EVA Checklist

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

Generic, Rev G
July 28, 2000

NOTE
For STS–106 and subsequent (chronological) flights per current schedule.
List of Implemented Change Requests (482s):

- EVA–1177A
- MULTI–1582
- EVA–1350
- EVA–1354

Incorporate the following:

1. Replace iii & iv
2. Replace 1–3 thru 1–8
3. Replace 9–5 & 9–6
4. Replace 14–13 & 14–14
5. Replace 15–3 & 15–4

Prepared by: __________________________
Book Manager

Approved by: __________________________
Lead, EVA Systems Group               Lead, EVA Task Group

Chief, EVA and Crew Systems
Operations Branch

Encl: 14 pages

Verify this is the correct version for the pending operation (training, simulation or flight).
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EVA CHECKLIST

GENERIC, REV G
July 28, 2000

PREPARED BY:

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Brian H. Peavey
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APPROVED BY:

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Randall S. McDaniels  Mary A. Fitts
Lead, EVA Task Group  Lead, EVA Systems Group

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### EVA CHECKLIST

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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)

C7 3. ✓ LEH O2 SPLY 1,2 vlv (two) – OP
L2 4. O2 XOVR SYS 2 – CL

C6, MO32M, MO69M

MO39M 5. LEH O2 4(5,6,7) outlet – connect O2 hose

C6, MO32M, MO69M

6. MIDDECK COMM CCU PWR – OFF
   outlet – connect comm cable
   CCU PWR – ON

7. Decrease HIU volume control

C6, MO32M, MO69M

8. LEH O2 4(5,6,7) vlv – OP

9. Don mask

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

10. Set mask O2 control to EMERGENCY
11. Momentarily pull mask away from face and verify O2 flow
12. ✓ Comm
13. 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

14. 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 CNTRL PRI A,B – OFF:
   If FREON LOOP 1,2 EVAP OUT T between 41–47 degF:
   RAD CNTRL OUT TEMP – HI
   When FREON EVAP OUT TEMP > 50 degF,
   RAD CNTRL OUT TEMP – NORM (then immediately)
   FLASH EVAP CNTRL 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 CNTRL PRI A(B) – ON
   L1 If FLASH EVAP CNTRL 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
   If internal airlock:

ML31C 7. √VAC VENT ISOL VLV BUS SEL – MNA
   √CNTL – ctr (tb–OP)
   √NOZ HTR – ON

8. If CO2 RMVL SYS flown: Perform CO2 RMVL SYS DEACT, 4–8

AW18A 9. LTG FLOOD (four) – ON

DCM 10. √PURGE vlv – op (up)

11. Remove LTA restraint bag (1 ea EMU)

AW82B 12. AIRLK DEPRESS vlv cap – vent, remove

---

RESET FDA & C/W LIMITS

X: SM 60 SM TABLE MAINT

13. Contact MCC for uplink of B/U C/W and SM ALERT TMBU (if desired)

Changes enclosed in

---

PARAMETER NAME | C/W | H/W/C/W | H/W & B/U C/W | PARA ID | B/U C/W
-----------------|-----|---------|--------------|---------|---------
CABIN PRESS (OV102) | 4 | 2.50 | 3.85 ENA | 0612405 | 10.0 | 15.2
(OV103) | 4 | 2.45 | 3.80 ENA | 0612405 | 10.0 | 15.2
(OV104) | 4 | 2.50 | 3.85 ENA | 0612405 | 10.0 | 15.2
(OV105) | 4 | 2.50 | 3.85 ENA | 0612405 | 10.0 | 15.2
O2 FLOW 1 | 14 | 4.90 INH | 0612105 | 4.9
2 | 24 | 4.90 INH | 0612205 | 4.9
PPO2 A | 34 | 2.55 | 3.60 ENA | 0612511 | 2.55 | 3.6
B | 44 | 2.55 | 3.60 ENA | 0612513 | 2.55 | 3.6
N2 FLOW 1 | 54 | 4.90 INH | 0612553 | 4.9
2 | 64 | 4.90 INH | 0612554 | 4.9
FAN ΔP | 74 | 1.75 | 4.25 ENA | 0612556 | 2.8 | 6.8

---

PARAMETER NAME | ENA/ INH | PARA ID | SM ALERT
-----------------|---------|---------|---------
AV BAY FAN ΔP 3 (OV104) | ENA | 0612658 | 2.0 | 5.1
IMU FAN ΔP | ENA | 0612869 | 2.7 | 4.95
CABIN O2 CONCENTRATION | ENA | 0922104 | 28.5
AIRLK P | INH | 0640101 | 13.8 | 15.7
EXT AIRLK P | INH | 0640126 | 13.8 | 15.7
H2O LOOP ICH OUT T1 | ENA | 0612744 | 33.0
T2 | ENA | 0612724 | 33.0

---

EVA/ALL/GEN G,3
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

1. 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

2. START DEPRESS
Config vlvs per DEPRESS CHART

3. Continue plotting CABIN P vs PPO2 every 60 sec using SM SYS SUMM 1. Reconfig vlvs when plot transitions into different zone

4. 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
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

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)
   If internal airlock and CO2 RMVL SYS flown:
4. Perform CO2 RMVL SYS ACT (EVA PREP)

