EVA Checklist

Mission Operations Directorate
EVA, Robotics, and Crew Systems
Operations Division

Generic, Rev H
March 4, 2005

NOTE
For STS-114 and subsequent (chronological) flights per current schedule.

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, Texas

Verify this is the correct version for the pending operation (training, simulation or flight).
Electronic copies of FDF books are available. URL: http://mod.jsc.nasa.gov/do3/FDF/index.html
PCN-14 (Apr 15, 2008) Sheet 1 of 1

List of Implemented Change Requests (482s):

EVA-1758

Incorporate the following:

1. Replace iii and iv
2. Replace 4-11 and 4-12

NOTE
For STS-124 and subsequent flights

Prepared by: [Signature]  
Book Manager

Approved by: [Signature]  
Lead, EVA Systems Group

Accepted by: [Signature]  
Chief, EVA and Crew Systems  
Operations Branch

Encl: 4 pages

File this PCN immediately behind the front cover as a permanent record
PCN-13 (Feb 15, 2008) Sheet 1 of 1

List of Implemented Change Requests (482s):
EVA-1756
EVA-1757

Incorporate the following:
1. Replace iii and iv, vii and viii
2. Replace 14-7 and 14-8
3. Replace 15-11 and 15-12
4. Replace 19-1 and 19-2
   After 9-12, add 19-13 and 19-14

NOTE
For STS-123 and subsequent flights

Prepared by: [Signature]
Book Manager

Approved by: [Signature]
Lead, EVA Systems Group

Accepted by: [Signature]
Chief, EVA and Crew Systems
Operations Branch

Encl: 12 pages

File this PCN immediately behind the front cover as a permanent record
List of Implemented Change Requests (482s):
EVA-1755

Incorporate the following:
1. Replace iii and iv
2. Replace 4-1 and 4-2

NOTE
For STS-123 and subsequent flights

Prepared by: [Signature]  
Book Manager

Approved by: [Signature]  
Lead, EVA Systems Group

Accepted by: [Signature]  
Chief, EVA and Crew Systems  
Operations Branch

Encl: 4 pages

File this PCN immediately behind the front cover as a permanent record
List of Implemented Change Requests (482s):
EVA-1754       MULTI-1806

Incorporate the following:
1. Replace iii thru vi
2. Replace 3-3 and 3-4, 3-7 and 3-8
3. Replace 4-5 and 4-6, 4-9 and 4-10
4. Replace 10-1 and 10-2, 10-11 and 10-12
   After 10-12, add 10-13 and 10-14
5. Replace 12-7 and 12-8, 12-19 thru 12-22

NOTE
For STS-120 and subsequent flights

Prepared by:       [Signature]
Book Manager

Approved by:       [Signature]
Lead, EVA Systems Group

Accepted by: [Signature]
for Angela Prince, Chief, EVA and Crew Systems Operations Branch

Encl: 24 pages

File this PCN immediately behind the front cover as a permanent record.
PCN-10 (July 18, 2007) Sheet 1 of 1

List of Implemented Change Requests (482s):
EVA-1753

Incorporate the following:
1. Replace iii and iv
2. Replace 4-5 and 4-6, 4-9 and 4-10
3. Replace 12-7 and 12-8, 12-19 thru 12-22

NOTE
For STS-118 and subsequent flights

Prepared by: [Signature]
Book Manager

Approved by: [Signature]
Lead, EVA Systems Group

Accepted by: [Signature]
Chief, EVA and Crew Systems
Operations Branch

Encl: 12 pages

File this PCN immediately behind the front cover as a permanent record
PCN-9 (June 15, 2007) Sheet 1 of 1

List of Implemented Change Requests (482s):
EVA-1749        MULTI-1787
EVA-1750
EVA-1751
EVA-1752

Incorporate the following:
1. Replace iii thru vi
2. Replace 1-3 thru 1-10
3. Replace 4-5 and 4-6
4. Replace 8-1 and 8-2
   After 8-6, add 8-7 and 8-8
5. Replace 10-7 and 10-8

NOTE
For STS-118 and subsequent flights

Prepared by: John Smith
Book Manager

Approved by: Bob Johnson
Lead, EVA Systems Group

Accepted by: Jane Doe
Chief, EVA and Crew Systems
Operations Branch

Encl: 20 pages

File this PCN immediately behind the front cover as a permanent record.
PCN-8 (May 22, 2007) Sheet 1 of 1

List of Implemented Change Requests (482s):
EVA-1747
EVA-1748

Incorporate the following:
1. Replace iii and iv
2. Replace 9-3 thru 9-6
3. Replace 10-7 thru 10-10

NOTE
For STS-117 and subsequent flights

Prepared by: ____________________________
Book Manager

Approved by: ____________________________
Lead, EVA Systems Group

Accepted by: ____________________________
Chief, EVA and Crew Systems
Operations Branch

Encl: 10 pages

File this PCN immediately behind the front cover as a permanent record
List of Implemented Change Requests (482s):

EVA-1742  EVA-1745
EVA-1743  EVA-1746
EVA-1744

Incorporate the following:
1. Replace iii thru vi
2. Replace 3-1 and 3-2, 3-7 thru CC 3-10
3. Replace 4-7 thru 4-10
4. Replace section 8 (6 pages)
5. Replace section 9 (6 pages)
6. Replace 10-1 and 10-2
   After 10-4, add 10-4a and 10-4b
   Replace 10-11 and 10-12

Prepared by:  

Approved by:  

Accepted by:  

Encl: 32 pages

File this PCN immediately behind the front cover as a permanent record
PCN-6 (Nov 10, 2006) Sheet 1 of 1

List of Implemented Change Requests (482s):

EVA-1722
EVA-1723
EVA-1724
EVA-1735
EVA-1736

Incorporate the following:

1. Replace iii and iv
2. Replace 3-3 thru 3-8
3. Replace 4-5 and 4-6
4. Replace 10-9 and 10-10
5. Replace 11-1 thru 11-4
6. Replace 15-9 and 15-10, 15-13 and 15-14

NOTE
For STS-116 and subsequent flights

Prepared by:  

Book Manager

Approved by:  

Lead, EVA Systems Group

Accepted by:  

Chief, EVA and Crew Systems  
Operations Branch

Encl: 20 pages

File this PCN immediately behind the front cover as a permanent record
List of Implemented Change Requests (482s):
EVA-1686  EVA-1716
EVA-1688
EVA-1689
EVA-1690

Incorporate the following:
1. Replace iii and iv
2. Replace 1-3 thru 1-8
3. Replace 3-3 thru 3-8
4. Replace 4-5 thru 4-8
5. Replace 12-3 and 12-4
6. Replace 19-9 and 19-10

NOTE
For STS-115 and subsequent flights

Prepared by:  

Approved by:  

Accepted by:  

Encl: 22 pages

File this PCN immediately behind the front cover as a permanent record
PCN-4 (June 12, 2006) Sheet 1 of 1

List of Implemented Change Requests (482s):

EVA-1654
EVA-1655
EVA-1656
EVA-1667
EVA-1680

Incorporate the following:

1. Replace iii thru viii
2. Replace 1-3 thru 1-8
3. Replace section 3 (12 pages)
4. Replace 4-1 thru 4-10
   After 4-10, add 4-11 and 4-12
5. Replace 5-1 and 5-2
6. Replace A6-1 and CC A6-2, B6-1 and CC B6-2
7. Replace 12-1 thru 12-4, 12-19 thru 12-22
8. Replace 14-3 thru 14-10, 14-13 and 14-14, 14-17 thru 14-22
9. Replace section 15 (14 pages)
10. Replace 19-9 and 19-10
11. Replace 20-1 and 20-2

Prepared by:  

[Signature]
Book Manager

Approved by:  

[Signature]
Lead, EVA Systems Group

Accepted by:  

[Signature]
Chief, EVA and Crew Systems
Operations Branch

Encl: 84 pages

File this PCN immediately behind the front cover as a permanent record
List of Implemented Change Requests (482a):

- EVA-1633
- EVA-1652

Incorporate the following:
1. Replace iii thru viii
2. Replace 15-1 thru 15-4

NOTE
For STS-121 and subsequent flights

Prepared by: [Signature]  
Book Manager

Approved by: [Signature]  
Acting Lead, EVA Systems Group

Accepted by: [Signature]  
Chief, EVA and Crew Systems Operations Branch

Encl: 10 pages

File this PCN immediately behind the front cover as a permanent record
List of Implemented Change Requests (482s):

EVA-1608

Incorporate the following:
1. Replace iii and iv
2. Replace 12-15 and 12-16

NOTE
For STS-114 and subsequent flights

Prepared by: [Signature]
Book Manager

Approved by: [Signature]
Acting Lead, EVA Systems Group

Accepted by: [Signature]
Chief, EVA and Crew Systems
Operations Branch

Encl: 4 pages

File this PCN immediately behind the front cover as a permanent record
List of Implemented Change Requests (482s):

| EVA-1563 | EVA-1574 | MULTI-1694 |
| EVA-1566 | EVA-1575 |
| EVA-1570 (R) | EVA-1576 |
| EVA-1573 |

(R) Remainder of a previous partial implementation is in this publication

Incorporate the following:

1. Replace iii and iv
2. Replace 1-3 thru 1-10
3. Replace 2-1 and 2-2
4. Replace 4-5 thru 4-8
5. Replace 9-3 and 9-4
6. Replace 12-9 thru 12-14
7. Replace 15-3 and 15-4
8. Replace 19-5 and 19-8

Prepared by: [Signature]  
Bock Manager

Approved by: [Signature]  
Lead, EVA Systems Group

Accepted by: [Signature]  
Chief, EVA and Crew Systems Operations Branch

Encl: 28 pages

File this PCN immediately behind the front cover as a permanent record
MISSION OPERATIONS DIRECTORATE

EVA CHECKLIST

GENERIC, REV H
March 4, 2005

PREPARED BY:

Paul G. Boehm
Book Manager

APPROVED BY:

Randall S. McDaniels
Lead, EVA Task Group

Randall S. McDaniels
Acting Lead, EVA Systems Group

Angela R. Prince
Chief, EVA and Crew Systems Operations Branch

This document is under the configuration control of the Crew Procedures Control Board (CPCB). All proposed changes must be submitted on FDF Workflow Crew Procedure Change Request (CR) to DC3/FDF Manager.

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(P) – Partially implemented in this publication

AREAS OF TECHNICAL RESPONSIBILITY

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iii .................. | ALL/GEN H,14 | 5-1 .......... | ALL/GEN H  |
v .................... | ALL/GEN H,4 | 5-2 .......... | ALL/GEN H,4 |
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vii .................. | ALL/GEN H,4 | 5-4 .......... | ALL/GEN H  |
viii .................. | ALL/GEN H,13 | A6-1 .......... | NOM/GEN H  |
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4-10 ..........| ALL/GEN H,11 | 11-2 .......... | ALL/GEN H,6 |

* – Omit from flight book
Δ – Replace with page from Flight Supplement, if applicable. Otherwise, not flown
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\(\Delta\) – Replace with pages from Flight Supplement, if applicable. Otherwise, not flown

\(*)\) – Omit from flight book
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MASK PREBREATHE INITIATE

1. Take one aspirin tablet (325 mg) if not taken previously
2. Configure quick don mask, HIU, and 14 ft comm/O2 umbilicals (two)
3. \( \sqrt{\text{LEH O2 SPLY 1,2 vlv (two)} - \text{OP}} \)
4. O2 XOVRSYS 2 – CL
5. LEH O2 4(5,6,7) outlet – connect O2 hose
6. MIDDECK COMM CCU PWR – OFF
   outlet – connect comm cable
   CCU PWR – ON
7. Decrease HIU volume control
8. LEH O2 4(5,6,7) vlv – OP

WARNING
Positive mask O2 pressure and fit are necessary to ensure adequate prebreathe

9. Verify black plates in top of mask are seated in silicon
10. Don mask
11. Set mask O2 control to EMERGENCY
12. Momentarily pull mask away from face and verify O2 flow
    * If no positive O2 flow, contact MCC  *
13. \( \sqrt{\text{Comm}} \)
14. Configure ATU for PTT/PTT as reqd to alleviate comm noise

WARNING
Do not terminate prebreathe until cabin pressure at 10.2 psia and 1 hr prebreathe completed

15. Note time and continue mask prebreathe at least 1 hr
PREP FOR 10.2 PSI CABIN
PRESS/CRYO SYS CONFIG

L2 1. √O2 SYS 1,2 SPLY (two) – ctr (tb-OP)
   √XOVR SYS 1   – OP
   2 – CL
2. √N2 SYS 1,2 SPLY (two) – ctr (tb-OP)
   √REG INLET (two) – ctr (tb-OP)
3. O2/N2 CNTLR VLV SYS 1 – OP (N2)
   2 – CL (O2)

SM 88 APU/ENVIRON THERM

4. If FLASH EVAP CNTLR PRI A,B – OFF:
   If FREON LOOP 1,2 EVAP OUT T between
   41-47 degF:
   RAD CNTLR OUT TEMP – HI
   When FREON EVAP OUT TEMP > 50 degF,
   RAD CNTLR OUT TEMP – NORM (then
   immediately)
   FLASH EVAP CNTLR PRI A(B) – ON
   After ~1 min
   √FREON EVAP OUT TEMP ~39 degF
   If FREON LOOP 1,2 EVAP OUT T not between
   41-47 degF:
   FLASH EVAP CNTLR PRI A(B) – ON

L1 If FLASH EVAP CNTLR PRI A(B) – ON, continue:

AIRLOCK/MIDDECK PREP

MO10W 5. O2 REG INLET SYS 1 vlv – CL
   2 vlv – OP
6. √N2 XOVER vlv – CL
AW18A 7. LTG FLOOD (four) – ON
DCM 8. √PURGE vlv – op (up)
9. Remove LTA Restraint Bag (1 ea EMU)
AW82B 10. AIRLK DEPRESS vlv cap – vent, remove

RESET FDA & C/W LIMITS

X: SM 80 SM TABLE MAINT
11. Contact MCC for uplink of B/U C/W and SM ALERT
    TMBU (if desired)
    Changes enclosed in

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1-3 EVA/ALL/GEN H,9
**CABIN DEPRESS TO 10.2 PSI**

**WARNING**
Do not initiate depress until EV1 and EV2 have completed 45 min of mask prebreathe.
Do not terminate prebreathe until cabin pressure at 10.2 psia and 1 hr mask prebreathe completed.

**EV**
1. Momentarily pull mask away from face and verify O2 flow
   * If no positive O2 flow, contact MCC *
2. Plot initial CABIN P vs PPO2 on 10.2 PSIA DEPRESS CHART using [SM SYS SUMM 1]

**WARNING**
Cabin O2 concentration ([SM SYS SUMM 1]) must be maintained below 28.5% to protect against increased flammability risk
Terminate all WCS activity while flowing N2 thru 14.7 CAB REG INLET SYS 1

**NOTE**
Expect klaxon each time airlock depress valve opened

AW82B, MO10W
3. **START DEPRESS**
   Config vlvs per DEPRESS CHART
4. Continue plotting CABIN P vs PPO2 every 60 sec using [SM SYS SUMM 1]. Reconfig vlvs when plot transitions into different zone
5. **STOP DEPRESS**
   When CABIN P and PPO2 are in CONTROL ZONE (TARGET ZONE preferred), stop depress by configuring as listed at lower left of 10.2 PSIA DEPRESS CHART
When in **CONTROL ZONE** (TARGET ZONE preferred):

- **STOP DEPRESS**
- AIRLK DEPRESS vlv – CL
- Install AIRLK DEPRESS vlv Cap
- 14.7 CAB REG INLET SYS 1 – CL
- 14.7 CAB REG INLET SYS 2 – CL

---

**NOTE**

Trend of plot should closely parallel slope of lines in each zone. If it does not, verify valve config.
### 10.2 PSI CABIN CONFIG

**X:** SM 60 SM TABLE MAINT

**R13**

1. Reset FDA & C/W limits
   Changes enclosed in
   --
2. Contact MCC for uplink of B/U C/W and SM ALERT
   TMBU (if desired)

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3. Perform SM CHECKPOINT INITIATE (ORB OPS, DPS)

**L2**

4. O2 XOVR SYS 2 – OP

5. If O2 bleed orifice not installed:

**MO69M**

\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`\`

- LEH O2 vlv 8 – CL
- Unstow and insert O2 bleed orifice in O2 QD
- LEH O2 vlv 8 – OP

### MASK PREBREATHE TERMINATE

---

**WARNING**

Do not terminate prebreathe until cabin pressure at 10.2 psia and 1 hr prebreathe completed

**EV**

1. Momentarily pull mask away from face to verify O2 flow

   * If no positive O2 flow, contact MCC *

2. Set mask O2 control to NORMAL

3. Doff mask

**C6,**

**MO32M,**

**MO69M**

4. LEH O2 4(5,6,7) vlv – CL

**MO39M**

5. MIDDECK COMM CCU PWR – OFF

   outlet – Disconnect
   comm cable
   CCU PWR – ON

6. Depress Mask O2 control

**C6,**

**MO32M,**

**MO69M**

7. LEH O2 4(5,6,7) outlet – Disconnect hose

8. Stow mask, HIU, and 14 ft comm/O2 umbilical
10.2 PSI MAINTENANCE

**WARNING**
Cabin O2 concentration (SM SYS SUMM 1) must be maintained below 28.5%. See chart this page.
Terminate all WCS activity while flowing N2 thru 14.7 CAB REG INLET SYS 1

**CAUTION**
Do not perform 10.2 PSI MAINTENANCE in parallel with EMU purge.

X: SM SYS SUMM 1

**NOTE**
Perform 10.2 PSI MAINTENANCE procedure post airlock repress and post sleep while 10.2 psi operations desired. Perform pre-sleep maintenance, if reqd, using target area in control zone.

1. If PPO2 < 2.70 psia:
   - If pre-sleep:
     - Perform OCAC filter cleaning as reqd
     - OCAC PWR – OFF
   - Direct O2 – OP

2. When PPO2 ~2.70 psia or when CABIN PRESS ~10.4 psia:
   - Direct O2 – CL
   - If pre-sleep:
     - OCAC PWR – ON

3. If CABIN PRESS < 10.40 psia:
   - 14.7 CAB REG INLET SYS 1 vlv – OP (N2)
   - When CABIN PRESS ~10.40 psia:
     - 14.7 CAB REG INLET SYS 1 vlv – CL

**CABIN LEAK MONITORING**

4. Log 10.2 PSI MAINTENANCE times (MET)
   1. __________ 5. __________
   2. __________ 6. __________
   3. __________ 7. __________
   4. __________ 8. __________

**NOTE**
If MCC requests maintenance, then log time and use that time to compare to next maintenance.

5. If successive maintenance reqd because CABIN PRESS decreased from 10.40 to 10.00 psia:
   - For \( \Delta t < 40 \) min, go to O2(N2) FLOW HIGH/CAB P LOW/dP/dT (ORB PKT, ECLS)
   - For 40 min \( \Delta t < 10 \) hr, go to MAL, ECLS SSR-8, SMALL CABIN-LEAK ISOL
### CABIN REPRESS TO 14.7 PSI

**WARNING**

Terminate all WCS activity during repress to 14.7 psia

### SETUP

**X: SM 60 SM TABLE MAINT**

**R13**

1. Reset C/W and FDA limits
2. Contact MCC for uplink of B/U C/W and SM ALERT TMBU (if desired)

Changes enclosed in [ ]

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### REPRESS

**X: SM 66 ENVIRONMENT**

MO10W 3. 14.7 CAB REG INLET SYS 1,2 vlv (two) – OP
L2 4. \(\text{O}_2/N_2\) CNTLR VLV SYS 1 – OP

5. Contact MCC to determine if FES should remain ON
6. If FES operation not reqd:

L1 FLASH EVAP CNTLR PRI A(B) – OFF
14.7 PSI CABIN CONFIG

ORBITER PCS 1(2) CONFIG

MO10W 1. O2 REG INLET SYS 1(2) vlv – OP
   2(1) vlv – CL
2. H2O TK N2 REG INLET SYS 1(2) vlv – OP
   2(1) vlv – CL
3. H2O TK N2 ISOL SYS 1,2 vlv (two) – OP
4. If prior to shuttle airlock repress:
   14.7 CAB REG INLET SYS 1,2 vlv (two) – CL
   If after shuttle airlock repress:
   14.7 CAB REG INLET SYS 1(2) vlv – OP
   2(1) vlv – CL
L2 5. O2/N2 CNTLR VLV SYS 1(2) – AUTO
   2(1) – CL(O2)

RESET C/W AND FDA LIMITS

R13U 6. Contact MCC for uplink of B/U C/W and SM ALERT
       TMBU (if desired)
       Changes enclosed in

7. Go to SM CHECKPOINT INITIATE (ORB OPS, DPS)

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AIRLOCK CONFIG

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EMU SWAP .................................................................................................................... 2-3
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  INSTALLATION ....................................................................................................... 2-6
AIRLOCK PREP (50 min)

Retrieve or unstow following equipment:

- MF28G 3/8-in breaker bar, 4-in ext w/3/8-in drive
- IFM Tool Kit 1/2-in socket w/3/8-in drive
- Vol H EMU Equipment Bag – attach to middeck wall
  Helmet Lights
  EVA Bag
  Contamination Detection Kit (location flight specific)
- FDF Locker Cuff Checklists (2) – stow in EMU Equipment Bag

DEPRESS/REPRESS Cue Card

1. √ Inner hatch Equal vlv (two) – OFF
2. LTG FLOOD (four) – ON
3. Remove from airlock, as reqd:
   Airlock Stowage Bag
   Airlock Floor Pallet using 3/8-in breaker bar, 4-in ext w/3/8-in drive, and
   1/2-in socket w/3/8-in drive
4. Stow Vol H Bags in Vol H
5. Transfer to airlock:
   EVA Bag – install on airlock wall
   DEPRESS/REPRESS Cue Card
   Helmet Lights
   Contamination Detection Kit – install on airlock wall
6. Install IVA foot restraint, as reqd
7. Unbuckle SCU straps, Velcro SCU to wall
8. Install EMU lights on helmets (EMU 1, EMU 2)
9. Disconnect helmets from Airlock EMUs, temp stow
10. Remove comm caps from LTA Restraint Bags and connect to electrical
    harnesses
11. Install helmets (not reqd if proceeding directly to EMU Checkout)
12. Remove LTA Restraint Bags
13. Disconnect waist rings; remove and stow any equipment stowed in HUT/LTA
14. Stow LTA Restraint Bags on AAPs
15. √ Thermal cover clear of waist ring
16. Waist ring – engage posn
17. Connect LTA to HUT, lock
18. Remove 20-g Crash Bag from middeck EMU, as reqd
EMU SWAP (30 min)

NOTE
EMU X is to be removed and EMU Y is to be installed

EMU X
1. Install gloves

AW18H
2. √PWR/BATT CHGR EMU 1,2 BUS SEL (two) – OFF
   √MODE (two) – OFF

DCM
3. Disconnect SCU, install DCM cover
4. Stow SCU on AAP, Velcro to wall
5. Connect LTA to HUT, lock (if reqd)
6. Disconnect helmet with sunshades down and helmet cover installed; stow
7. Release EMU from AAP, transfer EMU to middeck
8. Install helmet
9. Remove 20-g Crash Bag on middeck EMUs (if flown)

EMU Y
10. Disconnect helmet, temp stow
11. Remove comm cap from LTA Restraint Bag and connect to electrical harness
    (if reqd)
12. Remove LTA Restraint Bag
13. Release EMU from middeck AAP, transfer to airlock
14. Mount EMU on AAP
15. Install helmets (not reqd if proceeding directly to EMU Checkout)
16. Disconnect waist ring; remove and stow any equipment stowed in HUT/LTA
17. Waist ring – engage posn
18. Connect LTA to HUT, lock

NOTE
O2 vlv for SCU connected to EMU Y must be closed prior to checkout of EMU Y

AW82B
19. If performing EMU CHECKOUT of EMU Y:
   EV-1(EV-2) O2 vlv – CL

EMU X
20. Attach EMU to middeck AAP
21. Attach LTA Restraint Bag
BOOSTER FAN DEACTIVATION/REMOVAL (15 min)

MO13Q 1. ARLK FAN A,B (two) – OFF
MA73C:G 2. cb AC1,2 ARLK TNL FAN A,B (six) – op
EXT A/L 3. Disconnect flex duct from booster fan muffler inlet, direct airflow into airlock, temp secure
4. Disconnect vent duct from booster fan outlet and external airlock duct inlet; temp stow in middeck
If booster fan to be removed:
5. Disconnect flex duct from booster fan inlet; rotate and stow in launch bracket
6. Demate booster fan electrical connectors from J1,J2 (two) on tunnel extension wall; loosen cable harnesses (two) from Velcro strips (four)
7. Stow electrical connectors (two) on booster fan dummy fittings, secure cable harnesses with Velcro strips
8. Loosen booster fan fasteners (four)
9. Remove booster fan assy, temp stow in middeck

BOOSTER FAN INSTALLATION/ACTIVATION (15 min)

If booster fan to be installed:
MA73C:G 1. cb AC1,2 ARLK TNL FAN A,B (six) – op
MO13Q 2. ARLK FAN A,B (two) – OFF
EXT A/L 3. Install booster fan assy, secure fasteners (four)
4. Demate electrical connectors (two) from booster fan dummy fittings and Velcro strips
5. Mate booster fan electrical connectors J1,J2 (two) on tunnel extension wall; secure cable harnesses (two) with Velcro strips (four)
6. Unstow/connect flex duct from launch bracket to booster fan inlet
7. Unstow/connect vent duct to external airlock duct inlet and booster fan outlet
8. Unstow/connect flex duct from middeck to fan muffler inlet
MA73C:G 9. cb AC1,2 ARLK TNL FAN A,B (six) – cl
MO13Q 10. ARLK FAN A(B) – ON
11. Check for airflow at top of external airlock halo

EMU REMOVAL (15 min)

1. As reqd, install gloves
2. As reqd, perform LTA RESTRAINT STRAP INSTALLATION (AIRLOCK CONFIG)
3. As reqd, relocate LTA spring hooks (four) from AAP rings to SAFER mount brackets
4. Disconnect EMUs from AAPs, stow in middeck

EMU INSTALLATION (15 min)

1. Transfer EMUs to A/L, connect to AAPs
2. As reqd for EVA, perform LTA RESTRAINT STRAP REMOVAL (AIRLOCK CONFIG)
3. As reqd, relocate LTA spring hooks (four) from SAFER mount brackets to AAP rings
EMU CHECKOUT PREP (30 min)

AW18A
1. LTG FLOOD (four) – ON
2. Remove Airlock Stowage Bag from airlock (if flown)

Vol H
3. Unstow:
   - EMU Equipment Bag – attach to middeck wall
   - EMU Servicing Kit – mark with Gray Tape; label “Shuttle”; temp stow
   - Drink Bags for later use (stow on top of Vol H Bags)
4. Stow Vol H Bags in Vol H
5. Unbuckle SCU straps, Velcro SCU to wall
6. Remove 20-g Crash Bag from middeck EMU (if flown)
7. Disconnect helmets from airlock EMUs, temp stow
8. Remove comm caps from LTA Restraint Bags and connect to electrical harnesses in EMU
9. Remove LTA Restraint Bags
10. Disconnect waist rings; remove and temp stow any equipment stowed in HUT/LTA
11. Stow LTA Restraint Bags on AAP
12. √Thermal cover clear of waist rings
13. Waist ring – engage position
14. Connect LTA to HUT, lock
15. Install helmet with sunshades down and helmet cover installed; lock (not reqd if proceeding directly to EMU Checkout)
LTA RESTRAINT STRAP REMOVAL (15 min)

NOTE
May be performed on EMU 1 and 2 simultaneously. Perform steps as reqd for current EMU config

1. As reqd, remove comm cap from LTA Restraint Bag; temp stow
2. Remove EMU from AAP
3. Disconnect all restraint attachments from SAFER mount brackets (two)
4. Loosen cinch strap mechanism, remove SAFER mount brackets
5. Remove strap from PLSS
6. Stow strap in LTA Restraint Bag Pouch with D-rings (three) connected
7. Engage EMU in AAP
8. Stow LTA Restraint Bag/strap

LTA RESTRAINT STRAP INSTALLATION (15 min)

NOTE
May be performed on EMU 1 and 2 simultaneously. Perform steps as reqd for current EMU config. Procedure written to install in Launch/Landing config shown below

1. Unstow LTA Restraint Bag/strap
2. Remove EMU from AAP
3. Install SAFER mount brackets (two)
4. Install elastic band of strap around SOP
5. Tighten cinch strap mechanism
6. Attach strap French hooks (two) to SAFER mount brackets
7. Engage EMU in AAP
8. Stow LTA, suit arms inside LTA Restraint Bag
9. Connect upper spring hooks (two) over suit shoulders to upper AAP attachment rings (two)
10. Connect lower spring hooks (two) around suit arms to SAFER mount brackets (two)
11. Tighten all LTA bag straps with bag as high as possible on EMU

LTA RESTRAINT STRAP APPLICATION

EMU LAUNCH AND LANDING CONFIGURATION

(LTA Restraint Strap installed)

NOTE
French hooks should be attached to SAFER mount brackets for launch and landing
CHECKOUTS

EMU CHECKOUT ........................................................................................................... 3-2
EMU POWERUP AND COMM CHECK ........................................................................ 3-2
PRIMARY REGULATOR/FAN/PUMP CHECK .......................................................... 3-4
SOP CHECK .............................................................................................................. 3-5
BATTERY CHARGE CHECK INIT ........................................................................... 3-6
BATTERY CHARGE CHECK TERM ........................................................................... 3-6
EMU SWAP DURING CHECKOUT ........................................................................... 3-7
POST EMU C/O RECONFIG ..................................................................................... 3-7
SAFER CHECKOUT ....................................................................................................... 3-8
SELF TEST SEQUENCE ........................................................................................... 3-9
SAFER CHECKOUT RESULTS ................................................................................... CC 3-10
SAFER STATUS TROUBLESHOOTING ..................................................................... CC 3-11
REBA POWERED HARDWARE CHECKOUT ............................................................... 3-12
EMU CHECKOUT

NOTE
Procedures are written for simultaneous C/O of EMUs #____ (stbd) and #_____ (port) in airlock. An additional C/O of EMU(s) #_____ uses same procedure after performing EMU SWAP during C/O.

