately
* | **cmd Stop Execute**

When BTS 1 or BTS 2 – X, immediately

cmd Bolt Power – Off Execute

Verify MBA Current <15 mA

Verify Pwr On – blank
Verify BBS – blank
Verify BTS 1 – X
Verify BTS 2 – X
Verify Common Power Relay – Closed
Verify Limit Switch Return – Closed

sel Reset Stop Flags Cmds

SSAS BBC Reset Stop Flags

'Reset Stop Flags'

cmd Step 1 Execute

Verify Limit Switch Cutoff Flag – Not Set

cmd Step 2 Execute

Verify Limit Switch Cutoff Flag – Not Set

SSAS Manual Bolting Commands

Repeat

S1S3 SSAS MANUAL MATE

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19. CONFIGURING ATTITUDE CONTROL

√**MCC-H** for required MCS Configuration

NOTE

At this point in the operation, **MCC-H** is nominally expected to take over control and complete remaining steps of SSAS mate to allow crew to support SSRMS ungrapple and subsequent EVA RMS support.

20. DEACTIVATING S1S3 SSAS IMCA-2

20.1 Inhibiting IMCA-2 RT FDIR

S1S3 SSAS Overview

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 2

LB MECH S2

sel RT Status

LB MECH S2 RT Status

'12 SSAS S1/S3 L2'

√RT Status – Ena

cmd RT FDIR Status – Inhibit FDIR **Execute**

√RT FDIR Status – Inh

20.2 Deactivating IMCA-2

S1S3 SSAS Overview

'SSAS Graphical Representation'

'IMCA-2 Pwr'

sel S13A G RPC 15

RPCM S13A G RPC 15

cmd RPC Position – Open (Verify – Op)

cmd Close Cmd – Inhibit (Verify – Inh)

20.3 Inhibiting IMCA-2 RT I/O

S1S3 SSAS Overview

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 2

LB MECH S2

sel RT Status

LB MECH S2 RT Status

'12 SSAS S1/S3 L2'

√RT FDIR Status – Inh

cmd RT Status – Inhibit Execute

√RT Status – Inh

20.4 Enabling IMCA-2 Inadvertent Motion Autosafing

NOTE

The following command to Enable Inadvertent Motion Autosafing and its associated telemetry does not exist on PCS and, thus, can only be sent and verified by **MCC-H**.

MCC-H

cmd Prim_EXT_Ena_ECZ_Function_Tmplt Execute

<Cmd PUI: S0DD96IM1658K>

<Template IMCA_SAS_S1S3_L2_INADVERT_MOTION
_AUTOSAFING_9A>

input – 4 0

S1S3 SSAS Latching MSKVIEW

'Latching Cautions & Advisories'

Verify IMCA-2 Inadvertent Motion – Ena

CAUTION

1. To prevent overtightening of Bolts and possible hardware damage in Manual State, it is imperative that the operator send the Bolt Power – Off command immediately upon detection of the first Bolt Tight Switch (BTS) closing (represented by an “X” on command displays and a green status light on the bolting graphical display).
2. To prevent damage to bolt hardware, operator should be prepared to send **cmd Bolt Power – Off Execute** if the MBA Current exceeds the specified limits during Bolt tightening.

NOTE

Each SSAS Bolt takes approximately 8.5 minutes to complete its tightening. During the tightening of each Bolt, when both Bolt Tight Switches (BTS) close, the Limit Sw Cutoff Flag will turn green and will go gray when the Bolt Power – Off or Reset Stop Flags – step 1 command is sent. This is an indication that the Bolt tightened nominally.

* If a Latching malfunction led to performance of Manual
* | Latching steps (refer to previous Caution box), then
* | Do not perform the following manual bolting steps.
* | Perform bolting steps from nominal mate procedure.

21. TIGHTENING S1S3 SSAS BOLT - BOLT 4 (AOS/M)

SSAS Manual Bolting Commands

'Drive Bolt'

cmd Bolt 4 Execute

* If MBA Current exceeds 300 mA just after Drive
* | Bolt command is sent, immediately
* | **cmd Stop Execute**

Verify Bolt Selected – Bolt 4

Verify MBA Current (steady state): 100 to 175 mA

- Verify Pwr On – X
- Verify BBS – blank
- Verify MBA Posn, Rev – incrementing
- Verify MBA On, seconds – incrementing

* If MBA Current exceeds 175 mA at anytime
* | before MBA On of 480 seconds, immediately
* | **cmd Stop Execute**

Wait approximately 8.5 minutes for Bolt to tighten.

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When BTS 1 or BTS 2 – X, immediately

cmd Bolt Power – Off Execute

Verify MBA Current < 16 mA

Verify Pwr On – blank

Verify BBS – blank

Verify BTS 1 – X

Verify BTS 2 – X

Verify Common Power Relay – Closed

Verify Limit Switch Return – Closed

sel Reset Stop Flags Cmds

SSAS BBC Reset Stop Flags

'Reset Stop Flags'

cmd Step 1 Execute

Verify Limit Switch Cutoff Flag – Not Set

cmd Step 2 Execute

Verify Limit Switch Cutoff Flag – Not Set

22. OPENING COMMON POWER RELAY (AOS/HD)

S1S3 SSAS Bolting

sel Common Power Relay Cmds

SSAS BBC Common Power Relay

'SSAS MANUAL MODE - Relay Position'

cmd Open Execute

Verify Commanded Relay Position – Op

Verify Actual Relay Position – Op

* If a Latching malfunction led to performance of Manual
* Latching steps then:
* Do not perform the following manual latching steps to
* deploy the latch immediately following the tightening
* of the fourth bolt, but perform the steps to deactivate
* the SSAS because deploying the latch after the bolt
* tightening may interfere with S3/S4 Activation.
* At a later date, after S3/S4 Activation is complete,
* perform necessary steps from S1S3 SSAS Prep for
* Mate procedure to activate both IMCAs, one BBC,
* and transition SSAS to Manual State before
* performing the following steps.

23. INITIALIZING IMCA-1 WITH SAFING INITFRAME AND MODE TO ON (AOS/HD)

S1S3 SSAS Overview
'Operations'

sel Latching

S1S3 SSAS Latching
sel Manual Latching

SSAS Manual Latching Commands
'Select IMCA Initframe'

cmd Safing Execute

Verify Initframe Selected – Safing

'IMCA Mode'

Verify Standby – √

'Mode Cmds'

cmd On Execute

'IMCA Mode'

Verify On – √

Verify IMCA Turns: 0 ± 2 Rev

Verify Accum IMCA Turns: 3110 ± 2 Rev

24. INITIATING FIRST STAGE DEPLOY OF CAPTURE LATCH (AOS/HD)

SSAS Manual Latching Commands

'Select IMCA Initframe'

cmd First Stage Deploy **Execute**

Verify Initframe Selected – First Stage Deploy

'Mode Cmds'

cmd Enabled **Execute**

'IMCA Mode'

Verify Enabled– √

Verify IMCA Turns – decrementing

Verify Accum IMCA Turns – decrementing

Wait approximately 4 minutes for completion of First Stage Deploy.

25. VERIFYING IMCA-1 STOP CONDITIONS AT REMOVE PRELOAD POSITION (AOS/HD)

SSAS Manual Latching Commands

'IMCA Mode'

Verify On – √

Verify IMCA Turns: -1500 ± 2 Rev

Verify Accum IMCA Turns: 1610 ± 2 Rev

S1S3 SSAS Latching

'IMCA-1'

Verify Latch Status – Stopped

'SSAS Graphical Representation'

Verify IMCA-1 Closed – gray

SSAS Manual Latching Commands

'Mode Cmds'

cmd Standby **Execute**

'IMCA Mode'

Verify Standby – √

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26. TRANSITIONING SSAS TO STANDBY STATE

'SSAS State'

sel State Commands

cmd Standby Execute

Verify SSAS State – Standby

27. DEACTIVATING S1S3 SSAS IMCA-1

27.1 Inhibiting IMCA-1 RT FDIR

sel Primary EXT MDM

sel LB Mech S 1

sel RT Status

'12 SSAS S1/S3 L1'

√RT Status – Ena

cmd RT FDIR Status – Inhibit FDIR Execute

√RT FDIR Status – Inh

27.2 Deactivating IMCA-1

'SSAS Graphical Representation'

'IMCA-1 Pwr'

sel S14B G RPC 15

cmd RPC Position – Open (Verify – Op)

cmd Close Cmd – Inhibit (Verify – Inh)

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27.3 Inhibiting IMCA-1 RT I/O

S1S3 SSAS Overview

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 1

LB MECH S1

sel RT Status

LB MECH S1 RT Status

'12 SSAS S1/S3 L1'

√RT FDIR Status – Inh

cmd RT Status – Inhibit Execute

√RT Status – Inh

27.4 Enabling IMCA-1 Inadvertent Motion Autosafing

NOTE

The following command to Enable Inadvertent Motion Autosafing and its associated telemetry does not exist on PCS and, thus, can only be sent and verified by **MCC-H**.

MCC-H

cmd Prim_EXT_Ena_ECZ_Function_Tmplt Execute

<Cmd PUI: S0DD96IM1658K>

<Template IMCA_SAS_S1S3_L1_INADVERT_MOTION
_AUTOSAFING_9A>

input – 3 9

S1S3 SSAS Latching MSKVIEW

'Latching Cautions & Advisories'

Verify IMCA-1 Inadvertent Motion – Ena

28. DEACTIVATING S1S3 SSAS BBC-1

28.1 Inhibiting BBC-1 RT FDIR

S1S3 SSAS Overview

sel Primary EXT MDM

Primary Ext MDM

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sel LB Mech S 1

LB MECH S1

sel RT Status

LB MECH S1 RT Status

'13 SSAS S1/S3 B1'

√RT Status – Ena

cmd RT FDIR Status – Inhibit FDIR Execute

√RT FDIR Status – Inh

28.2 Inhibiting BBC-1 RT I/O

LB MECH S1 RT Status

'13 SSAS S1/S3 B1'

cmd RT Status – Inhibit Execute

√RT Status – Inh

28.3 Deactivating BBC-1

S1S3 SSAS Overview

'BBC-1 Pwr'

sel S14B G RPC 01

RPCM S14B G RPC 01

cmd RPC Position – Open (Verify – Op)

cmd Close Cmd – Inhibit (Verify – Inh)

28.4 Enabling BBC-1 Inadvertent Power Autosafing

NOTE

The following command to Enable Inadvertent Power Autosafing and its associated telemetry does not exist on PCS and, thus, can only be sent and verified by **MCC-H**

MCC-H

cmd Prim_EXT_Ena_ECZ_Function_Tmplt Execute

<Cmd PUI: S0DD96IM1658K>

<Template BBC_SAS_S1S3_B1_INADVERT_POWER
_AUTOSAFING_9A>

input – 6 3

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S1S3 SSAS Bolting MSKVIEW
'Bolting Cautions & Advisories'

Verify BBC-1 Inadvertent Power – Ena

29. TRANSITIONING SSAS TO IDLE STATE, AND DEACTIVATING SSAS APPLICATION

S1S3 SSAS Overview
'SSAS State'

sel State Commands

SSAS State Commands

cmd Idle Execute

Verify SSAS State – Idle

S1S3 SSAS Overview
'SSAS Application'

sel Application Commands

SSAS Application

cmd SSAS Application S/W Status – Deactivate Execute

- √SSAS Application S/W Status – Deactivated
- √SSAS IMCA S/W Status – Activated
- √SSAS BBC S/W Status – Activated

NOTE

As a non-time critical clean-up step after completion of the mating event, the default Mechanism Autosafing PPLs are reloaded into the Primary and Backup C&C MDMs to return to the default configuration.

MCC-H 30. PERFORMING FILE UPLINK AND DATA LOAD COMMANDS FOR MECHANISM AUTOSAFING PPLs

- 30.1 Building RDF 207 PPL Uplink to Primary C&C MDM (OSO)
Using the following, perform {1.232 CCS BUILD FILE UPLINK COMMAND} (SODF: GND AVIONICS: C&DH: NOMINAL), then:

Ops Name = YYYY_DDD_HH_CC_Hot_Mech_Safing_207_PPL_3
Source Device = Ground
Storage Type = RAM
Select Destination Filename = /mcc/fsw/{ISS Flight ID}/ppl/ccsr4_460/ccs_ppl_0207_4_a_04001.lif

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Verify Source Filename = /mcc/fsw/{ISS Flight ID}/
ppl/ccsr4_460/ccs_ppl_0207_4_a_04001.lif
Storage Type = RAM
Destination Device = C&C HOT
Priority = High
Uplink after = completion of S1S3 SSAS Nominal Mate
Remarks = re-engages default PPL after mate is completed

- 30.2 Building RDF 207 PPL Uplink to Backup C&C MDM (OSO)
Using the following, perform {1.231 [CCS BUILD DATA LOAD COMMAND](#)}, all (SODF: GND AVIONICS: C&DH: NOMINAL),
then:

Ops Name = YYYY_DDD_HH_CC_Warm_Mech_Safing_207_PPL_4
Select Load File = /mcc/fsw/{ISS Flight ID}/ppl/ccsr4_460/ccs_ppl_
0207_4_a_04001.lif
Memory Type = RAM
Destination Device = C&C WARM
Priority = High
Uplink after = completion of S1S3 SSAS Nominal Mate
Remarks = re-engages default PPL after mate is completed

- 30.3 Building RDF 243 PPL Uplink to Backup C&C MDM (OSO)
Using the following, perform {1.231 [CCS BUILD DATA LOAD COMMAND](#)}, all (SODF: GND AVIONICS: C&DH: NOMINAL),
then:

Ops Name = YYYY_DDD_HH_CC_Warm_Mech_Safing_243_PPL_5
Select Load File = /mcc/fsw/{ISS Flight ID}/ppl/ccsr4_460/ccs_ppl_
0243_4_a_04001.lif
Memory Type = RAM
Destination Device = C&C WARM
Priority = High
Uplink after = completion of S1S3 SSAS Nominal Mate
Remarks = re-engages default PPL after mate is completed.

- 30.4 Performing PPL File Uplink and Data Loads (ODIN)
To uplink RDF 207 PPL to the Primary C&C MDM, perform {1.232 [CCS BUILD FILE UPLINK COMMAND](#)}, all (SODF: GND
AVIONICS: C&DH: NOMINAL), then:

To uplink RDF 207 PPL to the Backup C&C MDM, perform {1.231 [CCS BUILD DATA LOAD COMMAND](#)}, all (SODF: GND
AVIONICS: C&DH: NOMINAL), then:

To uplink RDF 243 PPL to the Backup C&C MDM, perform {1.231 [CCS BUILD DATA LOAD COMMAND](#)}, all (SODF: GND
AVIONICS: C&DH: NOMINAL), then:

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30.5 Verifying PPL Version IDS (OSO)

S1S3 SSAS Overview

'Operations'

sel Latching

S1S3 SSAS Latching

sel Manual Latching

SSAS Manual Latching Commands

'Capture Autosafing'

sel Mechanism Autosafing

Mechanism Autosafing

'Autosafing PPL Version IDs - Safing Cmds'

Verify Primary C&C: 04001

Verify Backup C&C: 04001

'Autosafing PPL Version IDs - Safing Default'

Verify Backup C&C: 04001

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S1S3 SSAS CAPTURE LATCH DEPLOYMENT - POST MATE

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OBJECTIVE:

Activate the S1S3 Segment to Segment Attachment System (SSAS) by powering on both Integrated Motor Controller Actuators (IMCAs) and powering one of the Bolt Bus Controllers (BBC) in order to complete the partial deployment of the Capture Latch in Normal State. The deployment which removes pre-load from the latch is to be performed anytime after S3/S4 Activation is complete. This procedure also performs a check of the Bolt Tight Switches (BTS) subsequent to the mating event.

LOCATION:

Starboard side of S1 Truss

DURATION:

1 hour

REFERENCED PROCEDURE(S):

None

NOTE

1. Step titles followed by the notation "(AOS/M)" indicate that AOS during the execution of that step is mandatory. If current LOS or expecting LOS prior to completion of an AOS/M step, wait for the next AOS to perform.
2. Step titles followed by the notation "(AOS/HD)" indicate that AOS during the execution of that step is highly desired. If communication will be regained within 10 minutes of reaching such a step, wait for AOS to perform.
3. For any off-nominal steps or any attention symbols that appear, refer to {2.903 SSAS MALFUNCTION} (SODF: S&M: MALFUNCTION: TRUSS SYSTEMS).
4. Ignore all attention symbols, switch indications, cautions and advisories prior to activation of SSAS software, path selection and devices being powered.
5. To stop mechanism actuation the following commands may be sent:
in Manual State: **cmd Stop Execute**
in Normal State: **cmd Pause Execute**
in any SSAS state: **cmd Abort Execute** (device power will be cut with Abort command)
6. In order to prevent erroneous autosafing, the IMCA Inadvertent Motion and BBC Inadvertent Power autosafing capabilities will be inhibited during use of IMCAs and BBC.
7. Caution events for the IMCA Inadvertent Motion and BBC Inadvertent Power should be inhibited (event codes: 10331, 10332, 10315, and 10316).
8. If crew performing procedure steps, Advisories on PCS should be turned on.
9. IMCA and BBC activation, deactivation, and bolt drive tests will be performed by **MCC-H** using command scripts, with script information contained in Table 1.

S1S3 SSAS CAPTURE LATCH DEPLOYMENT - POST MATE

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Table 1. S1S3 SSAS Command Script Information

Command Script	Script Function	Procedure Step(s)
S1S3_SSAS_IMCA_1_Activate	Activate S1S3 SSAS IMCA 1	6
S1S3_SSAS_IMCA_2_Activate	Activate S1S3 SSAS IMCA 2	7
S1S3_SSAS_BBC_2_Activate	Activate S1S3 SSAS BBC 2	8
S1S3_SSAS_BBC_2_Deactivate	Deactivate S1S3 SSAS BBC 2	14
S1S3_SSAS_IMCA_1_Deactivate	Deactivates S1S3 SSAS IMCA 1	15
S1S3_SSAS_IMCA_2_Deactivate	Deactivates S1S3 SSAS IMCA 2	16

1. VERIFYING RPCM STATUS

PCS

S1: S&M: SSAS S1/S3

'BBC-2 Pwr'

sel S13A G RPC 01

√Integration Counter – incrementing

'IMCA-1 Pwr'

sel S14B G RPC 15

√Integration Counter – incrementing

'IMCA-2 Pwr'

sel S13A G RPC 15

√Integration Counter – incrementing

2. RECORDING CDH CONFIGURATION

Record Primary MDM: EXT _____

Record Backup MDM: EXT _____

Record LB MECH S1 Ch _____

Record LB MECH S2 Ch _____

sel Primary EXT MDM

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Primary Ext MDM

sel LB Mech S 1

LB MECH S1

sel RT Status

LB MECH S1 RT Status

'12 SSAS S1/S3 L1'

√RT Status – Inh

√RT FDIR Status – Inh

Verify RT Comm Failed Status – blank

Primary Ext MDM

sel LB Mech S 2

LB MECH S2

sel RT Status

LB MECH S2 RT Status

'12 SSAS S1/S3 L2'

√RT Status – Inh

√RT FDIR Status – Inh

Verify RT Comm Failed Status – blank

'13 SSAS S1/S3 B2'

√RT Status – Inh

√RT FDIR Status – Inh

Verify RT Comm Failed Status – blank

3. ACTIVATING SSAS SOFTWARE APPLICATION

NOTE

Before SSAS software activation, a nominal SSAS State indication of 'Idle' will be displayed.

S1S3 SSAS Overview

'SSAS Application'

sel Application Commands

S1S3 SSAS CAPTURE LATCH DEPLOYMENT - POST MATE

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SSAS Application

cmd SSAS Application S/W Status – Activate **Execute**

Verify SSAS Application S/W Status – Activated

√SSAS IMCA S/W Status – Activated

√SSAS BBC S/W Status – Activated

4. TRANSITIONING SSAS STATE TO STANDBY

S1S3 SSAS Overview

'SSAS State'

sel State Commands

SSAS State Commands

cmd Standby **Execute**

Verify SSAS State – Standby

5. SELECTING SSAS PATH

S1S3 SSAS Overview

'S1S3 Path Selection'

sel Path Commands

S1S3 SSAS Path Commands

'Nominal Commands'

cmd IMCA-2 and BBC-2 **Execute**

S1S3 SSAS Overview

'S1S3 Path Selection'

Verify SSAS Selected – S1S3

Verify IMCA Selected – IMCA 2

Verify BBC Selected – BBC 2

Verify SSAS Path – S1S3 IMCA 2 BBC 2

S1S3 SSAS CAPTURE LATCH DEPLOYMENT - POST MATE

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NOTE

1. IMCA-1 and IMCA-2 telemetry fields on Latching graphical display update at 0.1 Hz rate. Data on Latching command displays update at 1.0 Hz rate and should be used first for data verification.
2. Each IMCA will take 6 seconds to complete Power On Self Test (POST) and mode to Standby after power has been applied.

6. ACTIVATING S1S3 SSAS IMCA-1

NOTE

The following commands to Inhibit Inadvertent Motion Autosafing and their associated telemetry do not exist on PCS and, thus, can only be sent and verified by **MCC-H**.

MCC-H

6.1 Inhibiting IMCA-1 Inadvertent Motion Autosafing

cmd Prim_EXT_Arm_Inh_ECZ_Function_Tmplt Execute

<Cmd PUI: S0DD96IM1665K>

<Template IMCA_SAS_S1S3_L1_INADVERT_MOTION
_AUTOSAFING_9A>

input – 3 9

S1S3 SSAS Latching MSKVIEW

'Latching Cautions & Advisories'

Verify IMCA-1 Inadvertent Motion – Arm

cmd Prim_EXT_Inh_ECZ_Function_Tmplt Execute

<Cmd PUI: S0DD96IM1672K>

<Template IMCA_SAS_S1S3_L1_INADVERT_MOTION
_AUTOSAFING_9A>

input – 3 9

S1S3 SSAS Latching MSKVIEW

'Latching Cautions & Advisories'

Verify IMCA-1 Inadvertent Motion – Inh

S1S3 SSAS CAPTURE LATCH DEPLOYMENT - POST MATE

(ASSY OPS/13A/FIN)

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6.2 Opening IMCA-1 RPC

NOTE

The RPC powering IMCA-1 was closed to allow IMCA to be continuously powered in order to prevent loss of heating should the Capture Latch heaters fail similar to the S1S3 SSAS. Thus, in order to clear the IMCA Watchdog Timer, the IMCA RPC is opened prior to its reactivation and Enabling of the Remote Terminal communication.

S1S3 SSAS Overview

'IMCA-1 Pwr'

sel S14B G RPC 15

RPCM S14B G RPC 15

cmd RPC Position – Open (Verify – Op)

6.3 Enabling IMCA-1 RT I/O

S1S3 SSAS Overview

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 1

LB MECH S1

sel RT Status

LB MECH S1 RT Status

'12 SSAS S1/S3 L1'

√RT FDIR Status – Inh

cmd RT Status – Enable **Execute**

Verify RT Status – Ena

6.4 Activating IMCA-1

S1S3 SSAS Overview

'Operations'

sel Latching

S1S3 SSAS Latching

'Latching Graphical Representation'

'IMCA-1 Pwr'

S1S3 SSAS CAPTURE LATCH DEPLOYMENT - POST MATE

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sel S14B G RPC 15

RPCM S14B G RPC 15

cmd RPC Position – Close (Verify – Cl)

Verify Open Cmd – Ena

S1S3 SSAS Latching

'IMCA-1'

Verify Built In Test Errors – no attention symbol

'Mode'

Verify Standby – green

NOTE

The next check verifies RTD Voltage changes after IMCA activation. The RTD Voltage should change at least once within a 30 second period. If RTD Voltage does not change, √MCC.