L2

5. O2 XOVR SYS 2 – OP

6. If O2 bleed orifice not installed:
   √ LEH O2 vlv 8 – CL
   Unstow and insert O2 bleed orifice in O2 QD
   LEH O2 vlv 8 – OP

MAST PREBREATHE TERMINATE

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

1. Set mask O2 control to NORMAL
2. Doff mask

C6, MO32M, MO69M

3. LEH O2 4(5,6,7) vlv – CL

MO39M

4. MIDDECK COMM CCU PWR – OFF
   outlet – Disconnect comm cable
   CCU PWR – ON

5. Depress Mask O2 control

C6, MO32M, MO69M

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

7. 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:
   OCAC
   Perform OCAC filter cleaning as reqd (if flown)
   OCAC PWR – OFF (if flown)
   C5
   DIRECT O2 – OP

2. When PPO2 > 2.70 psia or when
   CABIN PRESS > 10.4 psia:
   DIRECT O2 – CL
   OCAC
   OCAC PWR – ON (if flown)

3. If CABIN PRESS < 10.40 psia:
   MO10W
   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 Δt < 40 min, perform O2(N2) FLOW HIGH/CAB P LOW/dP/dT (ORB PKT, ECLS)
   For 40 min < Δt < 10 hr, perform 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

NOTE
Verify outer hatch(es) closed

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
### 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 – 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 [ ]

#### HI EU B/U C/W PARAMETER

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- CABIN PRESS (OV102) (OV103) (OV104) (OV105)
- O2 FLOW 1 2
- PPO2 A 8
- N2 FLOW 1 2
- FAN ∆P

#### HI EU B/U C/W

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#### HI EU C/W

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

---

1–9 EVA/ALL/GEN G,2
AIRLOCK CONFIG

AIRLOCK PREP ................................................................. 2–2
EMU SWAP ................................................................. 2–3
BOOSTER FAN DEACTIVATION/REMOVAL ........................ 2–4
  INSTALLATION/ACTIVATION ........................................ 2–4
EVA TOOL TRANSFER ...................................................... 2–4
EMU REMOVAL ............................................................. 2–4
  INSTALLATION ........................................................... 2–4
LTA RESTRAINT STRAP REMOVAL ................................. 2–5
  INSTALLATION ........................................................... 2–5
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 lockers/wall
- Cooling Loop Jumper – stow in EMU Equipment Bag
- EMU Servicing Kit – temp stow
- Helmet Lights – remove covers
- EVA Bag
- FDF Locker Cuff Checklists (2) – stow in EMU Equipment Bag

DEPRESS/REPRESS Cue Card

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

2. AW18A 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

   CAUTION
   Do not stow EMU lights in locker with batteries installed

4. Stow Vol H Bags in Vol H
5. Transfer to airlock:
   - EVA Bag – install on airlock wall
   - DEPRESS/REPRESS Cue Card
   - Helmet Lights
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 all helmets, temp stow
10. Remove comm caps from LTA restraint bags and connect to electrical
    harnesses
11. Remove LTA restraint bags
12. Disconnect waist rings; remove and stow any equipment stowed in
    HUT/LTA
13. Remove Drink Bag restraint bags – stow in EV1,EV2 mesh bags
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. √ Tether hook operation
19. 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
2. ✗ PWR/BATT CHGR EMU 1,2 BUS SEL (two) – OFF
   ✓ MODE (two) – OFF

AW18H
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, stow
7. Release EMU from AAP, transfer EMU to middeck
8. Install helmet
9. Remove 20–g Crash Bag on middeck EMUs (if flown)

DCM

EMU Y
10. ✗ Helmet disconnected, stowed
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. Disconnect waist ring; remove and stow any equipment stowed in HUT/LTA
16. Waist ring – engage posn
17. Connect LTA to HUT, lock
18. ✗ Tether hook operation

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

**EVA TOOL TRANSFER** (30 min)

1. Remove tools from Spacehab/ODS per EVA Equipment Stowage List
   (EVA FS, TOOLS/TIMELINES)
2. As reqd, stow in middeck, airlock, or tunnel adapter

**EMU REMOVAL** (30 min)

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

**EMU INSTALLATION** (30 min)

1. Transfer EMUs to A/L, connect to AAPs
2. As reqd for EVA, perform LTA RESTRAINT STRAP REMOVAL (AIRLOCK CONFIG)
3. Relocate LTA spring hooks (four) from SAFER mount brackets to AAP rings
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. Disconnect all attachments (six) from SAFER mount brackets (two)
2. Loosen cinch strap mechanism, remove SAFER mount brackets
3. Remove strap from PLSS
4. Stow strap in LTA restraint bag pouch with D–rings (three) connected
5. Engage EMU in AAP
6. 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

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

3–1
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.

If external airlock:

X: SM 60 SM TABLE MAINT

1. 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>ALERT</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXT A/L H2O LINE T</td>
<td>0640182</td>
<td>INH</td>
</tr>
<tr>
<td>LCG 2 SPLY T ZN 1</td>
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<td></td>
</tr>
</tbody>
</table>

EMU CHECKOUT

EMU POWERUP (2 min)

NOTES
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 occurs and BITE light is illuminated whenever EMU power is cycled.