X: SM 60 SM TABLE MAINT

1. Contact MCC for uplink of SM ALERT TMBU (if desired)

<table>
<thead>
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<th>Param ID</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
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<td>EXT A/L LCG 2 SPLY ZN 1 T</td>
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<td>OSH</td>
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<tr>
<td>VOLTS EMU 2</td>
<td>0640213</td>
<td>OSL</td>
<td>OSH</td>
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</table>

EMU POWERUP AND COMM CHECK (15 min)

NOTE
If procedure is being repeated for 3rd EMU #_____ only, other previously checked EMU #_____ is reqd in airlock to perform EMU POWERUP and COMM CHECK procedures to verify EMU-to-EMU comm.

PWR RESTART msg and BITE light should be illuminated whenever EMU power is cycled. Display and tone tests only occur during cold restarts.

2. Retrieve, position SCUs; remove DCM covers
3. Connect SCUs to DCM, \locked
4. PWR – BATT

CAUTION
EMU must be on BATT pwr when airlock power supply is turned on

5. PWR/BATT CHGR EMU 1,2 MODE (two) – PWR
   BUS SEL (two) – MNA(MNB)
6. √EMU INPUT 1,2 volts = 18.0-20.0

7. √AIRLK AUD PWR – OFF

8. COMM mode – ALT

9. √Comm FREQ – LOW

10. √AUD CTR UHF A/G 1,2 (two) – OFF
    A/A – T/R

11. √cb MNA UHF EVA – cl
    √MNC UHF EVA – cl
12. BIOMED CH 1 – EVA 1
   CH 2 – EVA 2

IVA ATU

13. √AUD PWR – AUD/TONE
    A/G 1,2 (two) – OFF
    A/A – T/R
    ICOM A,B (two) – OFF (as reqd)

O6

14. UHF SPLX/EVA PWR AMP – OFF
    MODE – EVA

15. Helmets disconnected

16. Don comm caps

**NOTE**
After the next step, be prepared to verify no missing segments on display and that all tones are audible.

17. PWR – SCU

18. Verify no missing segments during display test
    Verify BITE light extinguishes
    Verify status (continuous) tone and warble tone are audible

Report any anomalies to MCC

19. Perform onboard A/A comm check per table

<table>
<thead>
<tr>
<th>EMUs MODE</th>
<th>FREQ</th>
<th>EVA STRING</th>
<th>IV O6: UHF SPLX/EVA XMIT FREQ</th>
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<tr>
<td>ALT LOW</td>
<td>2</td>
<td>259.7/414.2</td>
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</tr>
<tr>
<td>ALT HIGH</td>
<td>2</td>
<td>296.8/417.1</td>
<td></td>
</tr>
<tr>
<td>PRI HIGH</td>
<td>1</td>
<td>296.8/417.1</td>
<td></td>
</tr>
<tr>
<td>PRI LOW</td>
<td>1</td>
<td>259.7/414.2</td>
<td></td>
</tr>
</tbody>
</table>

20. AUD A/G 1(2) – T/R

21. AUD CTR UHF A/G 1(2) – T/R
    √A/G 2(1) – OFF
    A/A – OFF

22. Verify RF comm with MCC

23. AUD CTR UHF A/G 1(2) – OFF

24. Doff comm caps

If procedure is being repeated for 3rd EMU #____ only, then on other previously checked EMU #____:

25. Install helmet, lock

26. COMM mode – OFF

27. PWR/BATT CHGR EMU 1(2) BUS SEL – OFF

28. DISP – STATUS, until [DATA?COMBO] displayed
    – YES (hold for 2 sec)
    – STATUS, until [DATA EMU?] displayed
    – YES (hold for 2 sec)
    Verify [DATA?EMU] displayed
PRIMARY REGULATOR/FAN/PUMP CHECK (40 min)

MD (flr)  29. EMU O2 ISOL VLV – OP

DCM  30. √STATUS: O2 P = 850-950

<table>
<thead>
<tr>
<th>EMU</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tbody>
<tr>
<td>O2 P</td>
<td></td>
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</tbody>
</table>

AW82B  31. EV-1, EV-2 O2 vlv (two) – OP
  32. Install helmet, lock
  33. √Suit arms aligned
  34. √Gloves locked
  35. √Helmet purge vlv – cl, locked

DCM  36. PURGE vlv – cl (dn)
  37. √O2 ACT – IV
  38. √STATUS: SUIT P = 0.4-1.4 and stable (compare w/gauge)

<table>
<thead>
<tr>
<th>EMU</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUIT P (IV)</td>
<td></td>
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</tbody>
</table>

DCM  39. √O2 ACT – PRESS
  40. √STATUS: SUIT P = 4.2-4.4 and stable (compare w/gauge)

<table>
<thead>
<tr>
<th>EMU</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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</thead>
<tbody>
<tr>
<td>SUIT P (PRESS)</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>H2O TEMP</td>
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<tr>
<td>H2O GP</td>
<td></td>
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<tr>
<td>H2O WP</td>
<td></td>
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</tbody>
</table>

DCM  41. √DISP – STATUS, until LEAK CHECK? displayed

<table>
<thead>
<tr>
<th>EMU</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tbody>
<tr>
<td>ΔP</td>
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</tbody>
</table>

* If LEAKAGE HI/ SUIT P msg occurs (ΔP > 0.3 psi), *
* go to FAILED LEAK CHECK (14.7/10.2 PSI) Cue *
* Card, CC 6-4 *

DCM  42. O2 ACT – OFF
  43. PURGE vlv – op (up)
  44. √STATUS: SUIT P < 0.4 (compare w/gauge)
  45. Disconnect glove
  46. Reconnect glove
  47. Disconnect helmet, temp stow
  48. Disconnect waist ring – secure LTA to outer hatch handrail
  49. Remove Multiple Water Connector cover, temp stow
  50. Connect LCVG, √locked
  51. √Temp control vlv – Max C
CAUTION
Minimize fan operation with O2 ACT – OFF (~2 min)

☐☐ 52. FAN – ON (PWR RESTART may occur)
  Verify flow at neck ring vent port

AW18H  ☐☐ 53. √EMU INPUT amps = 1.5-4.7 (1.5-5.0 at 14.7)

<table>
<thead>
<tr>
<th>EMU</th>
<th>1</th>
<th>2</th>
<th>3</th>
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</thead>
<tbody>
<tr>
<td>53. INPUT AMPS</td>
<td></td>
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</tbody>
</table>

☐☐ 54. Install SCOF, lock

DCM  ☐☐ 55. O2 ACT – IV, [NO VENT FLOW] msg, DISP – PRO
  √Cooling flow in LCVG

☐☐ 56. √STATUS: [H2O TEMP] decrease from step 40

<table>
<thead>
<tr>
<th>EMU</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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</thead>
<tbody>
<tr>
<td>56. H2O TEMP</td>
<td></td>
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</tbody>
</table>

  * If no temp decrease, depress and hold pump priming *
  * valve on back of EMU, while slowly cycling TCV *
  * between 7 and Max C (30 sec minimum) *

AW18H  ☐☐ 57. √EMU INPUT amps = 1.5-3.6 (1.5-4.0 at 14.7)
  √EMU INPUT amps decrease from step 53

<table>
<thead>
<tr>
<th>EMU</th>
<th>1</th>
<th>2</th>
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<th>4</th>
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<tbody>
<tr>
<td>57. INPUT AMPS</td>
<td></td>
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</tbody>
</table>

DCM  ☐☐ 58. PWR – BATT, [NO VENT FLOW] message, DISP – PRO

☐☐ 59. √STATUS: [BAT VDC] ≥ 16.5
  [BAT AMPS] = 2.3-3.7 (2.4-4.0 at 14.7)
  [RPM] = 18.0-20.0 K

<table>
<thead>
<tr>
<th>EMU</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tbody>
<tr>
<td>59. BAT VDC</td>
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<tr>
<td>BAT AMPS</td>
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<tr>
<td>RPM</td>
<td></td>
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</tbody>
</table>

☐☐ 60. √Fan noise steady

☐☐ 61. O2 ACT – OFF

☐☐ 62. FAN – OFF

☐☐ 63. PWR – SCU

SOP CHECK (5 min)

☐☐ 64. Perform step 28 to reset data to EMU mode

DCM  ☐☐ 65. √STATUS: [SOP P] = 5410-6800

<table>
<thead>
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<th>4</th>
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<tbody>
<tr>
<td>65. SOP P</td>
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</tbody>
</table>
SOP

66. \(\sqrt{SOP\ gauge\ 5400-6800}\), note SOP interstage gauge

<table>
<thead>
<tr>
<th>EMU</th>
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<th>2</th>
<th>3</th>
<th>4</th>
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<tbody>
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<td>66. SOP GAUGE</td>
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<tr>
<td>INT GAUGE</td>
<td></td>
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</tbody>
</table>

DCM

67. DISP – STATUS until \[\text{SUIT P}\] displayed
   – YES (hold for 2 sec) to lock parameter

68. Depress SOP manual override (50 sec max):
   \(\sqrt{\text{SOP interstage gauge} < 600}\)

<table>
<thead>
<tr>
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<th>4</th>
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<td>68. SUIT P</td>
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<tr>
<td>INT GAUGE</td>
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</table>

69. \(\sqrt{\text{STATUS: } [\text{SOP P}] = 3.4-3.9}\)

<table>
<thead>
<tr>
<th>EMU</th>
<th>1</th>
<th>2</th>
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</thead>
<tbody>
<tr>
<td>69. SOP P</td>
<td></td>
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</tr>
</tbody>
</table>

70. Remove SCOF, stow

71. Disconnect LCVG, stow (as reqd if transferring to ISS)

72. Install Multiple Water Connector cover

73. Install helmet, LTA

DCM

74. COMM mode – OFF

BATTERY CHARGE CHECK INIT (15 min)

AW18H

75. PWR/BATT CHGR EMU 1,2 BUS SEL (two) – OFF

MODE (two) – CHARGE

BUS SEL (two) – MNA(MNB)

76. Continue charge 15 min, minimum

BATTERY CHARGE CHECK TERM

When PWR/BATT CHGR EMU INPUT AMPS < 1 and 15 min minimum charge complete:

77. PWR/BATT CHGR EMU 1,2 BUS SEL (two) – OFF

MODE (two) – OFF

Cont next page
EMU SWAP DURING CHECKOUT (30 min) (If reqd)

NOTE

EMU(s) #_____ to be removed from airlock.
EMU(s) #_____ to be installed in airlock.
Procedure written for swap of one or two EMUs

EMU ____ □ 78. √Gloves installed
DCM □ 79. Disconnect SCU, install DCM cover
□ 80. Stow SCU on AAP, Velcro to wall
□ 81. Release EMU from AAP, transfer EMU to middeck
EMU ____ □ 82. Disconnect helmet, stow
□ 83. Remove comm cap from LTA Restraint Bag and connect to electrical harness
□ 84. Remove LTA Restraint Bag
□ 85. Release EMU from middeck AAP, transfer to airlock
□ 86. Install EMU on AAP
□ 87. Disconnect waist ring; remove and stow any equipment stowed in HUT/LTA
□ 88. Waist ring – engage posn
□ 89. Connect LTA to HUT, lock

NOTE

O2 vlv for SCU connected to EMU(s) #_____
must be closed prior to checkout of EMU

AW82B □ 90. EV-____ O2 vlv – CL
EMU ____ □ 91. Install EMU on middeck AAP
□ 92. Attach LTA Restraint Bag, as reqd
□ 93. Go to EMU POWERUP AND COMM CHECK, 3-2

POST EMU C/O RECONFIG (5 min)

When EMU C/O for all EMUs complete:

IV O6 □ 94. UHF MODE – OFF
    □ SPLX/EVA XMIT FREQ – 259.7/414.2
    □ PWR AMP – OFF
    □ SPLX SQUELCH – ON
R10 □ 95. BIOMED CH 1 – EVA 1
    □ CH 2 – EVA 2
AW82B □ 96. EV-1,EV-2 O2 vlv (two) – CL
BOTH DCM □ 97. Remove SCUs, install DCM covers
□ 98. Stow SCU on AAP, Velcro to wall
IV ML86B:C □ 99. cb MNC EXT ARLK HTR LINE ZN 1,2 (two) – cl
                      (heaters will be deactivated on MCC call)
                      [X: SM 60 SM TABLE MAINT]
□ 100. Contact MCC for uplink of SM ALERT TMBU (if desired)
Changes enclosed in □

<table>
<thead>
<tr>
<th>Param Name</th>
<th>Param ID</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
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<td>OSL</td>
<td>OSH</td>
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</tbody>
</table>
SAFER CHECKOUT (30 min if first checkout of SAFER unit, 
20 min for subsequent checks)

NOTE
Procedures written for simultaneous C/O of two SAFERs

1. Remove SAFER and SAFER CHECKOUT RESULTS Cue Card from Stowage Bag/FDF Locker
2. Verify Inhibitor installed, properly engaged
   If first SAFER CHECKOUT:
3. Remove power switch guard
4. Stow HCM
5. Remove stowage straps from thruster towers, unfold towers
6. Remove SAFER latch guards from latches (leave lanyard straps attached to towers)
7. Inspect:
   Thruster tower hinges
   Tower latches
   TMG not blocking thrusters
   SAFER latch guard lanyard strap attached to SAFER towers above tower hinges
8. Peel back SAFER tower TMG on both towers and install SAFER latch guards over SAFER latches
   Latch guard lanyards routed under tower TMG
   Re-attach tower TMG to secure latch guards in place
9. Fold thruster towers
10. Install stowage straps
11. MAN ISOL vlv – OP (dn)
12. Deploy HCM; \proper deployment

CAUTION
Minimize time with SAFER powered (~1 min)

NOTE
Have SAFER CHECKOUT RESULTS Cue Card w/proper serial number ready to record status.

From power on to entry into Test Mode, the SAFER will be in Automatic Attitude Hold (AAH) (Green LED on). Try to hold SAFER steady against a wall. Changes in SAFER attitude may result in AAH-induced thruster firings

13. As reqd, review SELF TEST SEQUENCE (refer to box next page)
14. Perform Self Test:
   Start timer
   PWR – TST/ON
   Wait until GN2 XX% PWR XX% displayed
   AAH LED (green) on
   PWR – ON

Cont next page
NOTE
Be prepared to count thruster clicks (24) after PWR – TST/ON

PWR – TST/ON
Follow displayed instructions on HCM:
\(\sqrt{\text{SELF TEST – WAIT}}\) displayed; if able, count thruster clicks (twenty four)

* If [NSI CIRCUIT OPEN] or [FAIL: ...] msg *
* [displayed or non-responsive display]: *
* Note failure msg *
* Press DISP sw to resume test *
* If [HC TO DETENT] msg displayed: *
* Note msg *
* HC grip springs to center position *

When [RATE CHECK] displayed, rotate SAFER at least + and - 3 deg/sec sequentially in each rotational axis

15. \(\sqrt{\text{GO FOR EVA}}\) or [FAILED TEST] displayed
16. PWR – ON
17. DISP: Record GN2%, PWR%, BATT V (SAFER CHECKOUT RESULTS Cue Card)
18. PWR – OFF
19. Stop timer, record ‘ON Time’ (~1 min desired)
20. \(\sqrt{\text{GN2\%}} \geq 87\)
    \(\sqrt{\text{PWR\%}} \geq 45\)
    \(\sqrt{\text{BATT V}} \geq 35\)
21. Report GN2%, PWR%, BATT V, and SAFER serial number to MCC
22. MODE – ROT

**CAUTION**
Do not stow HCM to be used for EVA with power switch guard installed

**NOTE**
When stowing HCM, verify that umbilical will not snag during deployment

23. Stow HCM
24. Stow SAFER and Cue Card in Stowage Bag
25. Inhibitor installed
26. MAN ISOL vlv – CL (up)

**SELF TEST SEQUENCE (for reference only; do not perform)**

HCM
1. NSI circuit test
2. \(\sqrt{\text{SELF TEST – WAIT}}\) Twenty-four thruster clicks and THR LED (red) flashing
3. DEPRESS AAH
4. [MODE – ROT] (if in TRAN)
5. MODE – TRAN
6. HC grip detent test
7. [HC +X] (fwd), (-X, +Y (rt), -Y, +Z (dn), -Z, +P (twist up), -P)
8. RATE CHECK; rotate SAFER at least + and - 3 deg/sec sequentially in each rotational axis
### SAFER CHECKOUT RESULTS

<table>
<thead>
<tr>
<th>SAFER SERIAL #</th>
<th>GMT</th>
<th>ON Time</th>
<th>GN2%</th>
<th>PWR%</th>
<th>BATT V</th>
<th>GMT</th>
<th>ON Time</th>
<th>GN2%</th>
<th>PWR%</th>
<th>BATT V</th>
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### NOTES
SAFER battery expected to last for 52 1-min checkouts and have at least 45% PWR remaining.

### BATTERY CHANGEOUT

<table>
<thead>
<tr>
<th>GMT</th>
<th>OLD BATT SERIAL #</th>
<th>NEW BATT SERIAL #</th>
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<tr>
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EVA-3a/O/C

(reduced copy)
## SAFER STATUS TROUBLESHOOTING

<table>
<thead>
<tr>
<th>GMT Failure Message</th>
<th>NOMINAL STATUS</th>
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<tbody>
<tr>
<td>GN2%</td>
<td>87-99%</td>
</tr>
<tr>
<td>PWR%</td>
<td>45-99%</td>
</tr>
<tr>
<td>TANK P</td>
<td>&gt; 6575 psi</td>
</tr>
<tr>
<td>TANK T</td>
<td>-40 to 140 degF</td>
</tr>
<tr>
<td>RATE R</td>
<td>± 30 deg/s</td>
</tr>
<tr>
<td>RATE P</td>
<td>± 30 deg/s</td>
</tr>
<tr>
<td>RATE Y</td>
<td>± 30 deg/s</td>
</tr>
<tr>
<td>DISPL R</td>
<td>± 99.9 deg</td>
</tr>
<tr>
<td>DISPL P</td>
<td>± 99.9 deg</td>
</tr>
<tr>
<td>DISPL Y</td>
<td>± 99.9 deg</td>
</tr>
<tr>
<td>BATT V</td>
<td>≥ 35.0 V</td>
</tr>
<tr>
<td>BATT T</td>
<td>50 to 90 degF</td>
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<tr>
<td>Leak</td>
<td>NO LEAK</td>
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### SAFER JET NOMENCLATURE

![SAFER JET NOMENCLATURE Diagram]

(reduced copy)
REBA POWERED HARDWARE CHECKOUT (15 min)

NOTE
Procedure written for simultaneous C/O of 12 volt HDW on all EMUs

☐  1. Perform REBA BATTERY INSTALL (EMU MAINT/RECHARGE), as reqd
All EMUs

☐  2. √REBA sw (1 per EMU) – OFF toward left arm of suit
If EMU TV:
   ☑  3. Install EMU TV on helmets 1, 2; note camera addresses
      EV1 ___, EV2 ___ (see figure below)
PLSS
   ☑  4. Unstow EMU TV power cable, disconnect from ground plug
   ☐  5. Mate EMU TV power cable to EMU TV
PLSS
If no EMU TV:
   ☑  6. √EMU TV power cable mated to ground plug
   ☑  7. √Upper arm connections mated
   ☑  8. √Glove heater sw (one per glove) – OFF
   ☑  9. Connect lower arm pwr harness to gloves
   ☑ 10.  ☑  11.  ☐
      12.  ☑  13.  ☐
      14.  ☑  15.  ☐
      16.  ☐  17.  ☐
      18.  ☑  19.  ☑
      20.  ☑  21.  ☑

PLSS

TO AVOID EXCESSIVE BATTERY CONSUMPTION
AND HEAT BUILD UP, DEACTIVATE HEATERS
ONCE HEAT DETECTED AT FINGERTIPS

When heat detected on all outside fingertips:
      ☑  12. Glove heater sw (one per glove) – OFF
If EMU TV:
      15.  ☑  16.  ☐
      17.  ☑  18.  ☑
      19.  ☑  20.  ☑

PLSS

Cable Path: Cover cable in TMG

Helmet Light Gimbal

Camera address located at bottom of receiver

View from back of helmet looking forward.
Helmet light structure omitted for clarity
EVA PREP

MIDDECK PREP ...................................................................................................................... 4-2
EVA PREP ...................................................................................................................... 4-3
PREP FOR DONNING ........................................................................................................ 4-3
EMU DONNING ............................................................................................................ 4-5
EMU CHECK ..................................................................................................................... 4-7
EMU PURGE ..................................................................................................................... 4-7
EMU PREBREATHE ......................................................................................................... 4-8
SAFER DONNING ............................................................................................................. 4-8
EVA COMM CONFIG ....................................................................................................... 4-10
EVA COMM DECONFIG .................................................................................................... 4-10
APPROVED NON-EMU HARDWARE MATRIX ............................................................... 4-11
WARNING
Payload bay floods exceed EMU thermal limits during operation. If EVA crew will be operating in vicinity of PLB floods, floods must be turned off now. Cooldown time may be as long as 6 hr

NOTE
Wireless Video Heater pwr should be activated at least 4 hr before EVA to ensure quality video

MIDDECK PREP (30 min)

A7 1. WIRELESS VID HTR – ON
Vol H 2. Unstow EMU Servicing Kit
AW18A 3. LTG FLOOD (four) – ON
4. \EVA Bag installed in airlock
5. \Contamination Detection Kit installed in airlock
6. \REBA sw – OFF (toward left arm of suit)
7. \Helmet lights, helmet light batteries, and EMU TVs installed on helmets
   If EMU TV:
   PLSS 8. \EMU TV power cable demated, connected to ground plug
   9. Disconnect helmets, temp stow
HUT 10. Remove Drink Bag Restraint Bag

NOTE
Drink bag should be used within 24 hr if filled with non-iodinated water

11. Fill drink bag from galley with cold water, remove gas and insert drink bag in Restraint Bag
12. Install Drink Bag Restraint Bag in HUT and dispose of fill tool in wet trash
13. Unstow comm cap and inspect moisture barrier earphone diaphragms (MBEDs) (two) for damage. Replace if reqd (EMU Servicing Kit)
14. Apply anti-fog (EMU Servicing Kit), wipe off:
   Helmets (not Fresnel lens)
   EV glasses, attach to comm cap
15. Stow EMU Servicing Kit
16. Install helmets, lock
17. Attach Cuff C/L to EMUs
18. \Wrist mirrors installed
19. Stage crew preference items in EMU Equipment Bag as reqd

CAUTION
EV crewmembers should minimize application of hygiene and hydrocarbon-based products prior to EVA day to avoid introduction of irritants into EMU. Reference APPROVED NON-EMU HARDWARE MATRIX, 4-11, for acceptable items in EMU
EVA PREP (90 min)

<table>
<thead>
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<th>Param Name</th>
<th>Param ID</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
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<td>LCG 2 SPLY ZN 1 T</td>
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<td>SPLY ZN 2 T</td>
<td>0640186</td>
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</table>

X: SM 60 SM TABLE MAINT

1. Contact MCC for uplink of SM ALERT TMBU (if desired)

Changes enclosed in [ ]

PREP FOR DONNING (30 min)

2. Retrieve, position SCU; remove DCM cover
3. Connect SCU to DCM, √ locked
4. EV-1, EV-2 O2 vlv (two) – op
5. √ ARlk H2O S/O VLV – OPEN (tb-OP)
6. √ EMU O2 ISOL VLV – OP
7. cb MNC EXT ARLK HTR ZN 1,2 (two) – op
8. √ O2 XOVR SYS 1,2 (two) – OP

CAUTION
EMU must be on BATT pwr when airlock power supply turned on

10. PWR/BATT CHGR EMU 1,2 MODE (two) – PWR
    BUS SEL (two) – MNA(MNB)

11. PWR – SCU

12. √ STATUS: [BATT VDC] > 20.3

13. Verify panels as shown next page
14. Perform EVA COMM CONFIG, steps 1-4
15. Comm FREQ – LOW
16. COMM mode – PRI (EMU data only, no audio)
17. Disconnect, transfer, temp stow LTAs, helmets, additional EMU(s) to middeck
18. Remove Dosimeter from inflight garments; insert in LCVG
19. Unstow biomed OBS/EVA cable (EMU Servicing Kit), connect to elec harness
20. Don MAG, TCU, LCVG
21. Don biomed per figure; shave 3-in patch using shave gel and razor (as reqd) (EMU Servicing Kit), clean skin using shave gel and damp towel, dry skin, install stoma seals and apply paste to electrodes, adhere to chest and secure with overtapes
22. Don comm caps
23. Connect biomed to elec harness
24. Perform EVA COMM CONFIG, steps 5 and 6 (EMU hot mic)
25. Verify biomed signal, EMU data, and RF comm with MCC
26. COMM mode – HL

**NOTE**
Be prepared to verify a nominal powerup sequence after the next step and verify no missing segments on display and that all tones are audible

27. PWR – BATT
   Verify no missing segments during display test
   Verify status (continuous) tone and warble tone audible
   Verify BITE light extinguishes. Report anomalies to MCC
28. PWR – SCU

29. Doff comm caps
30. Disconnect biomed
31. AIRLK AUD PWR – AUD/TONE

**EMU DONNING** (55 min)

**NOTE**
May be performed by EV1 and EV2 simultaneously

32. Take one aspirin tablet (325 mg)
33. \( \sqrt{\text{STATUS:} \ [ \text{SOP P} ] = 5410-6800} \) (compare w/gauge)
34. \( \sqrt{\text{Waist ring – op}} \)
35. Don LTA, attach donning handles as reqd
   If boot bladder manipulation reqd:
   36. Disconnect boot from leg (sizing ring)
   37. Pull up excess boot bladder around full circumference of boot disconnect
   38. Connect boot to leg (sizing ring)
   39. Engage Lock 1
   40. \( \sqrt{\text{All locks (three per boot) engaged}} \)
41. Ingress airlock

42. √ Suit arms aligned

43. Disconnect gloves; √wrist disconnects – op

44. Stow IV glasses

45. Don thumb loops

46. √Drink valve posn before HUT donning

47. √Biomed elec harness outside of HUT

PLSS

48. √REBA sw – OFF

49. Don HUT

50. Release thumb loops

51. √Suit arms aligned

52. Don EV glasses as reqd

53. Don comm cap

DCM

54. √COMM mode – HL, vol as reqd

55. √Comm with IV

56. Connect biomed to elec harness

57. Connect LCVG to multiple water connector, √locked

58. √Thermal cover clear of waist ring

59. Waist ring – engage posn

60. Connect waist ring to HUT, √locked

61. Remove donning handles, stow in EMU Equipment Bag; cover waist ring

CAUTION
Pulling on drink bag blue bite vlv to adjust posn can cause vlv to release from stem

62. √Drink vlv posn after HUT donning

63. √Mike boom posn

64. Don comfort gloves, wristlets

65. Wrist rings – engage posn

66. Don EV gloves, √locked

67. Tighten palm restraint straps

If REBA battery:

IV

68. √Glove heater sw (two) – OFF

69. Connect lower arm pwr harness to gloves

70. Stow slack under arm TMG

71. √Cuff C/L posn

CAUTION
Minimize fan operation with O2 ACT – OFF (~2 min)

EV1 DCM

72. FAN – ON (PWR RESTART may occur)

73. √Elec harness clear of neck ring

74. Don helmet, √locked

DCM

75. O2 ACT – IV

76. √Helmet purge vlv – cl, locked

DCM

77. PURGE vlv – cl (dn)

If EMU TV:

PLSS

78. Unstow EMU TV power cable; disconnect from ground plug

79. Mate EMU TV power cable to EMU TV

EV2

80. Repeat steps 33-79 if done serially
EMU CHECK (5 min)

BOTH 81. √ Cooling

* If cooling insufficient slowly cycle temp control vlv between 7 and Max C while IV depresses and holds
* pump priming vlv on back of EMU (30 sec min)

82. Temp control vlv – as reqd
83. √ Wrist rings – covered
84. √ Waist rings – covered

DCM 85. √ COMM mode – HL
86. √ WATER – OFF
87. √ PWR – SCU
88. √ FAN – ON
89. √ Comm FREQ – LOW
90. √ Helmet Light ops
91. √ Helmet purge vlv – cl, locked

DCM 92. √ PURGE vlv – cl (dn)
93. DISP – STATUS: until [LEAK CHECK?] msg displayed
   DISP – YES (hold for 2 sec), follow displayed instructions