'Motor Status'

Verify RTD Voltage \leq 1251mV

'Latch Status'

Verify Latch Status – Stopped

'Latching Graphical Representation'

Verify IMCA-1 icon – no attention symbol

Verify Closed – gray

Verify Open – green

Verify RTL 1 – gray

Verify RTL 2 – gray

Verify RTL 3 – gray

6.5 Enabling IMCA-1 RT FDIR

S1S3 SSAS Latching

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 1

S1S3 SSAS CAPTURE LATCH DEPLOYMENT - POST MATE

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LB MECH S1

sel RT Status

LB MECH S1 RT Status

'12 SSAS S1/S3 L1'

√RT Status – Ena

cmd RT FDIR Status – Enable FDIR Execute

Verify RT FDIR Status – Ena

Verify RT Comm Failed Status – blank

7. ACTIVATING S1S3 SSAS IMCA-2

NOTE

The following commands to Inhibit Inadvertent Motion Autosafing and their associated telemetry do not exist on PCS and, thus, can only be sent and verified by **MCC-H**.

MCC-H

7.1 Inhibiting IMCA-2 Inadvertent Motion Autosafing

cmd Prim_EXT_Arm_Inh_ECZ_Function_Tmplt Execute

<Cmd PUI: S0DD96IM1665K>

<Template IMCA_SAS_S1S3_L2_INADVERT_MOTION
_AUTOSAFING_9A>

input – 4 0

S1S3 SSAS Latching MSKVIEW

'Latching Cautions & Advisories'

Verify IMCA-2 Inadvertent Motion – Arm

cmd Prim_EXT_Inh_ECZ_Function_Tmplt Execute

<Cmd PUI: S0DD96IM1672K>

<Template IMCA_SAS_S1S3_L2_INADVERT_MOTION
_AUTOSAFING_9A>

input – 4 0

S1S3 SSAS Latching MSKVIEW

'Latching Cautions & Advisories'

Verify IMCA-2 Inadvertent Motion – Inh

S1S3 SSAS CAPTURE LATCH DEPLOYMENT - POST MATE

(ASSY OPS/13A/FIN)

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7.2 Opening IMCA-2 RPC

NOTE

The RPC powering IMCA-2 was closed to allow IMCA to be continuously powered in order to prevent loss of heating should the Capture Latch heaters fail similar to the S1S3 SSAS. Thus in order to clear the IMCA Watchdog Timer, the IMCA RPC is opened prior to its reactivation and Enabling of the Remote Terminal communication.

S1S3 SSAS Overview

'IMCA-2 Pwr'

sel S13A G RPC 15

RPCM S13A G RPC 15

cmd RPC Position – Open (Verify – Op)

7.3 Enabling IMCA-2 RT I/O

S1S3 SSAS Latching

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 2

LB MECH S2

sel RT Status

LB MECH S2 RT Status

'12 SSAS S1/S3 L2'

√RT FDIR Status – Inh

cmd RT Status – Enable **Execute**

Verify RT Status – Ena

7.4 Activating IMCA-2

S1S3 SSAS Latching

'Latching Graphical Representation'
'IMCA-2 Pwr'

sel S13A G RPC 15

RPCM S13A G RPC 15

S1S3 SSAS CAPTURE LATCH DEPLOYMENT - POST MATE

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cmd RPC Position – Close (Verify – Cl)

Verify Open Cmd – Ena

S1S3 SSAS Latching

'IMCA-2'

Verify Built In Test Errors – no attention symbol

'Mode'

Verify Standby – green

NOTE

The next check verifies RTD Voltage changes after IMCA activation. The RTD Voltage should change at least once within a 30 second period. If RTD Voltage does not change, **√MCC**.

'Motor Status'

Verify RTD Voltage $\leq 1251\text{mV}$

'Latch Status'

Verify Latch Status – Stopped

'Latching Graphical Representation'

Verify IMCA-2 icon – no attention symbol

Verify Closed – gray

Verify Open – green

Verify RTL 1 – gray

Verify RTL 2 – gray

Verify RTL 3 – gray

'Command Validation'

Verify IMCA Cmd and Data Status – no attention symbol

7.5 Enabling IMCA-2 RT FDIR

S1S3 SSAS Latching

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 2

LB MECH S2

S1S3 SSAS CAPTURE LATCH DEPLOYMENT - POST MATE

(ASSY OPS/13A/FIN)

Page 11 of 21 pages

sel RT Status

LB MECH S2 RT Status

'12 SSAS S1/S3 L2'

√RT Status – Ena

cmd RT FDIR Status – Enable FDIR **Execute**

Verify RT FDIR Status – Ena

Verify RT Comm Failed Status – blank

8. ACTIVATING S1S3 SSAS BBC-2

NOTE

The following commands to Inhibit Inadvertent Power Autosafing and their associated telemetry do not exist on PCS and, thus, can only be sent and verified by **MCC-H**.

MCC-H

8.1 Inhibiting BBC-2 Inadvertent Power Autosafing

cmd Prim_EXT_Arm_Inh_ECZ_Function_Tmplt **Execute**

<Cmd PUI: S0DD96IM1665K>

<Template BBC_SAS_S1S3_B2_INADVERT_POWER
_AUTOSAFING_9A>

input – 6 4

S1S3 SSAS Bolting MSKVIEW

'Bolting Cautions & Advisories'

Verify BBC-2 Inadvertent Power – Arm

cmd Prim_EXT_Inh_ECZ_Function_Tmplt **Execute**

<Cmd PUI: S0DD96IM1672K>

<Template BBC_SAS_S1S3_B2_INADVERT_POWER
_AUTOSAFING_9A>

input – 6 4

S1S3 SSAS Bolting MSKVIEW

'Bolting Cautions & Advisories'

Verify BBC-2 Inadvertent Power – Inh

8.2 Activating BBC-2

CAUTION

Only one Bolt Bus Controller (BBC) may be powered at a given time to avoid short circuits between BBC-1 and BBC-2.

S1S3 SSAS CAPTURE LATCH DEPLOYMENT - POST MATE

(ASSY OPS/13A/FIN)

Page 12 of 21 pages

S1S3 SSAS Overview

'Operations'

sel Bolting

S1S3 SSAS Bolting

'Bolting Graphical Representation'

'BBC-2 Pwr'

sel S13A G RPC 01

RPCM S13A G RPC 01

cmd Close Cmd – Enable (Verify – Ena)

cmd RPC Position – Close (Verify – Cl)

8.3 Enabling BBC-2 RT I/O

S1S3 SSAS Bolting

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 2

LB MECH S2

sel RT Status

LB MECH S2 RT Status

'13 SSAS S1/S3 B2'

√RT FDIR Status – Inh

cmd RT Status – Enable **Execute**

Verify RT Status – Ena

S1S3 SSAS Bolting

'Command Validation'

Verify BBC Cmd and Data Status – no attention symbol

'BBC Status'

Verify BBC Selected – BBC 2

Verify MBA Current: 0 to 16 mA

S1S3 SSAS CAPTURE LATCH DEPLOYMENT - POST MATE

(ASSY OPS/13A/FIN)

Page 13 of 21 pages

Verify Bolt Direction – FWD
Verify Limit Sw Cutoff Flag – gray
Verify Current Cutoff Flag – gray
Verify Limit Sw Cutoff Override – gray

'Bolting Graphical Representation'

Verify Limit Switch Return Num 2 – Closed
Verify BBS (all) – green
Verify BTS (all) – gray
Verify BBC-1 icon – gray
Verify BBC-1 & BBC-2 icon – no attention symbol

8.4 Enabling BBC-2 RT FDIR

sel Primary EXT MDM

sel LB MECH S2

sel RT Status

'13 SSAS S1/S3 B2'

√RT Status – Ena

cmd RT FDIR Status – Enable FDIR Execute

Verify RT FDIR Status – Ena

Verify RT Comm Failed Status – blank

9. TRANSITIONING SSAS STATE TO NORMAL

'SSAS State'

sel State Commands

cmd Normal Execute

Verify SSAS State – Normal

NOTE

The partial deployment of the Capture Latch that removes the preload from the latch will be delayed until after the S3/S4 Activation procedure is completed. This will ensure no interference with EVA Nadir/Zenith Tray connection preparations.

S1S3 SSAS CAPTURE LATCH DEPLOYMENT - POST MATE

(ASSY OPS/13A/FIN)

Page 14 of 21 pages

10. INITIATING REMOVE PRELOAD PHASE OF CAPTURE LATCH (AOS/HD)

S1S3 SSAS Overview

'Operations'

sel Latching

S1S3 SSAS Latching

sel Normal Latching

SSAS Normal Latching Commands

'IMCA Mode'

Verify Standby – ✓

'Deploy Commands'

cmd Initialize First Phase Deploy **Execute**

Verify Initframe Selected – Initialize First Phase (momentary)

'IMCA Mode'

Verify On – ✓

Verify Latch Cntrlr Seq Step – First Phase Deploy - Initialize

'Deploy Commands'

cmd First Phase Deploy **Execute**

Verify Initframe Selected – First Phase Deploy

'IMCA Mode'

Verify Enabled – ✓

'IMCA Data'

Verify IMCA Turns – decrementing

Verify Accum IMCA Turns – decrementing

Verify Latch Cntrlr Seq Step: First Phase Deploy – Enabled

Verify IMCA Phase Time – incrementing

Wait approximately 4 minutes for completion of First Phase Deploy.

S1S3 SSAS CAPTURE LATCH DEPLOYMENT - POST MATE

(ASSY OPS/13A/FIN)

Page 15 of 21 pages

11. VERIFYING IMCA-1 STOP CONDITIONS AT REMOVE PRELOAD POSITION (AOS/HD)

SSAS Normal Latching Commands

'IMCA Mode'

Verify Standby – ✓

'IMCA Data'

Verify IMCA Turns: -1500 ± 2 Rev (momentary)

Verify Accum IMCA Turns: 1610 ± 2 Rev

Verify Latch Cntrlr Seq Step – None

Verify IMCA Phase Time ≤ 207 s

S1S3 SSAS Latching

'IMCA-1'

Verify Latch Status – Stopped

'Latching Graphical Representation'

Verify IMCA-1 Closed – gray

Verify IMCA-2 Closed – gray

12. BOLT TIGHT SWITCH CHECK

S1S3 SSAS Latching

'SSAS Graphical Representation'

sel S1S3 SSAS Overview

S1S3 SSAS Overview

'Operations'

sel Bolting

P1P3 SSAS Bolting

'Bolting Graphical Representation'

Verify BTS 1 (four) – green

Verify BTS 2 (four) – green

S1S3 SSAS CAPTURE LATCH DEPLOYMENT - POST MATE

(ASSY OPS/13A/FIN)

Page 16 of 21 pages

13. TRANSITIONING SSAS TO STANDBY STATE

S1S3 SSAS Overview

'SSAS State'

sel State Commands

SSAS State Commands

cmd Standby Execute

Verify SSAS State – Standby

14. DEACTIVATING S1S3 SSAS BBC-2

14.1 Inhibiting BBC-2 RT FDIR

S1S3 SSAS Overview

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 2

LB MECH S2

sel RT Status

LB MECH S2 RT Status

'13 SSAS S1/S3 B2'

√RT Status – Ena

cmd RT FDIR Status – Inhibit FDIR Execute

Verify RT FDIR Status – Inh

14.2 Inhibiting BBC-2 RT I/O

LB MECH S2 RT Status

'13 SSAS S1/S3 B2'

cmd RT Status – Inhibit Execute

Verify RT Status – Inh

14.3 Deactivating BBC-2

S1S3 SSAS Overview

'BBC-2 Pwr'

sel S13A G RPC 01

S1S3 SSAS CAPTURE LATCH DEPLOYMENT - POST MATE

(ASSY OPS/13A/FIN)

Page 17 of 21 pages

RPCM S13A G RPC 01

cmd RPC Position – Open (Verify – Op)

cmd Close Cmd – Inhibit (Verify – Inh)

14.4 Enabling BBC-2 Inadvertent Power Autosafing

NOTE

The following command to Enable Inadvertent Power Autosafing and its associated telemetry does not exist on PCS and, thus, can only be sent by **MCC-H**.

MCC-H

cmd Prim_EXT_Ena_ECZ_Function_Tmplt **Execute**

<Cmd PUI: S0DD96IM1658K>

<Template BBC_SAS_S1S3_B1_INADVERT_POWER
_AUTOSAFING_9A>

input – 6 4

S1S3 SSAS Bolting MSKVIEW

'Bolting Cautions & Advisories'

Verify BBC-2 Inadvertent Power – Ena

15. DEACTIVATING S1S3 SSAS IMCA-1

15.1 Inhibiting IMCA-1 RT FDIR

S1S3 SSAS Overview

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 1

LB MECH S1

sel RT Status

LB MECH S1 RT Status

'12 SSAS S1/S3 L1'

√RT Status – Ena

cmd RT FDIR Status – Inhibit FDIR **Execute**

√RT FDIR Status – Inh

S1S3 SSAS CAPTURE LATCH DEPLOYMENT - POST MATE

(ASSY OPS/13A/FIN)

Page 18 of 21 pages

15.2 Deactivating IMCA-1

S1S3 SSAS Overview

'SSAS Graphical Representation'
'IMCA-1 Pwr'

sel S14B G RPC 15

RPCM S14B G RPC 15

cmd RPC Position – Open (Verify – Op)

cmd Close Cmd – Inhibit (Verify – Inh)

15.3 Inhibiting IMCA-1 RT I/O

S1S3 SSAS Overview

sel Primary EXT MDM

Primary Ext MDM

sel LB Mech S 1

LB MECH S1

sel RT Status

LB MECH S1 RT Status

'12 SSAS S1/S3 L1'

√RT FDIR Status – Inh

cmd RT Status – Inhibit **Execute**

√RT Status – Inh

15.4 Enabling IMCA-1 Inadvertent Motion Autosafing

NOTE

The following command to Enable Inadvertent Motion Autosafing and its associated telemetry does not exist on PCS and, thus, can only be sent and verified by **MCC-H**.

MCC-H

cmd Prim_EXT_Ena_ECZ_Function_Tmplt **Execute**

<Cmd PUI: S0DD96IM1658K>

<Template IMCA_SAS_S1S3_L1_INADVERT_MOTION
_AUTOSAFING_9A>

input – 3 9

S1S3 SSAS CAPTURE LATCH DEPLOYMENT - POST MATE

(ASSY OPS/13A/FIN)

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'Latching Cautions & Advisories'

Verify IMCA-1 Inadvertent Motion – Ena

16. DEACTIVATING S1S3 SSAS IMCA-2

16.1 Inhibiting IMCA-2 RT FDIR

sel Primary EXT MDM

sel LB Mech S 2

sel RT Status

'12 SSAS S1/S3 L2'

√RT Status – Ena

cmd RT FDIR Status – Inhibit FDIR **Execute**

√RT FDIR Status – Inh

16.2 Deactivating IMCA-2

'SSAS Graphical Representation'

'IMCA-2 Pwr'

sel S13A G RPC 15

cmd RPC Position – Open (Verify – Op)

cmd Close Cmd – Inhibit (Verify – Inh)

16.3 Inhibiting IMCA-2 RT I/O

sel Primary EXT MDM

sel LB Mech S 2

S1S3 SSAS CAPTURE LATCH DEPLOYMENT - POST MATE

(ASSY OPS/13A/FIN)

Page 20 of 21 pages

LB MECH S2

sel RT Status

LB MECH S2 RT Status

'12 SSAS S1/S3 L2'

√RT FDIR Status – Inh

cmd RT Status – Inhibit Execute

√RT Status – Inh

16.4 Enabling IMCA-2 Inadvertent Motion Autosafing

NOTE

The following command to Enable Inadvertent Motion Autosafing and its associated telemetry does not exist on PCS and, thus, can only be sent and verified by **MCC-H**.

MCC-H

cmd Prim_EXT_Ena_ECZ_Function_Tmplt Execute

<Cmd PUI: S0DD96IM1658K>

<Template IMCA_SAS_S1S3_L2_INADVERT_MOTION
_AUTOSAFING_9A>

input – 4 0

S1S3 SSAS Latching MSKVIEW

'Latching Cautions & Advisories'

Verify IMCA-2 Inadvertent Motion – Ena

17. TRANSITIONING SSAS TO IDLE STATE AND DEACTIVATING SSAS APPLICATION

S1S3 SSAS Overview

'SSAS State'

sel State Commands

SSAS State Commands

cmd Idle Execute

Verify SSAS State – Idle

S1S3 SSAS Overview

'SSAS Application'

sel Application Commands

S1S3 SSAS CAPTURE LATCH DEPLOYMENT - POST MATE

(ASSY OPS/13A/FIN)

Page 21 of 21 pages

SSAS Application

cmd SSAS Application S/W Status – Deactivate **Execute**

√SSAS Application S/W Status – Deactivated

√SSAS IMCA S/W Status – Activated

√SSAS BBC S/W Status – Activated

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NOMINAL

NOMINAL

NOMINAL

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APCU ACTIVATION

(ASSY OPS/13A/FIN)

Page 1 of 1 page

NOTE

The APCUs are in a parallel configuration. When either APCU converter is turned ON, both APCU CONV talkbacks will be gray [tb APCU 1,2 CONV (two) – gray].

- R1
1. VERIFYING ORBITER PAYLOAD BUS CONFIGURATION
√tb PL PRI MNC – ON
√PL CAB – MNA(MNB)
√PL AUX – ON
- SSP 1
2. VERIFYING SWITCH POWER
√cb SW PWR 1 – cl
 3. CLOSING APCU 1 OUTPUT RELAY
√tb APCU 1,2 CONV – bp

APCU 1 OUTPUT RLY – cl
 4. TURNING APCU CONVERTER(S) ON
APCU 1(2) CONV – ON

√tb APCU 1,2 CONV – gray
√tb APCU 1 OUTPUT RLY– gray
- CRT
- SM 200 APCU Status
- √APCU 1(2) OUT VOLTS RES HIGH: 122 to 126.5 V

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APCU DEACTIVATION

(ASSY OPS/13A/FIN)

Page 1 of 1 page

NOTE

1. Expect '**S200 APCU 1(2) VOLT LMT**' message when APCU Converters are powered OFF.
2. The APCUs are in a parallel configuration. When either APCU converter is turned ON, both APCU CONV talkbacks will be gray [tb APCU 1,2 CONV (two) – gray].

CRT

SM 200 APCU Status

SSP 1

1. TURNING APCU CONVERTER(S) OFF

APCU 1(2) CONV – OFF

√tb APCU 1,2 CONV – bp

√tb APCU 1 OUTPUT RLY – bp

2. OPENING APCU 1 OUTPUT RELAY

APCU 1 OUTPUT RELAY – OP

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PAYLOAD DEACTIVATION

(ASSY OPS/13A/FIN 1) Page 1 of 1 page

L12U 1. cb SW PWR 1 – op
PDIP 1 PWR 2/KuBAND RLY – op
X1/X2 SW – op
X1/X2 SW PDIP 1 PWR 1 – op

L12L 2. cb PDIP 2 PWR 2 – op
PDIP 2 PWR 1 – op

L12 3. Ku BAND RATE – OFF

R1 4. PL CAB – OFF

ML86B:E 5. cb MNB MAR 2 – op

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PAYLOAD ENTRY SWITCH LIST/VERIFICATION

(ASSY OPS/13A/FIN 1) Page 1 of 1 page

TIG-1:55 PAYLOAD PWR CONFIG

- R1 1. √PL CAB – OFF
 √PRI MNC – ctr (tb-OFF)
 √MNB – ctr (tb-OFF)
 √FC3 – ctr (tb-OFF)
 √AUX – ON
 √AFT MNB – OFF
 √MNC – OFF
- L12U 2. √APCU 1 CONV – OFF (tb-bp)
 √OUTPUT RLY – OPEN (tb-bp)
 √APCU 2 CONV – OFF (tb-bp)
 √cb SW PWR 1 – op
 √cb PDIP 1 PWR 2/KuBAND RLY – op
 √tb OIU PWR – bp
 √TCS PWR – OFF (tb-bp)
 √cb X1/X2 SW – op
 √cb X1/X2 SW PDIP1 PWR1 – op
 √ODS CONN MATE X1 TLM PWR – OFF
 √X2 TLM PWR – OFF
- √OIU PWR – OFF
- L12L 3. √cb PDIP 2 PWR 2 – op
 √C/L CAM PWR – OFF
 √cb PDIP 2 PWR 1 – op
- L12 4. √Ku BAND RATE – OFF
 √DC PWR 1 CAB PL – OFF
 √2 CAB PL – OFF
- L11 5. √DC PWR 1 CAB PL – OFF
 √2 CAB PL – OFF
- ML86B:E 6. √cb MNB MAR 1 – cl
 √2 – op
- ML85E 7. √DC 10 AMP MNB S2 – OFF
 √S3 – ON
 √S4 – OFF
 √S5 – OFF
8. √cb DC 10 AMP MNB CB2 – op
 √CB3 – cl
 √CB4 – op
 √CB5 – op

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PAYLOAD REACTIVATION

(ASSY OPS/13A/FIN)

Page 1 of 1 page

N/A

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MALFUNCTION

MALFUNCTION

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MALFUNCTION

APCU

APCU AMPS ↑ (ASSY OPS/13A/FIN)

SM
ALERT

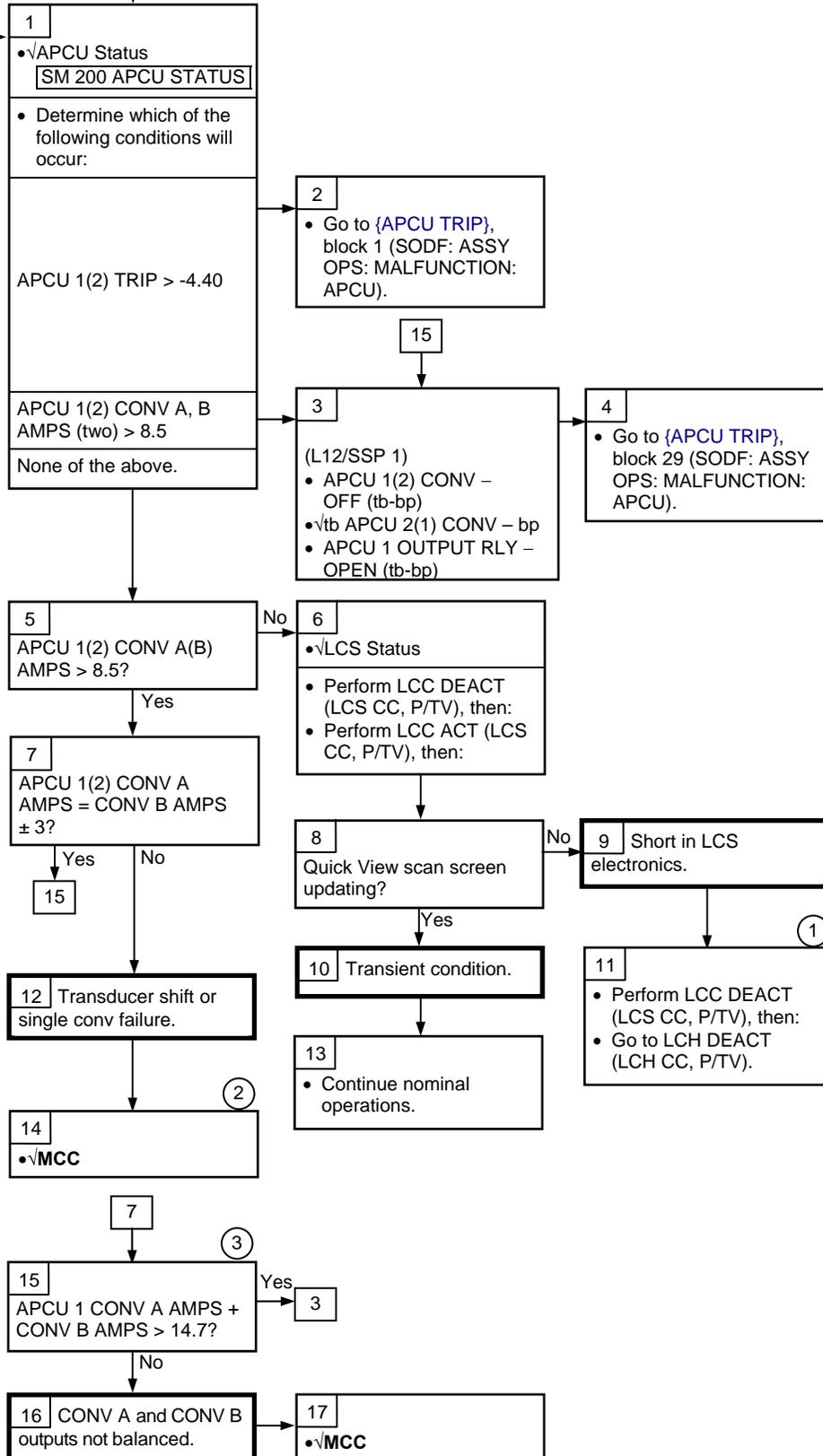
S200 APCU 1(2)
AMPS HIGH
If any APCU CONV
AMPS ≥ 8.5

Nominal Config:
R1
PRI PL MNC – ON
(tb-ON)
PL CAB –
MNA(MNB)
PL AUX – ON
(L12/SSP 1)
cb SW PWR 1 – cl

**Nominal Single
APCU Config:**
L12 (SSP 1)
APCU 1(2) CONV
– ON (tb-gray)
APCU 1 OUTPUT
RLY – CLOSE
(tb-gray)
APCU 2(1) CONV
– OFF (tb-gray)

The APCUs are in a
parallel
configuration.
When either APCU
converter is turned
ON, both APCU
CONV talkbacks
will be gray
[tb APCU 1,2
CONV (two) –
gray].