Perform all DCM PWR sw throws with firm, deliberate action

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. \( \sqrt{EMU INPUT} 1,2 \text{ volts} = 18.0–20.0 \)

7. PWR – SCU

COMM CHECK (13 min)

EV

AW18H

8. \( \sqrt{AIRLK AUD PWR} – OFF \)

AW18D

9. \( \sqrt{AUD CTR UHF A/G 1,2} \text{ (two)} – OFF} \)
   A/A – T/R

A1R

10. \( \sqrt{AUD PWR} – AUD/TONE} \)
    A/G 1,2 (two) – OFF
    A/A – T/R
    ICOM A,B (two) – OFF (as reqd)

IVA ATU

11. \( \sqrt{cb MNA UHF EVA} – \text{ cl} \)
    \( \sqrt{MNC UHF EVA} – \text{ cl} \)

R14:C
12. √UHF SPLX/EVA PWR AMP – OFF
   MODE – EVA

13. √Helmets disconnected

14. Don comm caps

15. Perform onboard A/A comm check per table (configure EMUs, then O6)

<table>
<thead>
<tr>
<th>EMUs</th>
<th>IV1 O6:</th>
</tr>
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<tbody>
<tr>
<td>MODE</td>
<td>FREQ</td>
</tr>
<tr>
<td>ALT</td>
<td>LOW</td>
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<td>ALT</td>
<td>HIGH</td>
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<tr>
<td>PRI</td>
<td>HIGH</td>
</tr>
<tr>
<td>PRI</td>
<td>LOW</td>
</tr>
</tbody>
</table>

16. AUD CTR UHF A/A – OFF

17. Perform EVA COMM CONFIG, steps 3,4, and 6 (EVA PREP)

18. Verify RF comm with MCC

19. Doff comm caps

20. AUD CTR UHF A/G 1 – OFF

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

21. Install helmet, lock

22. COMM Mode – HL

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

1. PRIMARY REGULATOR/FAN/PUMP CHECK (40 min)
   If external airlock:
   24. EMU O2 ISOL VLV – OP
   25. STATUS: √O2 P = 850–950

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<tr>
<th>EMU</th>
<th>1</th>
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<tr>
<td>25.</td>
<td>O2 P</td>
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</tbody>
</table>

26. EV–1, EV–2 O2 vlv (two) – OP
   27. Install Helmet, lock
   28. √Suit arms aligned
   29. √Gloves locked
   30. √Helmet purge vlv – cl, locked

29. DCM
   31. PURGE vlv – cl (dn)
   32. O2 ACT – IV
   33. STATUS: √SUIT P = 0.4–1.4 and stable (compare w/gauge)

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<thead>
<tr>
<th>EMU</th>
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<tr>
<td>33.</td>
<td>SUIT P (IV)</td>
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<td></td>
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</tbody>
</table>
34. O2 ACT – PRESS

35. STATUS:
   - SUIT P = 4.2–4.4 and stable (compare w/gauge)
   - H2O TEMP = ambient
   - H2O GP/WP = 14.0–16.0

<table>
<thead>
<tr>
<th>EMU</th>
<th>1</th>
<th>2</th>
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<tbody>
<tr>
<td>35. SUIT P (PRESS)</td>
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<tr>
<td>H2O TEMP</td>
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<tr>
<td>H2O GP</td>
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<tr>
<td>H2O WP</td>
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</tbody>
</table>

36. O2 ACT – IV, start timing manual leak check
   (2 min, SUIT ΔP ≤ 0.3 psi)

<table>
<thead>
<tr>
<th>EMU</th>
<th>1</th>
<th>2</th>
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<tbody>
<tr>
<td>36. ΔP</td>
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</tbody>
</table>

* If ΔP > 0.3 psi, go to FAILED LEAK CHECK *
* (14.7/10.2 PSI) Cue Card, CC 6–4 *

37. O2 ACT – OFF

38. PURGE vlv – op (up)

39. STATUS:
   - SUIT P < 0.4 (compare w/gauge)

40. Disconnect gloves, temp stow in airlock

41. Disconnect helmet, temp stow

42. Disconnect waist ring – secure LTA to outer hatch handrail

43. Connect LCVG, √locked

44. √Temp control vlv – Max C

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

45. FAN – ON (PWR RESTART may occur)

46. √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>
<th>4</th>
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</thead>
<tbody>
<tr>
<td>46. INPUT AMPS</td>
<td></td>
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</tbody>
</table>

47. Install SCOF, lock

48. O2 ACT – IV, ‘NO VENT FLOW’ msg, PROC

49. STATUS: √H2O TEMP decrease from step 35

<table>
<thead>
<tr>
<th>EMU</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>49. H2O TEMP</td>
<td></td>
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</tbody>
</table>

50. √EMU INPUT amps = 1.5–3.6 (1.5–4.0 at 14.7)
√EMU INPUT amps decrease from step 46

<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>50. INPUT AMPS</td>
<td></td>
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</tr>
</tbody>
</table>
51. PWR – BATT

STATUS: √BAT VDC ≥ 16.5
√BAT AMPS = 2.3–3.7 (2.4–4.0 at 14.7)
√RPM = 19.0–20.0 K

<table>
<thead>
<tr>
<th>EMU</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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</thead>
<tbody>
<tr>
<td>52.</td>
<td>BAT VDC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAT AMPS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RPM</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

53. Fan noise steady
54. O2 ACT – OFF
55. FAN – OFF
56. PWR – SCU

SOP CHECK (5 min)