* If PRESS FAIL/SUIT P X.X or LEAKAGE HI SUIT P X.X, go to FAILED LEAK CHECK (14.7/10.2 PSI), CC 6-4
* (Cue Card)

EMU PURGE


NOTE
Flex arms and legs periodically and avoid overcooling during purge/prebreathe

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BOTH DCM 1. O2 ACT – PRESS
2. Verify no EMU fit issues
3. PURGE vlv – op (up), begin purge clock
4. When N2 purge complete (per table):
   PURGE vlv – cl (dn)
   O2 ACT – IV
EMU PREBREATHE

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<th>MET / / /</th>
<th>MET / / /</th>
<th>MET / / /</th>
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<td>1. Begin prebreathe clock</td>
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<tr>
<td>2. O2 TK3 HTR A(B) – as reqd</td>
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<td>3. Egress AAP, stow handles</td>
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<tr>
<td>4. AIRLK DEPRESS vlv cap – vent, remove, stow</td>
<td>14.7</td>
<td>04:00</td>
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<tr>
<td>5. Remove loose equipment</td>
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<tr>
<td>6. If reqd, stow REBA jumper cable</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SAFER DONNING (If reqd)

<table>
<thead>
<tr>
<th>IV</th>
<th>R1</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Remove SAFER from Stowage Bag</td>
<td></td>
</tr>
<tr>
<td>8. Remove stowage straps from thruster towers, stow in EMU Equipment Bag; unfold thruster towers</td>
<td></td>
</tr>
<tr>
<td>9. Remove SAFER latch guard from SAFER latch (leave lanyard strap attached to thruster tower)</td>
<td></td>
</tr>
<tr>
<td>10. Inspect:</td>
<td></td>
</tr>
<tr>
<td>Thruster tower hinges</td>
<td></td>
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<tr>
<td>Tower latches</td>
<td></td>
</tr>
<tr>
<td>TMG not blocking thrusters</td>
<td></td>
</tr>
<tr>
<td>SAFER latch guard lanyard strap attached to SAFER towers above tower hinges</td>
<td></td>
</tr>
<tr>
<td>PM</td>
<td></td>
</tr>
<tr>
<td>11. TMG clear from SAFER striker plate on EMU PLSS</td>
<td></td>
</tr>
<tr>
<td>12. Remove Inhibitor; close, fasten port cover</td>
<td>13. MAN ISOL vlv – OP (dn)</td>
</tr>
<tr>
<td>14. Latch – PRELOAD</td>
<td></td>
</tr>
<tr>
<td>15. Rotate latch ccw to recess butterfly in housing</td>
<td></td>
</tr>
</tbody>
</table>

CAUTION
Rotating ccw past soft stop can bind latch

16. Rotate latch ccw to soft stop

17. Rotate latch cw to align latch collar with square bolt head

18. Latch – ENG
19. Mate PLSS to thruster towers
20. Push latch in and rotate cw until stop (~90°)
   * If latch will not engage:
   * Latch – PRELOAD
   * Rotate latch ccw until soft stop
   * Return to step 17

21. Latch – PRELOAD
22. Rotate latch cw until ratcheting

CAUTION
Rotating ccw may disengage SAFER

23. Continue ratcheting until lock marking on latch, tower aligned
24. Latch – LCK
25. Peel back SAFER tower TMG on both towers and install SAFER latch guards over SAFER latches
   * Latch guard lanyards routed under tower TMG
   * Re-attach tower TMG to secure latch guards in place
26. TMG butterfly is perpendicular to slot on PLSS
27. Access to HCM deploy lever
28. TMG not blocking thruster
29. Repeat for SAFER 2
As reqd per MCC,

EV1, EV2

Set battery amp-hours:

DCM

30. DISP – STATUS until [BATT? 32.0AH] displayed
31. DISP – YES (hold for 2 sec)
32. Use DISP to status to desired value
33. When desired value selected, DISP – YES (hold for 2 sec)

IV

34. Install MWS and BRTs (as reqd)

If DCS 760 EVA camera used:

Charger

35. SW2 CAMERA PWR – OFF (LED off)

DCS 760

36. Disconnect DCS 760 pwr cable from DC PWR ADAPTER port
37. Close thermal cover on DC PWR ADAPTER port or connect Ext Camera pwr cable to DC PWR ADAPTER port (as reqd)

EVA Flash

38. Install flash batteries (two) (as reqd)

39. √ EVA tools installed in airlock
40. As reqd, perform BOOSTER FAN DEACTIVATION/REMOVAL (AIRLOCK CONFIG)

A/L

41. Remove, stow appropriate vent ducts to allow hatch closure

MD(flr)

42. As reqd, disconnect vent duct from middeck floor fitting; stow
43. As reqd, unstow, install diffuser cap on middeck floor fitting
44. √ Loose middeck-stowed items clear of inner hatch and middeck diffuser cap air flow

DCM

45. Remove WATER switch guard (two), stow in EMU Equipment Bag
46. REBA sw – ON (toward right arm of suit)

If EMU TV:

47. EMU TV power pb – press, √ Green LED illuminated

If airlock with aft hatch:

A/L(flr)

48. Deploy floor EVA hatch supports

49. Egress airlock
50. Inner hatch – close, lock
51. √ Inner hatch Equal vlv caps (two) – removed
52. Inner hatch Equal vlv (two) – OFF
53. When prebreathe time complete, √ MCC for GO to DEPRESS/REPRESS (Cue Card)
## EVA COMM CONFIG

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| R14:C | 1. √cb MNA UHF EVA – cl  
   |   | √MNC UHF EVA – cl |
| O6 | 2. √UHF SPLX/EVA XMIT FREQ – 259.7/414.2  
   |   | √PWR AMP – OFF  
   |   | √EVA STRING – 1  
   |   | UHF MODE – EVA |
| IVA ATU | 3. √AUD A/G 1(2) – T/R |
| R10 | 4. BIOMED CH 1 – EVA 1  
   |   | 2 – EVA 2 |

If docked with ISS and EVA comm on A/G 1:

**NOTE**

In step 5, A/G 1 docked hardline disabled.  
UHF will become A/G 1 Shuttle-to-ISS link

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| A1R | 5. √MCC and ISS that UHF configured and in  
   |   | Public Call  
   |   | AUD CTR SPACELAB A/G 1 – OFF |
| A1R | 6. AUD CTR UHF A/G 1(2) – T/R  
   |   | √2(1) – OFF  
   |   | √A/A – OFF |

## EVA COMM DECONFIG

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
</table>
| O6 | 1. UHF MODE – OFF  
   |   | √SPLX/EVA XMIT FREQ – 259.7/414.2  
   |   | √PWR AMP – OFF  
   |   | √SPLX SQUELCH – ON  
   | If docked with ISS and EVA comm on A/G 1:  
   |   | AUD CTR SPACELAB A/G 1 – ON |
| A1R | 2. AUD CTR UHF A/G 1(2) – OFF  
   |   | √2(1) – OFF  
   |   | √A/A – OFF |

4-10  
EVA/ALL/GEN H,11
## APPROVED NON-EMU HARDWARE MATRIX

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number</th>
<th>Item</th>
<th>Part Number</th>
<th>Item</th>
<th>Part Number</th>
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</thead>
<tbody>
<tr>
<td>Passive Dosimeter</td>
<td>SED11100212</td>
<td>Band-Aids</td>
<td>8137004444</td>
<td>Genoptic Ophthalmic Ointment</td>
<td>17478-284-35</td>
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<tr>
<td>Panty Shield</td>
<td>S019BY2033</td>
<td>Band-Aids</td>
<td>8137004431</td>
<td>JAXA Crew Personal Dosimeter (JaCPD)</td>
<td>CPADLESXXX</td>
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<tr>
<td>Sock</td>
<td>528-40802</td>
<td>Band-Aids</td>
<td>8137004430</td>
<td>Kerlix Dressing</td>
<td>6715</td>
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<tr>
<td>Sock</td>
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<td>Band-Aids</td>
<td>09681</td>
<td>Kerlix Dressing</td>
<td>K6715</td>
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<td>Sock Liner</td>
<td>ST17C3309</td>
<td>Band-Aids</td>
<td>555-3036</td>
<td>Kling Dressing</td>
<td>6923</td>
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<tr>
<td>Hair Restraint</td>
<td>528-41572-XX</td>
<td>Band-Aid Sheer Dot</td>
<td>4930</td>
<td>Lidocaine Jelly</td>
<td>186033036</td>
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<tr>
<td>Croakie – Modified</td>
<td>528-21224</td>
<td>Band-Aid strips</td>
<td>NON256602</td>
<td>Lotrimin Cream</td>
<td>0085-0963-17</td>
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<tr>
<td>GRD Croakie</td>
<td>CP-3-XX-XX1-XX</td>
<td>Band-Aid Sheer Spot</td>
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<td>Moleskin</td>
<td>528-4304-1</td>
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<td>Croakie</td>
<td>528-41822</td>
<td>Benzoin Swabs</td>
<td>26-06-09</td>
<td>Moiste</td>
<td>1028</td>
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<td>European Crew Personal Dosimeter</td>
<td>EuCPD-FM-XXX-XXX</td>
<td>Benzoin Swabs</td>
<td>26-06-19</td>
<td>Neosporin Plus Cream</td>
<td>0501-3712-05</td>
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<tr>
<td>Eye Glasses</td>
<td>CP-3-XX-XX-XX</td>
<td>Bioclusive</td>
<td>2461</td>
<td>Polysporin Ointment</td>
<td>81079887</td>
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<tr>
<td>OBS Cable</td>
<td>SED42100961</td>
<td>Blistex</td>
<td>1015798221</td>
<td>Polytrim</td>
<td>23782410</td>
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<td>OBS Signal Cond</td>
<td>16843</td>
<td>Blistex</td>
<td>10157-9920-2</td>
<td>Povidone Iodine Swabs</td>
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<tr>
<td>OBS Sternal Harness</td>
<td>SH42100149</td>
<td>Ciloxan 0.3%</td>
<td>0065-0654-35</td>
<td>Pred Forte</td>
<td>1198018001</td>
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<td>OBS Sternal Harness</td>
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<td>Ciloxan Ointment</td>
<td>65065625</td>
<td>Proparacaine</td>
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<td>OBS Sternal Harness</td>
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<td>Ciprofloxacin Ointment</td>
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<td>MBED</td>
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<td>Clotrimazole Cream</td>
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<td>Russian Dosimeter</td>
<td>IBMP-CPD-001</td>
<td>Cortisporin Ophthalmic</td>
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<td>51570-131-20</td>
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<tr>
<td>3” Ace Bandage</td>
<td>23593-130</td>
<td>Coverlet</td>
<td>01307</td>
<td>Steri-Strip</td>
<td>R1547</td>
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<td>4” Ace Bandage</td>
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<td>Coverlet</td>
<td>47135</td>
<td>Steri-Strip</td>
<td>R1546</td>
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<td>6” Ace Bandage</td>
<td>54252A7</td>
<td>Coverlets</td>
<td>01306</td>
<td>Tears Naturale</td>
<td>65041830</td>
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<td>4” x 4” Gauze</td>
<td>555-6284</td>
<td>Cyclogyl</td>
<td>65039715</td>
<td>Tegaderm</td>
<td>1624W</td>
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<td>4” x 4” Vaseline Gauze</td>
<td>8884-414600</td>
<td>Dermabond</td>
<td>DB12</td>
<td>Tegaderm Dressing</td>
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<tr>
<td>Adaptec Dressing</td>
<td>K6112</td>
<td>Dermabond</td>
<td>301128243</td>
<td>Telfa Pads</td>
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<td>Adaptec Non-adhering Dressing</td>
<td>2012</td>
<td>Dermicel Tape</td>
<td>5143</td>
<td>Tobrex Solution</td>
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<td>Afrin Nasal Spray</td>
<td>8575608</td>
<td>Dermicel Tape</td>
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<td>Topicort</td>
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<td>Auralgan</td>
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<td>Elastoplast Tape</td>
<td>23631-040X</td>
<td>Triamcinolone Acetonide Dental Paste</td>
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<td>Bacitracin</td>
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<td>Eye Pads</td>
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<td>Triamcinolone Cream</td>
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<td>Bactroban Ointment</td>
<td>0029-1527-22</td>
<td>Famiciclovir</td>
<td>0007-4117-13</td>
<td>VIROPTIC</td>
<td>61570-037-75</td>
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<td>Bactroban Ointment</td>
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<td>Gauze Pads</td>
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<td>Zovirax Ointment</td>
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<td>Gauze Pads</td>
<td>555-6284</td>
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</tbody>
</table>
## EMU Status

### EMU Status Short Stack:
Used to periodically (every hour for the first 6.5 hr, then every 10 min) report to MCC-H if the EMU data downlink is not available.

### Table of Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Normal Status</th>
<th>EV1</th>
<th>EV2</th>
<th>EV1</th>
<th>EV2</th>
<th>EV1</th>
<th>EV2</th>
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</thead>
<tbody>
<tr>
<td>O2 Pos</td>
<td>EVA</td>
<td></td>
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<tr>
<td>Subl P</td>
<td>2.0 to 4.2 psia</td>
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<tr>
<td>Time EV</td>
<td>HR:MIN since PWR-BATT</td>
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<tr>
<td>Time LF</td>
<td>HR:MIN remaining at present use rate</td>
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<td>%PWR (O2) LF</td>
<td>Limiting consumable displayed</td>
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<tr>
<td>%O2 (PWR) LF</td>
<td>Nonlimiting consumable displayed</td>
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<tr>
<td>Suit P</td>
<td>4.2 to 4.4 psid (4.2 to 5.5 psid post depress)</td>
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<td>O2 P</td>
<td>150 to 950 psia</td>
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<td>O2 Rate</td>
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<td>Bat Vdc</td>
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<td>Bat Amp</td>
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<td>CO2</td>
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<td>H2O GP</td>
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<td>H2O WP</td>
<td>14.0 to 16.0 psid</td>
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<tr>
<td>Data?</td>
<td>COMBO</td>
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</tr>
<tr>
<td>Batt</td>
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<tr>
<td>Gauge</td>
<td>4.2 to 4.4 psid (4.2 to 5.5 psid post depress)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

---

5-2

EVA/ALL/GEN H,4
DEPRESS/REPRESS
DEPRESS (10 min)

When prebreathe complete
- DCM 1. \( \sqrt{\text{Comm FREQ} - \text{LOW}} \)
  2. COMM mode – PRI
- AW82B 3. AIRLK DEPRESS vlv – 5, EV ALERT TONE, monitor suit P gauge < 5.5
  * If gauge > 5.5, stop depress, \( \sqrt{\text{MCC}} * \)
  4. Airlock at 6.0, EV ALERT TONE
  5. When airlock at 5.0, AIRLK DEPRESS vlv – CL, EV ALERT TONE

BOTH DCM 6. DISP – STATUS: until [LEAK CHECK?] displayed, DISP – YES (hold for 2 sec), follow displayed instructions
  * If \( \text{LEAKAGE HI SUIT P X.X} \) go to FAILED *
  * LEAK CHECK (5 PSI), reverse side *

- AW82B 7. \( \sqrt{\text{O2 ACT} - \text{EVA}} \)
- BOTH 8. AIRLK DEPRESS vlv – 0, EV ALERT TONE, monitor suit P gauge < 5.5
  * If gauge > 5.5, stop depress, \( \sqrt{\text{MCC}} * \)

POST DEPRESS (5 min)

BOTH DCM
- AW18H 1. PWR – BATT, EV WARN TONE
  (IV record MET _ _ _ _ _ _ _ _)
- DCM 2. Temp control vlv – Max H
  3. WATER – ON
  7. DCM blank, BITE off
  8. Temp control vlv – 3 to MAX C
  9. STATUS, compare to Cuff C/L, 1 (IV record)
  10. Visors as reqd
  11. Perform AIRLOCK EGRESS, Cuff C/L, 47, or Flight Specific Timeline

IV ML86B:C 12. \( \sqrt{\text{cb MNC EXT ARLK HTR LINE ZN 1,2}} \) (two) – cl

PRE REPRESS (5 min)

- IV ML86B:C 1. \( \sqrt{\text{cb MNC EXT ARLK HTR LINE ZN 1,2}} \) (two) – op
- MD(fr) 2. \( \sqrt{\text{EMU O2 ISOL vlv – OP}} \)
- DCM 3. \( \sqrt{\text{SCUs connected to DCM}} \)
- BOTH 4. \( \sqrt{\text{WATER – OFF for 2 min}} \)
  5. Outer hatch closed and locked
  6. Disc waist tethers, attach to EMU

AW82B 7. \( \sqrt{\text{EV-1,EV-2 O2 vlv (two) – OP}} \)

AW18H 8. PWR/BATT CHGR EMU 1,2
  BUS SEL (two) – MAN(MAN)

DCM 9. PWR – SCU, EV WARN TONE
  (IV record MET _ _ _ _ _ _ _ _)

REPRESS (10 min)

WARNING

If on SOP, leave O2 ACT – EVA thru airlock repress

BOTH DCM
- BOTH 1. O2 ACT – PRESS
- 2. COMM mode – HL

NOTE

IV expect dP/dT alarm during repress

- AW82B 3. \( \sqrt{\text{AIRLK DEPRESS vlv – CL}} \)
  4. Inner hatch Equal vlv (one) – throttle OFF to NORM (as reqd), EV ALERT TONE
  5. Airlock at 4.0, EV ALERT TONE
  6. When airlock at 5.0, Equal vlv – OFF, EV ALERT TONE

DCM 7. \( \sqrt{\text{Airlock pressure integrity (2 min, } \Delta P < 0.1 \text{ psi)}} \)
  8. \( \sqrt{\text{EV Glove heaters – OFF, gloves clean}} \)

WARNING

If Cuff 1 symp resolve upon repress, report as Cuff 2
If any DCS, leave O2 ACT – PRESS

DCM
- 9. O2 ACT – IV
  10. Inner hatch Equal vlv (one) – NORM, EV ALERT TONE
  11. Airlock dP/dT – 0, EV ALERT TONE
  12. Go to POST EVA
DEPRESS/REPRESS
**DEPRESS** (25 min)

- When prebreathe complete
  - DCM 1. **√** Comm FREQ ~ LOW
  - COMM mode ~ PRI
  - AW82B 3. AIRLK DEPRESS vlv ~ 5, EV ALERT TONE, monitor suit P gauge < 5.5
    * If gauge > 5.5, stop depress, **√** MCC
  - 4. Airlock at 6.0, EV ALERT TONE
  - 5. When airlock at 5.0, AIRLK DEPRESS vlv ~ CL, EV ALERT TONE

**BOTH DCM**
- 6. DISP ~ STATUS; until **LEAK CHECK ?** displayed, DISP ~ YES (hold for 2 sec), follow displayed instructions
  * If **LEAKAGE HI [SUIT P X.X]** go to FAILED
  * **LEAK CHECK (5 PSI),** reverse side

- 7. **√** O2 ACT ~ EVA
- 8. **√** MCC for aft module pressure integrity
- **AW82B**
- 9. AIRLK DEPRESS vlv ~ 0, EV ALERT TONE, monitor suit P gauge < 5.5
  * If gauge > 5.5, stop depress, **√** MCC
- 10. Airlock dP/dt ~ 0, EV ALERT TONE

**POST DEPRESS** (15 min)

**BOTH DCM**
- 1. PWR ~ BATT, EV WARN TONE
  - (IV record MET ~ _ _ _ _)[PET = 00:00]
- **AW18H**
- 2. PWR/BATT CHGR EMU 1.2 BUS SEL (two) ~ OFF
- 3. Disc SCUs; install DCM covers
- 4. Stow SCUs on AAP, Velcro to wall
- 5. When EVA hatch dP < 0.5, EVA hatch ~ part op

**AW82B**
- 6. AIRLK DEPRESS vlv ~ CL
- 7. Attach waist tether(s) to A/L D-ring for egress
- 8. EVA hatch ~ open, stow
- **DCM**
- 9. Temp control vlv ~ Max H
- 10. WATER ~ ON
- 11. **√** DCM blank, BITE off
- 12. Temp control vlv ~ 3 to MAX C
- 13. **√** STATUS, compare to Cuff C/L, 1 (IV record)
- 14. Visors as reqd
- 15. Perform AIRLOCK EGRESS, Cuff C/L, 47, or Flight Specific Timeline

**IV**
- **ML86B:C**
- 16. cb MNC EXT ARLK HTR LINE ZN 1.2 (two) ~ cl

---

**PRE REPRESS** (5 min)

**IV**
- **ML86B:C**
- 1. **√** cb MNC EXT ARLK HTR LINE ZN 1.2 (two) ~ op
- **MD(flr)**
- 2. **√** EMU O2 ISOL vlv ~ OP

**BOTH DCM**
- 3. **√** WATER ~ OFF
- 4. **√** EVA hatch closed, locked
- 5. Unstow SCU, remove DCM cover, connect SCU, **√** locked
- 6. Disc waist tethers, attach to EMU
- **AW82B**
- 7. **√** EV-1, EV-2 O2 vlv (two) ~ OP
- **AW18H**
- 8. PWR/BATT CHGR EMU 1.2 BUS SEL (two) ~ MNA(MNB)
- **DCM**
- 9. PWR ~ SCL, EV WARN TONE
  - (IV record MET ~ _ _ _ _)

---

**REPRESS** (20 min)

**WARNING**

- If on SOP, leave O2 ACT ~ EVA thru airlock repress

**BOTH DCM**
- 1. **O2 ACT ~ PRESS**
- 2. **√** COMM mode ~ HL

**NOTE**

- IV1 expect dP/dT alarm during repress
- **AW82B**
- 3. **√** AIRLK DEPRESS vlv ~ CL
- 4. Inner hatch Equal vlv (one) ~ throttle OFF to NORM (as reqd), EV ALERT TONE
- 5. Airlock at 4.0, EV ALERT TONE
- 6. When airlock at 5.0, Equal vlv (two) ~ OFF, EV ALERT TONE
- **DCM**
- 7. **√** Airlock pressure integrity (4 min, dP ≤ 0.1 psi)
- 8. **√** EV Glove heaters ~ OFF, gloves clean

---

**WARNING**

- If Cuff 1 symp resolve upon repress, report as Cuff 2

**NOTE**

- If any DCS, leave O2 ACT ~ PRESS

**DCM**
- 1. **O2 ACT ~ IV**
- 2. Inner hatch Equal vlv (one) ~ NORM, EV ALERT TONE
- 3. AIRLK DEPRESS vlv ~ CL
- 4. Airlock dP/dT ~ 0, EV ALERT TONE
- 5. Go to **POST EVA**

---

**EVA-2a/TNL/O/V**
FAILED LEAK CHECK
FAILED LEAK CHECK (5 PSI)

1. Leaking EMU: Repeat leak check on watch and gauge as follows:
- O2 ACT – PRESS until SUIT P = 4.2 to 4.4 and stable, compare with gauge then
- O2 ACT – IV, start timing
  (1 min, Max ΔP = 0.3 psi)
2. If leak check passed:
   - Return to DEPRESS/REPRESS Cue Card, DEPRESS, step 7 (suit pressure sensor unreliable) >>
3. O2 ACT – IV
4. Equal vlv (one) – NORM
   - When ΔP < 0.5, open inner hatch
   - Equal vlv (one) – OFF
5. Repeat leak check as follows:
   - PURGE vlv – cl (dn)
   - O2 ACT – PRESS, until SUIT P = 4.2 to 4.4 and stable, compare with gauge then
   - O2 ACT – IV, start timing
     (1 min, Max ΔP = 0.3 psi)
6. Contact MCC

FAILED LEAK CHECK (14.7/10.2 PSI)

NOTE
The following steps are performed on the leaking EMU only

1. Leaking EMU: O2 ACT – PRESS
2. Rotate lower arm assemblies 180 degrees cw and 360 degrees ccw
3. Align suit arms
4. Sizing rings locked
5. Swivel hips from side to side
6. Repeat leak check as follows:
   - Helmet purge vlv – cl, locked
   - PURGE vlv – cl (dn)
   - O2 ACT – PRESS until SUIT P = 4.2–4.4 and stable (compare w/gauge)
   - O2 ACT – IV, start timing, 1 min
     (during EMU CHECKOUT, 2 min)
     (Max ΔP = 0.3 psi)

7. If leak check passed, go to step 11
   If leak check failed:
   - PURGE vlv – op (up), O2 ACT – OFF
   - FAN – OFF (if EVA PREP)
   - Cycle/inspect suit disconnects as follows:
     - Gloves, helmet (leave off), LTA, boots
     (if removed in EVA PREP)
     - FAN – ON (if EVA PREP)
8. Install helmet, repeat leak check step 6, then:
9. If leak check passed, go to step 11
   If leak check failed:
   - PURGE vlv – op (up), O2 ACT – OFF
   - FAN – OFF (if EVA PREP)
   - Cycle/inspect suit disconnects as follows:
     - Gloves, helmet (leave off)
     - Helmet purge vlv, Sizing rings
     - LiOH cartridge (O-rings)
     - FAN – ON (if EVA PREP)
10. Install helmet, repeat leak check step 6, then:
11. If leak check passed:
    - Waist ring, wrist rings covered
      Continue EMU CHECKOUT or EVA PREP >>
12. If leak check failed (EMU lost):
    - Contact MCC
FLIGHT SPECIFIC TIMELINES
TOOLS AND STOWAGE

PORT LIGHTWEIGHT TOOL STOWAGE ASSEMBLY (TSA) .............................................. 8-2
PGT CHECKOUT ........................................................................................................... 8-3
PGSC-PGT CONNECTION (A31P AND 760XD) .............................................................. 8-4
PROGRAM PGT SETTINGS .......................................................................................... 8-5
DOWNLOAD/ERASE EVENT LOG ................................................................................ 8-5
PGT CONTINGENCIES............................................................................................... 8-6
PGT STANDARD SETTINGS ....................................................................................... 8-7
PORT LIGHTWEIGHT TOOL STOWAGE ASSEMBLY (TSA)

- **Forward Tray layout and Labels**
- **Aft Tray Layout and Labels**

- **Centerline Latch Tools (2)**
- **3-Pt Latch Tools (2)**
- **Adjustable tethers (2)**
- **RMS Rope Reel**
- **This volume is flown empty**

To access PAD and PBA socket, pull this cushion out (cushion is tethered)
PGT CHECKOUT

1. Unstow PGT
2. √PWR – OFF
3. √Battery connector covering removed
4. Install battery
5. Ratchet collar – not MTR
6. Cycle MTL settings
7. Cycle bayonette fittings
8. Speed collar – CAL
9. PWR – ON
10. √‘TRIG TO CAL’ on display
11. Press, release trigger to calibrate
12. √‘CAL PASSED’ on display
13. Ratchet collar – MTR
14. √Illumination of all LEDs and ‘LED TEST’ displayed
15. Press trigger and hold
   √BATT VDC ≥ 36.0
16. Speed collar – cw
17. Press trigger and √drive rotates cw
18. Speed collar – ccw
19. Press trigger and √drive rotates ccw
20. To verify programmed settings, cycle MODE/torque collar/speed collar and compare with PGT SETTINGS TABLE
21. PWR – OFF
PGSC-PGT CONNECTION (A31P AND 760XD)

PGSC  
1. √ PGSC equipped with RS422 PCMCIA Card and adapters (two)
2. PWR – OFF
   √ PGT Battery installed
3. Ratchet collar – not MTR

   CAUTION
   Do not over-torque serial port cover screw

4. Open PGT serial port cover using 3/32” Allen Wrench attached to the
   PGT-RS422 Cable
5. Connect PGT-RS422 Cable to PGT Remote Programming Port

PGSC  
6. Connect PGT-RS422 Cable to COM 2 or COM 4 adapter box, as desired

PGT  
7. PWR – ON

PGSC  
If PGSC not powered:
8. PGSC PWR – ON
9. Select SHUTTLE APPS icon on PGSC Windows desktop, then select either
   ‘PGT (COM 2)’ or ‘PGT (COM 4)’ icon
   (Use PGT icon corresponding to COM port selected in step 6)
10. √ Tool Communication Check dialog box appears
    √ Serial Connection verified
    √ Intool software version 2.2

   * If dialog box in previous step indicates failure to read software version or*
   * reports a communication error, verify electrical connections are fully*
   * mated at identified locations below (1-5), then clear dialog box, close*
   * application, and repeat steps 9 and 10

   1 = RS422 PCMCIA Card to PGSC (check PC card is fully engaged)
   2 = RS422 PCMCIA Card to dongle
   3 = dongle to adapter box
   4 = adapter box to PGT RS422 Cable
   5 = PGT RS422 cable to PGT Remote Programming Port

11. Select CONTINUE
**PROGRAM PGT SETTINGS**

1. Perform PGSC-PGT CONNECTION (A31P AND 760XD)
   If loading settings from a set file in C:\SPOCAPPS\PGT32\SETTINGS:
   2. Select FILE, OPEN ...
   3. Select desired settings file, OPEN
   4. Select TORQUE/REVOLUTIONS SETTINGs tab in Pistol Grip Tool Remote Software window
   5. Enter changes to table as necessary
   6. Select SPEED & POWER MANAGEMENT SETTINGS tab
   7. Enter changes to table as necessary
   8. √Ratchet collar – not MTR
   9. Select TOOL, SEND DATA TO TOOL
   10. Select desired tables for upload
   11. √All sent settings – black on gray (programmed successfully)
   If saving new settings to a file:
   12. Select FILE, SAVE AS ...
   13. Type in new file name, SAVE
   14. Verify programmed settings on PGT by cycling MODE/torque collar/speed collar; compare displayed values to expected values