{APCU TEMP ↓↑}, block 3 (SODF: ASSY OPS: MALFUNCTION: APCU)
{APCU VOLTS ↑↓}, block 3 (SODF: ASSY OPS: MALFUNCTION: APCU)



① The APCU and the Primary Payload Bus will be deactivated in LCH DEACT.

② MCC will determine between a transducer shift and a real single converter failure.

③ Total output for each APCU must be maintained less than 14.7 amps and each CONV output must be maintained less than 8.5 amps.

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APCU

APCU TEMP ↓↑ (ASSY OPS/13A/FIN)

SM ALERT

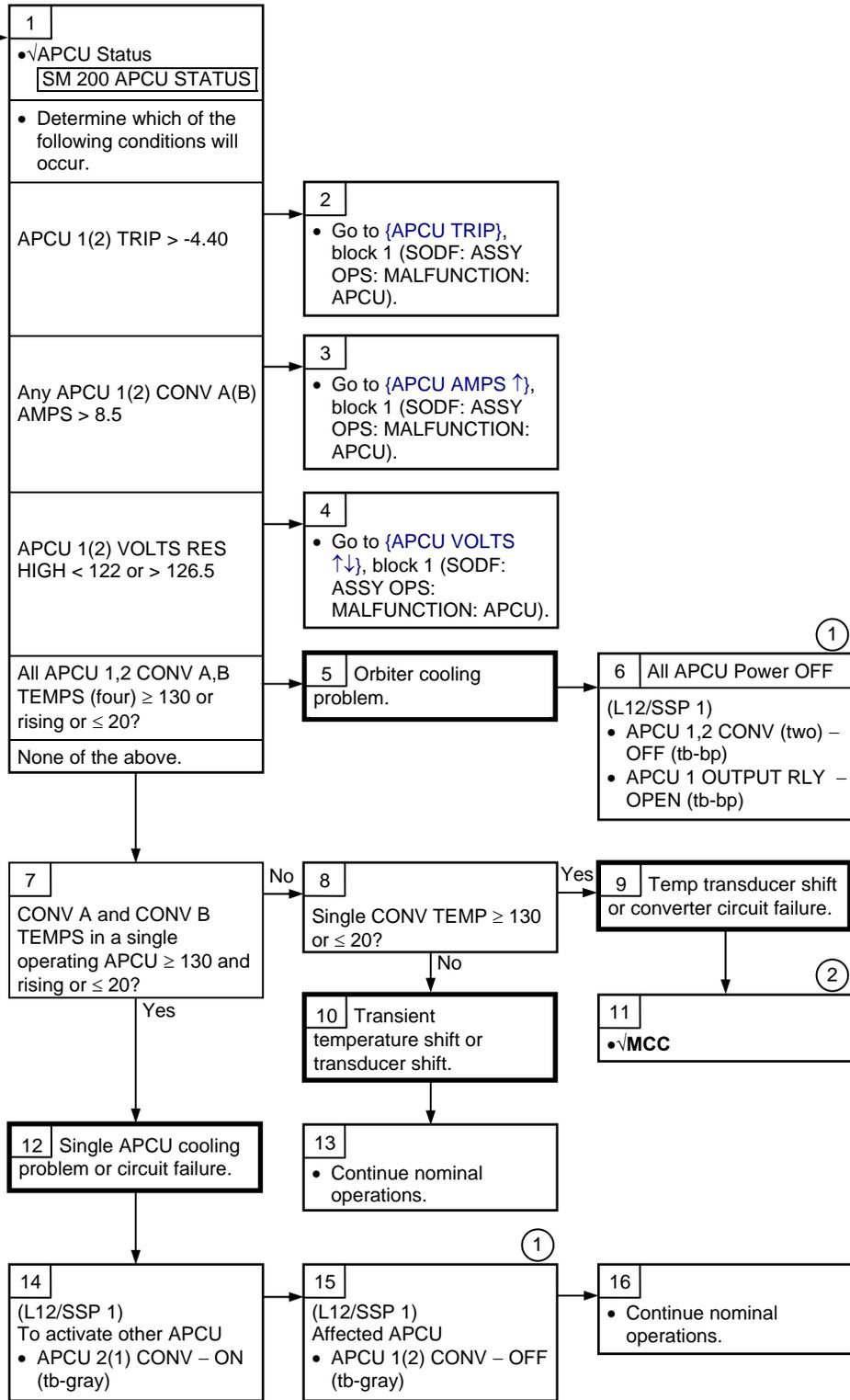
S200 APCU 1(2)
TEMP HIGH

If: APCU 1(2)
CONV TEMP A(B)
≤ 20 or ≥ 130

Nominal Config:
(R1)
PRI PL MNC – ON
(tb-ON)
PL CAB
– MNA(MNB)
PL AUX – ON
L12 (SSP 1)
cb SW PWR 1 (CB2)
– Close

**Nominal Single
APCU Config:**
L12 (SSP 1)
APCU 1(2) CONV
– ON (tb-gray)
APCU 1 OUTPUT
RLY – CLOSE
(tb-gray)
APCU 2(1) CONV –
OFF (tb-gray)

The APCUs are in a
parallel
configuration.
When either APCU
converter is turned
ON, both APCU
CONV talkbacks
will be gray
[tb APCU 1,2
CONV (two) – gray]



①
Loss of APCU 1
output results in
loss of orbiter 120 V
power to LCS/IDC.

②
MCC will determine
between a
transducer shift and
a real circuitry
failure.

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APCU

SM
ALERT

APCU TRIP (ASSY OPS/13A/FIN)

Page 1 of 5 pages

{APCU TEMP $\uparrow\downarrow$ }, block 2 (SODF: ASSY OPS: MALFUNCTION: APCU)
 {APCU VOLTS $\uparrow\downarrow$ }, block 2 (SODF: ASSY OPS: MALFUNCTION: APCU)
 {APCU AMPS $\uparrow\downarrow$ }, block 2 (SODF: ASSY OPS: MALFUNCTION: APCU)

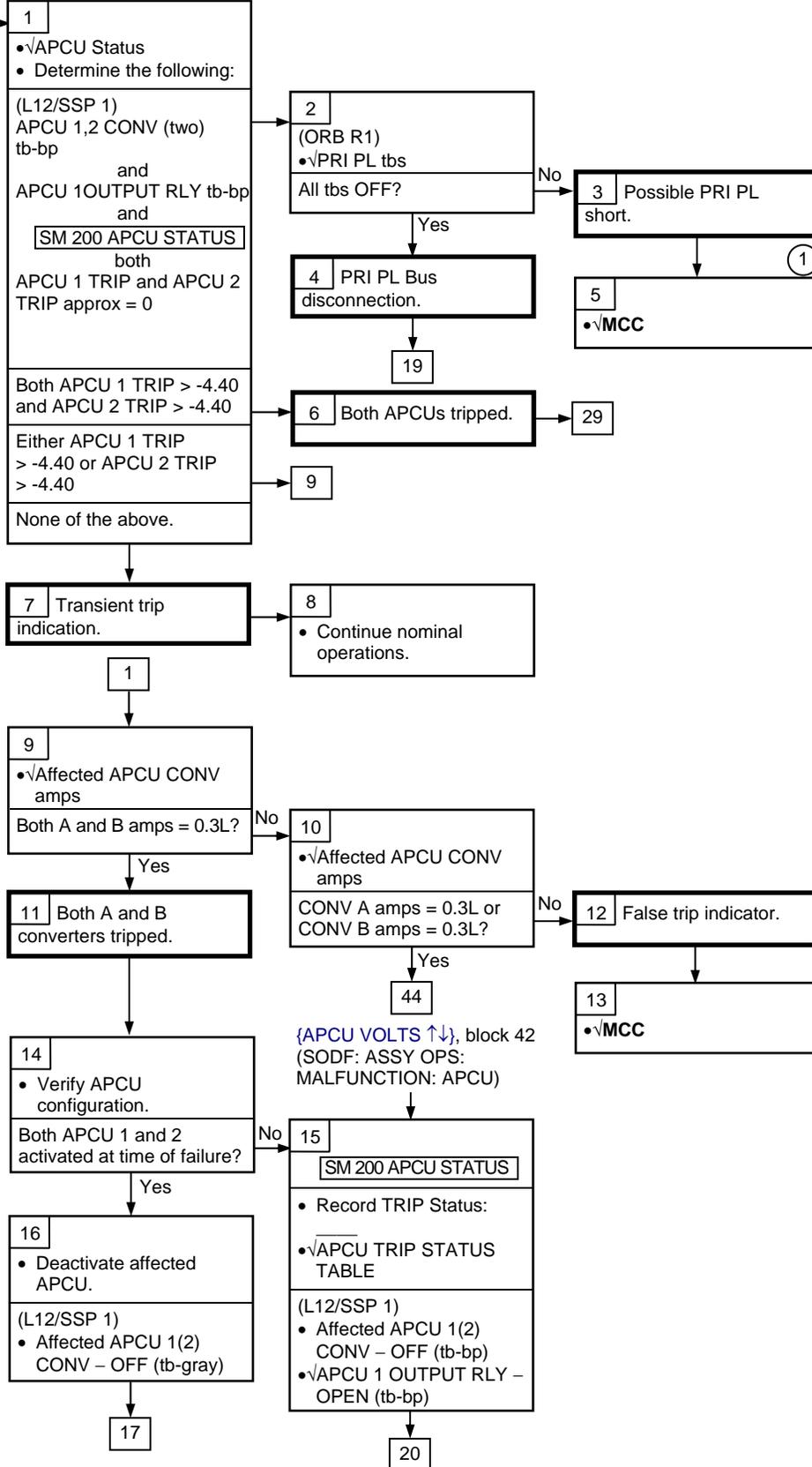
S200 APCU 1(2)
TRIP

If APCU TRIP
> -4.4
 \sqrt APCU TRIP
STATUS TABLE

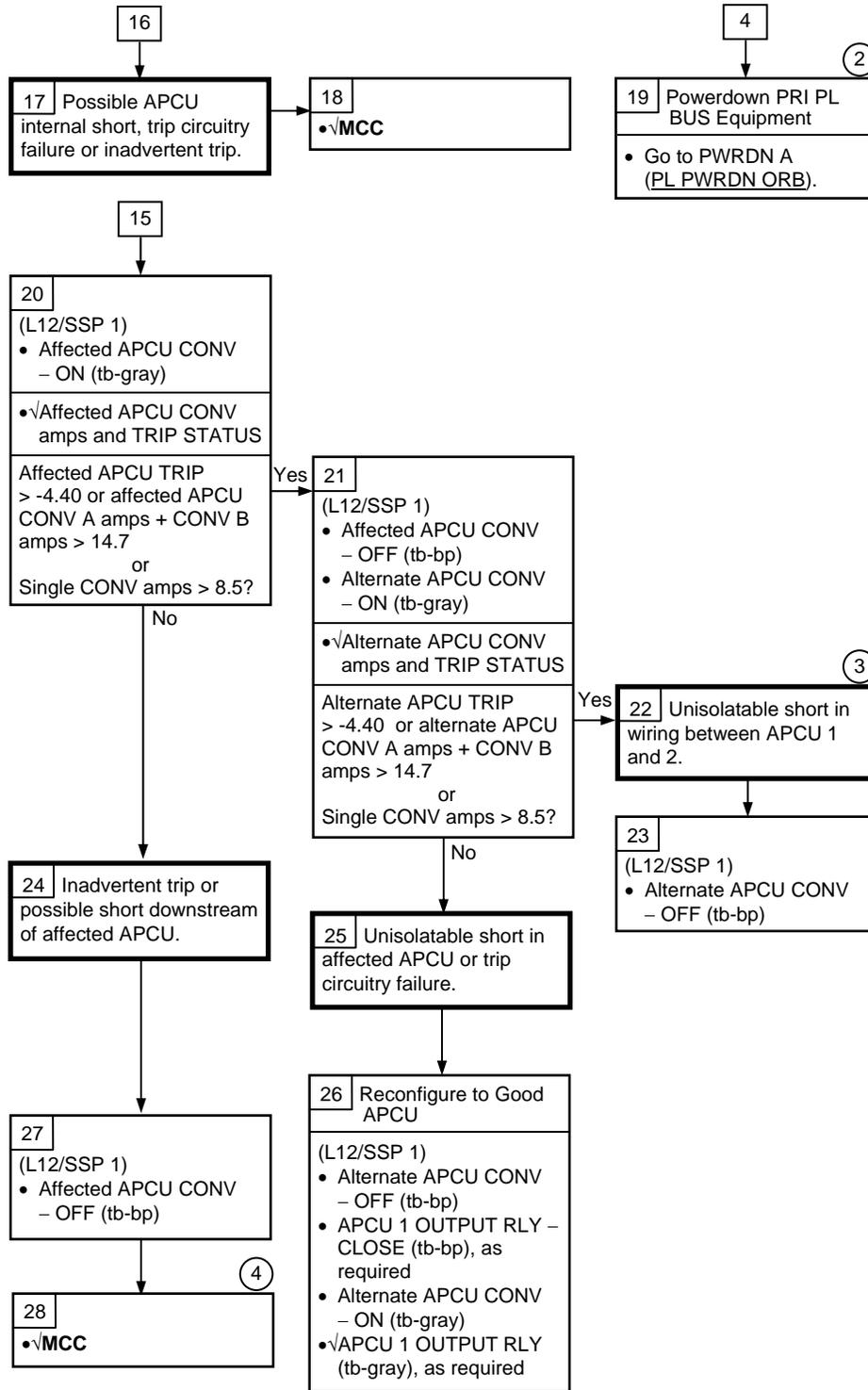
Nominal Config:
R1
PRI PL MNC – ON
(tb-ON)
PL CAB
– MNA(MNB)
PL AUX – ON
L12 (SSP 1)
cb SW PWR – Close

**Nominal Single
Config one bus
powered:**
L12 (SSP 1)
APCU 1(2) CONV
– ON (tb-gray)
APCU 1 OUTPUT
RLY – CLOSE
(tb-gray)
APCU 2(1) CONV
– OFF (tb-gray)

The APCUs are in a
parallel
configuration.
When either APCU
converter is turned
ON, both APCU
CONV talkbacks
will be gray
[tb APCU 1,2
CONV (two) –
gray].



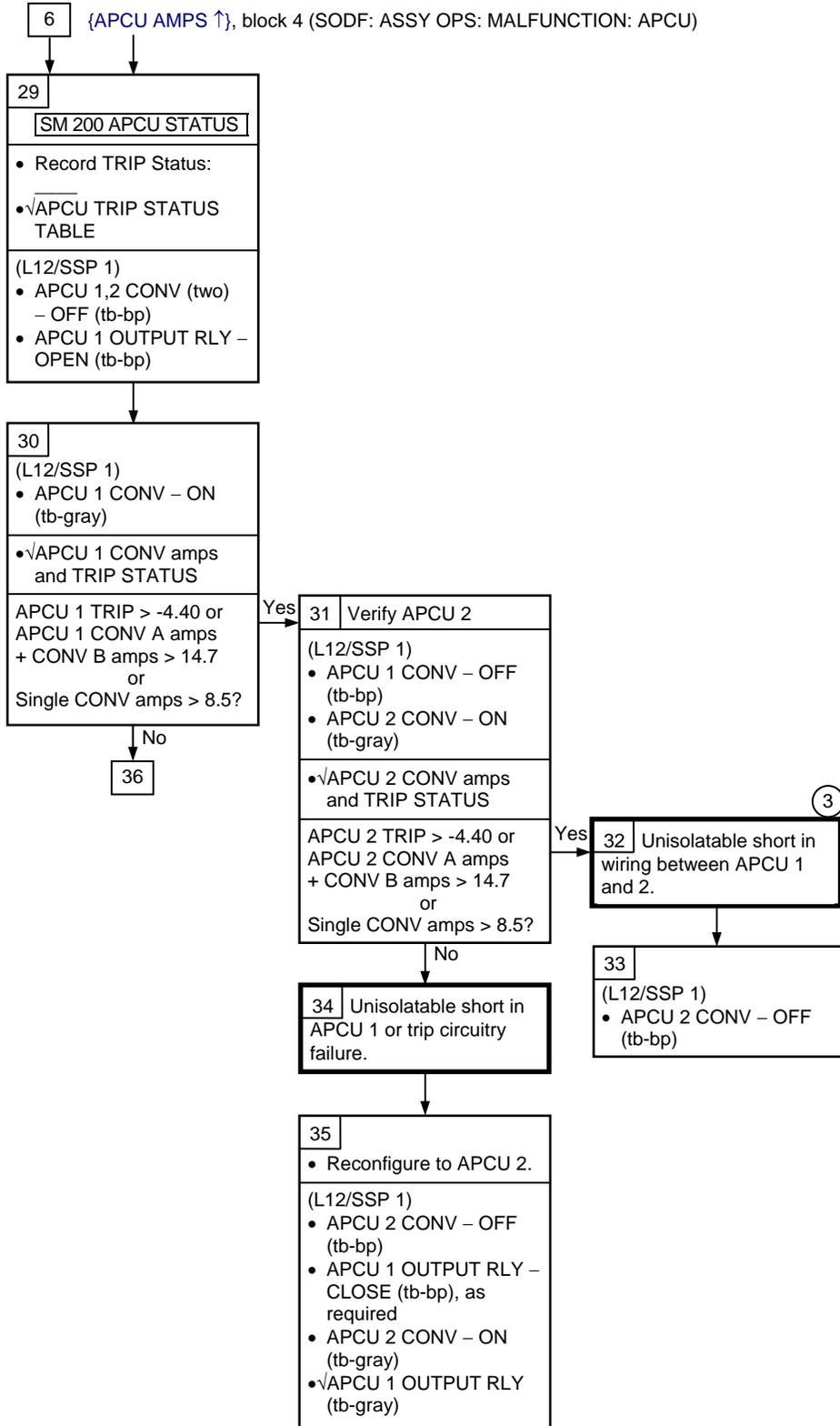
①
MCC will determine
cause of interruption
of power or signal to
the APCUs.



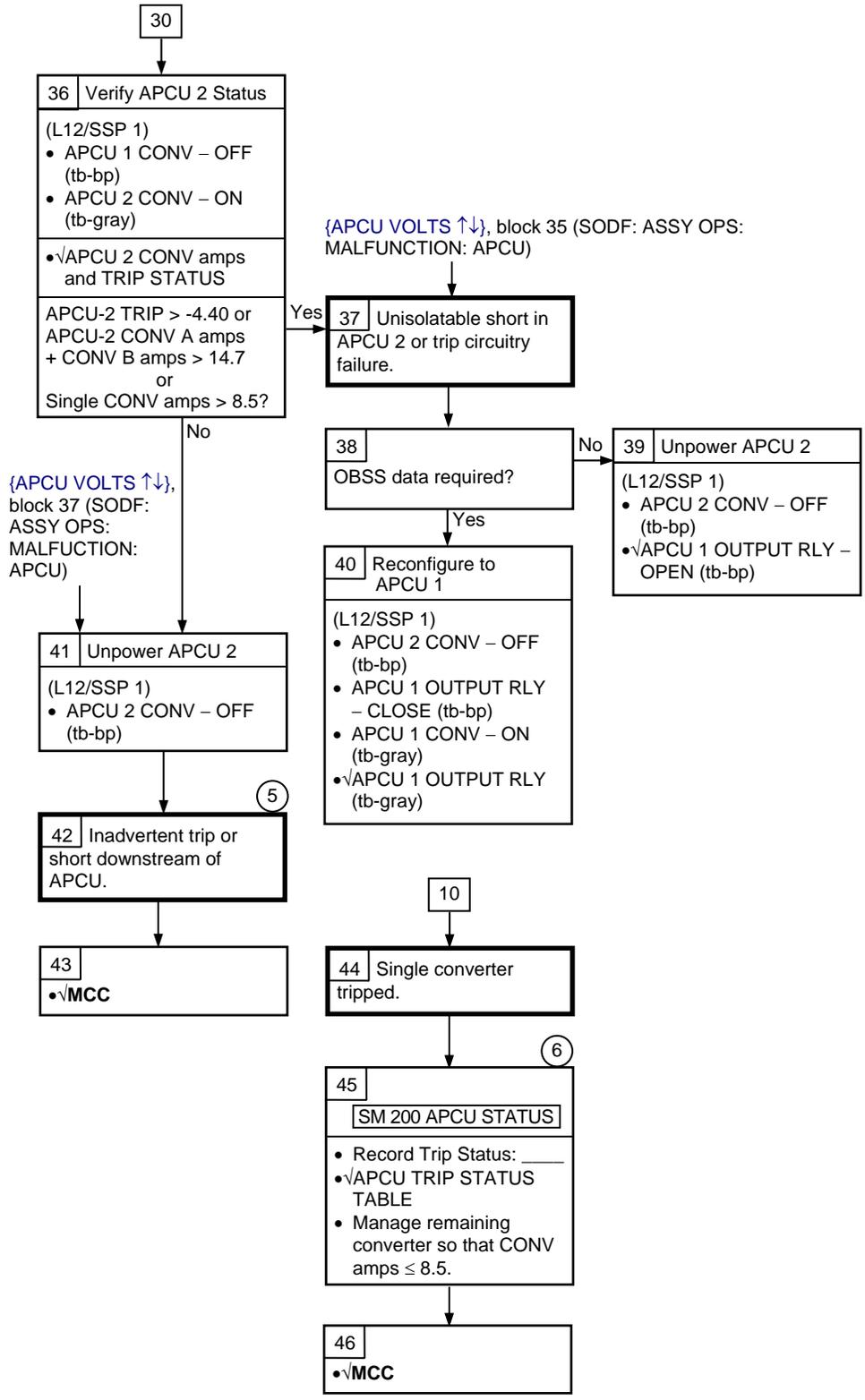
② **MCC** will coordinate recovery of the PRI PL bus and equipment.

③ Loss of APCU 1 output results in loss of orbiter 120V power LCS.

④ **MCC** will consider recovery actions. May activate downstream loads one at a time to find shorted load.



③
Loss of APCU 1 output results in loss of orbiter 120V power LCS.