57. STATUS: √SOP P = 5800–6800, cycle to SUIT P

<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>57.</td>
<td>SOP P</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

58. SOP gauge 5800–6800, note SOP interstage gauge

<table>
<thead>
<tr>
<th>EMU</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>58.</td>
<td>SOP GAUGE</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>INT GAUGE</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

59. Depress SOP manual override (50 sec max):
√SOP interstage gauge < 600

<table>
<thead>
<tr>
<th>EMU</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>59.</td>
<td>SUIT P</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>INT GAUGE</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

60. Remove SCOF, stow
If EMU to be used for EVA:
61. Stow LCVG in HUT
Else:
62. Disconnect LCVG, stow
63. Install helmet, LTA, gloves
64. COMM mode – HL

BATTERY CHARGE CHECK INIT (15 min)

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

66. Continue charge 15 min, minimum
67. Perform REBA BATTERY RECHARGE TERMINATE (EMU
    MAINT/RECHARGE), as reqd
68. Perform REBA BATTERY INSTALLATION (EMU
    & MAINT/RECHARGE), as reqd

Cont next page
BATTERY CHARGE CHECK TERM
When PWR/BATT CHGR EMU INPUT AMPS < 1 and 15 min minimum charge complete:

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

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 ____
☐ 70.  Gloves installed

DCM
☐ 71. Disconnect SCU; install DCM cover
☐ 72. Stow SCU on AAP, Velcro to wall
☐ 73. Disconnect helmet, stow
☐ 74. Release EMU from AAP, transfer EMU to middeck
☐ 75. Install helmet

EMU ____
☐ 76. Disconnect helmet, stow
☐ 77. Remove comm cap from LTA restraint bag and connect to electrical harness
☐ 78. Remove LTA restraint bag
☐ 79. Release EMU from middeck AAP, transfer to airlock
☐ 80. Install EMU on AAP
☐ 81. Disconnect waist ring; remove and stow any equipment stowed in HUT/LTA
☐ 82. Waist ring – engage posn
☐ 83. Connect LTA to HUT, lock
☐ 84.  Tether hook operation

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

AW82B
☐ 85. EV–____ O2 vlv – CL

EMU ____
☐ 86. Install EMU on middeck AAP
☐ 87. Attach LTA restraint bag, as reqd
☐ 88. Go to EMU POWERUP, 3–2

Cont next page
POST EMU C/O RECONFIG (5 min)

When EMU C/O for all EMUs complete:

IV O6  □ 89. UHF MODE – OFF

✓ SPLX/EVA XMIT FREQ – 259.7/414.2

✓ PWR AMP – OFF

✓ SPLX SQUELCH – ON

R10 □ 90. BIOMED CH 1,2 (two) – as reqd

If external airlock and EMU C/O for all EMUs complete:

AW82B □ 91. EV–1, EV–2 O2 vlv (two) – CL

BOTH DCM □ 92. Remove SCUs; install DCM covers

□ 93. Stow SCU on AAP, Velcro to wall

IV ML86B:C □ 94. cb MNC EXT ARLK HTR LINE ZN 1,2 (two) – cl

SAFER CHECKOUT (30 min if first checkout of SAFER unit, 20 min for subsequent checks)

NOTE

Procedures written for simultaneous
c/o of SAFER 1&2

BOTH  1. Remove SAFER and SAFER CHECKOUT RESULTS Cue Card

   from Stowage Bag/FDF Locker

PM  2. ✓ Inhibitor installed, properly engaged

   If first SAFER CHECKOUT:

HCM  3. Remove pwr sw guard

4. Stow HCM

5. Remove Stowage Strap from thruster towers, unfold towers

6. Inspect:

   Thruster tower hinges

   Tower latches

   ✓ TMG not blocking thrusters

7. Fold thruster towers

8. Install Stowage Strap

PM  9. MAN ISOL vlv – OP (dn)

10. Deploy HCM; ✓ proper deployment

CAUTION

Minimize time with SAFER powered (~1 min)

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

11. As reqd, review SELF TEST SEQUENCE (refer to box below)
12. Perform Self Test:
   Start timer
   HCM
   PWR – TST/ON
   Wait until GN2 XX% PWR XX% displayed
   √AAH LED on
   PWR – ON
   PWR – TST/ON
   Follow displayed instructions on HCM:
   √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

13. √GO FOR EVA or [FAILED TEST] displayed
14. PWR – ON
15. DISP: Record GN2%, PWR%, BATT V (SAFER CHECKOUT RESULTS Cue Card)
16. PWR – OFF
17. Stop timer, record ‘ON Time’ (~1 min desired)
18. √GN2% ≥ 87
   √PWR% ≥ 45
   √BATT V ≥ 35
19. Report status and SAFER serial number to MCC
20. MODE – ROT
21. Stow HCM
22. Stow SAFER and Cue Card in Stowage Bag
23. √Inhibitor installed
24. MAN ISOL vlv – CL (up)

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

HCM
1. NSI circuit test
2. [SELF TEST – WAIT]; √Twenty–four thruster clicks and THR LED flashing
3. DEPRESS AAH
4. [MODE – ROT] (if in TRAN)
   MODE – TRAN
5. HC grip detent test
6. HC +X (fwd), (–X, +Y (rt), –Y, +Z (dn), –Z, +P (twist up), –P)
7. 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>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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### NOTE
SAFER battery expected to last for 52 1-min checkouts and have at least 45% PWR remaining