**DOWNLOAD/ERASE EVENT LOG**

1. Perform PGSC-PGT CONNECTION (A31P AND 760XD)
2. √Ratchet collar – not MTR
3. Select EVENT LOG tab
4. Select TOOL, GET DATA FROM TOOL...
5. Select TOOL EVENT LOG DATA (READ-ONLY)
6. √DOWNLOAD PGT EVENT LOG dialog box appears
7. Select YES to download data
8. √SAVE EVENT LOG DATA TO FILE dialog box appears
9. Enter name for file
10. Select SAVE
11. √Event Log data displayed in viewer
12. If erasing Event Log data from PGT, select OK in ERASE EVENT LOG dialog box
<table>
<thead>
<tr>
<th>MESSAGE</th>
<th>CORRECTIVE ACTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BATTRY HITEMP</td>
<td>If alternate battery avail: power off, change battery. Otherwise, power off, switch to Ratchet mode.</td>
</tr>
<tr>
<td>BATTRY LOTEMP (blinking)</td>
<td>Drive tool with no load to increase battery temperature. If no joy and alternate battery avail: power off, change battery. Otherwise, power off, switch to Ratchet mode.</td>
</tr>
<tr>
<td>BATTRY LOVOLT (blinking)</td>
<td>Continue using until tool is unable to deliver sufficient torque. If no joy and alternate battery avail: power off, change battery. Otherwise, power off, switch to Ratchet mode.</td>
</tr>
<tr>
<td>CAL FAILED</td>
<td>Press, release trigger to repeat calibration. If no joy, power cycle, calibrate. If no joy, power off, switch to Ratchet mode.</td>
</tr>
<tr>
<td>COLLAR ERROR</td>
<td>Cycle Torque and Speed collars to clear error. If no joy, power cycle, calibrate. If no joy, power off, switch to Ratchet mode.</td>
</tr>
<tr>
<td>COMPAR ERROR</td>
<td>Cycle Torque collar and A/B mode switch. If no joy, power cycle, calibrate. If no joy, power off, switch to Ratchet mode.</td>
</tr>
<tr>
<td>EEPROM WR ERR (blinking)</td>
<td>Power cycle, calibrate. If no joy, power off, switch to Ratchet mode.</td>
</tr>
<tr>
<td>HI TORQ</td>
<td>If fault occurs during engagement and MTL did not slip, ignore message. Otherwise: power cycle, calibrate. If no joy, power off, switch to Ratchet mode.</td>
</tr>
<tr>
<td>HICURR</td>
<td>Reattempt operation. If no joy, power cycle, calibrate. If no joy, power off, switch to Ratchet mode.</td>
</tr>
<tr>
<td>HYBRID HITEMP</td>
<td>Power cycle, calibrate. If no joy, power off, switch to Ratchet mode.</td>
</tr>
<tr>
<td>LO TORQ</td>
<td>Reattempt operation until desired torque is reached. If no joy, power cycle, calibrate. If no joy, power off, switch to Ratchet mode.</td>
</tr>
<tr>
<td>LOCURR</td>
<td>Reattempt operation. If no joy, power cycle, calibrate. If no joy, power off, switch to Ratchet mode.</td>
</tr>
<tr>
<td>LOG IS FULL (blinking)</td>
<td>Continue operation.</td>
</tr>
<tr>
<td>MOTOR HITEMP</td>
<td>Power off, switch to Ratchet mode.</td>
</tr>
<tr>
<td>OVER CURR</td>
<td>Power cycle, calibrate. If no joy, power off, switch to Ratchet mode.</td>
</tr>
<tr>
<td>SLFTST FAIL X</td>
<td>Power cycle, calibrate. If no joy, power off, switch to Ratchet mode.</td>
</tr>
</tbody>
</table>
## PGT STANDARD SETTINGS

<table>
<thead>
<tr>
<th>SETTINGS</th>
<th>TORQUE SETPOINT (FT-LB)</th>
<th>TORQUE WINDOW (FT-LB)</th>
<th>TORQUE THRESHOLD (FT-LB)</th>
<th>TURNS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>2.5</td>
<td>± 1.0</td>
<td>1.0</td>
<td>--</td>
</tr>
<tr>
<td>A2</td>
<td>3.8</td>
<td>± 1.0</td>
<td>1.0</td>
<td>--</td>
</tr>
<tr>
<td>A3</td>
<td>4.8</td>
<td>± 1.0</td>
<td>1.0</td>
<td>--</td>
</tr>
<tr>
<td>A4</td>
<td>6.3</td>
<td>± 1.0</td>
<td>1.0</td>
<td>--</td>
</tr>
<tr>
<td>A5</td>
<td>7.0</td>
<td>± 1.0</td>
<td>1.0</td>
<td>--</td>
</tr>
<tr>
<td>A6</td>
<td>8.3</td>
<td>± 1.0</td>
<td>1.0</td>
<td>--</td>
</tr>
<tr>
<td>A7</td>
<td>9.2</td>
<td>± 1.0</td>
<td>1.0</td>
<td>--</td>
</tr>
<tr>
<td>B1</td>
<td>12.0</td>
<td>± 1.0</td>
<td>1.0</td>
<td>--</td>
</tr>
<tr>
<td>B2</td>
<td>16.0</td>
<td>± 1.2</td>
<td>1.0</td>
<td>--</td>
</tr>
<tr>
<td>B3</td>
<td>18.4</td>
<td>± 1.7</td>
<td>1.0</td>
<td>--</td>
</tr>
<tr>
<td>B4</td>
<td>19.4</td>
<td>± 1.9</td>
<td>1.0</td>
<td>--</td>
</tr>
<tr>
<td>B5</td>
<td>22.0</td>
<td>± 2.0</td>
<td>1.0</td>
<td>--</td>
</tr>
<tr>
<td>B6</td>
<td>24.0</td>
<td>± 2.0</td>
<td>1.0</td>
<td>--</td>
</tr>
<tr>
<td>B7</td>
<td>25.5</td>
<td>± 2.0</td>
<td>1.0</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SETTINGS</th>
<th>CCW1</th>
<th>CCW2</th>
<th>CCW3</th>
<th>CW3</th>
<th>CW2</th>
<th>CW1</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPEED (RPM)</td>
<td>10</td>
<td>30</td>
<td>60</td>
<td>60</td>
<td>30</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>SLEEP TIME</th>
<th>AUTO – OFF TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15 min</td>
<td>30 min</td>
</tr>
</tbody>
</table>

### MULTI-SETTING TORQUE LIMITER (MTL) SETTINGS
- 2.5
- 5.5
- 10.5
- 15.5
- 23.5
- 30.5
This Page Intentionally Blank
POST EVA

POST EVA ...................................................................................................................... 9-2
SUIT DOFFING .............................................................................................................. 9-2
SAFER DOFFING ........................................................................................................... 9-2
EMU WATER RECHARGE ........................................................................................ 9-3
SAFER STOW ............................................................................................................... 9-3
SUIT DRYING/SEAL WIPE ......................................................................................... 9-4
OXYGEN RECHARGE VERIFICATION ................................................................... 9-4
WATER FILL VERIFICATION ....................................................................................... 9-4
EMU POWERDOWN/OVERNIGHT STOW ............................................................... 9-5
**POST EVA** (00:45 if NOT performing 'If reqd' proc blocks)
(01:25 if performing all 'If reqd' proc blocks)

**SUIT DOFFING**

- **WARNING**
  - Do not doff EMU if DCS symptoms resolved during REPRESS. √MCC via PMC

### IV
- 1. When ΔP < 0.5, open hatch
- 2. As reqd, remove diffuser cap at middeck floor, stow
- 3. As reqd, unstow airlock vent duct, connect end to middeck floor fitting
- 4. Configure appropriate vent ducts for airflow into airlock
- 5. As reqd, perform BOOSTER FAN INSTALLATION/ACTIVATION (AIRLOCK CONFIG)
- 6. √Gloves clean

* If reqd, IV use damp towel to clean gloves *

### BOTH DCM
- 7. O2 ACT – OFF
- 8. PURGE vlv – op (up)
- 9. Install WATER sw guards (two)

**If EMU TV:**
- 10. EMU TV power pb – press; √Green LED not illuminated

**If REBA battery:**
- 11. √Glove heaters sw (one per glove) – OFF
- 12. REBA sw – OFF (toward left arm of suit)
- 13. Disconnect lower arm pwr harness from gloves
- 14. Stow lower arm and glove pwr harness connectors under TMG

### PLSS
- 15. Demate EMU TV power cable, mate to ground plug
- 16. √STATUS: [SUIT P] < 0.4 (compare w/gauge); disconnect gloves, stow in EMU Equipment Bag
- 17. Disconnect helmet, stow

### AW82B
- 18. AIRLK DEPRESS vlv – install cap

**SAFER DOFFING** (10 min) (If reqd)

### IV
- 19. Remove SAFER latch guard from SAFER latch (leave lanyard strap attached to thruster tower)
- 20. Latch – ENG
- 21. Rotate latch ccw until release (~90 deg)
- 22. Demate PLSS from thruster towers
- 23. Fold thruster towers
- 24. Transfer to middeck

### PM
- 25. Install inhibitor (not reqd if SAFER has been used)
- 26. Temp stow SAFER
- 27. Repeat for SAFER 2

Cont next page
28. If reqd, unstow REBA jumper cable
29. AAP release handles to 90°
30. Engage HUT in AAP (IV assist as reqd)
31. AAP release handles to lock
32. FAN – OFF (fwd)
33. COMM mode – OFF
34. Doff comm cap
35. Disconnect waist ring, LCVG, biomed
36. √ Wrist disconnects – op
37. Doff EV glasses
38. Doff HUT
39. Doff LTA, secure to handrail
40. Remove dosimeter from LCVG; insert in inflight garment
41. Doff: Biomed (disc OBS/EVA cable, stow in EMU Servicing Kit)
   LCVG (secure to HUT)
   TCU (allow to dry, as reqd)
   MAG, stow in wet trash
42. Install Multiple Water Connector cover
43. Perform EVA COMM DECONFIG (EVA PREP)
44. O2 TK3 HTR A(B) – as reqd
45. cb MNC EXT ARLK HTR LINE ZN 1,2 (two) – cl
46. SPLY H2O TKA OUTLET – CL (tb-CL)
47. Use TKB quantity:
   PARAM ID – ITEM 1 +0 6 2 0 4 2 0 EXEC
48. Log value before recharge
<table>
<thead>
<tr>
<th>Recharge #</th>
<th>H2O TKB %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>
49. √ EMU 1,2 H2O WASTE tb (two) – CL
   SPLY (two) – OP (tb-OP)
50. √ H2O TKB quantity decreasing

SAFER STOW (10 min) (If reqd)
51. √ Inhibitor installed
52. Latch – PRELOAD
53. Rotate latch cw until lock markings on latch and tower recess aligned
54. Push in latch, latch – LCK
55. Install latch guards over latches under TMG, and reattach TMG
56. Fold thruster towers
57. Unstow stowage straps from EMU Equipment Bag; install
58. MAN ISOL vlv – CL (up)
59. Stow SAFER in Stowage Bag
60. Repeat for SAFER 2
SUIT DRYING/SEAL WIPE

61. Wipe with drying towel:
   - LTA, legs, boots
   - HUT, suit arms
   - Gloves

62. Inspect Gloves for damage
    Report damage to MCC

**WARNING**

Avoid stericide contact with eyes. Wash hands thoroughly after application

63. Wipe LTA crotch and HUT armpit areas with stericide (in EMU Servicing Kit)

64. Lightly wipe seals on LTA waist ring, arm wrist rings, HUT neck ring with lint-free wipe (in EMU Servicing Kit)

65. Clean, refurbish biomed

66. Remove drink bag from HUT and dispose in wet trash

67. Drink Bag Restraint Bag installed in HUT

**OXYGEN RECHARGE VERIFICATION**

DCM 68. STATUS: O2 P ~850 (recharge complete)

**WATER FILL VERIFICATION** (10 min) (If reqd)

DCM 69. STATUS: H2O WP 8-15 psi and stable for ~30 sec
   (indicates charging complete)

**SM 60 TABLE MAINT**

60. Use TKB quantity:
  - PARAM ID – ITEM 1 +0 6 0 4 2 0 EXEC

61. Log value after recharge

<table>
<thead>
<tr>
<th>Recharge #</th>
<th>H2O TKB %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE**

Full charge = ~6%/EMU

62. SPLY H2O TKA OUTLET – OP (tb-OP)

63. FAN SEP same as HOSE BLOCK

64. MODE – COMMODE/MANUAL/EMU, posn guard over sw
   (airflow, WCS ON lt on)

AW82D 65. EMU 1,2 H2O SPLY (two) – CL (tb-CL)

66. Install SCOFS, lock

67. O2 ACT – IV

AW82H 68. EMU 1,2 H2O WASTE reg (two) – MAN OP

**NOTE**

Step 79 will be performed serially for EMU 1 and EMU 2

AW82D 79. EMU 1(2) H2O WASTE (one) – OP (tb-OP) (1 min), then
   – CL (tb-CL)
   – Repeat for other EMU

AW82H 80. EMU 1,2 H2O WASTE reg (two) – REGULATING

DCM 81. O2 ACT – OFF

82. Remove SCOFS, stow

WCS 83. MODE – AUTO (√WCS ON lt off)
EMU POWERDOWN/OVERNIGHT STOW

84. Stow comm cap in right arm of EMU
85. Install helmets and covers

AW18D
86. AIRLK AUD PWR – OFF

AW18H
87. PWR/BATT CHGR EMU 1,2 BUS SEL (two) – OFF
     PWR/BATT CHGR EMU 1,2 MODE (two) – OFF

AW82D
88. EMU 1,2 H2O WASTE, SPLY tb (four) – CL
AW82B
89. EV-1, EV-2 O2 vlv (two) – CL

If not performing in-suit EMU battery recharge:

BOTH
DCM
90. Remove SCU; install DCM cover
91. Stow SCU on AAP, Velcro to wall
92. Tether LTA to airlock handrail
93. Hang LCVGs, TCUs, and other EMU accessories for drying

If last EVA completed:

[ ] X: SM 60 SM TABLE MAINT
94. Contact MCC for uplink of SM ALERT TMBU (if desired)

Changes enclosed in [ ]

<table>
<thead>
<tr>
<th>Param Name</th>
<th>Param ID</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
</tr>
</thead>
<tbody>
<tr>
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<td>OSH</td>
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<td>EXT A/L O2 SPLY ZN 2 T</td>
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</table>
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WATER RECHARGE

IF EMU NOT ALREADY POWERED UP:

EMU POWERUP

BOTH DCM
1. Retrieve, position SCUs; remove DCM covers
2. Connect SCUs to DCM, √locked
3. PWR – BATT

CAUTION
EMU must be on BATT pwr when airlock pwr supply is turned on

AW18H 4. PWR/BATT CHGR EMU 1,2 MODE (two) – PWR
        BUS SEL (two) – MNA(MNB)

MD(flr) 5. √EMU O2 ISOL VLV – OP

AW82B 6. EV1,2 O2 vlv (two) – OP

DCM 7. PWR – SCU

WATER FILL

MO13Q 8. √ARLK H2O S/O VLV – OPEN (tb-OP)
R11L 9. √SPLY H2O TKA OUTLET – CL (tb-CL)

CRT 10. Use TKB quantity:
        PARAM ID – ITEM 1 +0 6 2 0 4 2 0 EXEC

11. Log value before recharge

<table>
<thead>
<tr>
<th>Recharge #</th>
<th>H2O TKB %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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</tr>
<tr>
<td>2</td>
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<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

AW82D 12. √EMU 1,2 H2O WASTE tb (two) – CL
        SPLY (two) – OP (tb-OP)

13. √H2O TKB quantity decreasing

NOTE
Full charge requires ~15 min

WATER FILL VERIFICATION

DCM 14. √STATUS: H2O WP 8-15 psi and stable for ~30 sec (indicates charging complete)

CRT 15. Use TKB quantity:
        PARAM ID – ITEM 1 +0 6 2 0 4 2 0 EXEC

16. Log value after recharge

<table>
<thead>
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<tr>
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<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Cont next page
NOTE
Full charge = ~6%/EMU

17. SPLY H2O TKA OUTLET – OP (tb-OP)
18. √FAN SEP same as HOSE BLOCK
19. MODE – COMMODE/MANUAL/EMU, posn guard over sw
   (√airflow, WCS ON it on)
20. EMU 1,2 H2O SPLY (two) – CL (tb-CL)
21. Install SCOFs, lock
22. O2 ACT – IV
23. EMU 1,2 H2O WASTE reg (two) – MAN OP

NOTE
Step 24 will be performed serially for EMU 1 and EMU 2

24. EMU 1(2) H2O WASTE (one) – OP (tb-OP) (1 min), then
    – CL (tb-CL)
    – Repeat for other EMU
25. EMU 1,2 H2O WASTE reg (two) – REGULATING
26. O2 ACT – OFF
27. Remove SCOFs, stow
28. MODE – AUTO (√WCS ON it off)
29. If EMU powerup performed, go to EMU POWERDOWN
EMU LiOH Changeout (20 min)

1. Transfer new cartridges to airlock
2. Transfer new batteries, as reqd, to airlock
3. Release EMU from AAP, posn as reqd
4. Unzip thermal cover, Velcro to top of EMU
5. Record used LiOH serial numbers

6. Remove, mark used LiOH cartridge

IF EMU BATTERY TO BE REPLACED:

AW18H  7. PWR/BATT CHGR EMU 1,2 BUS SEL (two) – OFF
DCM  8. √ PWR – SCU

CAUTION
Do not allow battery to impact airlock wall and use care when handling/stowing battery to avoid damaging aluminum cover

9. Remove used battery
10. Install new battery (√ connector alignment), latch

CAUTION
If 10.2 cabin used, possible ΔP across LiOH cartridge caps. Direct ports away from face
Limit exposure time of uncapped canister ports and avoid contact with seals

11. Holding new LiOH cartridge with aluminum plate serial number facing self, remove caps (left first), √O-ring seals for damage, install LiOH (attach Velcro retainer strap)
12. Close thermal cover zipper
13. Reinstall EMU in AAP
14. Place caps on used LiOH cartridge
15. Stow used batteries, LiOH in middeck lockers
INITIATE (20 min)
1. Unstow middeck battery charger
2. √ DC UTIL PWR – OFF on specified utility outlet (MUP)
3. Affix batteries to charger using Velcro straps on charger
4. Connect charger cables to batteries
5. Stow batteries/charger for charge
6. Connect charger power cable to specified MUP utility outlet
7. √ CB closed for specified utility outlet
8. DC UTIL PWR – ON
9. √ ON LEDs (red) – ON
   √ READY LEDs (green) – ON (for 10 sec at startup)
   √ READY LEDs (green) – blinking

NOTE
EMU batteries may experience a false charge completion due to passivation within the battery. The passivation is removed with repeated attempts (two to three times) at charging the battery.

After 15 min charging, verify charging is continuing:
10. √ ON LEDs (red) – ON
   √ READY LEDs (green) – blinking

* If ON LED (red) is OFF and READY LED (green) is ON (non-blinking):
  * 1. DC UTIL PWR – OFF (3 sec)
  * 2. DC UTIL PWR – ON
  * 3. ON LEDs (red) – ON

* READY LEDs (green) – ON 10 sec at startup
* READY LEDs (green) – blinking
* 4. Report anomaly to MCC

NOTE
The absence of any active LEDs represents an over-current or overvoltage condition that has caused the charger to shut down, or the charger has not been properly powered from the DC Utility Outlet. All protective conditions are resettable by taking the DC UTILITY POWER to OFF.

During the charge, the red ON LED will be illuminated and the green READY LED will continue to blink, giving positive indication that the charger is still charging.
NOTE
When a nominal charge is complete, the red ON LED will extinguish and the green READY LED will illuminate without blinking. The red ON LED will be illuminated only when the positive current flow into the battery is greater than 0.6A

11. When charge complete:
- Charger
  - √ ON LEDs (red) – OFF
  - √ READY LEDs (green) – ON
- ML85E (MUP)
  - DC UTIL PWR – OFF
  - Disconnect cables from batteries
12. Disconnect charger power cable from utility outlet
13. Stow charger and batteries
MIDDECK EMU BATTERY RECHARGE/LiOH REPLACEMENT

INITIATE (30 min)

NOTE
Refer to REF DATA for specific plug-in location

1. Unstow new LiOH cartridges
2. Unzip thermal cover, Velcro to top of EMU
3. Record used LiOH serial numbers

4. Remove, mark, stow used LiOH cartridge

DCM 5. √ PWR – SCU

CAUTION
Do not allow battery to impact airlock wall and use care when handling/stowing battery to avoid damaging aluminum cover

6. Remove, stow used battery

CAUTION
If 10.2 cabin used, possible ΔP across LiOH cartridge caps. Direct ports away from face
Limit exposure time of uncapped canister ports and avoid contact with seals

7. Holding new LiOH cartridge with aluminum plate serial number facing self, remove caps (left first), √O-ring seals for damage, install LiOH (attach Velcro retainer strap)
8. Close thermal cover zipper, stow EMU in middeck
9. Unstow middeck battery charger
10. √ DC UTIL PWR – OFF

11. Configure battery(s), charger, and straps for charge
12. Connect charger cable(s) to battery(s)
13. Stow battery(s)/charger for charge
14. Connect power cable to utility outlet

15. DC UTIL PWR – ON
16. √ON LEDs (red) – ON
   √READY LEDs (green) – ON (for 10 sec at startup)
   √READY LEDs (green) – blinking

NOTE
EMU batteries may experience a false charge completion due to passivation within the battery. The passivation is removed with repeated attempts (two to three times) at charging the battery

After 15 min charging, verify charging is continuing:

Charger 17. √ON LEDs (red) – ON
   √READY LEDs (green) – blinking
* If ON LED (red) is OFF and READY LED (green) is ON (non-blinking):
  * 18. DC UTIL PWR – OFF (3 sec)
  * 19. DC UTIL PWR – ON
  * Charger
  * 20. √ON LEDs (red) – ON
  * √READY LEDs (green) – ON 10 sec
  * at startup
  * √READY LEDs (green) – blinking
  * 21. Report anomaly to MCC

**NOTE**
The absence of any active LEDs represents an over-current or overvoltage condition that has caused the charger to shut down, or the charger has not been properly powered from the DC Utility Outlet. All protective conditions are resettable by taking the DC UTILITY POWER to OFF.

During the charge, the red ON LED will be illuminated and the green READY LED will continue to blink, giving positive indication that the charger is still charging.

**TERMINATE (15 min)**

**NOTE**
When a nominal charge is complete, the red ON LED will extinguish and the green READY LED will illuminate without blinking. The red ON LED will be illuminated only when the positive current flow into the battery is greater than 0.6A.

22. When charge complete:
   Charger
   √ON LEDs (red) – OFF
   √READY LEDs (green) – ON
   DC UTIL PWR – OFF
   Disconnect cable(s) from battery(s)
23. Unzip thermal cover, Velcro to top of EMU
24. Remove LiOH cartridge
25. Open battery latch
26. Install charged battery (√connector alignment); latch
27. Reinstall LiOH (attach Velcro retainer strap)
28. Close thermal cover zipper
IN-SUIT EMU BATTERY RECHARGE/CHARGE VERIFICATION

INITIATE

1. Retrieve, position SCUs; remove DCM covers
2. Connect SCUs to DCM, √locked

AW18H 3. PWR/BATT CHGR EMU 1,2 BUS SEL (two) – OFF
       MODE (two) – CHARGE
       BUS SEL (two) – MNA(MNB)

4. Continue charge as reqd:
   Verification: 15 min, minimum
   Full Charge: Up to 20 hr

TERMINATE

AW18H 5. √PWR/BATT CHGR EMU INPUT AMPS < 1 for both EMUs

6. PWR/BATT CHGR EMU 1,2 BUS SEL (two) – OFF
   MODE (two) – OFF

7. Remove SCU, install DCM cover
8. Stow SCU on AAP, Velcro to wall

EMU POWERDOWN

AW18H 1. PWR/BATT CHGR EMU 1,2 BUS SEL (two) – OFF
       MODE (two) – OFF

AW82D 2. √EMU 1,2 H2O WASTE,SPLY tb (four) – CL

3. Remove SCU, install DCM cover
4. Stow SCU on AAP, Velcro to wall
HELMET LIGHT/PGT BATTERY RECHARGE

INITIATE (10 min)

NOTE
Refer to REF DATA for specific plug-in location

1. Unstow, as reqd: EHIP Light Battery Charger
   EHIP DC PWR/REBA DC EXT Y-Cable
   EHIP-PGT Adapter cable (charger to battery) (2)
   PGT Batteries (2)
   Helmet Light Batteries (4)

2. DC UTIL PWR – OFF

3. Plug EHIP DC PWR/REBA DC EXT Y-Cable into charger, then into
   orbiter pwr supply

4. DC UTIL PWR – ON

   \Blue LEDs illuminated

   * If blue LEDs not illuminated:
     * DC UTIL PWR – ON
   * If blue LEDs still not illuminated:
     * DC UTIL PWR – OFF
     * Unplug EHIP DC PWR/REBA DC EXT Y-Cable
     * from charger
   * Change fuse (7.5A)
   * Plug EHIP DC PWR/REBA DC EXT Y-Cable
     * into charger
     * DC UTIL PWR – ON

IFM Pin Kit

* Change fuse (7.5A)
* Plug EHIP DC PWR/REBA DC EXT Y-Cable
* into charger
* DC UTIL PWR – ON

If charging helmet light batteries:
   5. Install batteries (four) into charger
If charging PGT batteries, for EACH battery:
   6. Release captive screw on PGT battery door using screwdriver
   7. Pry open PGT battery door, rotate away from cavity
   8. Remove cap from EHIP PGT Adapter cable into charger
   9. Remove battery jumper, temp stow on EHIP-PGT Adapter cable cap
   10. Install EHIP-PGT Adapter cable into charger

11. yellow LED illuminated; start timer (MET _____/_____:_____:____):
    temp stow charger

   * If yellow LED not illuminated, see chart below *

<table>
<thead>
<tr>
<th>Indicator</th>
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<th>Solution</th>
</tr>
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<tbody>
<tr>
<td>Green and red LED illuminated</td>
<td>Cold batt (≤ 50 degF)</td>
<td>Leave batt installed in charger (batt will warm up and automatically change LED to yellow)</td>
</tr>
</tbody>
</table>
| Red LED illuminated | Hot batt (≥ 113 degF) | DC UTIL PWR – OFF
Remove batt or EHIP-PGT adapter if PGT batt
DC UTIL PWR – ON |

12. Wait 15 min and check LEDs
If yellow LEDs illuminated:
   13. Continue charging
If green LED(s) illuminated:
   14. DC UTIL PWR – OFF
   15. Remove battery or EHIP-PGT Adapter cable from affected station(s)
   16. DC UTIL PWR – ON
   17. Wait for blue LED(s) to illuminate
   18. Re-install battery or EHIP-PGT Adapter cable
   19. yellow LED(s) illuminated
   20. Continue charging

Cont next page
TERMINATE (10 min)

NOTE
Refer to REF DATA for specific plug-in location

1. √Green LED illuminated

WARNING
Ensure charger is unpowered before disconnecting batteries

CAUTION
Do not leave batteries installed after unpowering charger to prevent possible charger damage and battery discharge

2. DC UTIL PWR – OFF

If helmet light batteries charged:
3. Remove batteries from charger
4. Install batteries in lights
5. √EMU light ops

CAUTION
Do not stow EMU lights in locker with batteries installed

If PGT batteries charged, for each battery:
6. Remove EHIP-PGT Adapter cable from charger
7. Unplug battery from EHIP-PGT Adapter cable; reinstall cap on cable

NOTE
PGT battery will not function if jumper is not installed

8. Re-install battery jumper
9. Rotate battery door into place, tighten screw using screwdriver
10. Mark batteries “charged”, stow in locker
11. Stow as reqd:
   EHIP Light Battery Charger(s)
   EHIP DC PWR/REBA DC EXT Y-Cable
   EHIP-PGT Adapter cables (2)
   PGT Batteries (2)

REBA BATTERY INSTALLATION

1. Unstow REBA from locker or charger
2. Remove EMU from AAP, unzip TMG to access REBA pouch and EMU power harness
3. \Glove heater sw (two) – OFF
4. Remove REBA J1 fabric cover
5. Install REBA on EMU
6. Route REBA sw pull tabs thru TMG loops
7. \REBA sw (one per EMU) – OFF (toward left arm of suit)
8. Connect EMU power harness (P1) to REBA (J1); verify locked by gently pulling on EMU power harness cable
9. Zip TMG closed, install EMU on AAP
EMU BATTERY REMOVAL/INSTALL (5 min)

CAUTION
Do not allow battery to impact airlock wall and use care when handling/stowing battery to avoid damaging aluminum cover

WARNING
EMU pwr switch must be in SCU position with airlock pwr OFF during battery changeout

DCM
1. √PWR – SCU
   If SCU connected to DCM:
2. √PWR/BATT CHGR EMU 1,2 BUS SEL (two) – OFF