5 MCC will consider recovery action.

6 APCU reconfiguration may be required for loads ≥ 8.5 amps.

Table 1. APCU Trip Status

TRIP (STATUS VOLTAGE)	TRIP CAUSE(S)			
	OV	OUV	OC	IUV
+4.88	X	X	X	X
+4.23	X	X	X	
+3.59	X	X		X
+2.95	X	X		
+2.27	X		X	X
+1.62	X		X	
+0.98	X			X
+0.34	X			
-0.30		X	X	X
-0.95		X	X	
-1.59		X		X
-2.23		X		
-2.91			X	X
-3.56			X	
-4.20				X
-4.86 (no trip)				

NOTE
 OV: Output Overvoltage
 OUV: Output Undervoltage
 OC: Output Overcurrent
 IUV: Input Undervoltage
 Tolerance for all reported voltages is $\pm 0.20V$

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APCU

APCU VOLTS \updownarrow (ASSY OPS/13A/FIN)

{APCU TEMP $\downarrow\uparrow$ }, block 4 (SODF: ASSY OPS: MALFUNCTION: APCU)

SM
ALERT

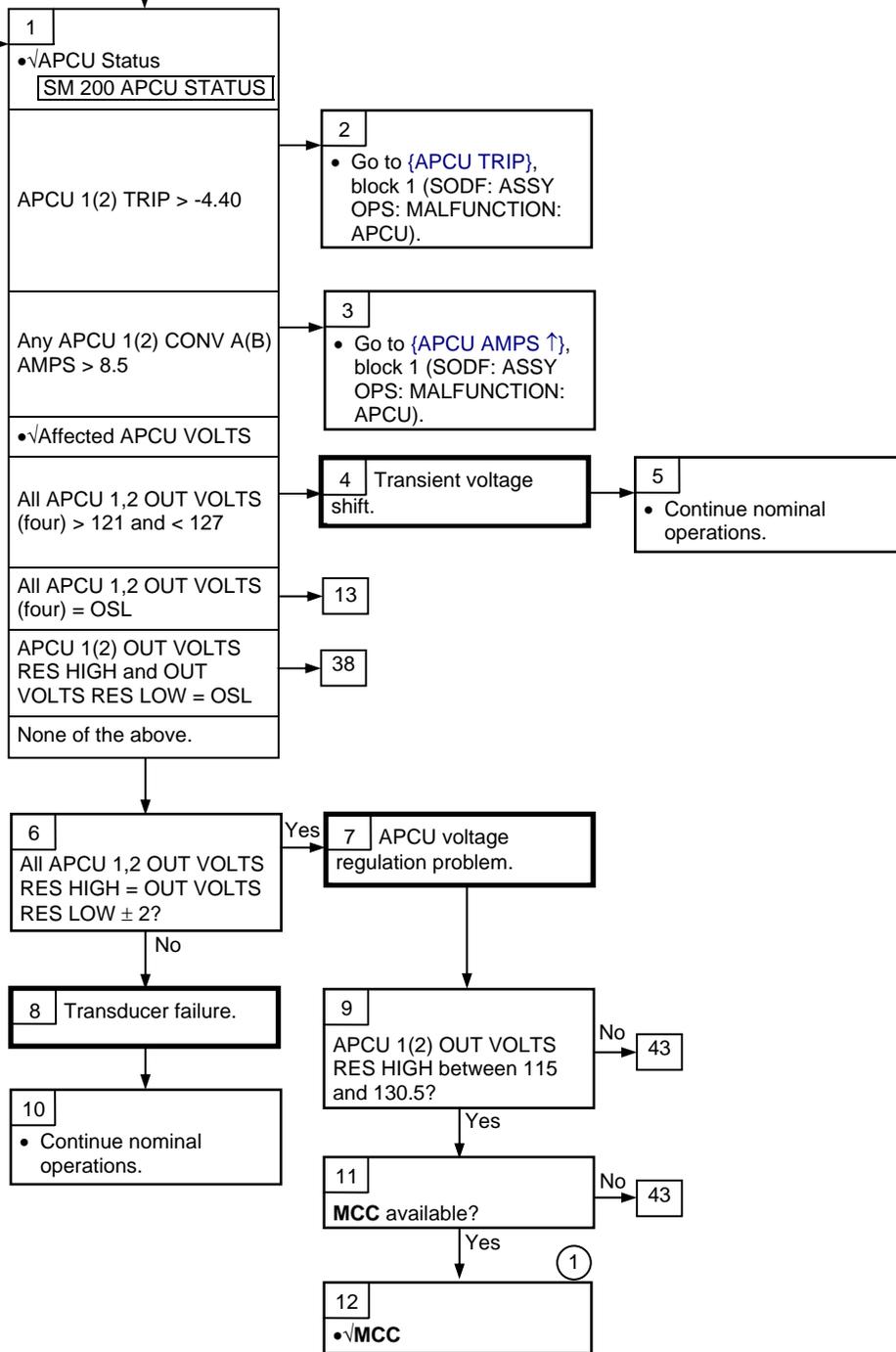
S200 APCU 1(2)
VOLT LMT

If: APCU VOLTS
RES HIGH \geq
126.5 or \leq 122

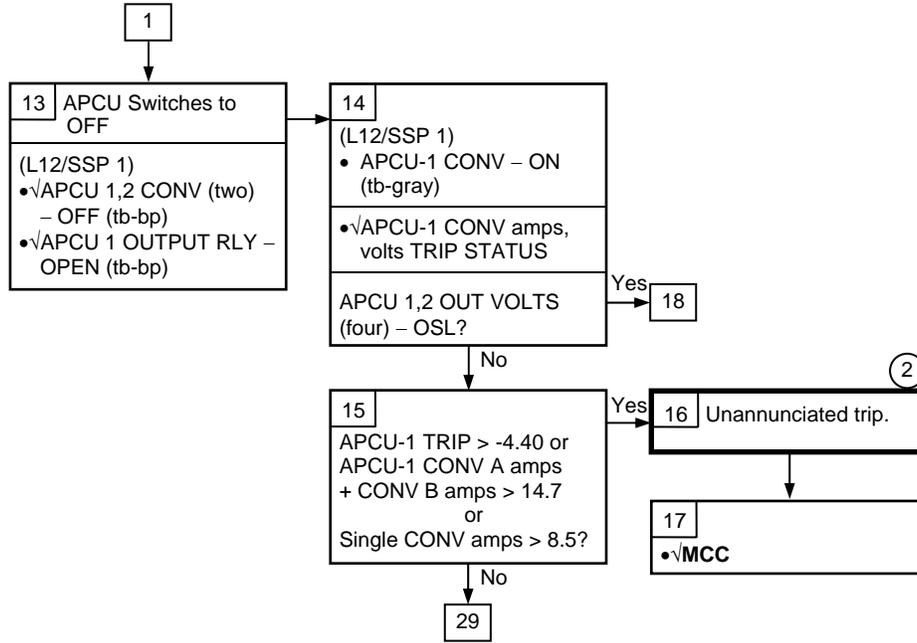
Nominal Config:
R1
PRI PL MNC – ON
(tb-ON)
PL CAB
– MNA(MNB)
PL AUX – ON
L12 (SSP 1)
cb SW PWR 1
– Close

**Nominal Single
APCU Config:**
L12 (SSP 1)
APCU 1(2) CONV
– ON (tb-gray)
APCU1 OUTPUT
RLY – CLOSE
(tb-gray)
APCU 2(1) CONV
– OFF (tb-gray)

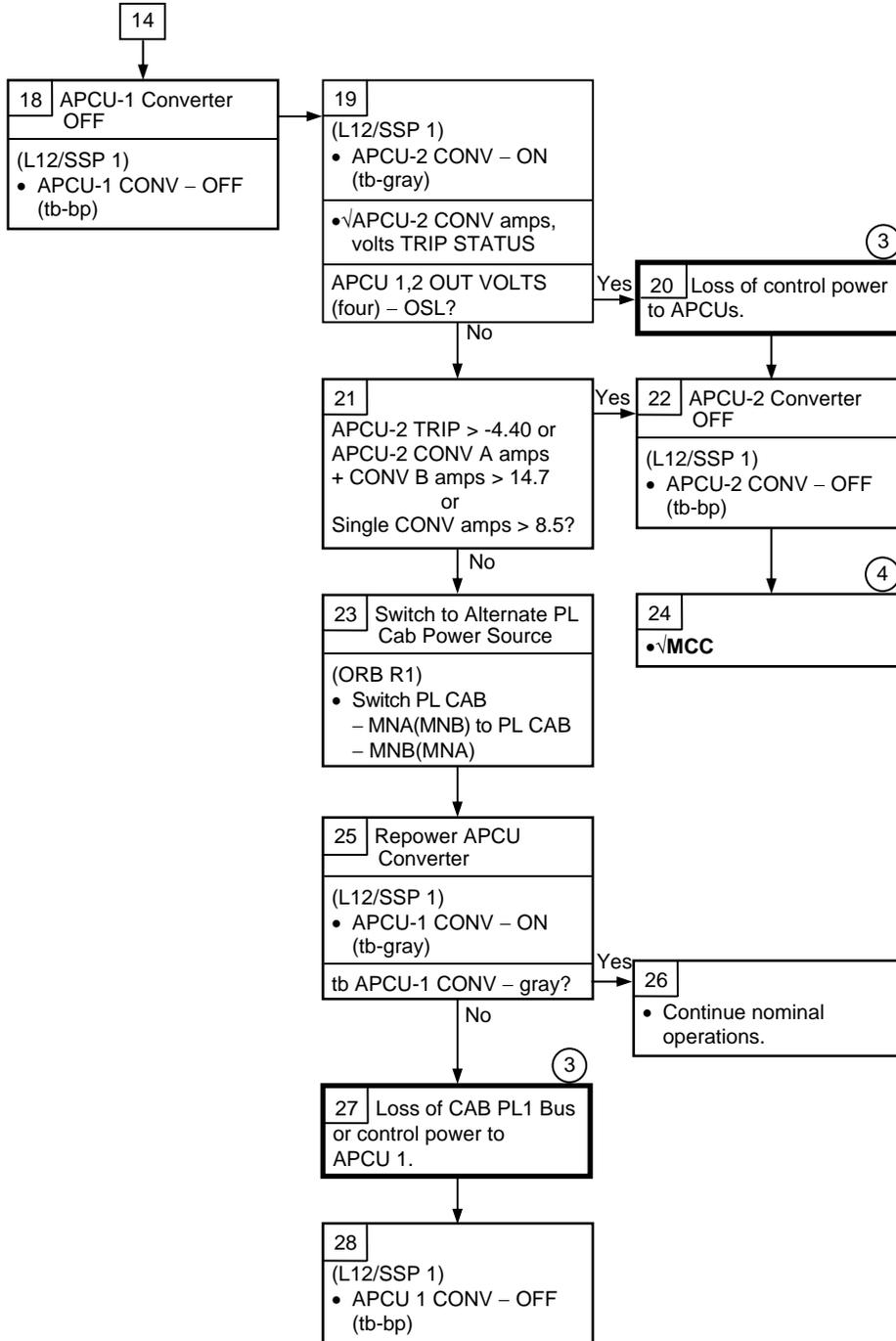
The APCUs are in a
parallel
configuration.
When either APCU
converter is turned
ON, both APCU
CONV talkbacks
will be gray
[tb APCU 1,2
CONV (two) - gray]



①
SPEC voltage for
APCU in the 120
volts mode is 122 to
126.5 volts. If
APCU volts are
outside this range
but stable and
usable,
consideration will be
given to continuing
APCU operation.

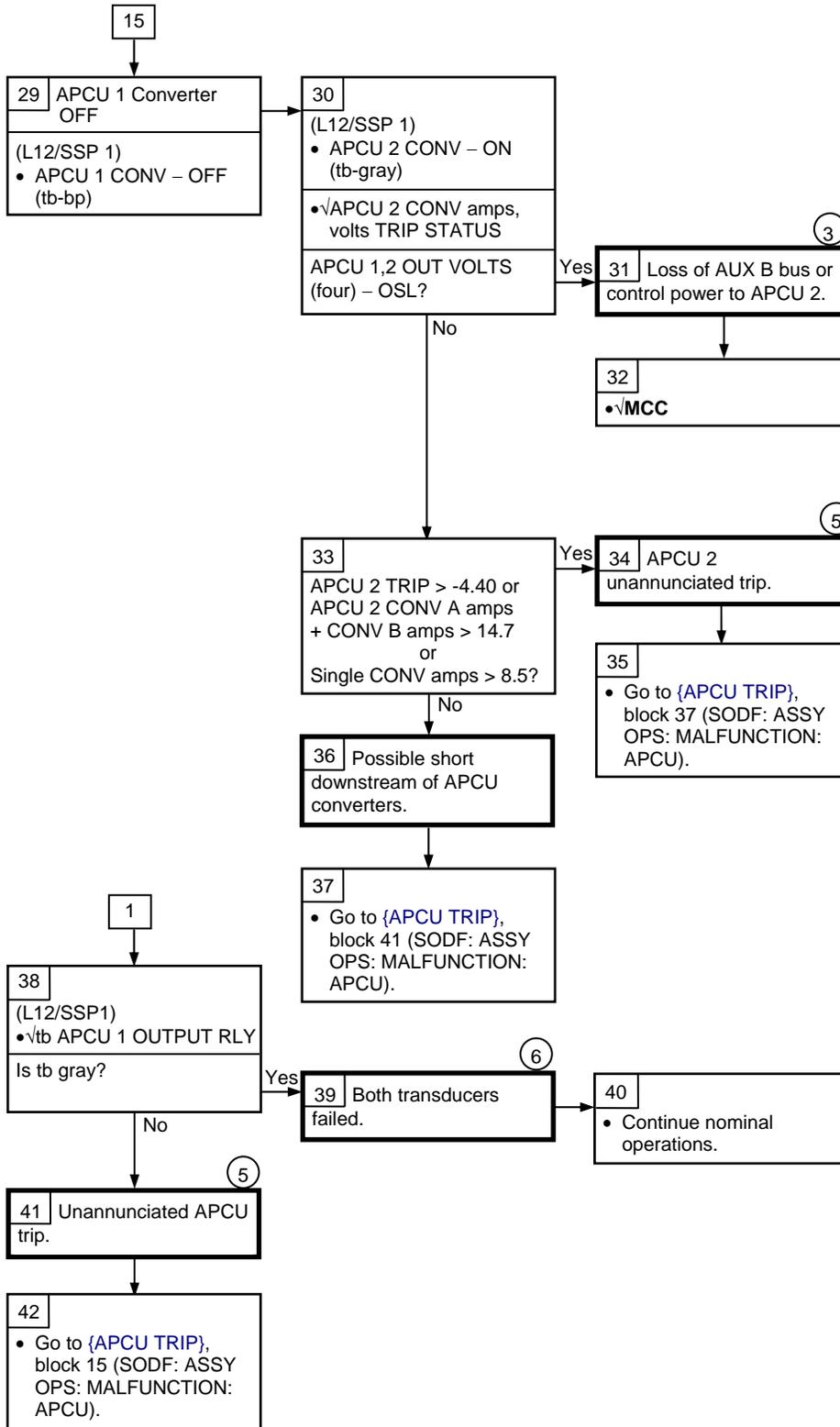


② APCU tripped but failed to set trip indicator (possible for a short circuit directly at the APCU output).



③ Loss of APCU 1 output results in loss of orbiter 120 V power to LCS/IDC.

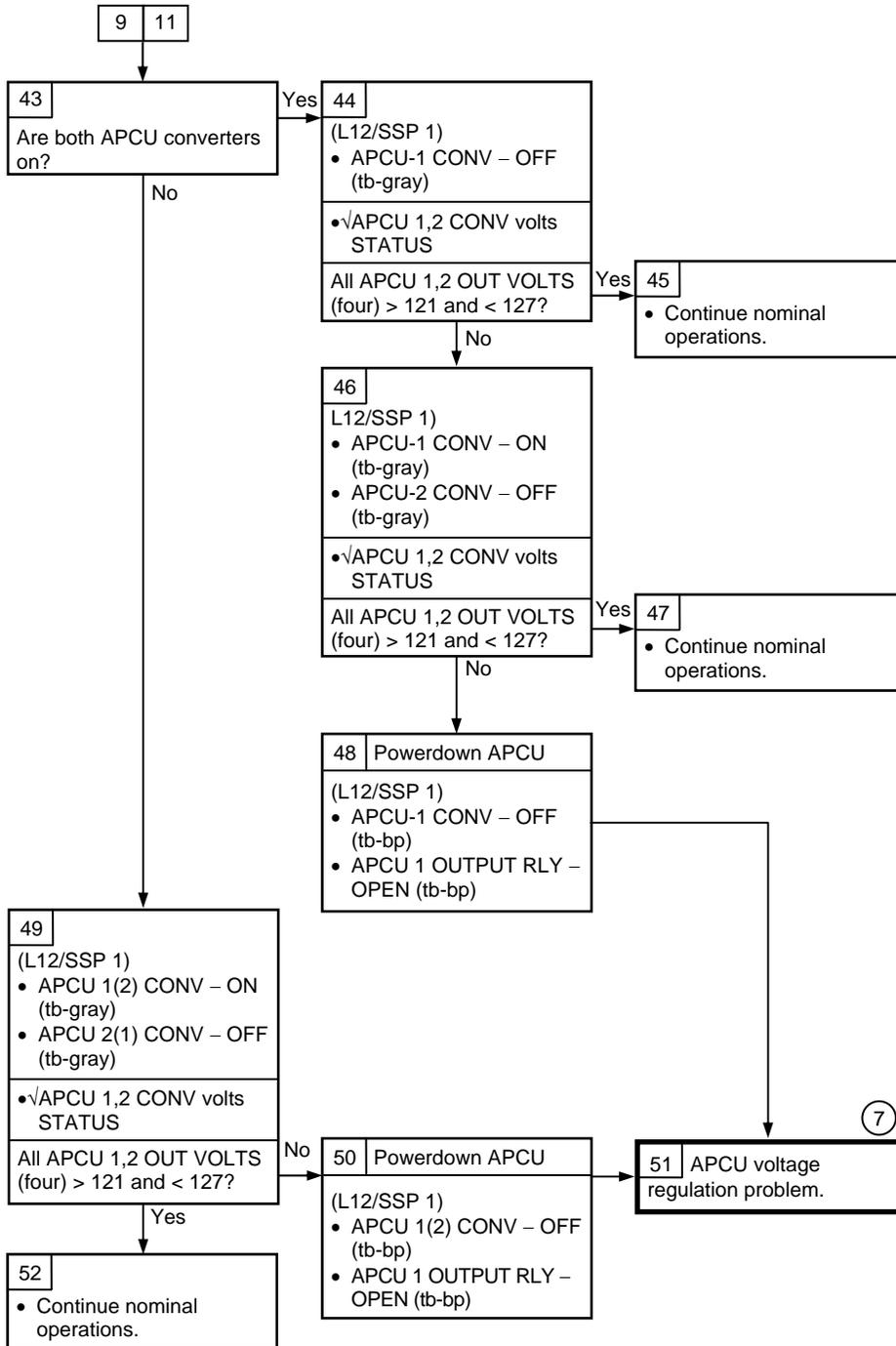
④ MCC will determine cause of the power interruption.



5 APCU tripped but failed to set trip indicator (possible for a short circuit directly at the APCU output).

3 Loss of APCU 1 output results in loss of orbiter 120 V power to LCS/IDC.

6 There is a single point failure that will cause both the HIGH and LOW RES VOLTS to read low (broken wire).

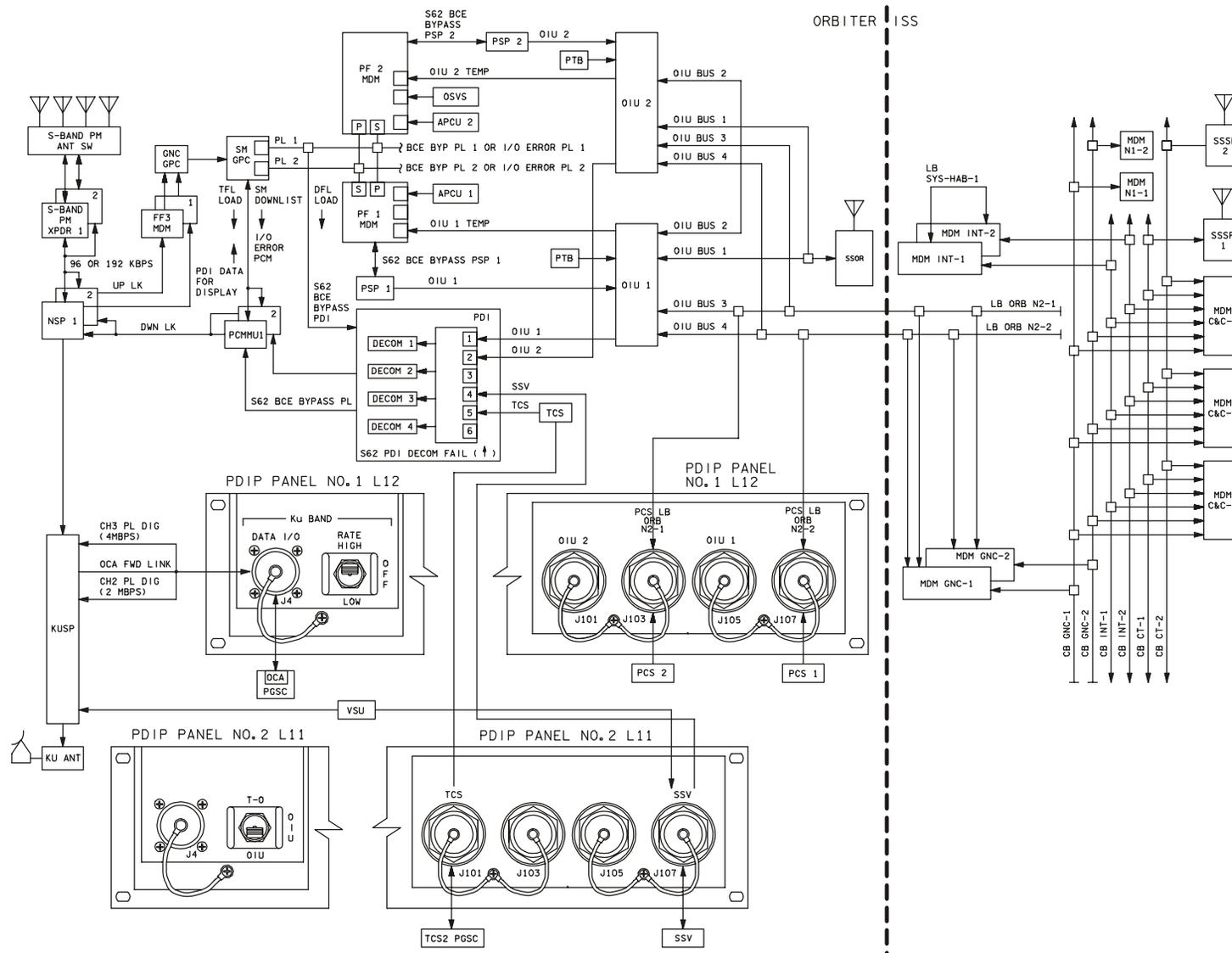


⑦
Loss of APCU 1 output results in loss of 120 V orbiter power to LCS/IDC. Loss of APCU 2 output is no impact.