<table>
<thead>
<tr>
<th>GMT</th>
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<th>NEW BATT SERIAL #</th>
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### BATTERY CHANGEOUT

(reduced copy)
## SAFER STATUS TROUBLESHOOTING

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<tr>
<td>PWR%</td>
<td>45–99%</td>
</tr>
<tr>
<td>TANK P</td>
<td>&gt; 6575 psia</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>
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<td>DISPL R</td>
<td>± 99.9 deg</td>
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<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>
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<table>
<thead>
<tr>
<th>GMT:</th>
<th>NOMINAL STATUS</th>
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<tr>
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<tr>
<td>RATE Y</td>
<td>± 30 deg/s</td>
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<td>DISPL R</td>
<td>± 99.9 deg</td>
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<td>DISPL P</td>
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<td>BATT T</td>
<td>50 to 90 degF</td>
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<tr>
<td>Leak</td>
<td>NO LEAK</td>
</tr>
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</table>

### SAFER JET NOMENCLATURE
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
If EMU TV:
☐☐ 3. Install EMU TV on helmets 1,2; note camera addresses
   EV1 ___, EV2 ___ (see figure below)
☐☐ 4. Unstow EMU TV power cable, disconnect from ground plug
☐☐ 5. Mate EMU TV power cable to EMU TV
If no EMU TV:
☐☐ 6. √EMU TV power cable mated to ground plug
☐☐ 7. √Upper arm connections mated
☐☐ 8. Connect lower arm pwr harness to Gloves

NOTE
To avoid excessive battery consumption and heat buildup, deactivate heaters once heat detected at fingertips

☐☐ 9. REBA sw (1 per EMU) – ON, pull tab toward right arm of suit
☐☐ 10. Glove heater sw (two per EMU) – ON
When heat detected on all outside fingertips:
☐☐ 11. Glove heater sw (two per EMU) – OFF
If EMU TV:
☐☐ 12. EMU TV power pb – press, √Green LED illuminated
☐☐ 13. EMU TV power pb – press, √Green LED not illuminated
☐☐ 14. REBA sw (1 per EMU) – OFF, pull tab toward left arm of suit
☐☐ 15. Disconnect lower arm pwr harness from Gloves
☐☐ 16. Stow lower arm and glove pwr harness connectors under TMG
EMU ___ ☐☐ 17. Attach LTA restraint bag, as reqd
## EVA PREP

<table>
<thead>
<tr>
<th>Task</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIDDECK PREP</td>
<td>4–2</td>
</tr>
<tr>
<td>EVA PREP</td>
<td>4–2</td>
</tr>
<tr>
<td>PREP FOR DONNING</td>
<td>4–2</td>
</tr>
<tr>
<td>EMU DONNING</td>
<td>4–4</td>
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<tr>
<td>CHECK</td>
<td>4–5</td>
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<tr>
<td>EMU PURGE</td>
<td>4–6</td>
</tr>
<tr>
<td>EMU PREBREATHE</td>
<td>4–6</td>
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<tr>
<td>SAFER DONNING</td>
<td>4–6</td>
</tr>
<tr>
<td>EVA COMM CONFIG</td>
<td>4–8</td>
</tr>
<tr>
<td>CO2 RMVL SYS DEACT</td>
<td>4–8</td>
</tr>
<tr>
<td>ACT</td>
<td>4–8</td>
</tr>
</tbody>
</table>
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

MIDDECK PREP (30 min)

AW18A
1. LTG FLOOD (four) – ON
2. EVA Bag installed in airlock
3. REBA sw – OFF
   If EMU TV:
   4. Demate EMU TV power cable; connect ground plug
   5. Disconnect helmets; Velcro to lockers
4. Remove Drink Bag restraint bag
5. Fill Drink Bag from galley, remove gas and insert Drink Bag in restraint bag
6. Install Drink Bag restraint bag in HUT and dispose of fill tool in wet trash
7. Apply anti–fog (EMU Servicing Kit), wipe off:
   Helmets (not Fresnel lens)
   EV glasses, attach to comm cap
8. Stow EMU Servicing Kit
9. Install Helmets; lock
10. Attach Cuff C/L to EMUs

EVA PREP (90 min)

PREP FOR DONNING (30 min)

If internal airlock:
ML31C
1. VAC VENT ISOL VLV CNTL tb – OP
2. NOZ HTR – ON

If external airlock:

BOTH DCM
2. Retrieve, position SCU; remove DCM cover
3. Connect SCU to DCM, locked

AW82B
4. EV–1, EV–2 O2 vlv (two) – op

MO13Q
5. ARLK H2O S/O VLV – OP (tb–OP)