AW18H
3. Release EMU from AAP as reqd
4. Unzip thermal cover, Velcro to top of EMU
5. Open LiOH(Metox) latches
6. Rotate LiOH(Metox) canister outward until softstop or remove canister
7. Open battery latches
8. Remove/install EMU battery as reqd (√connector alignment)
9. Close battery latches
10. Reinstall LiOH(Metox), latch
11. Close thermal cover
12. Reinstall EMU in AAP as reqd
13. Stow or charge batteries as reqd
HELMET LIGHT BULB CHANGEOUT (15 min)

NOTE
Light assembly has several loose pieces which may be spring loaded. Be prepared to capture them during changeout

CAUTION
Handle bulbs with care. Do not touch bulbs with bare hands (could degrade bulb life span)

1. Remove battery from affected side of lights
2. If EMU TV installed, remove camera from affected side of lights
3. Obtain, don comfort glove
4. Depress faceplate; open faceplate sliders (two) on affected side of lights
5. Remove faceplate
6. Remove reflector housing by pulling straight out
7. Remove affected bulbs as reqd, replace
8. Mark, stow used bulbs

NOTE
Contacts on spot bulb may be difficult to reseat fully into socket

9. Install reflector housing and flood bulb reflector, seat spot bulb
10. Install faceplate, lock sliders (two)
11. Install battery; √EMU light ops
12. If EMU TV installed, attach camera back to affected side of lights
13. Remove, stow comfort glove
REBA BATTERY RECHARGE

INITIATE (10 min)

NOTE
Refer to REF DATA for specific plug-in plan location

1. Unstow: REBA Charger
   EHIP DC PWR/REBA DC EXT Y-Cable
   25' REBA/EHIP Ext Pwr cable (if reqd)

2. \( \sqrt{\text{DC UTIL PWR – OFF}} \)
   If in-suit recharge:
   3. Plug EHIP DC PWR/REBA DC EXT Y-Cable into charger, 25'
      REBA/EHIP Ext Pwr cable into EHIP DC PWR/REBA DC EXT
      Y-Cable, 25' REBA/EHIP Ext Pwr cable into orbiter power supply
   Else:
   4. Plug EHIP DC PWR/REBA DC EXT Y-Cable into charger and orbiter
      power supply

5. \( \sqrt{\text{DC UTIL PWR – ON}} \)
   \( \sqrt{\text{Blue LEDs (two) illuminated}} \)
   * If blue LED not illuminated: *
   * \( \sqrt{\text{DC UTIL PWR – ON}} \)  *
   * \( \sqrt{\text{cb – cl}} \)  *
   * \( \sqrt{\text{Cable connections mated}} \)  *
   * If blue LED still not illuminated: *
   * \( \sqrt{\text{DC UTIL PWR – OFF}} \)  *
   * Unplug EHIP DC PWR/REBA DC EXT Y-Cable from charger *
   REBA Charger
   * Change fuse (4.0 Amps) *
   * Plug EHIP DC PWR/REBA DC EXT Y-Cable into charger *
   * \( \sqrt{\text{DC UTIL PWR – ON}} \)  *

6. \( \sqrt{\text{REBA sw (two) – OFF}} \)
7. Demate REBA jumper cables (two)
8. Mate charger cables (two) to REBA jumper cables

REBA Charger

9. \( \sqrt{\text{Yellow LEDs (two) illuminated; temp stow charger on wall}} \)
   *
   * If yellow LED not illuminated, see chart below *

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<td>Cold batt ((\leq 50\ \text{degF}))</td>
<td>Leave REBA connected to charger (REBA will warm up and automatically change LED to yellow)</td>
</tr>
</tbody>
</table>
| Red LED illuminated        | Hot batt \((\geq 113\ \text{degF})\) | DC UTIL PWR – OFF Disconnect REBA from charger. 
                             |                                          | Allow REBA to cool DC UTIL PWR – ON 
                             |                                          | Mate charger cable to REBA jumper cable |

When 15 min of charge complete:

10. \( \sqrt{\text{READY LEDs (green) – Off}} \)
   * If READY LED (green) – On: *
   * DC UTIL PWR – OFF *
   * Disconnect REBA from charger *
   * DC UTIL PWR – ON *
   * When NO BATTERY LED (blue) – On: *
   * Mate charger cable to REBA jumper cable *
   * \( \sqrt{\text{CHARGING LED (yellow) – On}} \)  *
TERMINATE (10 min)

NOTE
Refer to REF DATA for specific plug-in plan location

1. \[\checkmark\] Green LED illuminated

WARNING
Ensure charger is unpowered before disconnecting batteries

CAUTION
Do not leave batteries installed after unpowering charger to prevent possible charger damage and battery discharge

2. DC UTIL PWR – OFF
3. Disconnect REBA from charger
4. Mate REBA jumper cables
5. Stow: REBA Charger
    EHIP DC PWR/REBA DC EXT Y-Cable
    25' REBA/EHIP Ext Pwr cable (if reqd)
POST EVA ENTRY PREP (45 min if SAFER not flown)  
(55 min if SAFER flown)

AW18D 1. Airlk Aud Pwr – OFF  
AW18H 2. Pwr/Batt CHGR EMU 1,2 Bus Sel (two) – OFF  
     Mode (two) – OFF  
MD(flr) 3. EMU O2 Isol Vlv – CL  
AW82B 4. EV-1, EV-2 O2 Vlv (two) – CL  
AW82D 5. √EMU 1,2 H2O Waste, Sply tb (four) – CL  
     6. Stow in FDF locker: DEPRESS/REPRESS (Cue Card)  
     Cuff C/L (two)  
    7. Disconnect comm caps (two) from elec harness, temp stow  
    8. Remove LTA, √Multiple Water Connector cover installed  
    9. Stow LCVG and EV Crew Options Kit (ECOK) in HUT  
   10. Connect LTA to HUT  
   11. Install gloves  
    12. √Any wrist tethers attached to glove tether loop with only one hook (other hook  
on D-ring or first hook) and cinched down around wrist  
If REBA:  
    13. Remove REBA batteries from all EMUs, stow  

CAUTION  
EMU TV and helmet lights must be removed prior to landing  

If EMU TV:  
   14. Remove EMU TVs from helmet lights, stow  
   15. Transfer EMU lights to middeck  
   16. Install helmets and covers, lock  
   17. Remove SCU, install DCM cover  
DCM 18. Stow SCU on AAP, rebuckle straps  
   19. √PURGE vlvs – op (up)  
   20. Perform LTA RESTRAINT STRAP INSTALLATION (AIRLOCK CONFIG)  
     as reqd for landing configuration  
   21. Attach LTA Restraint Bags over LTA, suit arms; tighten straps  
   22. Stow comm caps in LTA Restraint Bag pouch  
   23. Install and loosely secure airlock floor pallet using 1/4-in drive ratchet,  
     4-in ext w/1/4-in drive, and 1/2-in socket w/1/4-in drive. Torque to  
     200 in-lb using torque wrench  

SAFER ENTRY STOW (10 min) (if reqd)  
   24. Deploy HCM  
   25. Install pwr sw guard  
   26. Stow HCM in foam outside of SAFER  
   27. Stow SAFER in stowage bag  
   28. Install additional EMU(s)/Airlock Stowage Bag(s) in airlock; √bag,  
     strap installed  
   29. Install 20-g Crash Bag on middeck EMUs (if flown)  
   30. Remove batteries from lights, stow in lockers  

CAUTION  
To prevent possible equipment damage, do not stow  
EMU lights in locker with batts installed  

Vol H  31. Stow EMU lights, EMU Equipment Bag, EVA Bag in middeck  
Inner Hatch  32. Equal vlv (two) – NORM, install caps  
* If outer hatch leaking or integrity suspect:  
*   Equal vlv (two) – OFF, install caps  
33. Inform MCC, Post EVA Entry Prep complete
POST ISS EVA ENTRY PREP (45 min if SAFER not flown)
(55 min if SAFER flown)

MD(flr) 1. EMU O2 ISOL VLV – CL
AW18D 2. AIRlk AUD PWR – OFF
AW18H 3. √PWR/BATT CHGR EMU 1,2 BUS SEL (two) – OFF
       MODE (two) – OFF
AW82B 4. √EV-1,EV-2 O2 vlv (two) – CL
AW82D 5. √EMU 1,2 H2O WASTE, SPLY tb (four) – CL
       √No helmet lights or EMU TV installed on helmets
    6. Remove helmets, temp stow
    7. Remove LTA, √Multiple Water Connector cover installed
    8. Disconnect comm caps from EMU electrical harness, temp stow
    9. Remove LTA, √No LCVG and EV Crew Options Kit (ECOK) in HUT
   10. Connect LTA to HUT
   11. √Gloves installed, locked
   12. √Any wrist tethers attached to glove tether loop with only one hook (other hook
       on D-ring or first hook) and cinched down around wrist
   13. Install helmets, lock
   14. Install helmet covers if not already installed
   15. √SCU stowed on AAP, straps buckled
DCM   17. √PURGE vlvs – op (up)
Vol H 18. √No loose items temp stowed in Vol H (waist tethers, etc). Install as reqd
   19. Attach LTA Restraint Bags over LTA, suit arms, tethers; tighten straps
   20. Stow comm caps in LTA Restraint Bag pocket
       If airlock floor pallet removed:
       21. Install and loosely secure airlock floor pallet using 1/4–in drive ratchet, 4–in
           ext w/1/4–in drive, and 1/2–in socket w/1/4–in drive. Torque to 200 in–lb
           using torque wrench
       22. Install floor Airlock Stowage Bag in airlock; √bag, strap installed
       23. Install 20–g Crash Bag on middeck EMUs (if flown)

SAFER ENTRY STOW (10 min) (If SAFER returning)
   24. Deploy HCM
   25. Install power switch guard (‘PWR’ over PWR switch)
   26. Stow HCM in foam outside of SAFER
   27. Stow SAFER in stowage bag

Inner Hatch 28. Equal vlv (two) – NORM, install caps

* If outer hatch leaking or integrity suspect: *
* Equal vlv (two) – OFF, install caps *

29. Inform MCC, Post ISS EVA Entry Prep complete
30. Stow in FDF/ODF locker (if reqd):
    FDF EVA Checklist
    Used EVA Prebreathe Cue Card
    ISS EVA Systems Checklist
OFF-NOMINAL PROCEDURES
EMU CONTINGENCY PROCS

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DISPLAY LOSS DURING POWER TRANSFER (WARM RESTART)

DCM If PWR – BATT and SCU connected:
AW18H 1. √PWR/BATT CHGR EMU 1(2) BUS SEL – OFF
DCM If PWR – SCU:
2. PWR – BATT
AW18H 3. PWR/BATT CHGR EMU 1(2) BUS SEL – OFF

WARNING
Fan will be off from steps 4 to 9 during which time CO2 buildup is a concern

NOTE
Affected EMU will be without comm after step 6. Steps 6 and 7 should be read together before step 6 is performed

DCM 4. FAN – OFF (expect [FAN SW OFF] msg, DISP – PRO)
IV 5. Inform affected EV crewmember of impending comm loss
DCM 6. PWR – SCU (7 sec)
7. PWR – BATT
When power restart complete:
8. √Display – O2 POS XX, expect [FAN SW OFF] msg, DISP – PRO
9. As reqd, FAN – ON
If display blank or locked up:
10. Contact MCC
If SCU power desired:
11. √SCU connected to DCM
AW18H 12. PWR/BATT CHGR EMU 1(2) MODE – PWR
BUS SEL – MNA(MNB)
13. √EMU INPUT 1(2) Volts = 18.0 – 20.0
DCM 14. PWR – SCU
DCM 15. √Display – O2 POS XX

VACUUM H2O RECHARGE (MANNED)

WARNING
Procedure should be used only if performing a contingency EVA

EV 1. Perform AIRLOCK INGRESS, Cuff C/L, 30 (Close hatch, partially engage latches)
2. √Helmet purge vlv – cl, locked
DCM 3. √PURGE vlv – cl (dn)
4. √WATER – OFF
IV MO13Q 5. √ARLK H2O S/O VLV – OPEN (tb-OP)
MD(flr) 6. √EMU O2 ISOL VLV – OP
ML86B:C 7. √cb MNC EXT ARLK HTR LINE ZN 1,2 (two) – op
AW82B 8. √EV-1(EV-2) O2 vlv – OP
EV AW18H 9. PWR/BATT CHGR EMU 1(2) BUS SEL – MNA(MNB)
DCM 10. PWR – SCU (fwd), WARN TONE
IV R11L If SPLY H2O XOVR VLV closed (tb-CL or bp) (water transfer config):
11. SPLY H2O TKA OUTLET – CL (tb-CL)
If SPLY H2O XOVR VLV open (tb-OP) (nominal config):
L1 12. √RAD CNTLR OUT TEMP – NORM
ML31C 14. SPLY H2O TKB OUTLET – CL (tb-CL)
R11L 15. SPLY H2O TKC INLET – CL (tb-CL)
TKA OUTLET – CL (tb-CL)
TKC OUTLET – OP (tb-OP)
EV  AW82D  16. √EMU 1(2) H2O WASTE – CL (tb-CL)
                SPLY – OP (tb-OP)

WARNING
O2 will be off. IV stand by inner hatch
Equal vlvs for emergency repress

EV  DCM  17. O2 ACT – OFF, monitor SUIT P (√SUIT P > 3.6)

* When SUIT P ≤ 3.6:
  * O2 ACT – PRESS until SUIT P = 4.2-4.4
  * – OFF

18. √STATUS: [H2O WP] ~8-15 psi and stable for ~30 sec (indicates charging complete), then:
O2 ACT – PRESS until SUIT P = 4.2-4.4
– EVA

IV  R11L  If SPLY H2O XOVR VLV closed (tb-CL or bp) (water transfer config):
  19. SPLY H2O TKA OUTLET – OP (tb-OP)
If SPLY H2O XOVR VLV open (tb-OP) (nominal config):
  20. SPLY H2O TKC INLET – OP (tb-OP)
       TKB OUTLET – OP (tb-OP)

22. If FES reqd, perform TOPPING FES STARTUP (ORB OPS, ECLS)

EV  AW82D  23. EMU 1(2) H2O SPLY – CL (tb-CL)

NOTE
Disregard fault msgs until CWS updated with: O2 ACT – EVA, WATER – ON, and H2O TEMP < 60

24. Go to DEPRESS/REPRESS Cue Card, DEPRESS, step 11
    (POST DEPRESS, step 1, if tunnel adapter)

LiOH REPLACEMENT (MANNED)

CAUTION
If 10.2 cabin used, possible ΔP across LiOH cartridge caps. Direct ports away from face
Limit exposure time of uncapped canister ports and avoid contact with seals

IV  1. Unstow new LiOH cartridge with aluminum plate serial number facing self, remove caps (left first)
IV  2. Unzip EMU thermal cover, fold back, Velcro to top of EMU

WARNING
Fan will be off during changeout. Perform changeout as quickly as possible

CAUTION
Vent loop is pressurized. Restrains LiOH cartridge

DCM  3. √O2 ACT – IV
4. Helmet purge vlv – op
5. FAN – OFF

IV  EMU  6. Remove used cartridge
7. Holding new LiOH cartridge with aluminum plate serial number facing self, √O-ring seals for damage, install LiOH (attach Velcro retainer strap)
NOTE
EMU may issue CO2 HIGH or MONITOR CO2 message

DCM
8. FAN – ON (PWR RESTART may occur)
9. Helmet purge vlv – cl, locked

DCM
10. O2 ACT – PRESS
11. PURGE vlv – op (up)
12. Begin timing 2-min purge

IV
13. Close EMU thermal cover zipper
14. Place caps on used LiOH cartridge

IV
15. Mark used cartridge, stow in middeck

When purge time = 2 min:

DCM
16. √STATUS: [CO2] < 8.0 mmHg, then PURGE vlv – cl (dn)
17. O2 ACT – IV

NOTE
A minimum of 40 min of prebreathe reqd to condition LiOH cartridge

18. Continue EVA PREP or EMU PREBREATHE with minimum of 40 min prebreathe

BATTERY REPLACEMENT (MANNED)

IV
1. Unstow new battery

CAUTION
Do not allow battery to impact airlock wall and use care when handling/stowing battery to avoid damaging aluminum cover

PLSS
2. Unzip EMU thermal cover, fold back, Velcro to top of EMU

WARNING
Power switch must be in SCU during battery changeout
Fan will be off during changeout. Perform changeout as quickly as possible

If no SCU power available:

DCM
3. √O2 ACT – IV
4. Helmet purge vlv – op
5. FAN – OFF

NOTE
EMU will be without comm after step 6 until battery power is restored at step 18

DCM
6. PWR – SCU
If degraded/dead battery:

DCM
7. √PWR – SCU
8. √O2 ACT – IV
9. Helmet purge vlv – op

DCM
10. FAN – OFF (fwd)
PLSS
11. Open battery latch
12. Open LiOH cartridge latches
WARNING
Vent loop is pressurized. Restrain LiOH canister during battery changeout to avoid injury and breaking seal.

13. Rotate LiOH cartridge outward until limited by Velcro retainer strap
14. Remove used battery
15. Install new battery (√connector alignment); engage latch
16. √LiOH cartridge seated in vent ports, rotate downward until latch pins engage
17. Close LiOH cartridge latches
   If no SCU power available:
   18. PWR – BATT
19. FAN – ON (aft) (PWR RESTART may occur)
20. Helmet purge vlv – cl, locked
   * If LiOH cartridge seal broken: *
   *DCM 21. O2 ACT – PRESS *
   * 22. PURGE vlv – op (up) *
   * 23. Begin 2 min purge *
   * 24. When 2 min complete: *
   *DCM 25. PURGE vlv – cl (dn) *
   * 26. O2 ACT – IV *

DCM

26. √STATUS: BATT VDC
27. Report following to MCC as comm permits:
   Old battery barcode/serial number and stowage location
   New battery barcode/serial number and BATT VDC reading
28. Close EMU thermal cover zipper

NOTE
EMU-calculated TIME EV and TIME LF do not reset despite battery changeout. A cold restart is reqd to reset those parameters

29. If reqd per MCC, perform EMU COLD RESTART (EMU CONT PROCS)
30. Continue EVA PREP
WATER DUMP

BOTH
1. Connect SCUs to DCM, √locked
2. PWR – BATT

DCM
3. Connect SCUs to DCM, √locked
4. PWR – SCU

WCS
5. √FAN SEP same as HOSE BLOCK
6. MODE – COMMocrin/MANUAL/EMU; posn guard over sw
   (√airflow, WCS ON lt on)

AW82D
7. √EMU 1,2 H2O SPLY (two) – CL (tb-CL)
8. Remove helmets with sunshades down and helmet covers installed; stow
9. Install SCOFs, lock

AW82H
10. EMU 1,2 H2O WASTE reg (two) – MAN OP

NOTE
EMU will be dumped serially in step 12

AW82H
11. EMU 1,2 H2O WASTE reg (two) – REGULATING

DCM
12. EMU 1(2) H2O WASTE (one) – OP (tb-OP) (until H2O WP < 7
    and stable for ~1 min)
    – CL (tb-CL)
    – Repeat for other EMU

AW82H
13. EMU 1,2 H2O WASTE reg (two) – REGULATING

DCM
14. O2 ACT – OFF
15. Remove SCOFs, stow
16. Install helmets with covers, lock

WCS
17. MODE – AUTO (√WCS ON lt off)
SCU SWAP (UNMANNED)

BOTH DCM  
1. √ FAN – OFF
2. √ O2 ACT – OFF
3. √ COMM mode – OFF

AW18H 4. PWR/BATT CHGR EMU 1,2 BUS SEL (two) – OFF

DCM 5. Swap SCUs
6. PWR – BATT

AW18H 7. PWR/BATT CHGR EMU 1,2 MODE (two) – PWR
8. PWR/BATT CHGR EMU 1,2 BUS SEL (two) – MNA(MNB)

DCM 9. √ EMU INPUT 1,2 volts = 18.0-20.0
10. PWR – SCU

SCU SWAP (MANNED)

BOTH DCM  
1. Temp control vlv – Max C

O6:A1R 2. Perform EVA COMM CONFIG (EVA PREP), steps 2, 3, and 6

DCM 3. COMM mode – PRI
4. Comm FREQ – LOW
5. PWR – BATT

AW18H 6. PWR/BATT CHGR EMU 1,2 BUS SEL (two) – OFF

DCM 7. Swap SCUs

AW18H 8. PWR/BATT CHGR EMU 1,2 MODE (two) – PWR
9. PWR/BATT CHGR EMU 1,2 BUS SEL (two) – MNA(MNB)

DCM 10. √ EMU INPUT 1,2 volts = 18.0-20.0

11. PWR – SCU
12. COMM mode – HL
13. Temp control vlv – as reqd

EMU COLD RESTART (MANNED)

WARNING

This procedure should only be used at airlock pressures of 8.0 psi and higher. Fan and O2 will be off during restart. Perform restart as quickly as possible.

DCM 1. FAN – OFF
2. O2 ACT – OFF
If PWR – SCU:
3. PWR – BATT (2 sec)
4. PWR – SCU
If PWR – BATT:
5. PWR – SCU (2 sec)
6. PWR – BATT
7. O2 ACT – IV
8. FAN – ON
12.1 STS EVA DECONTAMINATION

1. Perform detailed visual inspection of EMU
   Contamination detected on EMU or seen contacting EMU?
   Yes → 2. EMU in vicinity of leak when detected visually or by orbiter/station instrumentation. Suspected contamination
   No → 3. Confirmed contamination

2. EMU in vicinity of leak when detected visually or by orbiter/station instrumentation. Suspected contamination
   No → 4. Brush off crystals using hydrazine brush
   Yes → 5. Perform detailed visual inspection of EMU

3. Confirmed contamination
   Contamination seen?
   Yes → 4. Brush off crystals using hydrazine brush
   No → 5. Perform detailed visual inspection of EMU

4. Brush off crystals using hydrazine brush
   Sublime ice using prybar or other large warm metal

5. Perform detailed visual inspection of EMU
   Contamination seen?
   No → 6. Start Bakeout
   PET clock
   PET = 0:00 at (___:___)
   Docked with ISS?
   Yes → 7. Provide periodic EVA position reports to MCC for thermal tracking
   Continue EVA tasks not in vicinity of leak
   No → 8. Docked with ISS?

6. Start Bakeout
   PET clock
   PET = 0:00 at (___:___)

8. Docked with ISS?
   (MCC-H/ISS-IV)
   US Lab: ECLSS: AR Rack
   LAB AR Rack Overview
   TCCS
   If State – Off, perform {1.301 ATMOSPHERE REVITALIZATION RACK ACTIVATION}, step 8 (SODF: ECLSS: A&C: ARS), then:

   (ISS-IV)
   For hydrazine contamination only:
   • To set up Portable Fan with ATCO Canister in PMA2, perform {4.302 ECLSS FRP-3: CARBON DIOXIDE REMOVAL KIT ACTIVATION/DEACTIVATION}, steps 2 to 4.3 (SODF: ECLSS: CORRECTIVE: ARS), then:

   For ammonia contamination only:
   • Perform {6.1 AIR SAMPLE COLLECTION USING DRAEGER AIR SAMPLER (шпд)} steps 1,2 (RODF: SM: СКДС), then:

1. Ammonia visual inspection should be performed in night or shaded ambient light with helmet spot lights used to illuminate TMG. Use of sunvisor during inspection should be avoided. View TMG from an oblique angle. Following are indications of ice on EMU:
   a. Loss of TMG thread pattern
   b. Waxy gloss or hard pack snow appearance
   c. Unusual contours

2. For confirmed contamination 1:55 (2:10 if from ISS thruster) of EMU consumables must be available to support activities from ingress through EMU doffing. For suspected contamination 0:55 (1:10 if from ISS thruster) of consumables reqd. EVA tasks must be deferred to protect these consumables. Bakeout on SCU does not consume Metox/LiOH if helmet purge valve is open
12.1 (Cont)

10 Bakeout

When EVA tasks complete or if EMU consumables require a faster bakeout:
- Translate to preferred bakeout location per MCC
- External airlock preferred bakeout location?

11 Bakeout

- If SCU not connected, perform TERMINATE EVA
- Open Helmet Purge valve, lock
- Hold Thermal Cover slightly ajar
- On MCC GO, close Helmet Purge valve, lock
- Close Thermal Cover

12 Bakeout

- Perform INGRESS
- Perform PRE REPRESS
- Start Vacuum Hold PET Timer

When Vacuum Hold PET = 15 min
- Repress Airlock to 5 psi, perform REPRESS steps 1 to 8

ISS thruster contamination
Shuttle oxidizer contamination
Shuttle hydrazine contamination (MMH)
Ammonia contamination

13 Bakeout

- Perform CONTAMINATION TEST
- Ammonia Contamination Test failed?

14 Bakeout

Greater than 1:05 EMU consumables remaining?

15 Bakeout

(BCM)
- O2 ACT – EVA
- COMM mode – PRI
- Outer Hatch Equalization v lv – NORM, monitor suit P gauge < 5.5
- Airlock dP/dT = 0
- EV ALERT TONE
- When outer hatch △P < 0.5, outer hatch – open, stow
- Outer Hatch Equalization v lv – OFF

Bakeout on SCU does not consume Metox/LiOH if helmet purge valve is open
For ammonia or oxidizer only, if the contamination test passed at 5 psia, no further mixing is required. If the test failed and EMU consumables would not support an additional depress/repress cycle, atmospheric mixing with Booster Fan should be performed for 10 min to completely mix the airlock and crew module. Maximum dilution is approximately 12:1 (airlock only) or 7:1 (tunnel adapter). Dilution with ISS will further reduce concentration by 6:1 over 2 hr.

The WCS filter will reduce ammonia concentration by 63% every 60 min for a shuttle equivalent volume.
12.1 (Cont)

23
(MCC-H)
- Inhibit ISS Rapid Depress Response and Alarm
- Verify Russian Segment Rapid Depress Response inhibited (EV)
- ODS Upper Hatch Equal vlv – NORM
- When ODS Upper Hatch ∆P < 0.5, open hatch
- ODS Upper Hatch Equal vlv – OFF (ISS IV)
- Don PBA (all crew)
- Perform (2.104 HATCH OPEN AND SHUTTLE/ISS DUCT INSTALLATION) step 13 to end of procedure (SODF: JNT OPS: INGRESS STATION), then:

24
(ISS IV)
- In airlock, perform (6.1 AIR SAMPLE COLLECTION USING DRAEGER AIR SAMPLER (шнд)) step 3 (RODF: SM: CKQC), then:

25
(ISS IV)
- Draeger reading > 10 ppm?
- Yes
- Egress Airlock
- Discard used Draeger tube
- Wait 10 min for atmospheric mixing and dilution

- No

26
- Doff PBA and QDMs
- Discard used Draeger tube and tips
- Stow unused Draeger tubes and pump

22

27
On MCC call:
- Perform POST EVA

(L1)
- H2O PUMP LOOP 1 – GPC
- H2O LOOP 2 BYP MODE – AUTO
- CAB TEMP sel – adj rotary as desired

(WCS)
- COMMODE CNTL – OFF (BACK/DOWN)
- MODE – AUTO
For ammonia or oxidizer only, if the contamination test passed at 5 psia, no further mixing is required. If the test failed and EMU consumables would not support an additional depress/repress cycle, atmospheric mixing with Booster Fan should be performed for 10 min to completely mix the airlock and crew module. Maximum dilution is approximately 12:1 (airlock only) or 7:1 (tunnel adapter). Dilution with ISS will further reduce concentration by 6:1 over 2 hr.

On ISS, it is impossible to determine if a propulsion leak was fuel or oxidizer. Therefore, tests must be performed for both oxidizer and UDMH.

(MCC-H)
- Inhibit ISS Rapid Depress Response and Alarm
- Verify Russian Segment Rapid Depress Response inhibited (EV)
- ODS Upper Hatch Equal vlv – NORM
- When ODS Upper Hatch \( dp/dt < 0.5 \), open hatch
- ODS Upper Hatch Equal vlv – OFF
- Connect Booster Fan inlet duct to middeck floor and Booster Fan Inlet
- Perform [2.104 HATCH OPEN AND SHUTTLE/ISS DUCT INSTALLATION] step 13 to end of procedure (SODF: JNT OPS: INGRESS STATION), then:
  - On MCC GO, go to POST EVA
12.1 (Cont)

38
Was contamination confirmed as determined by block 1?

39
- Airlock Pressure \( \geq 4.7 \) psia
- For hydrazine, perform CONTAMINATION TEST

38

39
Airlock Pressure \( \geq 4.7 \) psia
For hydrazine, perform CONTAMINATION TEST

Hydrazine test failed?

39

40
Greater than 1:05 EMU consumables remaining?

41 Parallel Activities for IV, ISS-IV, EV
NOTE Complete parallel activities, then proceed to block 45

41

42 (IV)
- Don long sleeves, long pants, and gloves as practical
- Prepare wet towels and Ziplock bags

(L1)
- H2O LOOP 2 BYP MODE – MAN
- H2O PUMP LOOP 1 – ON

(WCS)
- MODE – COMMODE/MANUAL/EMU
- COMMODE CNTL – PULL UP
- COMMODE CNTL – PUSH FWD

(Middeck)
- Install ATCO can in place of one LiOH can

43 (ISS-IV)
- Hatches to all other modules are open
- Don long sleeves, long pants, and gloves as practical
- PFA Power Switch → ON
- PFA Speed Control Knob → Full Flow
- Fan is running

44 (EV)
- Remove contamination sampler from Depress Valve
- Perform REPRESS, steps 9 to 11

45 (IV)
- When Inner Hatch \( \Delta P < 0.5 \), crack hatch
- Transfer wet towels and Ziplock bags to EV crew
- Close hatch

(EV)
- Wipe EMUs and airlock with towels (avoid electrical panels)
- Seal towels in bags

45

46
For ammonia or oxidizer only, if the contamination test passed at 5 psia, no further mixing is required. If the test failed and EMU consumables would not support an additional depress/repress cycle, atmospheric mixing with Booster Fan should be performed for 10 min to completely mix the airlock and crew module. Maximum dilution is approximately 12:1 (airlock only) or 7:1 (tunnel adapter). Dilution with ISS will further reduce concentration by 6:1 over 2 hr.