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COMM MALFUNCTION POINTS

(ASSY OPS/13A/FIN 1) Page 1 of 1 page



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COMM

OIU FAIL TO COMMAND

(ASSY OPS/13A/FIN)

Page 1 of 3 pages

No Response to
OIU Configuration
or Routed
Commands

Nominal Config:

(A1L)
S-BD PL
CNTL – CMD
PWR SYS – 1
PWR SEL – PSP
PSP OUTPUT
– PL UMB

(SSP1)
OIU PWR – OIU 1(2)
ON
tb OIU – UP(DN)

(R1)
PL CAB
– MNA(MNB)
PL AUX – ON

1 Requesting PSP
Dummy CMDs

- MCC will uplink PSP
Dummy CMDs and verify
telemetry.
- √PSP Dummy CMD 2(1)
- √PSP CONFIG ID 2(1)
- √UMB #4(1)
- √No SM/PSP LOAD errors
- √PSP I/F to OIU OFF(ON)

MCC CMD successful?

2 Power Cycling PSP 1(2)

(A1L)

- √S-BD PL CNTL – CMD
- S-BD PL PWR SYS – OFF
- S-BD PL CNTL – PNL
- S-BD PL PWR SYS – 1(2)
- S-BD PL CNTL – CMD
- S-BD PL PWR SYS – OFF

- Expect 'S62 BCE BYP PSP 1(2)'
message.

SM 62 PCMMU/PL COMM

- I/O RESET PSP 1(2) – ITEM 6(7) EXEC

Yes

No

3

- √OIU CMD
- SM 212 OIU
- √BUS 2 A – ITEM 8 (*)
- √BUS 2 B – ITEM 9 EXEC
(*)

CMD successful?

Yes

No

4 Transient PSP 1(2)
failure.

5 Determining Current
OIU FMT

SM 212 OIU

- √FMT (ITEM 1), and
log: ____

6 Returning BUS 2 to
Nominal Configuration

SM 212 OIU

- BUS 2 A – ITEM 8 EXEC
(*)

7 Power Cycling OIU
1(2)

On MCC GO
(SSP1)

- OIU PWR – ctr, then
- OIU PWR – OIU 1(2): ON
- √OIU tb – UP(DN)

OIU FMT block 5 = 255?

1

No

8

- Continue nominal
operations.

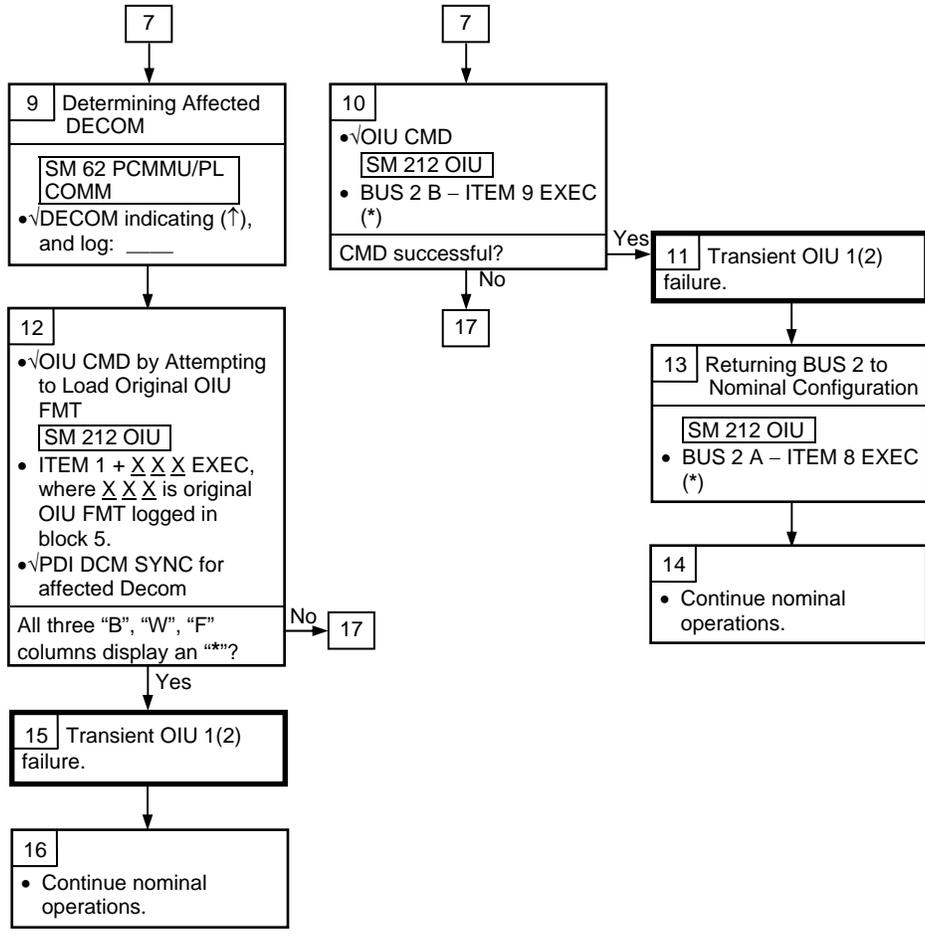
Yes

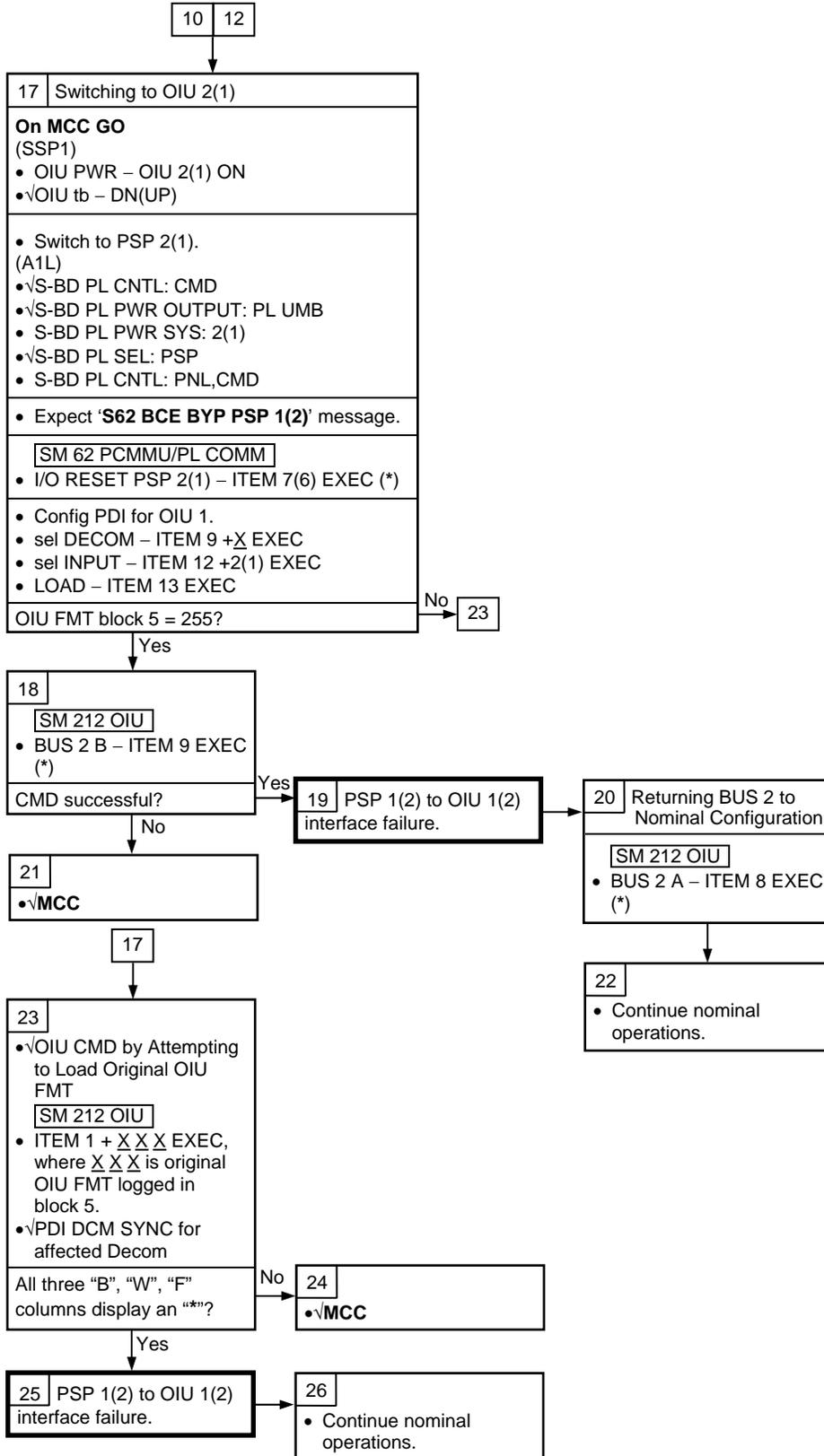
10

9

1

Power cycle will
place OIU in
Format 255. OIU
Station TLM will be
lost until OIU CMD
is recovered. OIU
H&S TLM will also
be lost if PDI is not
configured for OIU
FMT 255.





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ASSY OPS

OIU TEMP HIGH MALFUNCTION

(ASSY OPS/13A/FIN)

Page 1 of 1 page

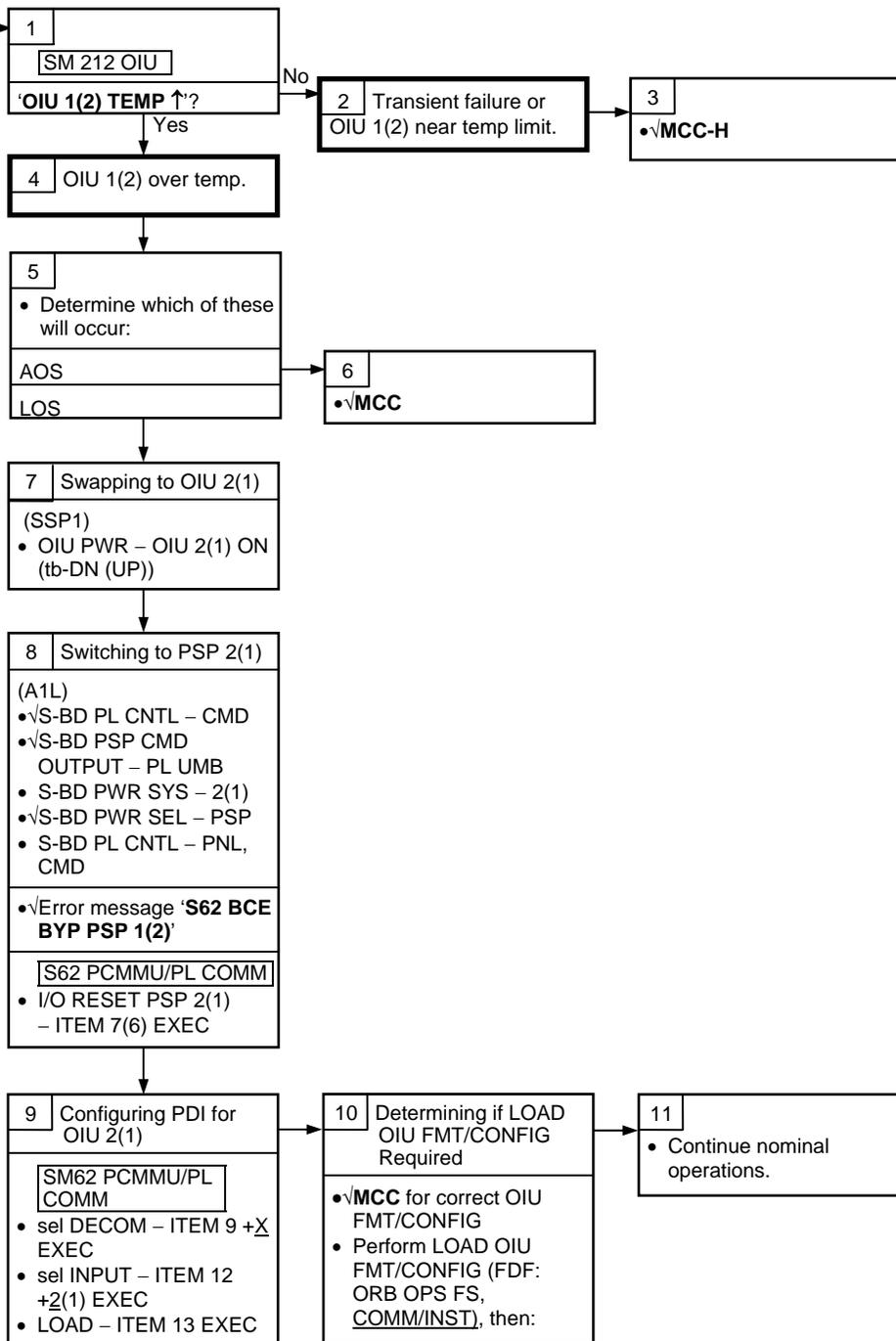
SM 212 OIU
TEMP

OIU message:
OIU TEMP > 212

Nominal Config:

(R1)
PL CAB
- MNA(MNB)
PL AUX - ON

(SSP 1)
OIU PWR - OIU 1(2)
ON
tb OIU - UP(DN)



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PL/DPS RECONFIGURATION

(ASSY OPS/13A/FIN)

Page 1 of 2 pages

Procedure	Secure Action	Recovery Action	Info
PL 1(2) MDM I/O ERROR; PL 1(2) MDM OUTPUT (FDF, ORB PKT, <u>DPS</u>)	N/A	N/A	A
5.3c I/O ERROR PL 1(2); MDM OUTPUT PL 1(2) (FDF, MAL, <u>DPS</u>)	N/A*	N/A	A
PASS SM GPC FAIL (FDF, ORB PKT, <u>DPS</u>)	N/A	D	B
GNC RECOVERY VIA G2FD (FDF, ORB PKT, <u>DPS</u>)	N/A	C,D	B
5.1a CS SPLIT(FDF, MAL, <u>DPS</u>)	N/A	C,D,E **	B
5.3g BCE BYP PL1(2) (FDF, MAL, <u>DPS</u>)	N/A*	N/A	A
GPC FRP-4 PASS RECOVERY AFTER BFS ENGAGE (ASCENT/ORBIT/ENTRY) (FDF, MAL, <u>DPS</u>)	N/A*	C,D	B
GPC FRP-7 DPS RECONFIG FOR LOSS OF AV BAY COOLING (FDF, MAL, <u>DPS</u>)	N/A*	C,D	B
DPS SSR-3 GNC REASSIGNMENT (FDF, MAL, <u>DPS</u>)	N/A*	N/A	B
DPS SSR-4 SM REASSIGNMENT (FDF, MAL, <u>DPS</u>)	N/A	C,D	B
ECLSS SSR-10 H2O PUMP OPS VIA GPC (FDF, MAL, <u>ECLSS</u>)	N/A	C,D,E**	B

*Note: Procedure does not call out PL/DPS RECONFIG, Secure

**Note: Procedure does not call out PL/DPS RECONFIG, Recovery

ACTION A

If '**I/O ERROR PL1**' message

Loss of ground and orbiter MCDS command interface to ISS via PSP 1/OIU 1.

For additional impacts, refer to [{ORBITER MDM LOSS IMPACTS}](#) (SODF: ASSY OPS: MALFUNCTION: CRITICAL EQUIPMENT LOSS).

If failure at IOP XMTR/RCVR at SM GPC

 If PL2 interface with SM GPC failed

 √**MCC** for SM GPC reassignment

 PF1 interface can be recovered by port moding PL 1/2 buses.

If '**I/O ERROR PL2**' message

Loss of ground and orbiter MCDS command interface to ISS via PSP 2/OIU 2.

For additional impacts, refer to [{ORBITER MDM LOSS IMPACTS}](#) (SODF: ASSY OPS: MALFUNCTION: CRITICAL EQUIPMENT LOSS).

If failure at IOP XMTR/RCVR at SM GPC

 If PL1 interface with SM GPC failed

 √**MCC** for SM GPC reassignment

 PF2 interface can be recovered by port moding PL 1/2 buses.

PL/DPS RECONFIGURATION

(ASSY OPS/13A/FIN)

Page 2 of 2 pages

ACTION B

If SM GPC affected

Note PL/ISS commanding via SM GPC (ground and orbiter MCDS) not possible until SM machine is restored and PL 1(2) MDM I/F is restored.

If GNC GPC affected

Ground commanding not possible until GNC machine is restored.

ACTION C

If PSP I/O reset not previously performed

SM 62 PCMMU/PL COMM

I/O RESET PSP 1(2) – ITEM 6(7) EXEC

Notify **MCC** when complete.

ACTION D

Reload PDI DECOM FORMAT (FDF, ORB OPS FS, COMM/INST).

As required, reenable PDI DECOM FDA.

Resume SPEC 62.

ACTION E

Reload PCMMU TFLs, load PCMMU FORMAT (FDF, ORB OPS FS, COMM/INST).

COMM

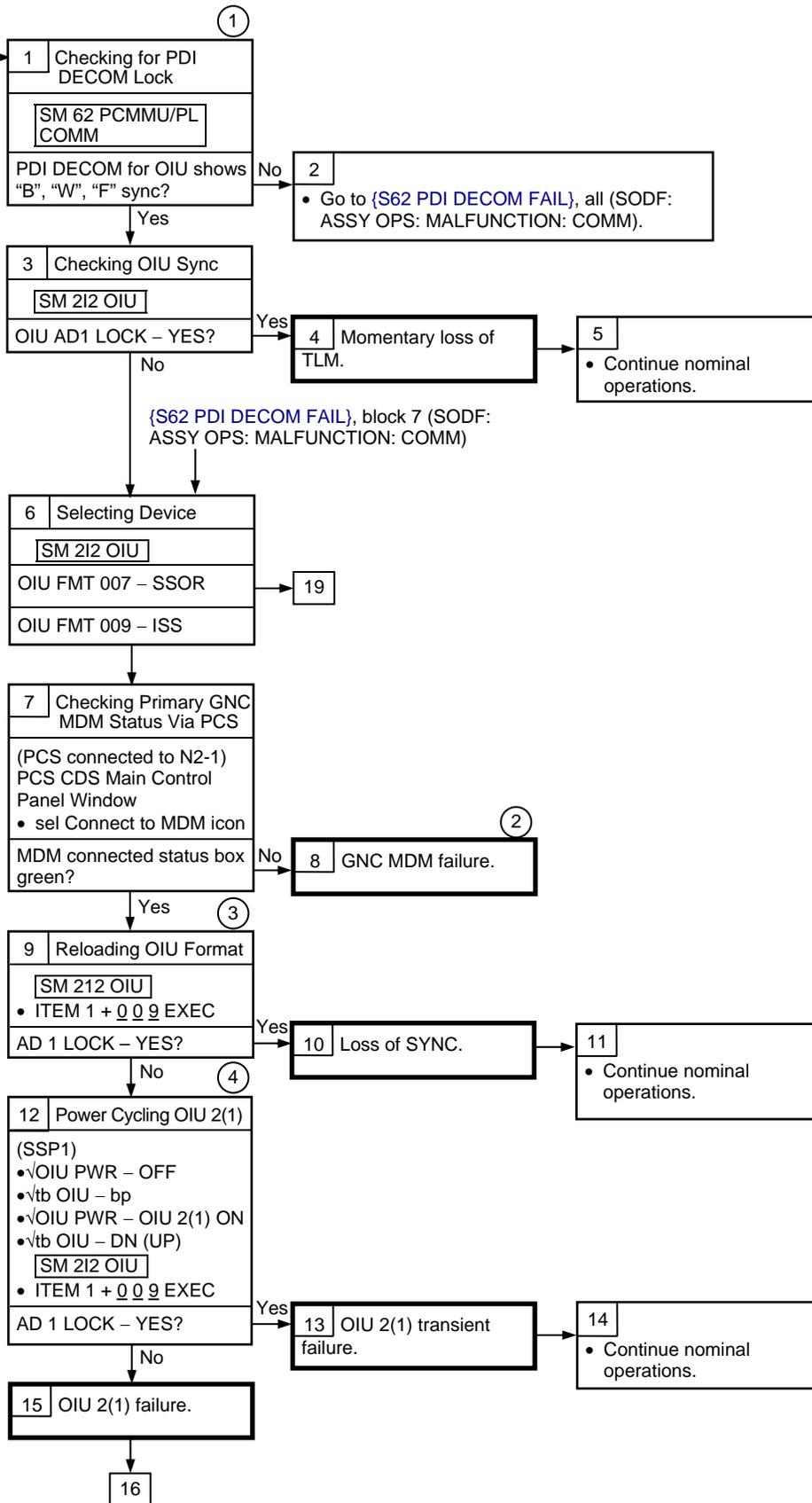
S212 OIU AD 1 NOLK/LOSS OF ISS OR SSOR TELEMETRY
(ASSY OPS/13A/FIN) Page 1 of 3 pages

SM ALERT

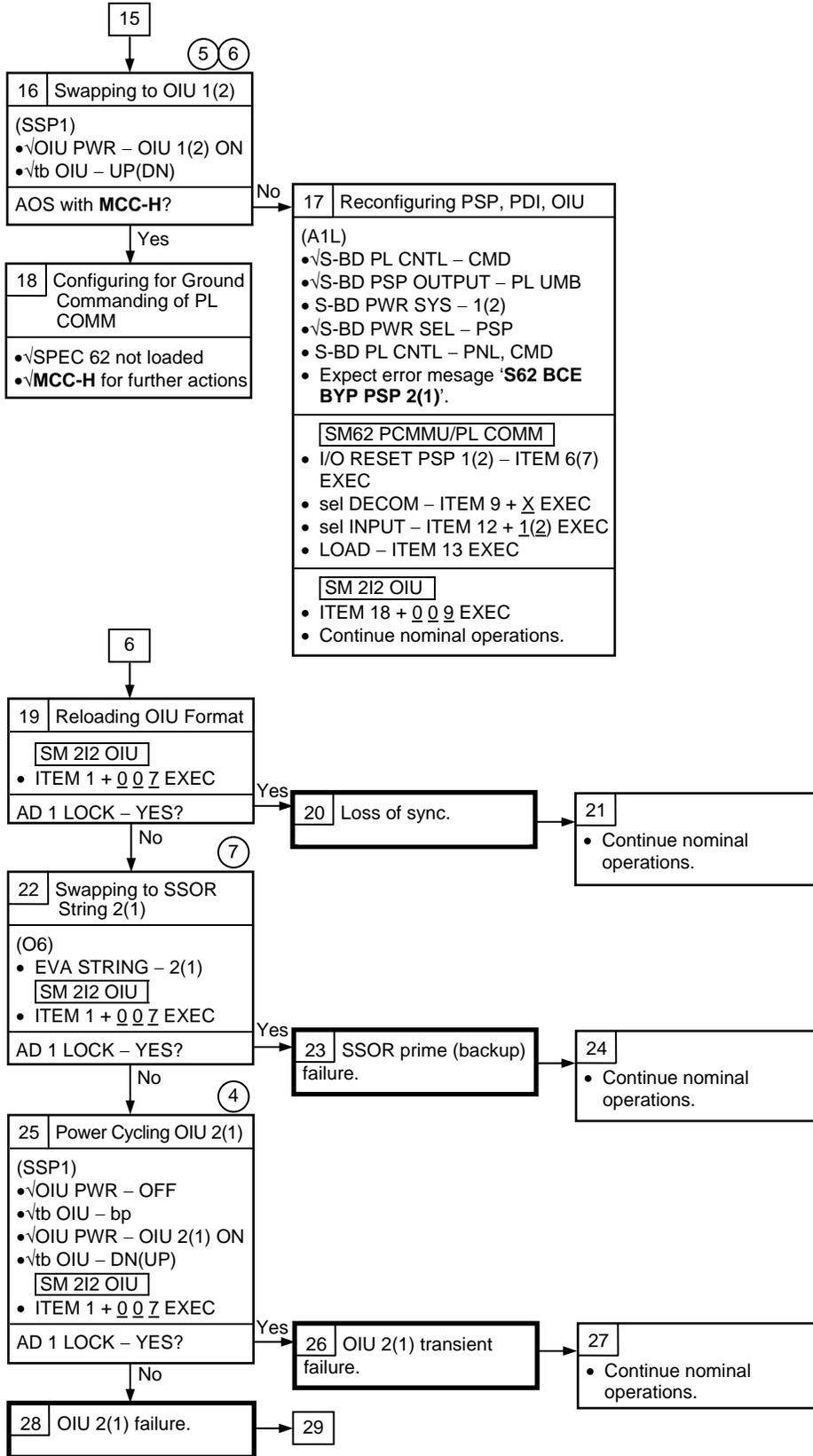
- S212 OIU AD1 NOLK
- Loss of Data On SPEC 205 During Undocking
- MCC-H Reports Loss of ISS Data To Ground Via OIU

Nominal Config:

- (R1)
- PL CAB
- MNB(MNA)
- PL AUX - ON (SSP1)
- OIU PWR
- OIU 2(1) ON
- tb OIU - DN(UP)
- For ISS:
- One PCS connected to Primary GNC MDM
- SM 212 OIU
- OIU FMT: 009
- For SSOR:
- (R14)
- cb MNA UHF EVA
- cl
- cb MNC UHF EVA
- cl
- (O6)
- EVA STRING: 1(2)
- UHF MODE - EVA
- SM 212 OIU
- OIU FMT - 007



- ① OIU to PDI problems would annunciate a 'S62 PDI DECOM FAIL' message if FDA enabled.
- ② MCC-H will likely direct STS or ISS crew to perform {3.301 LOSS OF PCS TELEMETRY} (SODF: POC: MALFUNCTION).
- ③ Reloading the OIU format forces a resync with the GNC MDM or SSOR.
- ④ OIU active device mapping occurs with format load.