MD(flr)
6. EMU O2 ISOL VLV – OP

ML86B:C
7. cb MNC EXT ARLK HTR ZN 1,2 (two) – op

L2
8. O2 XOVR SYS 1,2 (two) – OP

BOTH DCM
9. PWR – BATT

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

AW18H
10. PWR/BATT CHGR EMU 1,2 MODE (two) – PWR

DCM
11. PWR – SCU
12. Verify panels as shown next page
13. Perform EVA COMM CONFIG, steps 1, 4 thru 6
14. Disconnect, transfer, temp stow LTAs, helmets, additional EMU(s) to middeck
15. Remove Dosimeter from inflight garments; insert in LCVG
16. Disconnect LCVG
17. Connect biomed to elec harness
18. Don MAG (UCD), LCVG, biomed
19. Don Comm Caps
20. Disconnect, transfer, temp stow LTAs, helmets, additional EMU(s) to middeck
21. Remove Dosimeter from inflight garments; insert in LCVG
22. Disconnect LCVG
23. Don Comm Caps
24. Connect biomed to elec harness
25. Verify biomed signal, EMU data, and RF comm with MCC
26. Set COMM freq – HL
27. Doff Comm Caps
28. Disconnect biomed
29. Take one aspirin tablet (325 mg)
30. STATUS: SOP P = 5800–6800 (compare w/gauge)
31. Ingress airlock
32. Suit arms aligned
33. Disconnet gloves, wrist disconnects – op
34. Stow IV glasses
35. Don thumb loops
36. Biomed connector is outside of HUT
37. REBA sw – OFF
38. Don HUT
39. Release thumb loops
40. Suit arms aligned
41. Don EV glasses as reqd
42. Don Comm Cap
43. COMM mode – HL, vol as reqd
44. Connect biomed to elec harness
45. Connect LCVG, IV1 locked
46. Thermal cover clear of waist ring
47. Connect biomed to elec harness
48. Engage posn
49. Connect waist ring, IV1 locked
50. Remove donning handles, stow in EMU Equipment Bag, cover waist ring
51. Drink vlv posn
56. ✓Mike boom posn
57. Don Comfort Gloves, Wristlets
58. Wrist rings – engage posn
59. Don EV Gloves, IV1 ✓locked
60. Tighten palm restraint straps

If REBA battery:

IV1
61. ✓Glove heater sw (two) – OFF
62. Connect lower arm pwr harness to Gloves
63. Stow slack under arm TMG
64. ✓Cuff C/L posn

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

EV1 DCM 65. FAN – ON (PWR RESTART may occur)
66. Don Helmet, IV1 ✓locked
DCM 67. O2 ACT – IV
68. ✓Helmet purge vlv – cl, locked
DCM 69. PURGE vlv – cl (dn)

If EMU TV:
70. Unstow EMU TV power cable; disconnect from ground plug
71. Mate EMU TV power cable to EMU TV

EV2
72. Repeat steps 31–71

EMU CHECK (5 min)

BOTH 73. ✓Cooling

* If cooling insufficient, IV1 depress *
* and hold pump priming vlv on *
* back of EMU (30 sec min) *

74. Temp control vlv – as reqd
75. ✓Wrist rings – covered
76. ✓Waist rings – covered

DCM 77. ✓COMM mode – HL
78. ✓WATER – OFF
79. ✓PWR – SCU
80. ✓FAN – ON
81. ✓COMM freq – LOW
82. ✓Helmet purge vlv – cl, locked

DCM 83. ✓PURGE vlv – cl (dn)

NOTE
During LEAK CHECK procedure, when ‘SET O2 IV’ msg displayed, wait 30 sec and ✓SUIT P gauge stable (4.2–4.4) before moving O2 ACT–IV

84. STATUS: [LEAK CHECK?], PROC follow displayed instructions

* If [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

<table>
<thead>
<tr>
<th>BOTH DCM</th>
<th>O2 ACT – PRESS</th>
<th>PURGE lv  – op (up), begin purge clock</th>
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<tbody>
<tr>
<td>1.</td>
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<td>3. When N2 purge complete (per table):</td>
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<td>PURGE lv  – cl (dn)</td>
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<td>O2 ACT – IV</td>
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<tr>
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<th>PURGE DURATION (min)</th>
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<tr>
<td>10.2</td>
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EMU PREBREATHE

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<th>CABIN P</th>
<th>PREBREATHE DURATION</th>
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<tr>
<td></td>
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<td>10.2</td>
<td>12 hr</td>
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<th>O2 ACT – PRESS</th>
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<td></td>
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<td>14.7</td>
<td>04:00</td>
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SAFER DONNING (If reqd)

| IV1 | Remove SAFER from Stowage Bag |
|     | Remove Stowage Strap from thruster towers; stow in EMU Equipment Bag; unfold towers |
|     | Inspect: Thrueter tower hinges |
|     | Tower latches |
|     | √TMG not blocking thrusters |
|     | TMG clear from SAFER striker plate on EMU PLSS |

| PM | Remove Inhibitor; close, fasten port cover |
|    | MAN ISOL lv  – OP (dn) |
|    | Latch – PRELOAD |
|    | Rotate latch to recess butterfly in housing |

**CAUTION**
Rotating ccw past softstop can bind latch

| IV1 | Rotate latch ccw to softstop |
|     | Latch – ENGAGE |
|     | Mate PLSS to thruster towers |
|     | Push latch in and rotate cw until stop (~90°) |