Each ATCO canister will reduce the hydrazine concentration by 63% every 90 min for a shuttle equivalent volume.
CONTAMINATION TEST

To be performed in conjunction with 12.1 STS EVA DECONTAMINATION. It is performed with the external airlock at 5 psia following suspected hydrazine or oxidizer contamination

EV 1. √Inner hatch Equal vlv (two) – OFF

IV 2. Wait 30 sec for pressure stabilization
   Record AIRLK P from EV DCM

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. AIRLK P</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EV AW82B 3. Attach STS Contamination Sampler to depress valve
AW18A 4. √LTG FLOOD (four) – ON
5. Go to appropriate chemical test steps below

AMMONIA CONTAMINATION TEST
6. Using RET, retrieve ammonia detector from Contamination Detection Kit
7. Verify Draeger tube color – yellow
   * Use new tube if not proper color *

CAUTION
Minimize contact with fracture regions of Draeger tube. Minor glove RTV damage is possible, but protective pressure bladders and restraints unaffected

8. Using equipment hook of RET as a lever, break off both tether points on ammonia detector
AW82B 9. Insert ammonia detector into STS Contamination Sampler with orientation that allows number scale to be read

WARNING
Precise sampling times are critical for accurate testing. IV should coordinate start of timer with opening of AIRLK DEPRESS valve

10. AIRLK DEPRESS vlv – 5
11. Start timer (3:30 sampling time)
   When timer expired:
   12. AIRLK DEPRESS vlv – CL

   NOTE
   If ammonia is present, Draeger tube will turn deep blue

DCM 13. Compare AIRLK P to pressure in step 2
   If $\Delta P \geq 0.1$ psi (indicates leak in sampling hardware):
   14. To repress airlock to 5.0 psi, Inner hatch Equal vlv (one) – throttle NORM to OFF
   15. Go to step 1 to repeat test with new Draeger tube
16. Determine test results based on table 1 and report to MCC
TABLE 1.- AMMONIA TEST PASS/FAIL CRITERIA

<table>
<thead>
<tr>
<th>Reaction Line</th>
<th>Report Status</th>
<th>Assumed Concentration with 2x Factor of Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>None seen</td>
<td>Passed</td>
<td>10 ppm</td>
</tr>
<tr>
<td>$0 &lt; X &lt; 2$</td>
<td>Passed</td>
<td>30 ppm</td>
</tr>
<tr>
<td>$2 &lt; X &lt; 5$</td>
<td>Failed</td>
<td>60 ppm</td>
</tr>
<tr>
<td>$5 &lt; X &lt; 25$</td>
<td>Failed</td>
<td>180 ppm</td>
</tr>
</tbody>
</table>

17. Continue 12.1 STS EVA DECONTAMINATION

OXIDIZER CONTAMINATION TEST

18. Using RET, retrieve nitrous fumes detector from Contamination Detection Kit
19. Verify Draeger tube color pale gray

* Use new tube if not proper color *

**CAUTION**
Minimize contact with fracture regions of Draeger tube. Minor glove RTV damage is possible, but protective pressure bladders and restraints unaffected

AW82B 20. Using equipment hook of RET as a lever, break off both tether points on nitrous fumes detector

**WARNING**
Precise sampling times are critical for accurate testing. IV should coordinate start of timer with opening of AIRLK DEPRESS valve

21. AIRLK DEPRESS vlv – 5
22. Start timer (15:00 sampling time)

When timer expired:
23. AIRLK DEPRESS vlv – CL

**NOTE**
If oxidizer present, Draeger tube will turn blue gray

DCM 24. Compare AIRLK P to pressure in step 2
If $\Delta P \geq 0.1$ psi (indicates leak in sampling hardware)
25. To repress airlock to 5.0 psi, Inner hatch Equal vlv (one) – throttle NORM to OFF
26. Go to step 1 to repeat test with new Draeger tube
27. Determine test results based on table 2 and report to MCC

TABLE 2.- OXIDIZER TEST PASS/FAIL CRITERIA

<table>
<thead>
<tr>
<th>Reaction Line</th>
<th>Report Status</th>
<th>Assumed Concentration with 2x Factor of Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X &lt; 0.5$</td>
<td>Passed</td>
<td>1.5 ppm</td>
</tr>
<tr>
<td>$0.5 &lt; X &lt; 1$</td>
<td>Failed</td>
<td>3 ppm</td>
</tr>
<tr>
<td>$1 &lt; X &lt; 2$</td>
<td>Failed</td>
<td>6 ppm</td>
</tr>
</tbody>
</table>

28. Continue 12.1 STS EVA DECONTAMINATION
HYDRAZINE CONTAMINATION TEST

29. Retrieve hydrazine detector from Contamination Detection Kit

   NOTE
   Hydrazine detector is double bagged. Inner bag is not captive and should be constrained to prevent FOD

30. Tear open hydrazine detector packaging
    Stow packaging in small trash bag

31. Initial coupon color – white

AW82B 32. Insert hydrazine detector into STS Contamination Sampler
33. Helmet Lights – OFF

   WARNING
   Precise sampling times are critical for accurate testing. IV should coordinate start of timer with opening of AIRLK DEPRESS valve

34. AIRLK DEPRESS vlv – 5
35. Start timer (10:00 sampling time)
   When timer expired:
   36. AIRLK DEPRESS vlv – CL

DCM 37. Compare AIRLCK P to pressure in step 2
   If $\Delta P \geq 0.2$ psi (indicates leak in sampling hardware)
   38. To repress airlock to 5.0 psi, Inner hatch Equal vlv (one) – throttle NORM to OFF
   39. Go to step 1 to repeat test with new hydrazine detector

   NOTE
   Hue and intensity of test coupon color change is proportional to hydrazine concentration. For shuttle thruster leaks, compare coupon to US Propellant (MMH) color scale. For ISS thruster leaks, compare coupon to Russian Propellant (UDMH) color scale

40. Determine test results based on table 3 and report to MCC

TABLE 3.- HYDRAZINE TEST PASS/FAIL CRITERIA

<table>
<thead>
<tr>
<th>MMH</th>
<th>Report Status</th>
<th>Assumed Concentration with 2x Factor of Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>No color change seen</td>
<td>Passed</td>
<td>28 ppb</td>
</tr>
<tr>
<td>Unexposed $&lt; X &lt; 25$ ppb</td>
<td>Passed</td>
<td>50 ppb</td>
</tr>
<tr>
<td>$25$ ppb $&lt; X &lt; 50$ ppb</td>
<td>Failed</td>
<td>100 ppb</td>
</tr>
<tr>
<td>$50$ ppb $&lt; X &lt; 100$ ppb</td>
<td>Failed</td>
<td>200 ppb</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UDMH</th>
<th>Report Status</th>
<th>Assumed Concentration with 2x Factor of Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>No color change seen</td>
<td>Passed</td>
<td>54 ppb</td>
</tr>
<tr>
<td>Unexposed $&lt; X &lt; 50$ ppb</td>
<td>Passed</td>
<td>100 ppb</td>
</tr>
<tr>
<td>$50$ ppb $&lt; X &lt; 100$ ppb</td>
<td>Failed</td>
<td>200 ppb</td>
</tr>
<tr>
<td>$100$ ppb $&lt; X &lt; 300$ ppb</td>
<td>Failed</td>
<td>600 ppb</td>
</tr>
</tbody>
</table>

41. Continue 12.1 STS EVA DECONTAMINATION
SAFER BATTERY CHANGEOUT (15 min)

1. Unstow new battery
2. Install Inhibitor
3. MAN ISOL vlv – CL (up)
4. PWR – OFF
5. Remove T-Handle tool from lanyard while keeping Inhibitor installed on SAFER
6. Separate TMG Velcro on bottom of prop module to access battery
7. Loosen captive screws (eight) using 9/64-in Hex Wrench on T-Handle tool
8. Remove battery; disconnect battery umbilical connector
9. Stow used battery
10. Record new battery serial number (SAFER CHECKOUT RESULTS Cue Card)
    Report old battery serial number and new stowage location to MCC as comm permits
11. Connect new battery umbilical connector; install battery
12. Tighten captive screws (eight)
13. Reattach TMG Velcro
14. Attach T-Handle tool to lanyard
15. Go to SAFER CHECKOUT
BENDS TREATMENT ADAPTER (BTA) INSTALLATION (IN-SUIT)

BTA PREP
1. Unstow BTA with 3/8-in Wrench
2. Cut/break TMG tacks (see 12-23)
3. Unzip PLSS TMG (avoid pulling on antenna cable)
4. Remove impact shield
5. Disconnect hatch marked cable P3 (see 12-23); cut cable if reqd

NOTE
It may be necessary to extend the legs forward
to access the test port in a pressurized EMU

6. Remove test port F plug on SOP using 3/8-in end of BTA Wrench
   (4-6 turns ccw) (see SECONDARY OXYGEN PACKAGE below)

SECONDARY OXYGEN PACKAGE

BTA
7. Stow test port F plug (see 12-23) on BTA
8. Unstow poppet keeper screw from BTA, temp stow in EMU Servicing Kit

BTA TREATMENT
9. √SCU connected to DCM
10. Align BTA engage mark with PPRV mark
   Connect BTA to PPRV (rotate BTA cw to hard stop to lock), √locked

AW82B 11. √EV-1(EV-2) O2 vlv – OP
MD(flr) 12. √EMU O2 ISOL vlv – OP
DCM 13. √PWR – SCU
14. √FAN – ON
15. √COMM mode – HL, vol as reqd
16. DISP – PRO until BTA?OFF displayed
   – YES (hold for 2 sec), verify ENABLE BTA? displayed
   – YES (hold for 2 sec), verify BTA ENABLED displayed

If biomed reqd:
17. Perform EVA COMM CONFIG (EVA PREP), steps 1-6

DCM 18. Comm FREQ – LOW
   COMM mode – PRI

WCS 19. √FAN SEP same as HOSE BLOCK
20. MODE – COMMODE/MANUAL/EMU, posn guard over sw (√airflow,
    WCS ON lt on)

AW82D 21. √EMU 1(2) H2O SPLY – CL (tb-CL)
AW82H 22. EMU 1(2) H2O SPLY WASTE reg – MAN OP
AW82D 23. EMU 1(2) H2O WASTE – OP (tb-OP) (until H2O WP < 7 and stable for ~1 min)
24. EMU 1(2) H2O WASTE – CL (tb-CL)
AW82H 25. EMU 1(2) H2O SPLY WASTE reg – REGULATING
WCS 26. MODE – AUTO (√WCS ON lt off)
DCM 27. √STATUS: [SUIT P] = 4.2-4.4
28. O2 ACT – OFF (until SUIT P stabilizes)
NOTE
Suit pressure will nominally increase when O2 actuator taken to OFF. Suit P = [H2O GP] when O2 ACT – OFF. For actual suit P > 5.9 psi, suit P can only be directly read as [H2O GP]; actual suit P = 4.7 to 5.5 psi above BTA gauge pressure

CAUTION
If BTA gauge pressure increases while O2 ACT – PRESS, immediately set O2 ACT – OFF to prevent a hazardous condition; contact MCC

29. O2 ACT – PRESS (for 15 sec), [square root]BTA gauge not increasing when O2 ACT – PRESS
30. O2 ACT – OFF (until [H2O GP] stable)
31. [check box] STATUS: [H2O GP]
   DISP – YES (hold for 2 sec) to lock parameter; re-lock every 5 min
32. Repeat steps 29,30 until [H2O GP] = 6.0 psid and stable on DCM display with O2 ACT – OFF

As reqd to maintain H2O GP = 6.0 psid:
33. Repeat steps 29,30

NOTE
Initial treatment will be at 6 psid for Cuffs 2 and 3 and will be increased to 8 psid if symptoms do not resolve. Initial treatment for Cuff 4 will be 8 psid

34. Contact Surgeon for treatment length and changes in treatment pressure
BENDS TREATMENT ADAPTER (BTA) INSTALLATION (POST SUIT DOFFING)

BTA PREP
1. Unstow BTA with 3/8-in Wrench
2. Cut/break TMG tacks (see 12-23)
3. Unzip PLSS TMG (avoid pulling on antenna cable)
4. Remove impact shield
5. Disconnect hatch marked cable P3, cut cable if reqd (see 12-23)
6. Remove test port F plug on SOP using 3/8-in end of BTA Wrench (4-6 turns ccw) (see SECONDARY OXYGEN PACKAGE below)

SECONDARY OXYGEN PACKAGE

7. Stow test port F plug (see 12-23) on BTA

If LiOH replacement reqd by MCC:
8. Unstow new LiOH cartridge
9. Remove used LiOH cartridge
10. Holding new LiOH cartridge w/aluminum plate serial number facing self, remove caps (left first), O-ring seals for damage, install LiOH (attach Velcro retainer strap)
11. Install caps on used LiOH cartridge
   Tape an X on used LiOH cartridge and stow

BTA TREATMENT
12. √ SCU connected to DCM
13. Unstow Poppet Keeper Screw from BTA
14. Open Positive Pressure Relief Valve (PPRV) using BTA poppet keeper (thread cw to hard stop, pull, tighten nut) (see 12-23)
15. Align BTA engage mark with PPRV mark
   Connect BTA to PPRV (rotate BTA cw to hard stop to lock); locked
16. Don MAG, LCVG, biomed
17. Fill drink bag from galley, remove gas and insert drink bag in restraint bag
18. Install Drink Bag Restraint Bag in HUT and dispose of fill tool in wet trash

AW82B 19. √ EV-1(EV-2) O2 vlv – OP
MD(flr) 20. √ EMU O2 ISOL vlv – OP

CAUTION
EMU must be on BATT pwr when airlock pwr supply turned on

DCM 21. PWR – BATT

AW18H 22. PWR/BATT CHGR EMU 1(2) MODE – PWR
          BUS SEL – MNA(MNB)

DCM 23. PWR – SCU
24. √ Waist ring – op
25. Don LTA (attach donning handles as reqd)
26. √ Suit arms aligned
27. √ Wrist disconnects – op
28. Don thumb loops
29. √ Biomed connector outside of HUT
30. Don HUT
31. Release thumb loops
32. √Suit arms aligned
33. Don comm cap

**DCM**
34. √COMM mode – HL, vol as reqd
If biomed reqd:
35. Perform EVA COMM CONFIG (EVA PREP), steps 1-6

**DCM**
36. Comm FREQ – LOW
COMM mode – PRI
37. Connect biomed to elec harness
38. Connect LCVG to multiple water connector, √locked
39. √Thermal cover clear of waist ring
40. Waist ring – engage posn
41. Connect waist ring to HUT, √locked
42. Wrist rings – engage posn
43. Don EV gloves, √locked
44. √Mike boom posn

**DCM**
45. FAN – ON
46. √Elec harness clear of neck ring
47. Don helmet, √locked
48. √Helmet purge vlv – cl, locked
49. √PURGE vlv – op
50. O2 ACT – PRESS, begin purge clock (12 min)

**WCS**
51. √FAN SEP same as HOSE BLOCK
52. MODE – COMMODE/MANUAL/EMU, posn guard over sw (√airflow, WCS ON lt on)

**AW82D**
53. √EMU 1(2) H2O SPLY – CL (tb-CL)
**AW82H**
54. EMU 1(2) H2O SPLY WASTE reg – MAN OP
**AW82D**
55. EMU 1(2) H2O WASTE – OP (tb-OP)

When N2 purge time = 12 min:
56. EMU 1(2) H2O WASTE – CL (tb-CL)
**AW82H**
57. EMU 1(2) H2O SPLY WASTE reg – REGULATING

**WCS**
58. MODE – AUTO (√WCS ON lt off)

**DCM**
59. PURGE vlv – cl (dn)
60. √STATUS: [SUIT P] = 4.2-4.4
61. DISP – PRO until [BTA?OFF] displayed
   – YES (hold for 2 sec), verify [ENABLE BTA?] displayed
   – YES (hold for 2 sec), verify [BTA ENABLED] displayed

**NOTE**
Suit P will increase about ~.5 psi each time O2 ACT – OFF

62. O2 ACT – OFF (until Suit P incr stabilizes)
63. O2 ACT – PRESS (for 15 sec)
64. Repeat steps 62,63 until Suit P = 6.0 psig on BTA gauge

**NOTE**
BTA relief valve relieves at 7.95-8.45 psig

As reqd to maintain Suit P = 6.0 psig:
65. Repeat steps 62,63

**NOTE**
Initial treatment will be at 6 psid for Cuffs 2 and 3 and will be increased to 8 psid if symptoms do not resolve. Initial treatment for Cuff 4 will be 8 psid

66. Contact Surgeon for treatment length and changes in treatment pressure
BTA LOCATION ON EMU
NOTE

Procedures written for arm, thigh, and boot disconnects.
Arm, thigh, and boot sizing rings are not interchangeable
and cannot be stacked. See figures below and next page
as reference during procedure

1. Identify component(s) to be installed per appropriate resize matrix

Old component(s)/EMU

2. Peel back TMG from disconnect

If replacing arm components:
3. √REBA sw – OFF (toward left arm of suit)
4. Disconnect lower arm power harness from gloves and upper arm

WARNING
Threads on sizing rings and arm/leg/boot segments have
sharp edges. Avoid contact with skin and suit bladder

5. Lock 1 – OPEN (on arm, lock may reengage due to bladder)
6. Lock 2 – hold OPEN while turning ring to engage lock 2 OPEN against
disconnect
7. Lock 3 – hold OPEN while turning ring in OPEN direction
8. Demate segment/ring
9. Install protective caps on ends of components; place rings in protective
pouches
10. Repeat steps 2-9 as reqd

New component(s)/EMU

11. √Proper size located on bladder by disconnect

12. √All seals, threads and wipe with lint-free wipe (EMU Servicing Kit)
13. Lock 1 – OPEN (lock may reengage due to bladder on arm)
14. Align new component yellow hash marks with yellow bar on disconnect
15. Turn rings in LOCK direction
16. √Lock 2,3 – locked
17. Lock 1 – LOCK
18. √Cam adjustments (4 per segment) per appropriate resize matrix
19. If lower arm replaced, connect lower arm power harness to upper arm
20. Remate TMG covering disconnect
21. Repeat steps 11-20 as reqd

Old component(s)/EMU

22. Stow replaced component(s)

DISCONNECT IN LOCKED POSITION
EMU RESIZE (Cont)

**ARM CAM ADJUSTMENT**
(0.25-in per cam)

**NOTES**
Cam Adjuster only rotates in one direction.

Cam Adjuster should click and lock in the full SHORT and full LONG positions.

Cam positions/arms must be symmetric; likely minimum of four (4) cams to be adjusted.

**WAIST CAM ADJUSTMENT**
(1.0-in per cam)

**NOTES**
After adjusting, verify that restraint is routed around proper pin; that material is not damaged, twisted or pinched; and that movable pin is fully inserted.

With restraint in LONG position, the darkened area on Resizing Pull Tab should NOT be easily visible.

With restraint in SHORT position, the darkened area on Resizing Pull Tab should be easily visible.

Cam positions must be symmetric; minimum of two (2) cams to be adjusted.

**LEG CAM ADJUSTMENT**
(0.5-in per cam)

**NOTE**
After adjusting, verify that restraint is routed around the oval cam; that material is not damaged, twisted or pinched; and that Movable Pin is fully inserted.

Cam positions/legs must be symmetric; likely minimum of four (4) cams to be adjusted.

**CAUTION**
In SHORT position, the Movable Pin must be inserted thru oval cam, not just thru the restraint loop.

In LONG position, the restraint must NOT be around the Movable Pin; verify that oval cam and restraint are down.
Replace this page with page(s) from Flight Supplement
RMS/PRLA CONTINGENCY EVA

FOR RMS/PRLA FAILURES:

**PRE EVA RMS CONFIG [1]**

| IV | If MRL fails to latch:          |
|    |                               |
| A8L | RMS R-F-L tb (three) – gray |
|     | RMS tb – STO                  |
|     | Go to RMS TIEDOWN [4]         |
| A8L | RMS RETEN LAT – LAT (tb-LAT)  |
|     | MPMs stowed(deployed) as far as possible |
|     | Go to MPM STOW/DEPLOY [5]     |
|     | If Joint fails:               |
|     |   Position RMS for easy striker bar access |
|     |   Go to RMS JOINT ALIGN [6]   |

**PRE EVA EE/GF CONFIG [2]**

| IV |                      |
|    | A8U BRAKES – ON (tb-ON) |
|    | EE MODE – OFF         |
| A8L | RMS SEL – OFF         |
|     | Go to RMS FLIGHT RELEASABLE GRAPPLE FIXTURE RELEASE [8] |

**PRE EVA PRLA CONFIG [3]**

| IV |                      |
|    | MA73C:C cb MCA PWR AC1 3Φ MID 1 – op |
|    | :D cb MCA PWR AC2 3Φ MID 3 – op      |
| R13L | PL BAY MECH PWR 1,2 (two) – OFF     |
| A6U  | PL RETEN LOGIC PWR SYS 1,2 (two) – OFF |
|     | LAT (five) – OFF                   |
|     | Go to PRLA OPEN/CLOSE [9]          |
RMS/PRLA CONTINGENCY EVA (Cont)

FOR RMS/PRLA FAILURES (Cont):

RMS TIEDOWN [4]

IV If MRL fail to latch – monitor EV1 and EV2

Refer to RMS TIEDOWN figure, following page, as reqd

RMS TIEDOWN

TOOL BOX – PRDs (2), EVA TRASH BAG
IFM – 9/64-in ALLEN WRENCH (AW)
ELBOW – PRD aft of MPM, peel blanket (fwd of MPM) toward EE;
feed hook under cable harness (if reqd, remove cable harness
clamp bolt with AW, bend clamp out of way), adjust strap as far
fwd as possible
WRIST – PRD aft of MPM, strap rests just fwd of pitch joint
opening
END EFFECTOR – PRD fwd of MPM, peel blankets aft and fwd,
strap rests aft-most on yaw joint (at roll/yaw I/F), adjust strap
under bolt studs
1. Figure eight the strap
2. Pull minimum 6-in slack in strap
3. Ratchet PRD snug,
   (14 full strokes reqd)
4. □Strap in correct arm
   location, ratchet tight
5. Reattach blankets

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MPM STOW/DEPLOY [5]

IV1 If MPM fail to stow/deploy, monitor EV1 and EV2, then:

MPM STOW/DEPLOY

TOOL BOX – MPM WRENCH

1. Rotate torque shaft (8 revs) until MPMs are stowed/deployed,
   $X_0=693$

3 inch

IV When MPMs in stow(deploy) position:

□ RMS tb – STO(DPY)

or

4: SM 94 PDRS CONTROL
□ RMS STO/DPY
11 00 (00 11)

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EVA/ALL/GEN H,4
RMS/PRLA CONTINGENCY EVA (Cont)

RMS TIEDOWN

NOTE: DO NOT REMOVE BLANKET AT THIS JOINT
### RMS/PRLA CONTINGENCY EVA (Cont)

**FOR RMS/PRLA FAILURES (Cont):**

<table>
<thead>
<tr>
<th><strong>RMS JOINT ALIGN</strong> [6]</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV If Joint Fail – reposition RMS as reqd for RMS rope attachment – monitor EV1 and EV2</td>
</tr>
</tbody>
</table>

**RMS JOINT ALIGN**

TOOL BOX – ADJ TETHERS, SNATCH BLOCKS (2), RMS ROPE REEL
1. Attach RMS rope around end effector under handrail.
   - Translate to avoid wrapping rope around RMS
2. Attach snatch block(s) to handrail(s) and route rope as reqd
3. Reposition RMS as required for cradling
4. Pull RMS down into MPMs
5. Perform final positioning by hand to allow MRLs to latch

**RMS SHOULDER BRACE RELEASE** [7]

**TOOL BOX – RMS SHOULDER BRACE RELEASE TOOL**
1. Fold aside rub strip and thermal blankets
2. Insert tool and move handle down
3. Remove tool and reconfigure blankets

<table>
<thead>
<tr>
<th><strong>RMS SHOULDER BRACE RELEASE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>IV A8 \ RMS SELECT – OFF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>RMS SHOULDER BRACE RELEASE TOOL</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fold aside rub strip and thermal blankets</td>
</tr>
<tr>
<td>2. Insert tool and move handle down</td>
</tr>
<tr>
<td>3. Remove tool and reconfigure blankets</td>
</tr>
</tbody>
</table>

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**When RMS ready to latch:**

- **R13L** PL BAY MECH PWR SYS (two) – ON
- **A8L** RMS RETEN LAT – LAT (tb-LAT 18 sec max)
  - OFF
- If MPMs deployed:
  - Elbow Camr in aligned posn:
    - Pan 90° from X-AXIS
    - Tilt per DECAL
- **A8L** RMS – STO (tb-STO, 68 sec max)
  - OFF
- **A8U** BRAKES – ON (tb-ON)
- **R13L** PL BAY MECH PWR SYS (two) – OFF
RMS/PRLA CONTINGENCY EVA (Cont)

FOR RMS/PRLA FAILURES (Cont):

RMS FLIGHT RELEASABLE GRAPPLE FIXTURE RELEASE

RMS FLIGHT RELEASABLE GRAPPLE FIXTURE RELEASE

AIRLOCK – JETTISON STOWAGE BAG
TOOL BOX – 1/2-in BOX RATCHET, VELCRO/TAPE

EV

1. Rotate 10 o’clock posn release rod ccw to hard stop (~36 strokes of 90 deg)
2. Rotate 4 o’clock posn release rod cw to hard stop (~36 strokes of 90 deg – shaft will release from grapple fixture)
3. Clear worksite for RMS powerdown
4. Tape end of shaft to restrain slug within shaft
5. Cover end effector with jettison stowage bag to restrain grapple shaft

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RMS/PRLA CONTINGENCY EVA (Cont)

EFGF GRAPPLE SHAFT RELEASE

Tools Reqd:
1/2-in Box Ratchet, EVA Probe (PSA), Jettison Stowage Bag (Airlock), Spare Grapple Shaft w/Transfer Bag (if reqd, Airlock)

EV
1. Perform visual inspection of EE/GF interface to determine possible cause of failure
2. Remove tee pull (~10 lb)
3. Rotate release rod cw (break out < 20 ft-lb, running < 11 ft-lb) to hard stop (~90 strokes of 70 deg)

WARNING
If payload not restrained, rotation of release rod after grapple shaft release may impart movements to payload

IV
4. √Electrical connector disconnected
EV
5. If electrical connector not disconnected, insert probe into connector release port ~5.25 in for full release

IV
6. Clear worksite for RMS cradle
EV
7. Perform RMS POWERDOWN (PDRS OPS)

EV
8. Cover end effector with jettison stowage bag to restrain grapple shaft

SPARE SHAFT REPLACEMENT (If reqd)

EV
9. Rotate release rod cw to hardstop then rotate ccw five strokes of ~70 deg (at least one full rev reqd). This will insure that grapple shaft can be released for future failures
10. Insert spare shaft (~5 lb to overcome ball detent) using alignment pin and guide
11. Rotate release rod ccw to hardstop (~90 strokes of ~70 deg), apply slight axial pressure to grapple shaft for initial rotations. This is required to aid in engagement of Acme threads

If grapple shaft not engaged after four revs of release rod, repeat steps 9-11

12. Verify no gap between grapple shaft shoulder and grapple fixture cone. If gap is visible, release shaft and repeat insertion procedures
13. Replace tee pull
RMS/PRLA CONTINGENCY EVA (Cont)

ELECTRICAL FLIGHT GRAPPLE FIXTURE

EVA RELEASE ROD DRIVE
EVA TEE PULL
ELECTRICAL CONNECTOR
STANDARD PROBE
(VERIFY NO GAP)
EXTENDABLE GRAPPLE SHAFT
STANDARD 0.5-IN RATCHET BOX END WRENCH
EVA RELEASE ROD DRIVE
EVA CONNECTOR RELEASE PORT
ELECTRICAL CONNECTOR ASSEMBLY
RMS/PRLA CONTINGENCY EVA (Cont)

FOR RMS/PRLA FAILURES (Cont):

PRLA OPEN/CLOSE 9
Refer to EVA RELEASABLE PAYLOAD RETENTION LATCHES figures, 14-11, 14-12, as reqd

PRLA OPEN/CLOSE
AIRLOCK – RATCHET WITH 7/16 SOCKET
IV √PRLA PWR OFF
EV 1. Rotate ratchet in release direction (as marked above EVA drive) to shear pin
2. View yellow indicator as applicable
3. Continue to rotate drive 4-1/2 revs to disc gear train from drive shaft
   To open latch:
   4. Continue rotation in release direction (as marked above EVA drive) until latch open against stop
   To close latch:
   5. Rotate EVA drive in opposite direction of release (as marked above EVA drive) until latch closed against hardstop and over center
IV √PRLA tb LAT

CONT NEXT PAGE
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PRLA OPEN/CLOSE (CONT)
EV 6. Apply PRLA locking feature if applicable
   To lock:
   7. Rotate each bolt (two) cw 1/2 turn

For subsequent PRLA ops, release locking feature before operating EVA drive (two bolts ccw 1/2 turn); relock after operation

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POST EVA RMS CONFIG 10
IV A8U √BRAKES – ON (tb-ON)
Complete RMS POWERDOWN (PDRS OPS)
In-board end of shaft has yellow marks. Not aligned indicates motor disengaged.