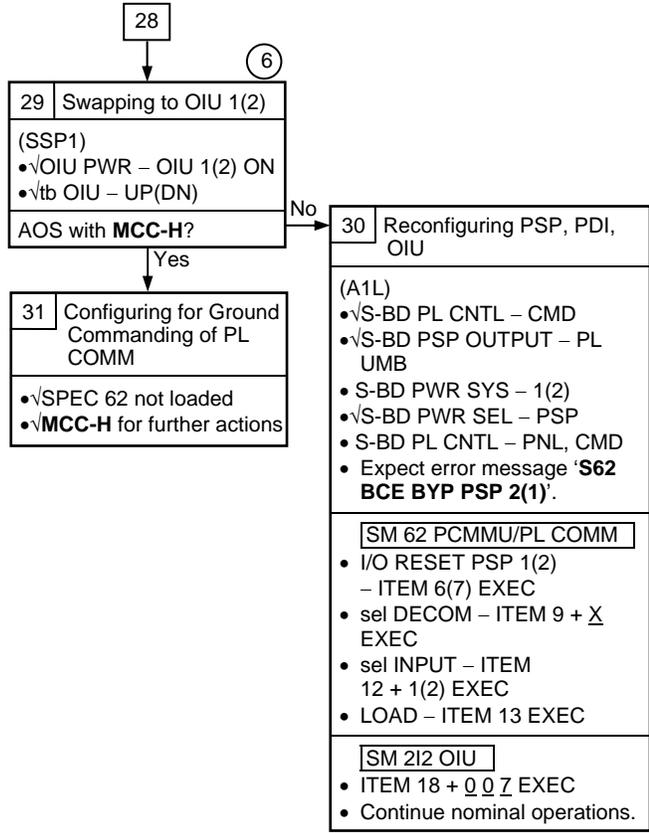


④ OIU active device mapping occurs with format load.

⑤ Malfunction restores operational capability; additional troubleshooting to determine BIA failure may be performed later.

⑥ OIU powerup config on OIU BUS 3 is RT on ch A.

⑦ Reloading the OIU format forces a resync with the SSOR.



⑥
 OIU powerup config on OIU BUS 3 is RT on ch A.

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COMM

SM
ALERT

S62 PDI DECOM FAIL

(ASSY OPS/13A/FIN) Page 1 of 2 pages

{S212 OIU AD 1 NOLK/LOSS OF ISS or SSOR TELEMETRY}, block 1 (SODF: ASSY OPS: MALFUNCTION: COMM) or 2.4g S62 PDI DECOM FAIL (FDF, MAL, COMM)

S62 PDI DECOM FAIL

1

1 Message accompanied by 'S62 BCE BYP PDI'?
Yes 2
• Go to 2.4e S62 BCE BYP PDI (FDF, MAL, COMM).

3 Determining Which DECOM FDA Indicating Fail
SM 62 PCMMU/PL COMM

PDI DECOM FDA 1(2, 3, 4) indicating fail (↑)?

6 AOS with MCC-H?

No Yes
21

4 SM 212 OIU
• OIU SYNC
AD 1 LOCK – YES?

7
• Go to {S212 OIU AD 1 NOLK/LOSS OF ISS OR SSOR TELEMETRY}, block 5 (SODF: ASSY OPS: MALFUNCTION: COMM).

5 Transient PDI DECOM failure.

8
• Continue nominal operations.

9 Reloading DECOM Indicating Fail
SM 62 PCMMU/PL COMM
• sel DECOM – ITEM 9 + X EXEC
• sel FMT – ITEM 10 + X X X EXEC
• Load – ITEM 11 EXEC
Load – CPL?

11 DECOM still indicating fail (↑)?

14 Selecting B/U DECOM Config (if Required)
• For alt PDI configuration, perform LOAD PDI DECOM FORMAT, all (FDF, ORB OPS FS, COMM/INST), then:
B/U DECOM indicating fail (↑)?

18 OIU to PDI I/F failure or OIU failure.

10 PDI DECOM failure.

12 Transient PDI DECOM memory failure.

15
• Continue nominal operations.

13 Selecting B/U DECOM Config (if Required)
• For alt PDI config, perform LOAD PDI DECOM FORMAT, all (FDF, ORB OPS FS, COMM/INST), then:
• Continue nominal operations.

16 PDI DECOM failure.

17 Load ALT PDI and PCMMU Configuration
• For alt PDI configuration, complete LOAD PDI DECOM FORMAT (FDF, ORB OPS FS, COMM/INST), then:
• For alt TFL, perform LOAD PCMMU FORMAT, all (FDF ORB OPS FS, COMM/INST), then:

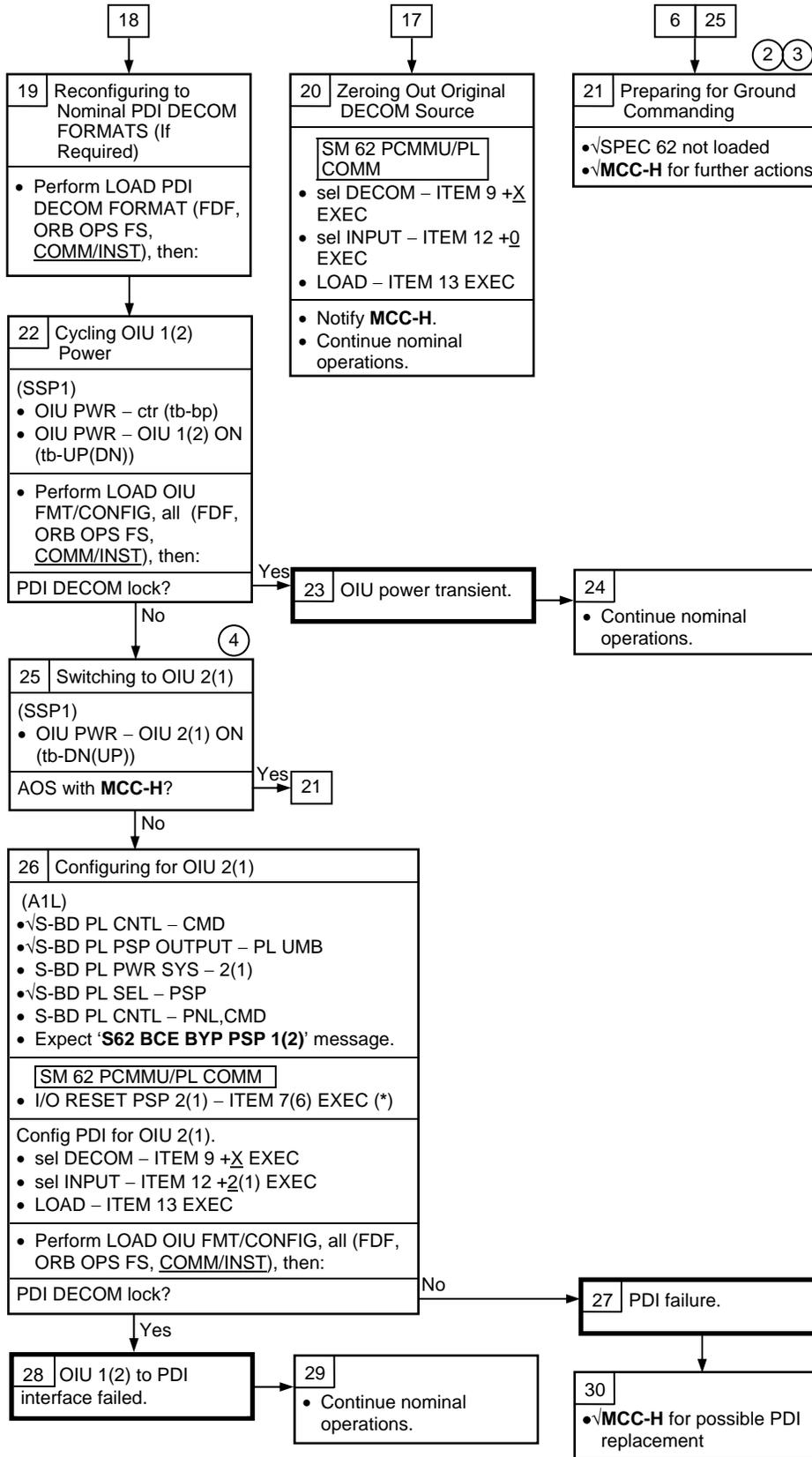
20

Nominal Config:
(A1L)
PL DATA INTLVR
PWR – ON

(R1)
PL CAB
– MNA(MNB)
PL AUX – ON

(SSP1)
OIU PWR – OIU 1(2)
ON
tb-UP(DN)

1
TCS and SSV not addressed in MAL; FDA not nominally enabled.



② For ground commanding of PL COMM system, SPEC 62 must not be loaded.

③ **MCC-H** can perform all PL COMM reconfig, except OIU PWR cycle and swap steps.

④ Alternate (OIU 1) requires PSP 1.

ORBITER ELECTRICAL BUS LOSS MATRIX

(ASSY OPS/13A/FIN 1) Page 1 of 2 pages

Table 1. Orbiter Electrical Bus Loss Matrix

ORBITER ELECTRICAL BUSES →	FC1		FC2		FC3	MNA DA1						MNB DA2						FC3	MNC DA3				MNC FPC3				
	ESS 1BC		ESS 2CA		ESS 3AB	R14	O14	A6&A14		MPC1		MPC2		A6&A14	APC5	FPC2	O15	R15	MAR1*	MAR2*	(R)	(R)	P	O16	R14	APC6	AC3
	O13&R15	O13&R15						AUX PLA	P	(R)	AUX PLB			APC2	AC2							PRI PL			APC3	A15	
									CABIN PL					AFT PLB	φA										AFT PLC	ACφC	
								PL1	PL2	PL3																	
ORBITER EQUIPMENT AND CARGO																											
APCU 1 Conv																											
APCU 2 Conv																											
OIU 1																											
OIU 2																											
ODS X1 Connector Mate Tlm/Pwr																											
ODS X2 Connector Mate Tlm/Pwr																											
TCS																											
Pri C/L Camera																											
Sec C/L Camera																											
PDIP #1																											
PDIP #2																											
Video Processing Unit																											
Payload Timing Buffer																											
OPP																											
PRIME PCS (Orbiter)																											
RSC Cam (Camera Htr/Illum/pwr)																											
SSOR																											
DTV MUX																											
ISS EQUIPMENT																											
PMA 2/3 Hooks -SYS A																											
PMA 2/3 Hooks -SYS B																											
PAYLOAD BUS CNTL PWR																											
CABIN PL MNA																											
CABIN PL MNB																											
AUX PLA																											
AUX PLB																											
PL PRI MNB																											
PL PRI MNC																											
PL PRI FC3																											
AFT PLB																											
AFT PLC																											

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X = Total loss of operational power
P = Loss of primary power source
R = Loss of redundant power source
(R) = Requires action to use redundant source
XC = Total loss of CNTL power
XRC = Loss of redundant CNTL power
*- CNTL bus name identifies power source (ex: CNTL BC1 is powered by MNB & MNC through RPCs and by MNA through cb and fuse)

ORBITER ELECTRICAL BUS LOSS MATRIX

(ASSY OPS/13A/FIN 1) Page 2 of 2 pages

Table 2. Orbiter Electrical Bus Loss Matrix (PRLA)

ORBITER ELECTRICAL BUSES→	MNA DA1		CNTL BUS*						MNB DA2	
	FPC1	PNL A6&A14	AB1	AB2	BC1	BC2	CA1	CA2	FPC2	PNL A6&A14
	AC1								AC2	
PRLA-PAYLOAD RETENTION LATCHES										
PRLA PL 1, 2, & 3- Latch 1/Sys A, 2/A, 3/A, 4/A, 5/A DC Logic Pwr		X								
PRLA PL 1, 2, & 3- Latch 1/Sys A, 2/A, 3/A, 4/A, 5/A Cntl Bus			XC							
PRLA PL 1, 2, & 3- Latch 1/Sys A, 2/A, 3/A, 4/A, 5/A AC Mech Pwr	X									
PRLA PL 1, 2, & 3- Latch 1/Sys B, 2/B, 3/B, 4/B, 5/B DC Logic Pwr										X
PRLA PL 1, 2, & 3- Latch 1/Sys B, 2/B, 3/B, 4/B, 5/B Cntl Bus					XC					
PRLA PL 1, 2, & 3- Latch 1/Sys B, 2/B, 3/B, 4/B, 5/B AC Mech Pwr									X	
Logic Pwr Sys 1		X								
Logic Pwr Sys 2										X
PL Bay Mech Pwr Sys 1	X		XRC	XRC			XRC	XRC		
PL Bay Mech Pwr Sys 2					XRC	XRC			X	

X = Total loss of operational power

P = Loss of primary power source

R = Loss of redundant power source

(R) = Requires action to use redundant source

XC = Total loss of CNTL power

XRC = Loss of redundant CNTL power

*- CNTL bus name identifies power source (ex: CNTL BC1 is powered by MNB & MNC through RPCs and by MNA through cb and fuse)

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Table 3. Payload Retention Usage

Payload	Latch	PL SEL	Latch Use	Latch Location
S3/S4 Truss	1	1	Latch/Release	Latch 1
	2	1	Latch/Release	Latch 2
	3	1	Latch/Release	Latch 3
	4	1	Latch/Release	Latch 4
	5	1	Not Used	
	1	2	Latch/Release	Keel Latch 1
	2	2	Latch/Release	Keel Latch 2
	3	2	Not Used	
	4	2	Not Used	
	5	2	Not Used	

ORBITER MDM LOSS IMPACTS

(ASSY OPS/13A/FIN)

Page 1 of 2 pages

FF1	Uplink through NSP 1 (secondary)
FF3	Uplink through NSP 2 (primary)
PF1	ISS Primary command path (via PSP 1 – UMB 1/OIU 1) APCU 1 telemetry OIU 1 telemetry (PDI TELEMETRY 1) input DIH ODS X2/PMA2 X1 connector mate telemetry – <u>1 4</u> input DIH ODS X1/PMA2 X2 connector mate telemetry – <u>1 5</u>
PF2	ISS Redundant command path (via PSP 2 – UMB 1/OIU 2) APCU 2 telemetry OIU 2 telemetry (PDI TELEMETRY 2) OSVS Interface input DIH ODS X1/PMA2 X2 connector mate telemetry – <u>0 8</u> input DIH ODS X2/PMA2 X1 connector mate telemetry – <u>0 9</u>
OF1	PCMMU 1 – mode select telemetry PCMMU 1,2 – ON/OFF power telemetry PCMMU 1,2 – RPC A telemetry PL AUX A – RPC ON/OFF telemetry MID MCA 1 OP STATUS 1, 2, 3, 4 telemetry MID MCA 3 OP STATUS 1, 2, 3, 4 telemetry PL BAY MECH PWR SYS 1, 2 telemetry PL RETEN LOGIC PWR SYS 1, 2 telemetry PRLA PL SEL 2: Latch/System 2B, 3B, 4B, 5B R-F-L, LAT, REL telemetry PRLA PL SEL 3: Latch/System 1B, 2B, 3B, 4B, 5B R-F-L, LAT, REL telemetry
OF2	PSP 1,2 – bit and frame sync PCMMU 2 – mode select telemetry PCMMU 2 RPC B telemetry PL AUX B – RPC ON/OFF telemetry MID MCA 1 OP STATUS 5, 6 telemetry MID MCA 3 OP STATUS 5, 6, 7, 8 telemetry PRLA PL SEL 1: Latch/System 1B, 2B, 3B, 4B, 5B R-F-L, LAT, REL telemetry PRLA PL SEL 2: Latch/System 1B, 5A R-F-L, LAT, REL telemetry PRLA PL SEL 3: Latch/System 1A, 2A, 3A, 4A, 5A R-F-L, LAT, REL telemetry PRLA PL SEL 1, 2, 3: System A REL and LAT command state telemetry

ORBITER MDM LOSS IMPACTS

(ASSY OPS/13A/FIN)

Page 2 of 2 pages

- OF3 Orbiter Comm system telemetry (refer to OI MDM/DSC Failure Impacts)
PL PRI MNC, MNB, FC3 – ON/OFF telemetry
PCMMU 1 RPC B telemetry
- OF4 Ku-Band – RADAR mode and output power
S-Band, Ku-Band – PNL/CMD switch position
PSP, GCIL – ON/OFF telemetry
ORBITER Comm system telemetry (refer to OI MDM/DSC Failure
Impacts)
CAB PL (MNA, MNB), PL AUX – ON/OFF telemetry
PRLA PL SEL 2:
 Latch/System 2A, 3A, 4A
 R-F-L, LAT, REL telemetry
- OA1 ODS X4/PMA X3 connector mate telemetry
PMA 2/3 GRP 1 passive hooks (1,3,5,7,9,11) Close telemetry
- DSC OA1 ODS X4/PMA X3 connector mate telemetry
PMA 2/3 GRP 1 passive hooks (1,3,5,7,9,11) Close telemetry
- OA2 AFT PL MNB PWR ON telemetry
AFT PL MNB amps
ODS X3/PMA X4 connector mate telemetry
PMA 2/3 GRP 2 passive hooks (2,4,6,8,10,12) Close telemetry
- DSC OA2 ODS X3/PMA X4 connector mate telemetry
PMA 2/3 GRP 2 passive hooks (2,4,6,8,10,12) Close telemetry
- OA3 AFT PL MNC PWR ON telemetry
AFT PL MNC amps
PRLA PL SEL 1:
 Latch/System 1A, 2A, 3A, 4A, 5A
 R-F-L, LAT, REL telemetry
PRLA PL SEL 2:
 Latch/System 1A
 R-F-L, LAT, REL telemetry

REFERENCE

REFERENCE

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SPEC 200 APCU STATUS

(ASSY OPS/13A/FIN)

Page 1 of 3 pages

This display monitors health and status of the two APCUs and is available in SM OPS 2. The APCUs are used to power the joint airlock Launch To Activation (LTA) heaters while the element is in the PLB. The display is generic and has been used on several missions. Figure 1 is a view of this display.

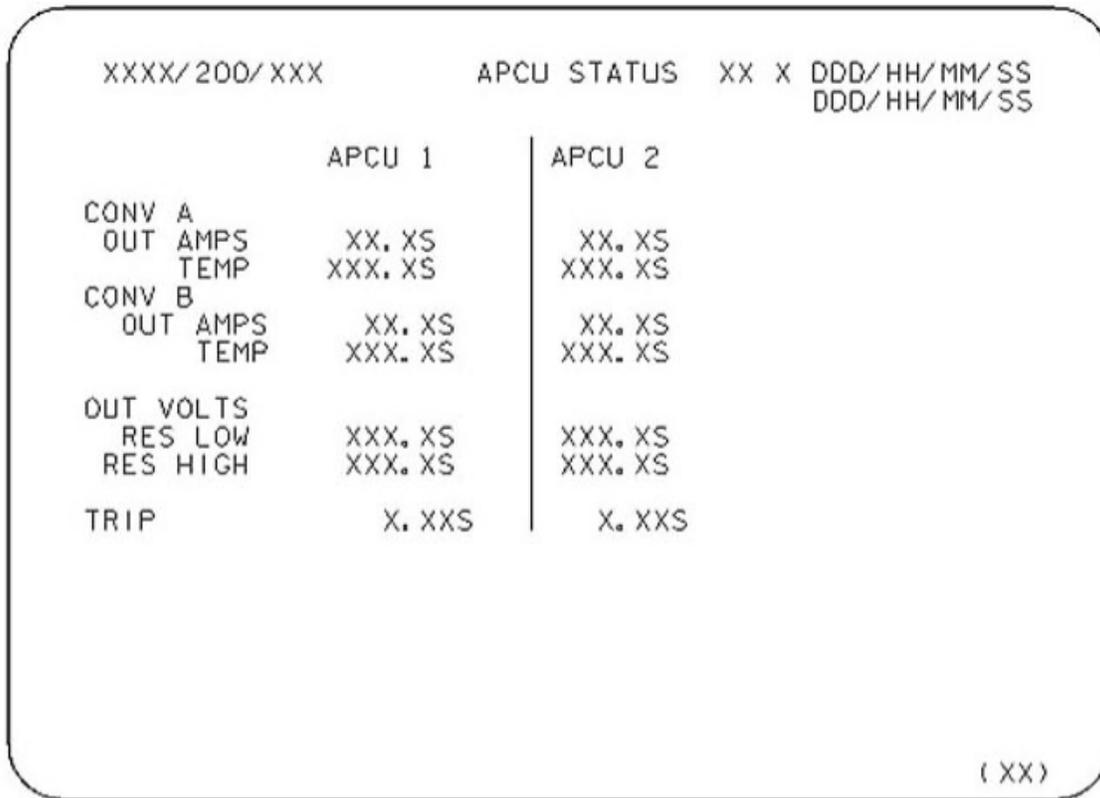


Figure 1.- APCU Status - MCDS Display.

TITLE: APCU STATUS

TYPE: SPEC 200

SPEC 200 APCU STATUS

(ASSY OPS/13A/FIN)

PARAMETER CHARACTERISTICS

Table 1. Parameter Characteristics

CRT NAME	MSID	UNITS	DISPLAY RANGE	STATUS IND [3]					FDA LIMITS	
				M	H	L	↑	↓	LO	HI
APCU 1 CONV A OUT AMPS	P50C9003V	amps	0 to 12.0	M	H	L	↑			8.5
APCU 1 CONV A TEMP	P50T9002V	deg F	0 to 212.0	M	H	L	↑	↓	20	130
APCU 1 CONV B OUT AMPS	P50C9004V	amps	0 to 12.0	M	H	L	↑			8.5
APCU 1 CONV B TEMP	P50T9005V	deg F	0 to 212.0	M	H	L	↑	↓	20	130
APCU 1 OUT VOLTS RES LOW [1]	P50V9001V	volts	0 to 180.0	M	H	L				
APCU 1 OUT VOLTS RES HIGH [1]	P50V9000V	volts	110 to 160.0	M	H	L	↑	↓	122	126.5
APCU 1 TRIP [2]	P50V9006V	volts	-5.00 to 5.00	M	H	L	↑			-4.40
APCU 2 CONV A OUT AMPS	P50C9009V	amps	0 to 12.0	M	H	L	↑			8.5
APCU 2 CONV A TEMP	P50T9010V	deg F	0 to 212.0	M	H	L	↑	↓	20	130
APCU 2 CONV B OUT AMPS	P50C9011V	amps	0 to 12.0	M	H	L	↑			8.5
APCU 2 CONV B TEMP	P50T9012V	deg F	0 to 212.0	M	H	L	↑	↓	20	130
APCU 2 OUT VOLTS RES LOW [1]	P50V9007V	volts	0 to 180.0	M	H	L				
APCU 2 OUT VOLTS RES HIGH [1]	P50V9008V	volts	110 to 160.0	M	H	L	↑	↓	122	126.5
APCU 2 TRIP [2]	P50V9013V	volts	-5.00 to 5.00	M	H	L	↑			-4.40

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SPEC 200 APCU STATUS

(ASSY OPS/13A/FIN)

Page 3 of 3 pages

REMARKS

- [1] OUT VOLTS LOW displays the measurements from the low-resolution voltage sensor. OUT VOLTS HIGH displays the measurements from the high-resolution voltage sensor.
- [2] APCU TRIP indicates the status of the APCU shutdown logic. This status can be interpreted using Table 2.