* If latch will not engage: * |
* Latch – PRELOAD * |
* Rotate latch ccw until stop * |
* Return to step 19 * |

| IV1 | Latch – PRELOAD |
|     | Rotate latch cw until ratcheting |

**CAUTION**
Rotating ccw may disengage SAFER

| IV1 | Continue ratcheting until lock marking on latch, tower aligned |
|     | Latch – LOCK |
|     | √Access to HCM deploy lever |
|     | √TMG not blocking thruster |
|     | Repeat for SAFER 2 |
| IV1 | □□□29. Install MWS and BRTs (as reqd) |
| A/L | □□□30. ✓ EVA tools installed in airlock |
|     | □□□31. As reqd, perform BOOSTER FAN DEACTIVATION/REMOVAL (AIRLOCK CONFIG) |
|     | □□□32. Remove, stow appropriate vent ducts to allow hatch closure |
| MD (flr) | □□□33. As reqd, disconnect vent duct from middeck floor fitting, stow |
|     | □□□34. As reqd, unstow, install diffuser cap on middeck floor fitting |
|     | □□□35. ✓ Loose middeck–stowed items clear of inner hatch and middeck diffuser cap air flow |
| DCM  | □□□36. Remove WATER switch guard (two), stow in EMU Equipment Bag |
|     | □□□37. REBA sw – ON |
|     | If EMU TV: |
|     | □□□38. EMU TV power pb – press, ✓ Green LED illuminated |
|     | If external airlock with aft hatch: |
| A/L (flr) | □□□39. Deploy floor hatch supports |
|     | □□□40. Egress airlock |
|     | □□□41. Inner hatch – close, lock |
|     | □□□42. ✓ Inner hatch Equal vlv caps (two) – removed |
|     | □□□43. Inner hatch Equal vlv (two) – OFF |
|     | If internal airlock: |
|     | □□□44. If flown: Perform CO2 RMVL SYS DEACT |
|     | □□□45. When prebreathe time complete, ✓ MCC for go to DEPRESS/REPRESS (Cue Card) |
### EVA COMM CONFIG

| O6 | 1. **UHF SPLX/EVA XMIT FREQ** – 259.7/414.2 |
|    | **PWR AMP** – **OFF** |
|    | **EVA STRING** – **1** |
|    | **MODE** – **EVA** |
| A1R | 2. **AUDCTR VOICE RCD SEL CH 1** – A/G 1 |
|    | **2** – **ICOM A** |
|    | 3. **AUD CTRL UHF A/G 1** – **TR** |
|    | **A/G 2** – **OFF** |
|    | **A/A** – **OFF** |
| IVA ATU | **AUD A/G 1** – **T/R** |
| R10 | 4. **BIOMETRIC CH 1** – **EVA 1** |
|    | **2** – **EVA 2** |
| DCM | 5. **COMM freq** – **LOW** |
|    | **Comm mode** – **PRI** |
|    | 6. **On ATUs in use by IVA, adjust VOL A/G 1** |
|    | **tw for comfortable EVA volume; then** |
|    | adjust VOL A/G 2 tw for comfortable MCC |
|    | **volume. (MCC uplinks on both A/G 1 and** |
|    | **A/G 2.)** **Record ATU tw settings** |

### CO2 RMVL SYS DEACT

| MO51F | CO2 RMVL SYS CNTLR 1(2) MODE – STBY (hold 3 sec) |
|       | Wait 6 sec |
|       | √CO2 RMVL SYS CNTLR 1(2) OPER lt – off |
|       | √FAIL lt – on |

### CO2 RMVL SYS ACT

| MO51F | CO2 RMVL SYS AC1(3) – OFF (hold 3 sec) |
|       | MNA(C) – OFF |
|       | CNTLR 1(2) FAIL lt – off |
|       | AC1(3) – ON (hold 3 sec) |
|       | MNA(C) – ON |
|       | CNTLR 1(2) MODE – OPER (hold 3 sec) |
|       | Wait 6 sec |
|       | √CO2 RMVL SYS CNTLR 1(2) OPER lt – on |
**EMU STATUS**

<table>
<thead>
<tr>
<th>TIME EV</th>
<th>EV1</th>
<th>EV2</th>
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<tbody>
<tr>
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<tr>
<td>% O2</td>
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<tr>
<td>GAUGE</td>
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</tbody>
</table>

**Report status to MCC when:**
- Any parameter outside normal range
- TIME LF ≤ reqd
- Limiting Consumable changes (PWR ↔ O2)
- ΔTIME LF between EV1 and EV2 ≥ 1 hr

**NORMAL STATUS**
- EVA
  - HR:MIN since PWR–BATT
  - HR:MIN remaining at present use rate
  - Displayed if not limiting consumable
- O2 POS
  - 4.2–4.4 psid
- SUIT P
  - 5800–6800 psia
- O2 P
  - 60–900 psid
- SOP P
  - 2.0–4.2 psia
- SUBLM P
  - 16.3–17.0
- BAT VDC
  - 3.0–4.0
- BAT AMP
  - 19.0–20.0 k
- RPM
  - 0.2–0.5 mmH
- CO2
  - 32–75 degF
- H2O GP/WP
  - 14.0–16.0 psid

**Airlock Egress**

**Airlock Ingress**
## DEPRESS (10 MIN)

When prebreathe complete:

**AW82B**
1. AIRLK DEPRESS vlv – 5, ALERT TONE, monitor suit P gauge < 5.5
   - If gauge > 5.5, stop depress, v/C MCC *
2. Airlock at 6.0, ALERT TONE
3. When airlock at 5.0, AIRLK DEPRESS vlv – CL, ALERT TONE