EVA RELEASABLE PAYLOAD RETENTION LATCHES

LWLL/MWLL/SMWLL
LIGHTWEIGHT LONGERON LATCH/
MIDDLEWEIGHT LONGERON LATCH/
SUPER MIDDLEWEIGHT LONGERON LATCH

MMWL
MODIFIED MIDDLEWEIGHT LATCH
RMS/PRLA CONTINGENCY EVA (Cont)

In-board end of shaft extends to show yellow stripe when motor disengaged

STANDARD WEIGHT LATCH
EVA RELEASABLE PAYLOAD RETENTION LATCHES (Cont)
96 BOLT PRE-EVA TOOL CONFIG

STOWAGE LOCATIONS AT LAUNCH
Flight specific Middeck stowage and PFR configuration will be uplinked

EMUs:
- MWS Baseplates (2)
- Retractable Tethers (2)
- Adj Equip Tethers (2)
- Waist Tethers (4)

Middeck:
- MWS T-bars (2)
- MWS Swing Arms (3)
- BRT (2)
- Waist Tethers Ext (2) (If flown)
- General Purpose (GP) Caddies (2)
- Adj Equip Tethers (2)
- Retractable Tethers (2)
- Crewlock Bag
- Right Angle Drive (RAD)
- Socket Caddy
- 6-in Exts (2)
- PGTs (2)
- PGT Batteries (3)
- Adj Fuse Tether
- Jettison Stowage Bag

Node Bag:
- 96 Bolt Bag:
  - 7/16-in Box End Wrenches (2)
  - ODS Clamps (2)
  - ODS Clamp Handles (2)
  - PB Articulating Socket
  - Bridge Rail Clamp
  - RAD w/7/16-in Sockets (2)

TSA (Port):
- Large Cutter
- PRDs (2)
- Sm EVA Trash Bags (2)

Fwd Bulkhead:
- PFR

Port PLB (Bay 2):
- Bridge Rail Clamp
- PB Articulating Socket

Configure Crewlock EVA Bag:
- PGT Spare Battery
- Socket Caddies w/6-in Exts (2), RAD (Spare)

Configure Adj Fuse Tether with one of following:
- GP Caddies (2)
- PGTs w/Batteries (2)

Configure Crewlock EVA Bag:
- PGT Spare Battery
- Socket Caddies w/6-in Exts (2), RAD (Spare)

Stow Adj Fuse Tether, Crewlock Bag, Jettison
Stowage Bag in Airlock pre-EVA

Remove ODS Centerline Camera pre-EVA
## 96 BOLT EVA TIMELINE

<table>
<thead>
<tr>
<th>PET</th>
<th>IV/RMS</th>
<th>EV1</th>
<th>EV2</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40:00</td>
<td>\DOCKING MECHANISM POWERDOWN (RNDZ, APDS) before start of DEPRESS</td>
<td>1. Perform DEPRESS (DEPRESS/REPRESS)</td>
<td>2. Perform DEPRESS (DEPRESS/REPRESS)</td>
</tr>
<tr>
<td></td>
<td>ML86B:D 1. cb MNA MMU GN2 SPLY ISOL VLV A – cl</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>R13L 2. MMU GN2 SPLY ISOL VLV A – CL (tb-CL)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-00:25</td>
<td>ML86B:D 3. cb MNA MMU GN2 SPLY ISOL VLV A – op</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-00:20 Confirm TCS powerdown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>00:00</td>
<td>MET at PWR – BATT</td>
<td>3. Perform POST DEPRESS (DEPRESS/REPRESS)</td>
<td>4. Perform POST DEPRESS (DEPRESS/REPRESS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>00:15</td>
<td>00:15 Confirm TCS powerdown</td>
<td>5. Perform AIRLOCK EGRESS (CUFF C/L, 47)</td>
<td>6. Perform AIRLOCK EGRESS (CUFF C/L, 47)</td>
</tr>
<tr>
<td></td>
<td>Add the following steps to AIRLOCK EGRESS:</td>
<td></td>
<td>Add the following steps to AIRLOCK EGRESS:</td>
</tr>
<tr>
<td></td>
<td>6a. Translate to GO2 ISOLATION VALVE on outside of airlock (aft port side)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6b. Open thermal cover; remove PIP pin</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6c. GO2 XFER ISO VLV – CL AW64L(E)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6d. Re-install PIP pin; close thermal cover</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6e. \ODS hatch (\Delta P &lt; 0.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6f. Open ODS Hatch per decal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6g. Remove docking lights (two):</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Release elec connector (one) at each light PIP pin (one) on each light boom</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6h. Remove Cross-Hair assembly; stow in bag</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6i. VENT – OP; FLOW – OP GN2 XFER PANEL</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6j. VENT – OP; FLOW – OP GO2 XFER PANEL</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6k. \Pressure gauges (two) – zero</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6l. Close ODS hatch per decal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6m. \ODS Equal vls (two) capped</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PET</td>
<td>IV/RMS</td>
<td>EV1</td>
<td>EV2</td>
</tr>
<tr>
<td>-----</td>
<td>--------</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>01:00</td>
<td>PAYLOAD BAY SETUP</td>
<td>1. Retrieve 96 Bolt Bag from Node Bag</td>
<td>PAYLOAD BAY SETUP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Attach 96 Bolt Bag to Ext A/L Truss near port TSA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Remove thermal blanket covering ODS bolts; temp stow in A/L with Adj Equip Tether</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Retrieve GP Caddy from Adj Fuse Tether; attach to MWS</td>
<td></td>
</tr>
<tr>
<td>01:20</td>
<td>TOOL CONFIG</td>
<td>1. Retrieve Right Angle Drives from 96 Bolt Bag and meet EV2 at Adj Fuse Tether</td>
<td>TOOL CONFIG</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Retrieve ODS Clamp and Handle from 96 Bolt Bag; install handle in clamp, √ locked; hand off to EV2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Retrieve ODS Clamp and Handle from 96 Bolt Bag; install handle in clamp; √ locked; attach Waist Tether from EMU to ODS Clamp</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Retrieve 7/16-in Box End Wrench from 96 Bolt Bag; attach to GP Caddy</td>
<td></td>
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<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>PGT: 25.5 ft-lb, CCW2, 30.5</td>
<td>INSTALL CLAMP – STBD</td>
<td>1. Tether ODS Clamp to handrail at worksite</td>
<td>INSTALL CLAMP – PORT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Release bolts 35 to 38 (four); pull to lock up</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Retract Clamp pip pin</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Install clamp between bolts 36,37</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Set clamp Turn bolt at top of clamp until upper jaws contact vestibule ring, then add1 3/4 turn; insert pip pin</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. √ Clamp Handle locked</td>
<td></td>
</tr>
<tr>
<td>01:45</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**CAUTION**
During clamp installation, do not apply any sideload on ODS gusset (may puncture A/L)
<table>
<thead>
<tr>
<th>PET</th>
<th>IV/RMS</th>
<th>EV1</th>
<th>EV2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>IF PFR REQUIRED:</td>
<td>IF PFR REQUIRED:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Retrieve Art Socket and Bridge Rail Clamp from 96 Bolt Bag</td>
<td>Port Bridge Rail Clamp and Art Socket launched in second to fwd-most available half-hole</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Install bridge rail clamp and art socket on stbd bridge rail in aft-most available half-hole, knob inboard</td>
<td>1. Move clamp assy to fwd-most available half-hole, knob inboard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Retrieve PFR from port side</td>
<td>2. Retrieve fwd bulkhead PFR and install</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PFR SETUP FOR CLAMP INSTALL</td>
<td>PFR SETUP FOR CLAMP INSTALL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Art Socket: $P = 2, Y = 6$</td>
<td>1. Art Socket: $P = 1, Y = 6$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. PFR: $P = 10, R = A, Y = 8$</td>
<td>2. PFR: $P = 10.5, R = A, Y = 3$</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>WARNING</strong> Cut ends of O2 and N2 lines present sharp edge hazard</td>
<td><strong>WARNING</strong> Cut ends of O2 and N2 lines present sharp edge hazard</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>CUT CABLES AND LINES</strong></td>
<td><strong>CUT CABLES AND LINES</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Use Large Cutter to cut all cables at 96 bolt interface</td>
<td>1. Use Large Cutter to cut all cables at 96 bolt interface</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Bend cables w/cutter to verify cables separated</td>
<td>2. Bend cables w/cutter to verify cables separated</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Cut O2 and N2 lines</td>
<td>3. Cut O2 and N2 lines</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Stow Large Cutter on available handrail</td>
<td>4. Stow Large Cutter on available handrail</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>USE BRT FOR BOLT RELEASE</strong></td>
<td><strong>USE BRT FOR BOLT RELEASE</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Release bolts 1-33, 40-48 and grounding strap between bolts 9 and 10</td>
<td>1. Release bolts 49-81, 88-96</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>SURVEY VESTIBULE</strong></td>
<td><strong>SURVEY VESTIBULE</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. All bolts except 34,39,82,87 locked up</td>
<td>1. All bolts except 34,39,82,87 locked up</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. All cables cut (21), all gas lines cut (two), and ground strap removed</td>
<td>2. All cables cut (21), all gas lines cut (two), and ground strap removed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. All tools, tethers removed from vestibule</td>
<td>3. All tools, tethers removed from vestibule</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Separation plane clear of all cables and lines</td>
<td>4. Separation plane clear of all cables and lines</td>
</tr>
</tbody>
</table>

02:05 Record Cables cut at following locations:
- Bolt 32 – 1 cable
- Bolt 24 – 7 cables
- Bolt 21 – 1 cable
- Bolt 19 – 1 cable
- Bolt 1 – 1 cable
- Bolt 95 – 2 cables
- Bolt 74 – 2 cables
- Bolt 69 – 3 cables
- Line 69 – 1 line N2
- Line 86 – 1 line O2
- Bolt 51 – 1 cable
- Bolt 47 – 2 cables

PGT: 25.5 ft-lb, CCW2, 30.5

03:15 Survey Vestibule
- All bolts except 34,39,82,87 locked up
- All cables cut (21), all gas lines cut (two), and ground strap removed
- All tools, tethers removed from vestibule
- Separation plane clear of all cables and lines
<table>
<thead>
<tr>
<th>PET</th>
<th>IV/RMS</th>
<th>EV1</th>
<th>EV2</th>
</tr>
</thead>
<tbody>
<tr>
<td>03:25</td>
<td>FREE DRIFT</td>
<td>PREP FOR RELEASE</td>
<td>PREP FOR RELEASE</td>
</tr>
<tr>
<td></td>
<td>PGT: 25.5 ft-lb, CCW2, 30.5</td>
<td>1. Receive PRD from temp stow on Truss</td>
<td>1. Receive PRD from temp stow on Truss</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Attach PRD fixed end to handrail, retractable end to Clamp Handle</td>
<td>2. Attach PRD fixed end to handrail, retractable end to Clamp Handle</td>
</tr>
<tr>
<td></td>
<td>03:25</td>
<td>3. Before releasing last two bolts, FREE DRIFT</td>
<td>3. Before releasing last two bolts, FREE DRIFT</td>
</tr>
<tr>
<td>03:50</td>
<td>Give EV GO for Clamp Release</td>
<td>4. Release bolts 34,39; pull to lock up</td>
<td>4. Release bolts 82,87; pull to lock up</td>
</tr>
<tr>
<td>04:00</td>
<td>PREP FOR RELEASE</td>
<td>5. Notify IV, GO for Clamp Release</td>
<td>5. Notify IV, GO for Clamp Release</td>
</tr>
<tr>
<td>04:05</td>
<td>SEPARATION BURN</td>
<td>CLAMP RELEASE</td>
<td>CLAMP RELEASE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Retract Clamp Handle pip pin; green stripe visible</td>
<td>1. Retract Clamp Handle pip pin; green stripe visible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CLAUTION</td>
<td>CAUTION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>During clamp release, do not apply any sideload on ODS gusset (may puncture A/L)</td>
<td>During clamp release, do not apply any sideload on ODS gusset (may puncture A/L)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CAUTION</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Posn body below separation plane for clamp release</td>
<td>Posn body below separation plane for clamp release</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CAUTION</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>During clamp release, do not apply any sideload on ODS gusset (may puncture A/L)</td>
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<tr>
<td>04:05</td>
<td>SEPARATION BURN</td>
<td>CLEANUP</td>
<td>CLEANUP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Translate to TSA w/96 Bolt Bag</td>
<td>1. Translate to TSA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Translate to TSA w/96 Bolt Bag</td>
<td>2. Stow PGTs (two) on Adj Fuse Tether</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Remove ODS Clamp and Handle from ODS gusset; stow Clamp, Handle, 7/16-in Box End Wrench in 96 Bolt Bag</td>
<td>3. Stow Adj Fuse Tethers in airlock</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Stow Waist Tether on EMU</td>
<td>4. Remove ODS Clamp and Handle from ODS gusset; stow Clamp, Handle, 7/16-in Box End Wrench in 96 Bolt Bag</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Remove and stow 96 Bolt Bag in airlock</td>
<td>5. Stow Waist Tether on EMU</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IF USED:</td>
<td>7. Close TSA door, close all latches</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Configure stbd PFR assy for landing:</td>
<td>IF USED:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bridge Rail Clamp: second to aft-most available half-hole; knob locked</td>
<td>8. Configure port PFR socket assy for landing:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Art Socket: P = 11.5, Y = 3; locked</td>
<td>Bridge Rail Clamp: second to fwd-most available half-hole; knob locked</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PFR to EV2 port side</td>
<td>Art Socket: P = 11.5, Y = 3; locked</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PFR: P = 10, R = A, Y = 6; locked</td>
</tr>
</tbody>
</table>
96 BOLT EVA TIMELINE (Cont)

<table>
<thead>
<tr>
<th>PET</th>
<th>IV/RMS</th>
<th>EV1</th>
<th>EV2</th>
</tr>
</thead>
</table>
| 04:40 | VERIFY 96 BOLT BAG STOWAGE | ODS Clamps (2)  
ODS Clamp Handles (2)  
Right Angle Drives with 7/16-in Socket (2)  
7/16-in Box End Wrenches (2) | VERIFY AIRLOCK STOWAGE | Adj Fuse Tethers  
PGTs w/batteries (2)  
GP Caddies (2)  
ODS Thermal Blankets with Adj Equip Tethers (2)  
96 Bolt Bag  
Crewlock Bag:  
PGT spare battery  
Socket Caddy w/6-in Exts (2), RAD |
| 05:15 | PERFORM AIRLOCK INGRESS, CUFF C/L, 30 | MWS w/swing arm  
BRT  
Retractable Tethers (2)  
Adj Equip Tethers (2)  
Waist Tethers (2) | PERFORM AIRLOCK INGRESS, CUFF C/L, 30 | MWS w/swing arm  
BRT  
Retractable Tethers (2)  
Adj Equip Tethers (2)  
Waist Tethers (2) |
| 05:30 | | | |
## CAPTURE LATCH MANUAL RELEASE (ODS/PMA)

<table>
<thead>
<tr>
<th></th>
<th>IV</th>
<th>EV</th>
</tr>
</thead>
<tbody>
<tr>
<td>A7</td>
<td>If APDS powered:</td>
<td><strong>TOOLS REQD</strong>&lt;br&gt;Jettison Stowage Bag&lt;br&gt;Russian Capture Latch Tool (if reqd, in Node Bag)</td>
</tr>
<tr>
<td></td>
<td>pb PWR OFF – push</td>
<td>BOTH</td>
</tr>
<tr>
<td></td>
<td>√STATUS It (eighteen) – off</td>
<td>1. Configure Waist Tethers as safety line inside ODS</td>
</tr>
<tr>
<td></td>
<td>Perform DOCKING MECHANISM POWERDOWN (RNDZ, APDS)</td>
<td>EV1 Attach at ODS Hatch D-ring nearest capture latches</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EV2 Attach at A/L D-ring behind EV1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EV2 2. Open outer hatch to improve EMU sublimator performance</td>
</tr>
<tr>
<td>EV1</td>
<td>3. ODS/PMA interface:</td>
<td>EV1 3. ODS/PMA interface:</td>
</tr>
<tr>
<td></td>
<td>Open ODS hatch</td>
<td>Open ODS hatch</td>
</tr>
<tr>
<td></td>
<td>Remove docking lights (two):</td>
<td>Remove docking lights (two):</td>
</tr>
<tr>
<td></td>
<td>Release elec connector (one) at each light</td>
<td>Release elec connector (one) at each light</td>
</tr>
<tr>
<td></td>
<td>pip pin (one) on each light boom</td>
<td>pip pin (one) on each light boom</td>
</tr>
<tr>
<td></td>
<td>Stow lights and booms in bag</td>
<td>Stow lights and booms in bag</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>NOTE</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>EV2 restrain/aid EV1 as reqd</td>
</tr>
<tr>
<td>EV1</td>
<td>4. Remove Cross-Hair assembly</td>
<td>EV1 4. Remove Cross-Hair assembly</td>
</tr>
<tr>
<td></td>
<td>Stow in bag</td>
<td>Stow in bag</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. √IV GO for release</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Release capture latch</td>
</tr>
<tr>
<td></td>
<td>Cont next page</td>
<td>Cont next page</td>
</tr>
<tr>
<td>IV</td>
<td>EV</td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>----</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>NOTE</strong>&lt;br&gt; If reqd, EV2 retrieve Russian Capture Latch Tool from Node Bag (requires safety tether reel ops)</td>
<td></td>
</tr>
<tr>
<td>7. Notify IV when capture latch released</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Close hatch at capture latch interface</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EV2</strong></td>
<td>9. If used, temp stow Russian Capture Tool in A/L and perform AIRLOCK INGRESS (CUF C/L, 30)</td>
<td></td>
</tr>
<tr>
<td>10. Close outer hatch</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BOTH</strong></td>
<td>11. Go to A/L REPRESS</td>
<td></td>
</tr>
</tbody>
</table>
### PLBD LATCH TOOL PLACEMENT WITH DUAL LATCH GANG FAILURES

<table>
<thead>
<tr>
<th>CASE*</th>
<th>FAILED GANG 1</th>
<th>FAILED GANG 2</th>
<th>Three Point Latch Tool Positions</th>
<th>Centerline Latch Tool Positions</th>
</tr>
</thead>
<tbody>
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<td>Cuff C/L, 37</td>
<td>Cuff C/L, 38</td>
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<td>A</td>
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<td>Fwd Bulkhead Stbd</td>
<td>FWD #2**</td>
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<td>FWD #4**</td>
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<td>Fwd Bulkhead Port</td>
<td>Centerline Fwd</td>
<td>FWD #2</td>
<td>CL #1</td>
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<td>FWD #4</td>
<td>CL #2</td>
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<tr>
<td>C</td>
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<td>Centerline Fwd</td>
<td>FWD #2</td>
<td>CL #1</td>
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<td></td>
<td>FWD #4</td>
<td>CL #2</td>
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<tr>
<td>D</td>
<td>Centerline Fwd</td>
<td>Centerline Mid Fwd</td>
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<tr>
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<td>Centerline Mid Aft</td>
<td>-</td>
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<td>CL #7</td>
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<tr>
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<td></td>
<td></td>
<td>CL #8</td>
</tr>
</tbody>
</table>

*Other combinations of Two-Gangs Out involve doors in the crush pressure zone (latches in compression) or have at least one closed gang between failed gangs (no tension loads bleeding between gangs, giving load distributions identical to single latch gang failures)

**Install both 3-pt tools on same side (Port or Stbd)
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DCM CONFIGURATION

NORMAL EVA STATUS

O2 POS EVA
SUBLM P 2.0-4.2 psia
TIME EV HR:MIN since PWR-BATT
TIME LF limit consum HR:MIN remaining at present use rate
% O2 (PWR) LF Non-limiting consumable will be displayed
% O2 (LF) LF Non-limiting consumable will be displayed
O2 P 150-900 psia
O2 RATE 0-4.0 ps/minute
SOP P 5410-6860 psia
BAT VDC ≥ 16.7
BAT AMP 3.0-4.0
RPM 18.0-20.0 K
CO2 0.2-4.0 mm
H2O TEMP 32-75 degF
H2O GP 14.0-16.0 psid
H2O WP 14.0-16.0 psid
DATA? COMBO
BATT 32.0 AH (as directed by MCC-H)
GAUGE 4.2-4.4 psid (4.7 during/after depress) psid

NOTE: BOLDFACE ind detailed proc

EMU MALFUNCTION INDEX

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NOTE: BOLDFACE ind detailed proc
### DECOMPRESSION SICKNESS (DCS)

#### Class 1
**Symptoms:** Mild pain (single/multiple sites) and/or single extremity numbness/tingling. Difficult to discern from suit pressure points. Symptoms do not interfere with performance.

**Action:** Report in POST EVA PMC.

#### Class 2
**Symptoms:** Moderate Class 1 symptoms that interfere with performance or symptoms that resolve upon repress.

**Action:** Perform worksite cleanup, minimize activity of affected crewmember. TERM EVA; REPRESS.

#### Class 3
**Symptoms:** Severe Class 1 symptoms or migratory, trunkal/multiple site numbness/tingling; unusual headache.

**Action:** Assist affected crewmember to A/L, safe PLB, TERM EVA; REPRESS.

#### Class 4
**Symptoms:** Serious symptoms – central neurological, cardiopulmonary.

**Action:** ABORT EVA. Assisted return of affected crewmember to A/L, repress affected crewmember solo. Unaffected crewmember safe PLB, TERM EVA; REPRESS.

### ABORT EVA

1. Ingress airlock.
2. Connect SCU.

#### BOTH:
- Ingress airlock.
- Unhook from reel
- Outer (EVA) hatch – close and lock
- Go to EMER REPRESS decal (airlock hatches)

### TERMINATE EVA

1. Ingress airlock.
2. Connect SCU.

**WARNING**
If terminating due to BATT AMPS HIGH (system short), do not perform step 3.

3. PWR/BATT CHGR EMU 1(2) BUS SEL – MNA(MNB)
4. 
5. 
6. PWR – SCU (fwd)
7. WATER – OFF (fwd)

**NOTE**
If fan stops during power transfer:
Cycle FAN sw – OFF, ON

7. Verify SUIT P ≥ 3.3 and stable
8. If SUIT P < 3.3:
   9. Go to ABORT EVA, 6
10. Monitor EMU status
11. Coordinate ingress with EV1(2)
SUIT P EMERG

SUIT P EMERG
CLOSE PURG V | SUIT P X.X
If Suit P gauge ≤ 4.0
1. DCM PURGE vlv – closed
   √Helmet purge vlv – closed and locked
   √O2 ACT – EVA
2. Go to ABORT EVA, 6 >>
If Suit P gauge > 4.0 (sensor failed)
3. Continue EVA, monitor Suit P gauge

NOTE
Message triggered when SUIT P < 3.1

SOP O2 ON

SOP O2 ON
TIME LF XX:XX
1. Go to ABORT EVA, 6

NOTE
Msg triggered when:
SUIT P < 4.0 and
SOP RATE > 36.0 psi/min

BATT AMPS HIGH

BATT AMPS HI | BAT AMPS X.X
1. Helmet purge vlv – op
2. FAN – OFF
   If BAT AMP w/o fan > 1.3 (system short):
   3. WATER – OFF
   4. Notify IV/EV of impending comm loss
   5. PWR – SCU, do not activate airlock power
   6. Go to TERM EVA, 7 >>
   If BAT AMP w/o fan 0.7-1.3 (fan short):
   7. Go to TERM EVA, 7

NOTE
Msg triggered when BATT AMPS > 5.0
Normal BAT AMP = 3.0-4.0
Normal BAT AMP w/o fan = 0.7-1.3

BATT V DECAY OR BATT VDC LOW

BATT V DECAY | BAT VDC XX.X
Or
BATT VDC LOW | BAT VDC XX.X
If BAT VDC < 13.0 and fan and communications still working:
1. Continue EVA (sensor failure) >>
Otherwise (battery failure)
   WARNING
   Impending fan and comm loss
2. Begin translating to Airlock for Terminate EVA
3. When vent flow lost, helmet purge vlv → op
4. Go to TERM EVA, 7

NOTE
BATT V DECAY message triggered when BATT VDC < 17.5
BATT VDC LOW message triggered when BATT VDC < 16.5
Normal Lithium Ion BATT VDC ≥ 18.0
Normal ICB BATT VDC ≥ 16.7
Normal Fan RPM: 19.0 to 20.0K
### SUIT P LOW

**SUIT P LOW | SUIT P X.X**

If O2 USE HIGH msg present:
1. Go to ABORT EVA, 6 >>

If O2 USE HIGH msg not present:
2. Continue EVA, monitor SUIT P, SOP P, and gauge
   If gauge < 4.0 and SOP P decreasing:
   3. Go to TERM EVA, 7

**NOTE**
Msg triggered when SUIT P < 4.05

---

### SUIT P HIGH

**SUIT P HIGH | O2 RATE XX.X | SOP RATE XXX**

If O2 RATE > 7.0 or SOP RATE > 8:
1. Go to TERM EVA, 7 >>

If O2 RATE < 7.0 and SOP RATE ≤ 8:
2. Monitor SUIT P, SOP P, and gauge
3. Continue EVA

**NOTE**
Msg triggered when SUIT P > 4.55
Normal O2 RATE ≈1.7 psi/min

### SOP P LOW

**SOP P LOW | SOP P XXX0 | SOP RATE XXX**

1. Go to TERM EVA, 7

**NOTE**
Msg triggered when SOP P < 4500, or SOP P < init SOP P – 600 (SOP P initialized at EMU powerup)

---

### O2 USE HIGH

**O2 USE HIGH | O2 RATE XX.X**

If SUIT P LOW msg present:
1. Go to ABORT EVA, 6 >>

If O2 P erratic or ~0:
2. Continue EVA
3. Recharge O2 periodically >>

If O2 RATE > 7.0:
4. Go to TERM EVA, 7 >>

Otherwise:
5. Recharge O2 as reqd
6. Continue EVA

**NOTE**
Msg triggered when:
- O2 RATE > 10.2 psi/min or
- O2 P < 150 and TIME EV < 5 hr

Normal O2 RATE ≈1.7 psi/min
### SUBLM PRESS

**SUBLM P XX.X SET H2O OFF**

1. √WATER – OFF (fwd)
   - If SUBLM P < 1.0 and stable:
     - When cooling desired, then:
     1. Temp control vlv – Max H
     2. WATER – ON (aft)
     3. Temp control vlv – as reqd
       - If cooling insufficient:
         1. Go to LOSS OF COOLING, 25, step 2
     - If cooling sufficient:
       1. Continue EVA, monitor SUBLM P and cooling
       2. Perform steps 2-4, continue EVA, monitor cooling

**NOTE**
- Msg triggered when SUBLM P < 1.5 or > 5.3
- Normal SUBLM P = 2.0-4.2

### H2O GP LOW

**H2O GP LOW**

- If H2O GP < 13.5:
  - If cooling insufficient (H2O reg fail):
    1. Go to LOSS OF COOLING, 25, step 2
  - If cooling sufficient (H2O reg shifted):
    1. Monitor cooling
    2. Continue EVA

- If H2O GP ≥ 13.5 (sensor fail):
  1. Monitor H2O GP (RESRV H2O ON msg may be inhibited)
  2. If H2O GP drops to < 12.0:
    1. Go to TERM EVA

**NOTE**
- Msg triggered when H2O GP < 13.5
- Normal H2O TEMP = 32-75 degF
- WP = 14.0-16.0

### RSRV H2O ON

**RSRV H2O ON TIME LF :XX**

<table>
<thead>
<tr>
<th>H2O GP</th>
<th>H2O WP</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>~15</td>
<td>~0</td>
<td>1. Monitor SUBLM P and H2O TEMP (WP xdcf fail)</td>
</tr>
<tr>
<td>&gt; 17.0</td>
<td>~15</td>
<td>2. Monitor H2O WP and H2O TEMP (GP xdcf fail)</td>
</tr>
<tr>
<td>~15</td>
<td>&lt; 12.0</td>
<td>4. Go to TERM EVA (reserve H2O on)</td>
</tr>
</tbody>
</table>

**NOTE**
- Msg triggered when GP minus WP > 2.1 psi
- Normal SUBLM P = 2.0-4.2 psia
- H2O TEMP = 32-75 degF
- GP/WP = 14.0-16.0

### H2O WP HIGH

**H2O WP HIGH**

**H2O WP XX.X**

- If H2O WP < 16.0 (H2O WP sensor failed):
  1. Monitor cooling (RESRV H2O ON msg inhibited)
  2. Continue EVA

**NOTE**
- Message triggered when H2O WP > 17.0
- Normal H2O WP and H2O GP: 14.0-16.0
- Normal H2O TEMP: 32 to 75 degF
- Normal O2 RATE ~ 1.7 psi/min
- Normal Suit P: 4.2-4.4 psi
### NO VENT FLOW

If fan is not running:
1. Cycle FAN sw – OFF, ON
   - If fan restarts:
     2. Continue EVA >>
   - If fan does not start:
     3. Helmet purge vlv – op
     4. Go to TERM EVA, 7 >>