Table 2

TRIP (STATUS VOLTAGE)	TRIP CAUSE(S)			
	OV	OUV	OC	IUV
+4.88	X	X	X	X
+4.23	X	X	X	
+3.59	X	X		X
+2.95	X	X		
+2.27	X		X	X
+1.62	X		X	
+0.98	X			X
+0.34	X			
-0.30		X	X	X
-0.95		X	X	
-1.59		X		X
-2.23		X		
-2.91			X	X
-3.56			X	
-4.20				X
-4.86 (no trip)				

NOTES
OV: Output Overvoltage
OUV: Output Undervoltage
OC: Output Overcurrent
IUV: Input Undervoltage
Tolerance for all reported voltages is 0.20 V.

- [3] The parameter status field for all parameters will be blank for normal operation or will display an "M" for missing data. For analog parameters, this field will also display an "H" or "L" for offscale data. Some parameters displayed will be limit-sensed for SM alerts or C&W alarms. For discretes that are limit-sensed, the undesirable state is defined in the FDA low limit field and the FDA high limit field is left blank. Satisfaction of the undesirable state triggers a "↓" indication. For analogs that are limit-sensed, an "↑" or a "↓" will be displayed when the parameter exceeds either an upper or lower limit. The symbols driven in the parameter status field have the following display priority from highest to lowest: 'M', "H", "L", "↑", "↓". All symbols driven in the parameter status column will be displayed four times the normal intensity.

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XXXX/205/XXX		ISS MCS MODING		XX X	DDD/HH:MM:SS
					DDD/HH:MM:SS
STATUS			CONTINGENCY DOCKING		
US GNC MODE	XXXXXXXX	DOCK SOFTWARE ENA			10
RS GNC MODE	XXXXXXXX	SEQUENCE INIT			11X
US/RS GNC COMM	XXXX	CONTINGENCY UNDOCKING			
GNC MDM FRAME COUNT	XX	POST DEP CNTL MODE		XXXXXXXX	
US PRI GNC MDM	XXXXS	UNDOCK SOFTWARE ENA			12
CMG ATT CNTL	XXXXS	SEQUENCE INIT			13X
REROUTE TO SSOR	1	TIME SINCE SEP			XXX
ROUTE NORM HARDLINE	2	OFF NOMINAL COMMANDS			
NO OP COMMAND	3 XXX	INCORP MASS PROP			14
¹⁵ INHIBITS ENA INH		DOCKED IND			15X
MODE XTION	4 8 XXX	UNDOCKED IND			16X
ATT MNVR	5 XXX	HOLD CURRENT ATTITUDE			17
DESAT REQ	6 XXX	RS TAKE LVLH ATT CNTL			18
ATT CNTL SHDN	7 XXX	HANDOVER CNTL TO ISS			
²⁰ HANDOVER CNTL TO ORB		RS PREP FOR CMG DESAT			19
US DRIFT AVAIL	XXX	THRSTR AVAIL FOR DESAT			XXX
MODE TO DRIFT	9	MODE TO CMG TA			20
²⁵					(XX)

Figure 1.- ISS MCS Moding Display - SPEC 205.

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For 12A thru 10A, there is no planned use of this display. For all flights after 10A, the purpose of this display is to allow the orbiter crew to command the ISS at dock and undock and provide the capability to execute the attitude control handover procedures. Specifically, the orbiter crew can command the ISS to free drift upon contact, or to activate attitude control upon separation. The orbiter crew could command at dock and undock from this display starting at 12A, however there is full redundancy in the ISS MCS moding system at that point until the redundancy is removed during Stage 10A. Stage 10A places Node 2 between the Lab and PMA2, and Node 2 does not contain any automatic ACS Moding wiring for undocking and only one string for docking, as opposed to two strings for each prior to Node 2.

For the capability of executing the attitude control handover procedures, the communication link will nominally be through the OIU / GNC Hardline. Therefore, all the commands on Spec 205 have a routing code for the OIU / GNC Hardline. For commanding the ISS at dock and undock, the communication link will nominally be through the SSOR. Since all the Spec 205 commands have a routing code through the OIU / GNC Hardline, the orbiter crew will send a reroute command that reroutes all Hardline commands to the SSOR.

PARAMETER CHARACTERISTICS

Table 1.

CRT NAME	MSID	UNITS	DISPLAY RANGE	STATUS IND					FDA LIMITS	
				M	H	L	↑	↓	LO	HI
STATUS [1]										
US GNC MODE [2]	P79X0845E P79X0846E P79X0847E	text	Refer to remarks							
RS GNC MODE [3]	P79X0842E P79X0843E P79X0844E	text	Refer to remarks							
US/RS GNC COMM [4]	P79X0857E	text	0 = 'GOOD' 1 = overbright 'FAIL'							
GNC MDM FRAME COUNT [5]	P79U0856D		Refer to remarks							
US PRI GNC MDM [6]	P79X0854E	text	0 = 'GOOD' 1 = overbright 'FAIL'					↓	1	
CMG ATT CNTL [7]	P79X0853E	text	0 = 'GOOD' 1 = overbright 'LOST'					↓	1	
NO OP COMMAND	P79U0855D	Hex								

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CRT NAME	MSID	UNITS	DISPLAY RANGE	STATUS IND					FDA LIMITS	
				M	H	L	↑	↓	LO	HI
INHIBITS										
MODE XTION	P79X0807E	text	0 = 'ENA' 1 = 'INH'							
ATT MNVR	P79X0812E	text	0 = 'ENA' 1 = 'INH'							
DESAT REQ	P79X0813E	text	0 = 'ENA' 1 = 'INH'							
ATT CNTL SHDN	P79X0806E	text	0 = 'ENA' 1 = 'INH'							
HANDOVER CNTL TO ORB										
US DRIFT AVAIL [8]	P79X0814E	text	0 = 'NO' 1 = 'YES'							
CONTINGENCY DOCKING [9]										
DOCK SEQUENCE INIT [10]	P79X0858E	text	0 = blank 1 = "*"							
CONTINGENCY UNDOCKING [11]										
POST DEP CNTL MODE [12]	P79X0818E P79X0819E	text	Refer to remarks							
UNDOCK SEQUENCE INIT	P79X0859E	text	0 = blank 1 = "*"							
TIME SINCE SEP [13]	P79W0860D	secs								
OFF NOMINAL COMMANDS [14]										
DOCKED IND	P79X0811E	text	0 = blank 1 = "*"							
UNDOCKED IND	P79X0811E	text	0 = "*" 1 = blank							
HANDOVER CONTL TO ISS										
THRSTR AVAIL FOR DESAT [15]	P79X0805E	text	0 = 'NO' 1 = 'YES'							

SPEC 205 ISS MCS MODING

REMARKS

- [1] The US (United States) GNC MODE and the RS (Russian Segment) GNC MODE allow the orbiter crew to know how the station is controlling attitude. For nominal ISS attitude control, the US GNC Mode = CMG TA, and the RS GNC Mode = CMG TA. If the RS was controlling, the US GNC Mode = Drift (although depending on the failure scenario, it could be any one of the modes), and the RS GNC Mode = Thruster. If the Orbiter was controlling, the US GNC Mode = Drift (although depending on the failure scenario, it could be any one of the modes), and the RS GNC Mode = CMG TA or Indicatr.
- [2] The US GNC MODE allows the orbiter crew to know how the US station is controlling attitude.

Table 2

MSID									
P79X0845E	0	0	0	0	1	1	1	1	
P79X0846E	0	0	1	1	0	0	1	1	
P79X0847E	0	1	0	1	0	1	0	1	
Displayed Text:	DEFAULT	WAIT	RESERVED	STANDBY	CMG ONLY	CMG TA	UDG	DRIFT	

- [3] The RS GNC MODE allows the orbiter crew to know how the RS station is controlling attitude.

Table 3

MSID									
P79X0842E	0	0	0	0	1	1	1	1	
P79X0843E	0	0	1	1	0	0	1	1	
P79X0844E	0	1	0	1	0	1	0	1	
Displayed Text:	RESERVED	THRUSTER	GY ONLY	GY+T H/US	GY+T H/RS	REBOOST	CMG TA	INDICATOR	

- [4] The US/RS GNC LOSS COMM: This Caution and Warning (C&W) is used in the handover of attitude control from Orbiter to CMG TA procedure, and if it is in alarm, the handover will not work. This C&W is coded on this Spec as conditional, which utilizes the overbright and flash functionality.
- [5] GNC MDM FRAME COUNT: This parameter is used to determine if the entire Spec in general is getting updated data from the ISS. This parameter is normally displayed in decimal form resulting in an increment counter. But due to flight software constraints, this parameter will be displayed in hex form. Hex is sufficient because this parameter just needs to update.

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- [6] US PRI GNC MDM FAIL: This Caution and Warning (C&W) is used in the handover of attitude control from Orbiter to CMG TA procedure, and if it is in alarm, the handover will not work. This C&W is FDA'd as a Class 3 Alert, which when TMBU enabled, will have an onboard audible alarm, a light indication, an Onboard Fault Summary message, and a down arrow on the Spec parameter status field. This C&W is coded on this Spec as conditional, which utilizes the overbright and flash functionality.
- [7] LOSS CMG ATT CNTL: This Caution and Warning (C&W) is used in the handover of attitude control from Orbiter to CMG TA procedure, and if it is in alarm, the handover will not work. This C&W is FDA'd as a Class 3 Alert, which when TMBU enabled, will have an onboard audible alarm, a light indication, an Onboard Fault Summary message, and a down arrow on the Spec parameter status field. This C&W is coded on this Spec as conditional, which utilizes the overbright and flash functionality.
- [8] US DRIFT AVAIL: If this parameter, US Drift Available = Yes, then the command Item 9 MODE TO DRIFT will be accepted by the ISS US GNC MDM.
- [9] CONTINGENCY DOCKING: These commands do not have any nominally planned use, but if there is a loss of redundancy to mode the ISS to free drift at docking, then MCC may decide to use this section.
- [10] DOCK SEQUENCE INIT: This parameter is set high if item 11 was commanded to start the manual ACS Moding software to execute and mode the ISS to free drift.
- [11] CONTINGENCY UNDOCKING: These commands do not have any nominally planned use, but if there is a loss of redundancy to mode the ISS to attitude control after undocking, then MCC may decide to use this section.
- [12] POST DEP CNTL MODE: The Post Departure Control Mode can be set to CMG TA, CMG Only, or RS CNTL. If this parameter reads RS CNTL, then after undocking, if the ACS Moding software properly executes, the ISS will resume control on Russian thruster control.

Table 4

MSID			
P79X0818E	0	0	1
P79X0819E	0	1	0
Displayed Text:	CMG TA	CMG ONLY	RS CNTL

- [13] TIME SINCE SEP: When the manual software is initiated or when the automatic software is initiated by the sensors, this time since separation parameter begins to count up from zero to a commanded value (typically 100 seconds) at which time the ISS will resume attitude control using the control method defined by the Post Departure Control Mode parameter.

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- [14] OFF NOMINAL COMMANDS: These commands do not have any nominally planned use, but may be used in MCC determined contingencies.
- [15] THRSTR AVAIL FOR DESAT: telemetry feedback for Item 19 RS PREP FOR CMG DESAT. If that command is successful, then this parameter will show YES, and the RS is prepared to enter CMG TA mode.

ITEM ENTRY CHARACTERISTICS

- Item 1: REROUTE TO SSOR: All the commands on this Spec are hardcoded with a routing code = 1, which is for the OIU / GNC Hardline. If the commands are to be sent through the SSOR, then this reroute command will tell the OIU that for any command with a routing code of 1, to change it to 2, which is the routing code for SSOR.
- Item 2: ROUTE TO NORMAL HARDLINE: If there was an activity that required commanding from Spec 205 through the SSOR and that commanding activity is complete, then this route to normal command should be sent. All the commands on this Spec are hardcoded with a routing code = 1, which is for the OIU / GNC Hardline. But, for commanding through the SSOR, the OIU can be configured to take all routing codes of 1 and change it to 2, which is SSOR. So, to return the OIU to a nominal configuration, this command will tell the OIU that for all commands with routing code of 1, to assign it a routing code of 1.
- Item 3: NO OP COMMAND: The commands to reroute to SSOR and route to normal hardline do not have any telemetry feedback. As a form of feedback, this no op command is sent and the command accept counter telemetry will increment, thus verifying the routing commands success.
- Item 4: MODE XTION ENA is used to command the Mode Transition Inhibit to a status of either enabled. The telemetry feedback is ENA.
- Item 5: ATT MNVR ENA is used to command the Attitude Maneuver Inhibit to a status of enabled. The telemetry feedback is ENA or INH.
- Item 6: DESAT REQ ENA is used to command the Desat Request Inhibit to a status of enabled. The telemetry feedback is ENA or INH.
- Item 7: ATT CNTL SHDN ENA is used to command the Attitude Control Shutdown Inhibit to a status of enabled. The telemetry feedback is ENA or INH.
- Item 8: MODE XTION INH is used to command the Mode Transition Inhibit to a status of either inhibited. The telemetry feedback is INH.
- Item 9: MODE TO DRIFT commands the ISS US GNC Mode to Drift.
- Item 10: DOCK SOFTWARE ENA commands the manual dock software within the ACS Moding software to be enabled.

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- Item 11: DOCK SEQUENCE INIT commands the manual dock software within the ACS Moding software to execute, if the manual dock software is enabled per Item 10. The software that executes is the same software that the automatic ACS Moding software executes if the Capture Long sensors worked.
- Item 12: UNDOCK SOFTWARE ENA commands the manual undock software within the ACS Moding software to be enabled.
- Item 13: UNDOCK SEQUENCE INIT commands the manual undock software within the ACS Moding software to execute, if the manual undock software is enabled per Item 12. The software that executes is the same software that the automatic ACS Moding software executes if the Interface Sealed sensors and Separation sensors worked.
- Item 14: INCORP MASS PROP is a command that incorporates the US GNC mass properties from a buffer location to active use.
- Item 15, 16: DOCKED IND and UNDOCKED IND are manual commands that toggle a bit in the Primary C&C MDM automatic ACS Moding software. This bit is used by the Russian Segment to update their mass properties.
- Item 17: HOLD CURRENT ATTITUDE is a command to the US GNC MDM that performs a snap and hold at the current attitude, assuming the US GNC Mode is already in CMG TA and controlling attitude.
- Item 18: RS TAKE LVLH ATT CNTL is an ISS Tier 1 command that tells the Russian Segment to take attitude control in Thrusters in the LVLH reference frame. This command is an off nominal command without handshake between the US GNC MDM and the RS TBM. The nominal command to have the Russian Segment take control 6-17 is with handshake, which means there is some Tier 2 communication between the US GNC MDM and the RS TBM.
- Item 19: RS PREP FOR CMG DESAT is a Tier 1 command that prepares the Russian Segment for CMG TA mode.
- Item 20: MODE TO CMG TA is a command that changes the US GNC Mode to CMG TA using CCDB slot number 1, and also will change the RS GNC Mode to CMG TA if it is not already so.

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The SM 211 ISS C&W display is available in SM OPS 2 and is used for monitoring pertinent ISS C&W telemetry. Since the PCS does not have the capacity to annunciate alarm tones, the tone status flag from the ISS will be used to trigger the orbiter C&W system.

PARAMETER CHARACTERISTICS

Table 1.

CRT NAME	MSID	UNITS	DISPLAY RANGE	STATUS IND [1]					FDA LIMITS	
				M	H	L	↑	↓	LO	HI
FIRE	P79X0803E			M				↓	1	
PRESS	P79X0801E			M				↓	1	
TOX ATM	P79X0802E			M				↓	1	
CAUT	P79X0830E			M				↓	1	
WARN	P79X0831E			M				↓	1	

REMARKS

[1] The parameter status field for all parameters will be blank for normal operation or will display an “M” for missing data. For analog parameters, this field will also display an “H” or “L” for offscale data. Some parameters displayed will be limit-sensed for SM alerts or C&W alarms. For discretes that are limit-sensed, the undesirable state is defined in the FDA low limit field and the FDA high limit field is left blank. Satisfaction of the undesirable state triggers a “↓” indication. For analogs that are limit-sensed, an “↑” or a “↓” will be displayed when the parameter exceeds either an upper or lower limit. The symbols driven in the parameter status field have the following display priority from highest to lowest: “M”, “H”, “L”, “↑”, “↓”. All symbols driven in the parameter status column will be displayed four times normal intensity.

[2] When the tone status flag is set for any FIRE, pressure (PRESS), toxic atmosphere (TOX ATM), caution (CAUT), or warning (WARN) event, a “↓” will be displayed in the appropriate status field. The FIRE, PRESS, and TOX ATM events will initiate a master alarm light and tone, B/U C&W light on panel F7, and a fault message. WARN and CAUT events will initiate an alert light, tone, and fault message. The PCS can be referenced for additional details on the fault condition.

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```

1      1      2      3      4      5
123456789012345678901234567890123456789012345678901
1  XXXX/212/XXX      OIU      XX X DDD/HH:MM:SS
2      DDD/HH:MM:SS
3  OIU 1 TEMP ±XXX.XS      OIU STATUS CTR  XX
4  OIU 2 TEMP ±XXX.XS      ISS BC TIME XX-XX-XX/XX:XX:XX
5
6  _____ STATUS _____
7  ACTIVE DEVICES      PDI
8      DCM      SYNC
9  AD  PD  BUS  LOCK      B  W  F
10  1  XXXX  X  XXXXS      1  XSXSXS
11  2  XXXX  X  XXXXS      2  XSXSXS
12  3  XXXX  X  XXXXS      3  XSXSXS
13  4  XXXX  X  XXXXS      4  XSXSXS
14
15  OIU CMD CTR  XXX
16      PSP I/F  XXX
17  FLOAT POINT XXXS      LAST CMD
18      PSP  XXX
19      OIU  XXX
20
21  SSOR
22  PRI FRM SYNC  XXXS      18 SPARE CMD
23  PRI STATUS   XXXS      XXX
24  B/U FRM SYNC  XXXS
25  B/U STATUS   XXXS
26
                                     1 FORMAT XXX
                                     BUS 1 RT  2X
                                     BC  3X
                                     A  4X
                                     B  5X
                                     BUS 2 RT  6X
                                     BC  7X
                                     A  8X
                                     B  9X
                                     BUS 3 RT 10X
                                     BC 11X
                                     A 12X
                                     B 13X
                                     BUS 4 RT 14X
                                     BC 15X
                                     A 16X
                                     B 17X
                                     (XX)

```

Figure 1.- OIU Display - SPEC 212.

SPEC 212 OIU

The SM 212 OIU display is available in SM OPS 2 and is used to configure the OIU for cargo element operations, monitor OIU status, and monitor relevant PDI, PSP, and SSOR statuses.

PARAMETER CHARACTERISTICS

Table 1.

CRT NAME	MSID	UNITS	DISPLAY RANGE	STATUS IND [9]					FDA LIMITS	
				M	H	L	↑	↓	LO	HI
OIU 1 TEMP [1]	P50T4000V	deg F	-23.4 to +304.3	M	H	L	↑			212
OIU 2 TEMP [1]	P50T4001V	deg F	-23.4 to +304.3	M	H	L	↑			212
OIU STATUS CTR [2]	P50U4106D	sec	00 to 59							
ISS BC TIME [2]	P50U4112D, P50U4113D, P50U4111D, P50U4114D, P50U4115D, P50U4116D	time	Refer to remarks							
AD 1 PD [3]	P50X4401E, P50X4402E, P50X4403E, P50X4404E, P50X4405E, P50X4406E	text	Refer to remarks							
AD 2 PD [3]	P50X4411E, P50X4412E, P50X4413E, P50X4414E, P50X4415E, P50X4416E	text	Refer to remarks							

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Continuation of Table 1.

CRT NAME	MSID	UNITS	DISPLAY RANGE	STATUS IND [9]					FDA LIMITS		
				M	H	L	↑	↓	LO	HI	
AD 3 PD [3]	P50X4421E, P50X4422E, P50X4423E, P50X4424E, P50X4425E, P50X4426E	text	Refer to remarks								
AD 4 PD [3]	P50X4431E, P50X4432E, P50X4433E, P50X4434E, P50X4435E, P50X4436E	text	Refer to remarks								
AD 1 BUS [4]	P50U4055D	n/a	0 to 7								
AD 2 BUS [4]	P50U4065D	n/a	0 to 7								
AD 3 BUS [4]	P50U4075D	n/a	0 to 7								
AD 4 BUS [4]	P50U4085D	n/a	0 to 7								
AD 1 LOCK [5]	P50X4440E, P50X4441E	text	0,0 = 'NONE' 0,1 = 'YES' 1,0 = 'NO' 1,1 = 'N/A'	M				↓	1,0		
AD 2 LOCK [5]	P50X4450E, P50X4451E	text	0,0 = 'NONE' 0,1 = 'YES' 1,0 = 'NO' 1,1 = 'N/A'	M				↓	1,0		
AD 3 LOCK [5]	P50X4460E, P50X4461E	text	0,0 = 'NONE' 0,1 = 'YES' 1,0 = 'NO' 1,1 = 'N/A'	M				↓	1,0		

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Continuation of Table 1.

CRT NAME	MSID	UNITS	DISPLAY RANGE	STATUS IND [9]					FDA LIMITS	
				M	H	L	↑	↓	LO	HI
AD 4 LOCK [5]	P50X4470E, P50X4471E	text	0,0 = 'NONE' 0,1 = 'YES' 1,0 = 'NO' 1,1 = 'N/A'	M				↓	1,0	
PDI DCM 1 B,W,F SYNC [13]	V75X6403D, V75X6402D, V75X6401D	text	0 = blank, 1 = " * " 0 = blank, 1 = " * " 0 = blank, 1 = " * "	M				↓	0	
				M				↓	0	
				M				↓	0	
PDI DCM 2 B,W,F SYNC [13]	V75X6407D, V75X6406D, V75X6405D	text	0 = blank, 1 = " * " 0 = blank, 1 = " * " 0 = blank, 1 = " * "	M				↓	0	
				M				↓	0	
				M				↓	0	
PDI DCM 3 B,W,F SYNC [13]	V75X6411D, V75X6410D, V75X6409D	text	0 = blank, 1 = " * " 0 = blank, 1 = " * " 0 = blank, 1 = " * "	M				↓	0	
				M				↓	0	
				M				↓	0	
PDI DCM 4 B,W,F SYNC [13]	V75X6415D, V75X6414D, V75X6413D	text	0 = blank, 1 = " * " 0 = blank, 1 = " * " 0 = blank, 1 = " * "	M				↓	0	
				M				↓	0	
				M				↓	0	
OIU CMD CTR [6]	P50U4132A	n/a	0 to 255							
OIU PSP I/F [7]	P50X4283E	text	0 = 'OK', 1 = 'ERR'							
FLOAT POINT [8]	P50X4288E	text	0 = 'OK', 1 = 'ERR'	M				↓	1	
PSP LAST CMD [10]	V92X1102X, V92X1116X, V92X1129X	text	1,0,1 = 'REJ' 0,1,1 = 'INC' else = 'OK'							
OIU LAST CMD [11]	P50X4281E, P50X4303E, P50X4287E	text	1,0,0 or 0,1,0 or 1,1,0 or 0,0,1 or 1,0,1 or 0,1,1 or 1,1,1 = 'REJ' else = 'OK'							
SSOR PRI FRM SYNC [12]	V74X2050E	text	0 = 'NO', 1 = 'YES'	M				↓	0	
SSOR PRI STATUS [12]	V74X2051E	text	0 = 'BAD', 1 = 'OK'	M				↓	0	

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Continuation of Table 1.

CRT NAME	MSID	UNITS	DISPLAY RANGE	STATUS IND [9]					FDA LIMITS	
				M	H	L	↑	↓	LO	HI
SSOR B/U FRM SYNC [12]	V74X2053E	text	0 = 'NO', 1 = 'YES'	M				↓	0	
SSOR B/U STATUS [12]	V74X2052E	text	0 = 'BAD', 1 = 'OK'	M				↓	0	
FORMAT [14]	P50U4010A	n/a	0 to 255							
BUS 1 RT [15]	P50X4021E	text	0 = " * ", 1 = blank							
BUS 1 BC [15]	P50X4021E	text	0 = blank, 1 = " * "							
BUS 1 A [15]	P50X4041E	text	0 = " * ", 1 = blank							
BUS 1 B [15]	P50X4041E	text	0 = blank, 1 = " * "							
BUS 2 RT [15]	P50X4022E	text	0 = " * ", 1 = blank							
BUS 2 BC [15]	P50X4022E	text	0 = blank, 1 = " * "							
BUS 2 A [15]	P50X4042E	text	0 = " * ", 1 = blank							
BUS 2 B [15]	P50X4042E	text	0 = blank, 1 = " * "							
BUS 3 RT [15]	P50X4023E	text	0 = " * ", 1 = blank							
BUS 3 BC [15]	P50X4023E	text	0 = blank, 1 = " * "							
BUS 3 A [15]	P50X4043E	text	0 = " * ", 1 = blank							
BUS 3 B [15]	P50X4043E	text	0 = blank, 1 = " * "							
BUS 4 RT [15]	P50X4024E	text	0 = " * ", 1 = blank							
BUS 4 BC [15]	P50X4024E	text	0 = blank, 1 = " * "							
BUS 4 A [15]	P50X4044E	text	0 = " * ", 1 = blank							
BUS 4 B [15]	P50X4044E	text	0 = blank, 1 = " * "							
SPARE CMD [16]	P93J0101C	n/a	1 to 12							

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REMARKS

- [1] The OIU TEMP parameters will read 140° F when the OIU associated with that measurement is OFF. Note that this is the only sure method to determine which OIU is powered up from this display alone. Additional insight is available via the panel L12 OIU PWR tb.
- [2] OIU STATUS CTR displays the OIU time parameter for seconds, reading from 00 to 59 and resetting to 00 again. This indicates OIU health by constantly counting from 00 to 59 and recycling when the OIU telemetry is being processed by the PDI. ISS BC TIME follows the format MM-DD-YY/HH:MM:SS and comes from whichever device is BC to the OIU. This parameter will read all zeros at powerup, will show the correct BC time at the time the BC comes up and starts sending telemetry to the OIU, and will remain static at the last good sample when the incoming telemetry from that BC goes away.
- [3] ACTIVE DEVICES: The OIU active device (AD) status section provides insight for OIU processing on the external telemetry sources with which the OIU can interface. Status shown for each AD (1 to 4) includes the physical device (PD) assigned to that AD, the BUS being used to acquire that device's telemetry, and a LOCK status indication. The computation used to drive the PD field is defined in the following table:

MSID											
Argument 1	0	0	0	0	0	0	0	0	0	0	0
Argument 2	0	0	0	0	0	0	0	0	0	0	0
Argument 3	0	0	0	0	0	0	0	0	1	1	1
Argument 4	0	0	0	0	1	1	1	1	0	0	0
Argument 5	0	0	1	1	0	0	1	1	0	0	1
Argument 6	0	1	0	1	0	1	0	1	0	1	0
Displayed Text:	OIU	GNC1	GNC2	SR-1	SR-2	MP-1	MP-2	N1-1	N1-2	FGB1	FGB2

If none of the above conditions are met, the default text displayed is ERR. Note that PD = OIU when no active device is assigned and is also displayed when OIU format supports an OIU error log dump, GNC1 and GNC2 are the ISS Tier 2 Guidance, Navigation and Control MDMs, SR-1 and SR-2 are the Space to Space Orbiter Radios (SSOR), MP-1 and MP-2 are the MPLM MDMs, N1-1 and N1-2 are the Node MDMs, and FGB1 and FGB2 are the ISS FGB MDMs.

- [4] BUS: Indicates the OIU bus 1 to 7, 0 indicates OIU bus 8. Note that the OIU hardware currently supports only buses 1 to 4.

- [5] LOCK: **'NONE'** if the current OIU format does not have an AD for this display location.
'YES' if the OIU is RT and in sync with the AD (ISS BC or SSOR).
'YES' if the AD is OIU in error log dump format (OIU must be in sync with itself).
'NO' if the OIU is RT and was in sync with the AD but has lost lock on the AD (ISS BC or SSOR).
N/A if the OIU is BC to the AD, except if the AD is SSOR.
Note that if LOCK goes from **'YES'** to **'NO'**, the OIU stops attempting to acquire sync with that AD. To force the OIU to attempt to resync with an AD, the OIU format must be reloaded.
- [6] OIU CMD CTR will start at 000 at powerup, and will increment by one whenever the OIU receives a valid command from the PSP. The counter reads in decimal, and will count from 000 to 255 and roll over to 000. All commands, whether from the **MCC** or the MCDS, will cause the counter to increment if received and processed by the OIU.
- [7] PSP I/F indicates OK if the OIU is receiving the 16 Khz command carrier from either PSP1 or PSP2. ERR is displayed if no command carrier is being received.
- [8] The OIU can convert one ISS floating point parameter value per PDI minor frame (maximum of 100 per major frame) into a shuttle PDI-compatible parameter value. If an ISS floating point value is invalid or results in an invalid floating point value/operation during the conversion process, the OIU annunciates an error. The FLOAT POINT display parameter will read ERR for this condition or **'OK'** if no floating point error/operation is detected.
- [9] The parameter status field for all parameters will be blank for normal operation or will display an "M" for missing data. For analog parameters, this field will also display an "H" or "L" for offscale data. Some parameters displayed will be limit-sensed for SM alerts or C&W alarms. For discretes that are limit-sensed, the undesirable state is defined in the FDA low limit field and the FDA high limit field is left blank. Satisfaction of the undesirable state triggers a "↓" indication. For analogs that are limit-sensed, an "↑" or a "↓" will be displayed when the parameter exceeds either an upper or lower limit. The symbols driven in the parameter status field have the following display priority from highest to lowest: "M", "H", "L", "↑", "↓". All symbols driven in the parameter status column will be displayed four times normal intensity.
- [10] PSP LAST CMD indicates the command acceptance for crew originated command: **'OK'** if the PSP has not rejected a crew command, REJ if the PSP rejected the last crew command, or INC if the PSP was not able to complete the transfer of the last crew command. The REJ and INC indications are cleared by the next successfully processed PSP command from either crew or ground.
- [11] OIU LAST CMD indicates the command acceptance by the OIU. REJ is displayed if the OIU has detected either a parity error or an incorrect byte count in a command received from the PSP. Otherwise, **'OK'** is displayed.

- [12] For both the primary (PRI) and a backup (B/U) Space to Space Orbiter Radio (SSOR), the FRM SYNC indication gives the status of the frame synchronizer. YES indicates SSOR frame sync with the ISS Space to Space Station Radio (SSSR), 'NO' indicates no SSOR frame sync, or the SSOR is off, or the SSOR is not present. The STATUS indication yields 'OK' if the SSOR is operating normally, or indicates 'BAD' if the SSOR BITE has sensed a failure.
- [13] PDI DCM SYNC gives indication of the Bit (B), Word (W), and Frame (F) synchronizer statuses for all four PDI decommutators. For each DCM, the B, W, and F columns will be blank if the decom is not in bit, word, or frame sync, respectively. An asterisk will be displayed in each of the B, W, or F columns if the sync conditions do exist. Note that the decom actually processing OIU telemetry is dependent on orbiter PDI/PCMMU config.
- [14] FORMAT: Indicates the currently loaded OIU format.
- [15] BUS 1 to 4: The OIU bus processing state [Bus Controller (BC) or Remote Terminal (RT)] and channelization (A or B) is indicated by asterisks for each of buses 1 to 4.
- [16] SPARE CMD: Displays the item entry index associated with the last Item 18.

ITEM ENTRY CHARACTERISTICS

- Item 1: FORMAT: indexed command item entry used to changing the OIU format (ITEM 1 + XXX EXEC). The valid decimal format numbers for entry via MCDS on STS-117 are 001 to 020, 250, 251, 254, and 255.
- Item 2 to 17: BUS 1 to BUS 4: This section allows changing the OIU's current bus processing state [Bus Controller (BC) or Remote Terminal (RT)] and bus channel (A or B) for any of the currently implemented four OIU buses. For example, if Bus 3 is BC, and using Channel A, there will be an asterisk next to Items 11 and 12. To change Bus 3 to RT, an ITEM 10 EXEC is performed. In the case of the bus channelization (A or B), the displayed telemetry indicates which channel is prime for command and telemetry transactions on that bus if the OIU is BC on that bus. If the OIU is BC on a bus, it will try to send a command for an AD using the prime channel. If the OIU receives no status message from that AD, it tries again on the prime channel, then it tries on the alternate channel. If the AD has not responded, it declares failure and stops trying to send a command to that AD. When the OIU is RT on a bus, it will respond on either channel, depending on which channel received a transaction from the BC; therefore, the channel indication has no meaning when the OIU is RT on a bus.

- Item 18: SPARE CMD: an indexed command that allows performing the following internal OIU function mapping:
- Item 18 + 1: Change FGB MDM active device to FGB-2 MDM physical device*.
 - Item 18 + 2: Change FGB MDM active device to FGB-1 MDM physical device*.
 - Item 18 + 3: Change Node 1 MDM active device to N1-2 MDM physical device*.
 - Item 18 + 4: Change Node 1 MDM active device to N1-1 MDM physical device*.
 - Item 18 + 5: Move FGB -2 MDM physical device to OIU Bus 4 *.
 - Item 18 + 6: Move FGB -2 MDM physical device to OIU Bus 3 *.
 - Item 18 + 7: Move FGB -1 MDM physical device to OIU Bus 4 *.
 - Item 18 + 8: Move FGB -1 MDM physical device to OIU Bus 3 *.
 - Item 18 + 9: Move N1-1 MDM physical device to OIU Bus 4 *.
 - Item 18 + 10: Move N1-1 MDM physical device to OIU Bus 3 *.
 - Item 18 + 11: Move N1-2 MDM physical device to OIU Bus 4 *.
 - Item 18 + 12: Move N1-2 MDM physical device to OIU Bus 3 *.
 - Item 18 + 13: Change GNC MDM active device to GNC-2 MDM physical device.
 - Item 18 + 14: Change GNC MDM active device to GNC-1 MDM physical device.
 - Item 18 + 15: Move GNC-1 MDM physical device to OIU Bus 4 (LB ORB N2-2).
 - Item 18 + 16: Move GNC-1 MDM physical device to OIU Bus 3 (LB ORB N2-1).
 - Item 18 + 17: Move GNC-2 MDM physical device to OIU Bus 4 (LB ORB N2-2).
 - Item 18 + 18: Move GNC-2 MDM physical device to OIU Bus 3 (LB ORB N2-1).

Items accompanied by “ * ” are not used on STS-117.

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STANDARD SWITCH PANEL 1

(ASSY OPS/13A/FIN)

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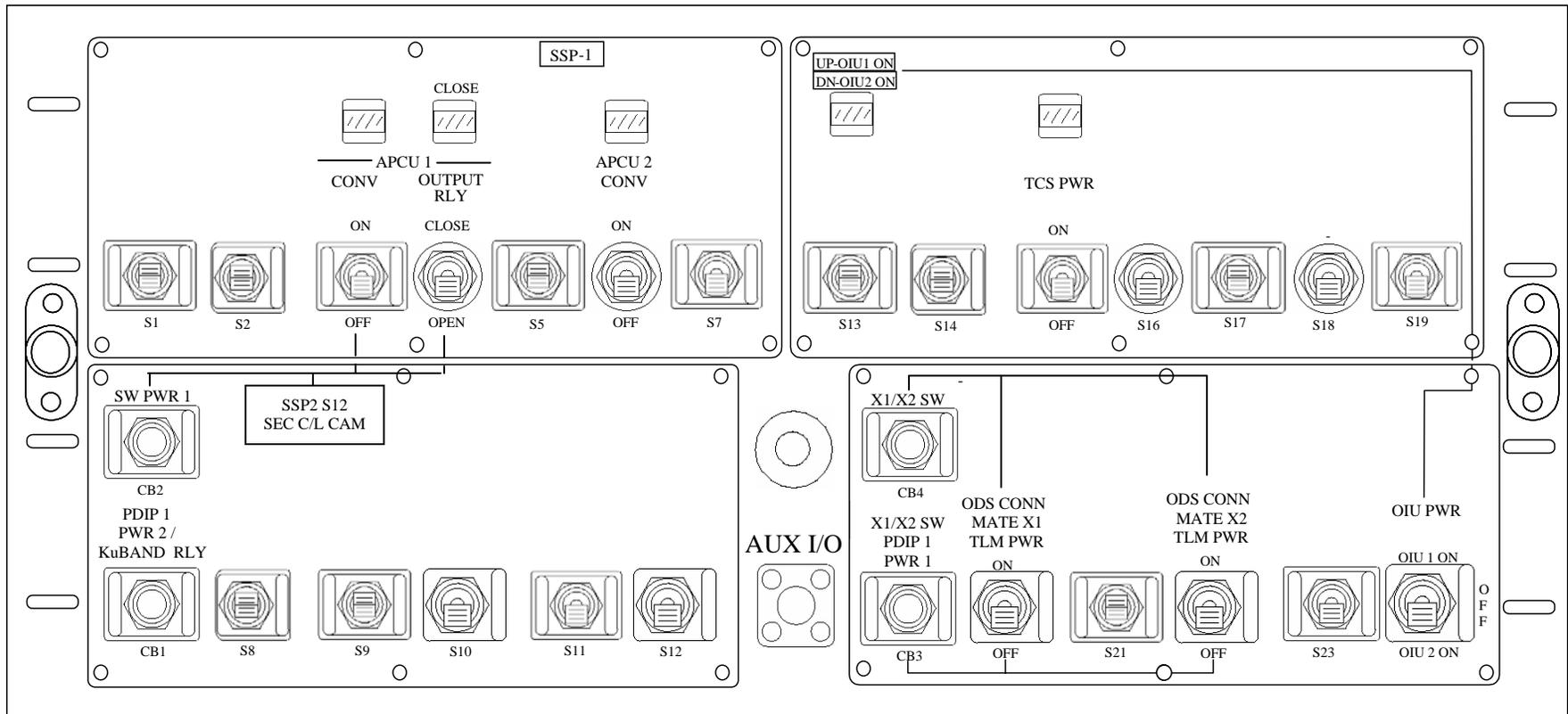


Figure 1.- Standard Switch Panel 1.

STANDARD SWITCH PANEL 1

(ASSY OPS/13A/FIN)

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ITEM	DEVICE TYPE	FUNCTION
CB2 SWITCH PWR 1	Circuit breaker, 5 amp	closed (in) - Applies orbiter CAB PL1 power to SSP1 S3 and S4, and SSP2 S12. open (out) - Removes power from SSP1 S3 and S4, and SSP2 S12.
CB1 PDIP 1 PWR 2/ KuBAND RLY	Circuit breaker, 5 amp	closed (in) - Applies orbiter CAB PL2 power to the PDIP DC PWR 2 switch outlet and KuBAND RATE switch. open (out) - Removes power from PDIP DC PWR 2 outlet and KuBAND RATE switch.
S3 APCU 1 CONV	Toggle switch, two - position (Maintained - Maintained)	ON (up) - Applies power to the APCU 1 converter OFF (dn) - Removes power from the APCU 1 converter
DS3 APCU 1 CONV	Event indicator, two - position	gray - Indicates APCU 1 converter powered bp - Indicates APCU 1 converter not powered
S4 APCU 1 OUTPUT RLY	Toggle switch, two - position (Maintained - Maintained)	CLOSE (up) - Closes the APCU 1 output relay OPEN (dn) - Opens the APCU 1 output relay
DS4 APCU 1 OUTPUT RLY	Event indicator, two - position	gray - Indicates APCU 1 output relay is closed bp - Indicates APCU 1 output relay is open
S6 APCU 2 CONV	Toggle switch, two - position (Maintained - Maintained)	ON (up) - Applies power to the APCU 2 converter OFF (dn) - Removes power from the APCU 2 converter
DS6 APCU 2 CONV	Event indicator, two - position	gray - Indicates APCU 2 converter powered bp - Indicates APCU 2 converter not powered
DS13	Event indicator, three - position	UP - Indicates that CAB PL3 power is being supplied to OIU 1. bp - Indicates power is removed from OIU 1 and OIU 2. DN - Indicates that AUX PLB power is being supplied to OIU 2.
S15 TCS PWR	Toggle switch, two - position (Maintained - Maintained)	ON (up) - Applies power to TCS. OFF (dn) - Removes power from TCS.

STANDARD SWITCH PANEL 1

(ASSY OPS/13A/FIN)

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ITEM	DEVICE TYPE	FUNCTION
DS15 TCS PWR	Event indicator, two - position	gray - Indicates TCS powered. bp - Indicates TCS not powered.
CB4 X1/X2 SW	Circuit breaker, 5 amp	closed (in) - Applies orbiter CAB PL3 power to SSP1 S20 and S22. open (out) - Removes power from SSP1 S20 and S22.
CB3 X1/X2 SWITCH PDIP1 PWR 1	Circuit breaker, 5 amp	closed (in) - Applies orbiter CAB PL2 power to PDIP DC PWR 1 outlet and redundant power to SSP1 S20 and S22. open (out) - Removes power from PDIP DC PWR 1 outlet and redundant power from SSP1 S20 and S22.
S20 ODS CONN MATE X1 TLM PWR	Toggle switch, two - position (Maintained - Maintained)	ON (up) - Supplies CAB PL2 and CAB PL3 power for PMA 2 X1 connector mate signal. OFF (dn) - Removes power for PMA 2 X1 connector mate signal.
S22 ODS CONN MATE X2 TLM PWR	Toggle switch, two - position (Maintained - Maintained)	ON (up) - Supplies CAB PL2 and CAB PL3 power for PMA 2 X2 connector mate signal. OFF (dn) - Removes power for PMA 2 X2 connector mate signal.
S24 OIU PWR	Toggle switch, three - position (Maintained - Maintained - Maintained)	OIU 1 ON (up) - Provides CAB PL3 power to OIU 1. OFF (ctr) - Removes power from OIU 1 and OIU 2. OIU 2 ON (dn) - Provides AUX PLB power to OIU 2.

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STANDARD SWITCH PANEL 2

(ASSY OPS/13A/FIN)

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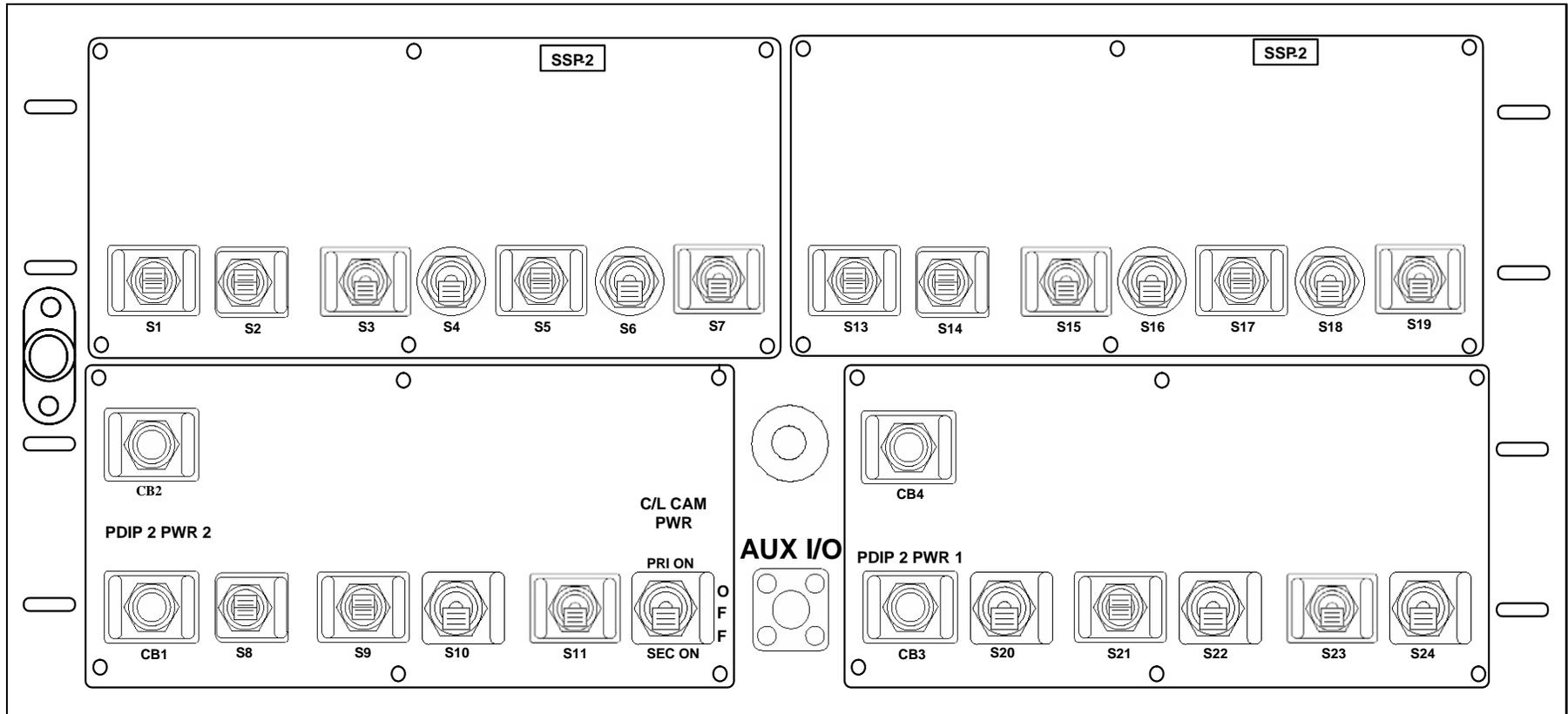


Figure 1.- Standard Switch Panel 2.

STANDARD SWITCH PANEL 2

(ASSY OPS/13A/FIN)

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Item	Device Type	Function
CB1 PDIP 2 PWR 2	Circuit breaker, 5 amp	closed (in) - Applies orbiter CAB PL2 power to PDIP2 S2 and S3. open (out) - Removes power from PDIP2 S2 and S3.
S12 C/L CAM PWR	Toggle switch, three-position	PRI - Applies CAB PL3 power to PRI C/L CAM. OFF - Removes power from both Cameras SEC - Applies CAB PL 1 power to SEC C/L CAM.
CB3 PDIP 2 PWR1	Circuit breaker, 5 amp	closed (in) - Applies orbiter CAB PL2 power to PDIP2 S1. open (out) - Removes power from PDIP2 S1.
CB4	Circuit breaker, 5 amp	closed (in)

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