If fan is running:
- If RPM < 18.0 K:
  5. Helmet purge vlv – op
  6. Go to TERM EVA, 7 >>
- If RPM ≥ 18.0 K:
  7. Assess helmet CO2 level
  8. Go to CO2 HIGH, 21, step 3

**NOTE**
- Msg triggered when flow < 3.7 cfm
- Normal vent flow = 6-8 cfm

---

### CO2 HIGH OR MONITOR CO2

**CO2 XX.X MM | MONITOR CO2** – PPCO2 > 8.0 MM
1. Minimize physical activity
2. Assess physical condition then go to step 3 below

**CO2 HIGH | OPEN PURGE V** – PPCO2 > 12.4 MM
1. √DCM PURGE vlv – cl, √Helmet purge vlv – op
   - If symptoms noted prior to opening purge vlv:
     2. Go to TERM EVA, 7 >>
   - If no symptoms noted (or inconclusive):
     3. Close/open helmet purge vlv as reqd to assess physical condition for high CO2
     - If symptoms noted:
       4. Helmet purge vlv – op
       5. Go to TERM EVA, 7 >>
     - If no symptoms noted:
       6. Helmet purge vlv – cl, locked
       7. Monitor physical condition and PPCO2
       8. Continue EVA

**NOTE**
- Normal PPCO2 = 0.2-4.0 MM
- If Suit P sensor failed: MONITOR CO2: 3.0 MM, CO2 HIGH: 8.0 MM

---

### CO2 SNSR BAD

1. Periodically monitor physical condition (CO2 sensor failed)
   - If CO2 symptoms noted:
     2. Helmet purge vlv – op
     3. Go to TERM EVA, 7 >>
     4. Continue EVA

**NOTE**
- Message triggered when PPCO2 increases from nominal value to ≥ 40 MM in < 2 min.
- Normal PPCO2: 0.2-4.0 MM

---

### COMM FAILURE

**AIR FLOW LOSS COOL**

**ALL**
1. √Proper config, EMU and orbiter (Mode, Vol, Freq)
   Perform following sequence until comm restored:

**BOTH**
If EV cm hears intermittent sidetones/comm or no sidetones:
2. Clear structure to recover comm (signal blockage)
   - If unresolved:
     3. Aff cm select ALT(PRI) (notify MCC)

**IV**
If IV no comm with EV1 and EV2:
3. IV select STRING 2(1)

**ALL**
If unresolved:
4. Perform coordinated freq change
   - If unable to restore minimum of relay comm:
     5. Go to TERM EVA, 7

---

### 22 05/11/06

**CO2 SNSR COMM FAIL**

---

### 23 05/11/06

**CO2 SNSR BAD**
AIR FLOW CONTAMINATION

If flow exiting helmet vent contaminated by caustic water or LiOH dust:
1. Helmet purge vlv – op
2. FAN – OFF
3. WATER – OFF
   If contamination still present:
   4. Go to ABORT EVA, 6 >>
Otherwise:
5. Go to TERM EVA, 7 >>
If excessive water in vent loop or helmet:
6. Contact MCC

NOTE
EMU water tanks hold ≈1 gal H2O

LOSS OF COOLING

1. Temp Control vlv – cycle 3 to Max C; leave in Max C
   If cooling restored, continue EVA >>
2. Begin translation to airlock for TERM EVA
   If SCU cannot be connected prior to overheating:
   3. Helmet purge vlv – op, lock
   4. If vent flow excessively hot:
   DCM
   FAN – OFF
   If helmet purge flow insufficient for cooling:
   5. Helmet purge vlv – cl, lock
   6. DCM purge vlv – op
   7. Connect SCU to DCM
   8. \FAN – ON
   IV
   \EMU O2 ISOL vlv – OP
   AW82B
   9. \EV-1(2) O2 vlv – OP
   If cooling sufficient:
   10. \Helmet purge vlv – cl, locked
   11. \DCM purge vlv – cl, locked
   If cooling insufficient:
   12. Perform steps 3-6
   13. Go to TERM EVA, 7

NOTE
Message triggered when SUIT P > 5.7

RLF V FAIL

RLF V FAIL STOP DEPRESS SUIT P X.X

AW82B
1. AIRLK DEPRESS vlv – CL
2. \Suit P gauge
3. Contact MCC

NOTE
Message triggered when SUIT P > 5.7

MISC MSGS 1

FW ANOMALY – Feedwater discretes in disagreement
SW/FAN FAIL – Verify RPMs nominal
VENT SW FAIL – Vent flow sensor unreliable

Built-In Tests
(BITE light illuminated) – may be accompanied by one of the following messages:
For all cases, perform following sequence:
14V SUP FAIL
1. \STATUS, IV record
If status list nominal:
5V REF FAIL
2. Continue EVA, inform MCC >>
BUS CK FAIL
If status list unreadable or erroneous
DRAM FAIL
3. Go to TERM EVA, 7
EE CSUM FAIL
4. Inform MCC
WAT DOG FAIL

A/L DISC

MISC 2

26 05/11/06
27 05/11/06
MISC MSGS (CONT) / TIME LF

- PAN SW OFF
- H2O IS OFF
- O2 ACT FAULT
- O2 IS OFF
- SET H2O OFF
- SET O2 EVA
- SET O2 PRESS
- SCU PWR AVAL

Verify proper config

Consumables

XX% O2 LF | TIME LF 'MM
XX% PWR LF | TIME LF 'MM

Triggered with 30 min of calculated time remaining for limiting consumable

1. Contact MCC to confirm calculation
   * If no comm with MCC: *
   * Go to TERM EVA, 7 *

AIRLOCK INGRESS

1. √TOOL BOX – closed, latched
2. Ingress airlock
3. Attach waist tether to A/L internal D-ring; lock hook
4. Attach EV2’s safety tether, retracting end to waist tether; lock hooks
5. Disconnect EV1 safety tether, retracting end – attach to self
6. Ingress airlock

BOTH

7. Unstow SCU, remove DCM cover, connect SCU to DCM (not reqd for tunnel adapter)
8. DCM WATER – OFF (fwd)
9. Thermal cover – close

CAUTION
Do not close hatch until EMU WATER is OFF for 2 min

10. EVA hatch handle – pre close posn
11. √EVA hatch seal clear, outer (EVA) hatch – close, lock
12. Go to PRE REPRESS (DEPRESS/REPRESS Cue Card)

AIRLOCK LATCH DISCONNECT

TOOL BOX/A/L – ADJ WRENCH, RATCHET WITH 7/16 SOCKET
TOOL BOX – EVA TRASH BAG, ADJ TETHERS
1. Remove bolt A, stow in trash bag
2. Rotate actuator handle
   If no rotation – jammed actuator:
   3. Force latches open
   4. Seal hatch w/repress and secure for ldg (IV)
   If free rotation – jammed latch:
   5. Locate and remove jam
   6. Reconnect actuator

HINGE DISCONNECT

TOOL BOX – ADJ TETHERS, VELCRO/TAPE
1. Remove hinge PIP pins, as reqd
2. Restraining hinge arm(s) and PIP pins clear of opening, ingress airlock, posn hatch for closing
3. Close, lock hatch

RADIATOR ACTUATOR DISCONNECT

IFM – 1/4-in ALLEN HEAD DRIVER
TOOL BOX – RADIATOR DISCONNECT/ 3/8 DRIVE RATCHET
IV √Pwr off
   Actuator disc sequence – aft to fwd
   1. Yellow shear pins (4) – retract to stop (6 revs ccw)
   When all actuators are disengaged:
   2. Manually close radiator panels and hold
IV √Pwr on
IV Latches – close

NOT IN EV CUFF
PLBD DRIVE CUT

TOOL BOX – TUBE CUTTER, VELCRO/TAPE

1. Cut #1, stow antenna if stbd side, perform WINCH OPS, 35, steps 1,2, then cut #6 thru #2 and perform WINCH OPS, 36, steps 3-7

<table>
<thead>
<tr>
<th>BANDS VISIBLE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-6</td>
<td>Cut upper rod in middle and restrain (27)</td>
</tr>
<tr>
<td>7-10</td>
<td>Cut lower rod between 2nd and 3rd bands from top and restrain (27)</td>
</tr>
</tbody>
</table>

DOOR DRIVE DISCONNECT

TOOL BOX – PDU DISCONNECT TOOL, TRASH BAG

1. Perform WINCH OPS, 35, steps 1,2
2. Remove fabric cover(s)
3. Insert Disc Tool in Door Drive PDU
4. Rotate tool cw to stop (60 deg) and leave tool in PDU
5. Rotate torque shaft at least 3 turns (see below)
6. Perform WINCH OPS, 36, steps 3-7
7. If reqd for other door, rotate tool ccw 60 deg and remove from PDU

WINCH OPERATIONS

IV Radiators – stow and latch
1. Winch
   CONTROL – REEL OUT
   Handle ratchet – blue (center)
   Attach rope to wrist tether
   Rope: Fwd – in clip and over rollers
   Aft – rope guide, under handrail, and over rollers
   Winch hook – under #4 latch bellcrank
2. Ratchet in rope slack only
   CONTROL – IN
   Handle ratchet – green (cw)

CONT NEXT PG
WINCH OPERATIONS (CONT)

IV  Pwr off
  1. PLBD(s) – close with winch
     If aft not READY TO LATCH, repeat steps 1 and 3 at aft
     winch
IV  Pwr on
IV  Latches – close
  4. Winch hook – remove from PLBD
  5. Rope – reel in excess
  6. Handle – stow
  7. Repeat steps 5-7 for aft winch, if reqd

3-PT TOOL INSTALLATION

TOOL BOX – 3-PT TOOLS, ADJUSTABLE TETHERS

IV  Pwr off
  1. Position installation handles as reqd
  2. Tools – install in sequence per IV table
  3. Ratchet select lever – green
  4. Handle – ratchet to hard stop
     – stow handle or
     restrain with
     Adj tether

TOOL RESET
  1. Ratchet – red
  2. Handle – ratchet to stop
  3. Tool – compress to latch handles

CL LATCH TOOL

TOOL BOX – CL LATCH TOOLS

IV  Pwr off
  1. Tools – install per IV table
  2. Trigger – safety off
     – depress
  3. Ratchet select lever – green
  4. Handle – ratchet to hard stop
     – stow

TOOL RESET
  1. Ratchet – red
  2. Handle – ratchet to stop
  3. Tool – compress to latch handles

RMS JOINT ALIGN

TOOL BOX – ADJ TETHERS, SNATCH BLOCKS (2), RMS ROPE REEL
  1. Attach RMS rope around end effector under handrail.
     Translate to avoid wrapping rope around RMS
  2. Attach snatch block(s) to handrail(s) and route rope
     as reqd
IV  3. Reposition RMS as required for cradling
  4. Pull RMS down into MPMs
  5. Perform final positioning by hand to allow MRLs to
     latch

RMS SHOULDER BRACE RELEASE

TOOL BOX – RMS SHOULDER BRACE RELEASE TOOL
  1. Fold aside rub strip
     and thermal blankets
  2. Insert tool and move
     handle down
  3. Remove tool and
     reconfigure blankets
MPM STOW/DEPLOY

TOOL BOX – MPM WRENCH

1. Rotate torque shaft (8 revs) until MPMs are stowed/deployed, \( X_0 = 693 \)

![Diagram of MPM](image)

RMS TIEDOWN

TOOL BOX – PRDs (2), EVA TRASH BAG
IFM – 9/64-in ALLEN WRENCH (AW)
ELBOW – PRD aft of MPM, peel blanket (fwd of MPM) toward EE; feed hook under cable harness (if reqd, remove cable harness clamp bolt with AW, bend clamp out of way), adjust strap as far fwd as possible
WRIST – PRD aft of MPM, strap rests just fwd of pitch joint opening
END EFFECTOR – PRD fwd of MPM, peel blankets aft and fwd, strap rests aft-most on yaw joint (at roll/yaw I/F), adjust strap under bolt studs

1. Figure eight the strap
2. Pull minimum 6-in slack in strap
3. Ratchet PRD snug, (14 full strokes reqd)
4. \( \sqrt{\text{Strap in correct arm location, ratchet tight}} \)
5. Reattach blankets

NOT IN EV CUFF 40 03/20/06

RMS FLIGHT RELEASABLE GRAPPLE FIXTURE RELEASE

AIRLOCK – JETTISON STOWAGE BAG
TOOL BOX – 1/2-in BOX RATCHET, VELCRO/TAPE

EV

1. Rotate 10 o’clock posn release rod ccw to hard stop (~36 strokes of 90 deg)
2. Rotate 4 o’clock posn release rod cw to hard stop (~36 strokes of 90 deg – shaft will release from grapple fixture)
3. Clear worksite for RMS powerdown
4. Tape end of shaft to restrain slug within shaft
5. Cover end effector with jettison stowage bag to restrain grapple shaft

NOT IN EV CUFF 40 03/20/06

PRLA OPEN/CLOSE

AIRLOCK – RATCHET WITH 7/16 SOCKET

IV \( \sqrt{\text{PRLA PWR OFF}} \)

EV

1. Rotate ratchet in release direction (as marked above EVA drive) to shear pin
2. View yellow indicator as applicable
3. Continue to rotate drive 4-1/2 revs to disc gear train from drive shaft

To open latch:
4. Continue rotation in release direction (as marked above EVA drive) until latch open against stop

To close latch:
5. Rotate EVA drive in opposite direction of release (as marked above EVA drive) until latch closed against hardstop and over center

IV \( \sqrt{\text{PRLA lb LAT}} \)

Cont next pg
**PRLA OPEN/CLOSE (CONT)**

**EV**

6. Apply PRLA locking feature if applicable
   To lock:
   7. Rotate each bolt (two) cw 1/2 turn

For subsequent PRLA ops, release locking feature before operating EVA drive (two bolts ccw 1/2 turn); relock after operation

---

**KU ANTENNA STOW**

1. Secure tether reel clear of antenna dish with wrist tether

   **CAUTION**
   Antenna dish is very fragile. Avoid contact with gold thermal blankets and black painted surfaces

2. Align $\alpha$ (dish roll) and $\beta$ (dish pitch) gimbals for pin engagement

3. Give IV GO to drive pins in short pulses

   **NOTE**
   Top lockarm (by wide beam horn and gold foil) drives fully before bottom lockarm (by silver gyro box)

---

**AIRLOCK EGRESS**

**DAISY CHAIN:** EV2 waist tether to A/L internal D-ring
   EV2 safety tether (retracting end) to EV1 waist tether

**EV1**

1. Thermal cover – open
2. Egress airlock
3. Attach safety tether, retracting end to ODS dogbone handrail (or orbiter handrail tether point); lock hook, reel unlocked
4. Attach EV2's safety tether, retracting end to separate ODS dogbone handrail; lock hook, reel unlocked

**BOTH**

5. Waist tethers – attach to self, stow extra waist tether (if reqd) in A/L clear of hatch

**EV2**

6. Egress airlock
7. Thermal cover – close
FLIGHT SPECIFIC REFERENCE
UNSCHEDULED/CONTINGENCY EVA TASKS
Replace this page with page(s) from Flight Supplement
EVA EMERGENCY
EMERGENCY PROCEDURES

EMERGENCY AIRLOCK REPRESS ................................................................. 19-3
EMERGENCY AIRLOCK REPRESS ................................................................. 19-4
POST EMERGENCY AIRLOCK REPRESS ....................................................... 19-4
SAFER RESCUE .......................................................................................... 19-5
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DAP/EVA RESCUE/RETRIEVE ................................................................. 19-7
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19.1 DCS TREATMENT .............................................................................. 19-10
CONTINGENCY SHUTTLE AIRLOCK INGRESS FROM ISS ......................... 19-13
EMERGENCY AIRLOCK REPRESS
**EMERGENCY AIRLOCK REPRESS**

NOTE: Ignore CWS functions

Outer (EVA) hatch – close and lock

Inner hatch Equal vlv (two) – EMER

AW82B: √AIRLK DEPRESS vlv – CL

DCM: WATER – OFF (fwd)

Open inner hatch

Go to POST EMERGENCY AIRLOCK REPRESS

---

**POST EMERGENCY AIRLOCK REPRESS**

WARNING
This procedure should not be performed following a Cuff 4 DCS incident

For affected crewmember:

DCM 1. PURGE vlv – op (up)
2. O2 ACT – OFF
3. √STATUS: $\text{SUIT P} < 0.4$ (compare with gauge)
4. Disconnect gloves
5. Disconnect helmet
6. Connect SCU to DCM

AW18H 7. PWR/BATT CHGR EMU 1(2) BUS SEL – MNA(MNB)
DCM 8. PWR – SCU

For unaffected crewmember:

DCM 9. O2 ACT – IV
10. Connect SCU to DCM

AW18H 11. PWR/BATT CHGR EMU 1(2) BUS SEL – MNA(MNB)
DCM 12. PWR – SCU

If single crewmember aborting EVA:

13. Outer (EVA) hatch Equal vlv caps (two) – remove, stow
14. √MCC
SAFER RESCUE
SAFER RESCUE

1. Deploy SAFER HCM
2. PWR – ON
3. Wait for AAH, line up with separation point
   Fly to vehicle
   Monitor GN2% and PWR%

   * If no gas flow:  *
   * √MAN ISOL vlv – OP (dn) *

4. IV/other EV
   Provide GCA (as reqd)
   Provide range and range rate using Laser Range Finder, as reqd
   Configure WVS and vehicle cameras to assist
   Turn on external vehicle lights, as reqd

5. Tether to nearest structure, √connection
6. Tether to available safety tether or other EV crewmember, √connection
7. PWR – OFF
8. MAN ISOL vlv – CL (up)
9. √MCC
EVA ORBITER CONFIG

1. GENERIC ORBITER CONFIGURATION

A6U
- SENSE – as reqd
- FLT CNTLR PWR – OFF
- DAP TRANS: PULSE/PULSE/PULSE

O14,
- cb MNA,C DDU AFT (two) – cl

O15,
- Pri RJD LOGIC, DRIVER (sixteen) – ON

O16

GNC 20 DAP CONFIG

CRT
- PRI TRAN PLS – ITEM 17 +0.10
- ITEM 37 +0.05

A1U
- KU CNTL – CMD
- PWR – STBY

Unstow, review EVA RESCUE procedure
2. REGION-SPECIFIC ORBITER CONFIGURATION
Using region charts, determine region(s) in which EVA crewmembers will be located.
Working in order top of table to bottom using the most restrictive region, configure orbiter systems per following table, performing any Initial Configuration Actions which contain a ‘√’
Items which do not have a ‘√’ may be configured as desired to meet mission-specific requirements

WARNING
Deviating from orbiter systems configuration called out in following table may put EVA crewmembers at risk of being plumed by RCS jets

NOTE
The following table should be used for initial configuration. It should not be used during the EVA (e.g., for EVA RESCUE).

If VERNs not available, use ALT instead. All other configuration actions remain unchanged

<table>
<thead>
<tr>
<th>INITIAL CONFIGURATION ACTIONS</th>
<th>In Bay</th>
<th>Above Bay</th>
<th>Above Nose</th>
<th>Above/Alt OMS Pods</th>
<th>Below Tail/Midbody</th>
<th>Below Nose</th>
<th>Beside Bay</th>
</tr>
</thead>
<tbody>
<tr>
<td>D VERN</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td>√</td>
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<tr>
<td>A ALT</td>
<td></td>
<td></td>
<td>√</td>
<td></td>
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<td></td>
<td>√</td>
</tr>
<tr>
<td>P LOW Z</td>
<td>√</td>
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<td>No LOW Z</td>
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</tr>
<tr>
<td>SPEC P/Y/JET OPTION PRI &amp; ALT, DAP A &amp; B – ALL</td>
<td>√</td>
<td>√</td>
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</tr>
<tr>
<td>20 SPEC P/Y/JET OPTION PRI &amp; ALT, DAP A &amp; B – TAIL</td>
<td>√</td>
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<tr>
<td>SPEC OVRD L/R MANFs 1,2,4 (six) – CL</td>
<td>√</td>
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</tr>
<tr>
<td>23 SPEC OVRD L/R MANFs 2,3,4 (six) – CL</td>
<td>√</td>
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</tr>
<tr>
<td>23 SPEC OVRD L/R MANFs 2,3,4 (six) – CL</td>
<td>√</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O14, RJDA L1/R1 (L2/R2, L4/R4) DRIVER (three) – OFF</td>
<td>√</td>
<td></td>
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</tr>
<tr>
<td>O15, RJDA L2/R2 (L3/R3, L4/R4) DRIVER (three) – OFF</td>
<td>√</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>O16, RJDF F1(F2,F3,F4) MANF DRIVER – OFF (four)</td>
<td>√</td>
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</tr>
<tr>
<td>MISC FLT CNTLR PWR (three) – OFF</td>
<td>√</td>
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</tr>
</tbody>
</table>

3. POST-EVA RECONFIGURATION
Return orbiter to desired/required systems configs
EVA RESCUE/RETRIEVE

NOTE
Assumes that EVA ORBITER CONFIG procedure has already been performed

1. CONFIGURATION

A6U

DAP: FREE(INRTL)

√ SENSE SWITCH as desired

O14:F, √ Pri RJD LOGIC, DRIVER (sixteen) – ON

O15:F,

O16:F

O16:F √ RJD MANF L5/F5/R5 DRIVER – ON

GNC 23 RCS

OVRD L/R MANF – OP (if OVRD CLOSED earlier)

A1U

KU CNTL – PNL

2. OPERATIONS

NOTE
When EVA crewmember clear of RCS jets, FLT CNTLR PWR ON and DAP INRTL

If TRANSLATION:

DAP: LO Z, as reqd (DAP A has larger TRANS PULSE size)

If ROTATION:

DAP: VERN(PRI), as reqd

NOTE
Translate, then rotate, as reqd to center crewmember over bay.

Null translational rates, then establish closing(opening) rate as reqd to crewmember in bay.

Use RMS and/or other EVA crewmember to assist if possible
19.1 DCS TREATMENT

1. EVA terminated to prevent progression to Cuff Class 4. If Cuff 2, affected crewmember will assist other EV with minor worksite cleanup, if possible, to expedite cleanup and then terminate EVA.

2. If estimated time reqd for DCS treatment exceeds LiOH consumables, a changeout should be performed. If 10 or 12 reqd, minimum treatment is ~3 hr.

3. For Cuff 2 or 3, private comm not required to allow for expedited treatment. For Cuff Class 3 only, affected crewmember waiting in A/L needs to be in contact with Surgeon due to severity and potential progression of symptoms.

4. Cuff Class 4 symptoms may be secondary to Type 2 DCS which is a medical emergency. Unstowing the resuscitator enables IV crew to be prepared to administer CPR, if reqd. Because it is critical to repress CPR, this may result in a one crewmember repress.

5. This decision block determines whether the cabin is being operated within 10.2 psi control range. Minor fluctuations above 10.6 have been seen; therefore, 11 psi was used to cover all 10.2 scenarios. Otherwise, cabin is being controlled at 14.7 psi.
If reqd, perform CABIN REPRESS TO 14.7 PSI (10.2 PSI CABIN) with following change to step 4:
(L2)
O2/N2 CNTLR VLV SYS 1.2 (two) – OP
- Perform BENDS TREATMENT ADAPTER (BTA) INSTALLATION (IN-SUIT) (EMU CONT PROCs)
- Continue BTA treatment at 6 psi in-suit for 20 min

DCS signs or symptoms resolved?

Continue at 6 psi for 2 hr
- CMO report changes in symp to Surgeon as requested

DCS signs or symptoms resolved?

MCC for DCS pharmacy treatment

If DCS pharm treatment reqd,
- O2 ACT – OFF
- DCM PURGE vlv – op
- Suit P ≤ 0.4 psid
- Doff Glove, Helmet
- FAN – OFF
- Don QDM
- Take meds as directed by Surgeon
- Don Glove
- FAN – ON
- Remove QDM, don Helmet
- O2 ACT – PRESS
After 12 min,
- DCM PURGE vlv – cl
- Leave O2 ACT – PRESS for 30 min
- CMO report changes in DCS symptoms per DCS exam criteria to Surgeon as requested

DCS signs or symptoms resolved?

MCC for further DCS treatment

Perform POST EVA
- O2 by QDM X 2 hr
- Surgeon for further DCS treatment
- CMO report changes in DCS symptoms per DCS exam criteria to Surgeon every 12 hr
- Surgeon for return to IV duty after 24 hr limited activity
- Surgeon for return to EVA duty
- Go to DCS AFTERCARE (MED C/L)
Max pressure should be used to treat Cuff Class 4 DCS (type 2 DCS).

Incapacitated crewmember needs hyperbaric treatment on Earth as soon as possible. If airlock not available due to single crewmember abort, perform POST EVA in middeck on battery power. EVA FCT should be prepared to modify procedure for single crewmember abort.

MCC will determine allowable cumulative O2 time based on O2 toxicity limit. O2 time will vary based on EVA time and pressure profile.

Because DCS symptoms unresolved, deorbit to site with hyperbaric facility reqd for add’l treatment. Affected crewmember should remain in pressurized EMU as long as possible.
CONTINGENCY SHUTTLE AIRLOCK INGRESS FROM ISS

CREWLOCK EGRESS
If EV hatch closed and $\Delta P < 0.5$ psi:
EV
1. $\sqrt{}$Tethers connected to crewlock D-ring, open EV hatch, stow
2. Perform POST DEPRESS steps as reqd on CREWLOCK DEPRESS/REPRESS CUE CARD (SODF: ISS EVA SYS: EVA PREP/POST)
EV1
3. Open thermal cover, egress crewlock
4. Configure safety tethers for EV1 and EV2, $\sqrt{}$locked
EV2
5. Egress crewlock, close thermal cover

SHUTTLE AIRLOCK PREP
NOTE
EV1 will translate to prep and open shuttle airlock hatch while EV2 remains to close ISS crewlock hatch after shuttle hatch is open
EV1
6. Retrieve two external spare safety tethers
7. Translate to shuttle airlock stopping at PMA/shuttle interface
8. Attach load alleviating strap of EV2 spare safety tether on shuttle side
9. Attach EV1 spare safety tether to shuttle, swap to spare safety tether
10. Stow ISS safety tether on ISS side
11. Retrieve EV2 safety tether anchor hook, attach to mini-workstation, continue to Ext A/L Aft Hatch

IV Aft Hatch MDK12.
12. Ext A/L Aft Hatch Equal vlv caps (two) – vent, remove caps, stow
13. Close Inner Hatch:
   - Position handle to preclosing position per decal
   - Hatch – rotate about hinge and push
   - Handle – ccw to LATCH
   - Lock lever to LOCKED
14. $\sqrt{}$Inner Hatch Equal vlvs (two) – OFF, caps installed

EV1
15. Open Ext A/L Aft Hatch thermal cover
IV
16. MCC for attitude control
EV1
17. On IV GO: Ext A/L Aft Hatch Equal vlvs (two) – EMER

---

IF CABIN DP/DT OR O2(N2) FLOW HI ALARM DURING AIRLOCK DEPRESS
EV crew: Ext A/L Aft Hatch Equal vlvs (two) – OFF
IV crew: Verify Inner Hatch closed and Inner Hatch Equal vlvs (two) – OFF

---

EV1
18. Monitor Ext A/L Aft Hatch $\Delta P$ gauge
   When $\Delta P < 0.5$ psi (~10 min), open hatch and ingress A/L, connect waist tether to A/L D-ring

EV1
19. Give EV2 GO for closing ISS crewlock EV Hatch
20. Connect anchor hook of EV2 spare safety tether to A/L D-ring

SHUTTLE AIRLOCK INGRESS
EV2
21. Open ISS crewlock thermal cover
22. On EV1 GO, close ISS crewlock EV Hatch:
   - Verify hatch clear of FOD and obstructions
   - EV hatch handle – preclose
   - Handle – cw to LATCH
   - Lock lever to LOCKED
   - Close thermal cover
23. Translate to PMA/shuttle interface
24. Swap to spare safety tether, stow ISS safety tether on ISS side
25. Retrieve EV1 safety tether anchor hook, attach to mini-workstation
26. Translate to shuttle airlock, ingress
27. Close thermal cover

BOTH
28. Retrieve, position SCU; remove DCM cover
29. Connect SCU to DCM, \locked

AW82B
30. EV-1, EV-2 O2 vlv (two) – OP

BOTH
31. WATER – OFF (fwd)

CAUTION
Do not close hatch until EMU WATER – OFF for 2 min

32. \Ext A/L Aft Hatch clear of FOD and obstructions, close hatch:
   Position handle to preclosing position per decal
   Hatch – rotate about hinge and push
   Handle – ccw to LATCH
   Lock lever to LOCKED

33. Ext A/L Aft Hatch Equal vlvs (two) – OFF, install caps

IV
34. Go to PRE-REPRESS/REPRESS (DEPRESS/REPRESS
   Cue Card)
CUE CARD CONFIGURATION
Refer to the following pages for cue cards and decals in this document:

- CC 3-10  SAFER CHECKOUT RESULTS Cue Card
- CC 3-11  SAFER STATUS TROUBLESHOOTING Cue Card
- CC A6-2  DEPRESS/REPRESS Cue Card (Nominal Config)
- CC B6-2  DEPRESS/REPRESS Cue Card (Tunnel Adapter)
- CC 6-4   FAILED LEAK CHECK Cue Card
- 19-4     EMERGENCY AIRLOCK REPRESS Decal