**BOTH DCM**
4. STATUS: [LEAK CHECK ?], PROC, follow displayed instructions
   - * If LEAKAGE HI | SUIT P X.X, go to FAILED *
   - * LEAK CHECK (5 PSI), reverse side *
5. O2 ACT – EVA
6. STATUS, Cuff C/L, 1

**AW82B**
7. AIRLK DEPRESS vlv – 0, ALERT TONE, monitor suit P gauge < 5.5
   - * If gauge > 5.5, stop depress, v/C MCC *
8. Attach waist tether(s) to A/L D-ring for egress
9. Airlock dP/dT = 0, ALERT TONE
10. When outer hatch ΔP < 0.5, outer hatch – open, stow

**AW82B**
11. AIRLK DEPRESS vlv – CL
12. Configure UHF, EVA COMM CONFIG, steps 1 thru 5 only (EVA PREP)

## POST DEPRESS (5 MIN)

**BOTH DCM**
1. PWR – BATT, WARN TONE (IV1 record MET _ _ _ _)

**AW82B**
2. PWR/BATT CHGR EMU 1.2 BUS SEL (two) – OFF
3. Disc SCU; install DCM cover
4. Stow SCU on AAP, Velcro to wall
5. Temp control vlv – Max H
6. WATER – ON
7. DCM blank, BITE off
8. Temp control vlv – as reqd
9. STATUS, Cuff C/L, 1 (IV1 Record)
10. Visors as reqd
11. Go to AIRLOCK EGRESS, Cuff C/L, 42, or Flight Specific Timeline

**IV1**
If internal airlock and CO2 RMVL SYS flown:

12. Perform CO2 RMVL SYS ACT (EVA PREP)

If external airlock:

**ML86B:C**
13. cb MNC EXT ARLK HTR LINE ZN 1.2 (two) – cl

## PRE REPRESS (5 MIN)

**IV1**
ML86B:C
1. cb MNC EXT ARLK HTR LINE ZN 1.2 (two) – op
2. EMU O2 ISO L vlv – OP

**MD(flrl)**
3. EMU O2 ISO L vlv – OP

**BOTH**
4. WATER – OFF
5. Disc waist tethers, attach to EMU
6. Retrieve, position SCUs; remove DCM covers
7. Connect SCUs to DCM, v/C locked

**AW82B**
8. EV–1, EV–2 O2 vlv (two) – OP

**AW18H**
9. PWR/BATT CHGR EMU 1.2 BUS SEL (two) – MNA(MNB)

**DCM**
10. PWR – SCU, WARN TONE (IV1 record MET _ _ _ _)

## DEPRESS/REPRESS

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

**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), ALERT TONE
5. Airlock at 4.0, ALERT TONE
6. When airlock at 5.0, Equal vlv – OFF, ALERT TONE

**DCM**
7. Airlock pressure integrity (2 min, ΔP ≤ 0.1 psi)

**WARNING**
If CUFF 1 sympl resolve upon repress, report as CUFF 2
If any DCS, leave O2 ACT – PRESS

8. O2 ACT – IV
9. Inner hatch Equal vlv (one) – NORM, ALERT TONE
10. Airlock dP/dT – 0, ALERT TONE
11. Go to POST EVA EVA–1a/NOM/O/G

**NOTE**
If CUFF 1 sympl resolve upon repress, report as CUFF 2
If any DCS, leave O2 ACT – PRESS
DEPRESS/REPRESS

TNL ADAPTER

B6–1
EVA/TNL/GEN G
DEPRESS (25 MIN)
When prebreathe complete
AW82B 1. AIRLKL DEPRESS vlv – 5, ALERT TONE,
monitor suit P gauge < 5.5
   * If gauge > 5.5, stop depress, MCC *
2. Airlock at 6.0, ALERT TONE
3. When airlock at 5.0, AIRLKL DEPRESS vlv –
   CL, ALERT TONE
   BOTH DCM 4. STATUS: LEAK CHECK ?, PROC, follow
   displayed instructions
      * If LEAKAGE HI SUIT P X.X, go to FAILED *
      * LEAK CHECK [3 PSI], reverse side *
   5. √ O2 ACT – EVA
   6. √ STATUS, Cuff C/L, 1
      √ MCC for aft module pressure integrity
   AW82B 7. AIRLKL DEPRESS vlv – 0, ALERT TONE,
   monitor suit P gauge < 5.5
      * If gauge > 5.5, stop depress, MCC *
   8. Airlock dp/dT –0, ALERT TONE
   9. Configure UHF, EVA COMM CONFIG, steps 1 thru
      5 only (EVA PREP)
IV1
   POST DEPRESS (15 MIN)
   BOTH DCM 1. PWR – BATT, WARN TONE
      (IV1 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 ΔP < 0.5, EVA hatch – part op
   AW82B 6. AIRLKL 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 – as reqd
      13. √ STATUS, Cuff C/L, 1 (IV1 Record)
      14. Visors as reqd
      15. Go to AIRLOCK EGRESS, Cuff C/L, 42, or
         Flight Specific Timeline
         If internal airlock and CO2 RMVL SYS flown:
   IV1 16. Perform CO2 RMVL SYS ACT (EVA PREP)
   If external airlock:
   ML86B:C 17. cb MNC EXT ARLKL HTR LINE ZN 1,2 (two) – CL

PRE REPRESS (5 MIN)
   If external airlock:
   IV 1. √ cb MNC EXT ARLKL HTR LINE ZN 1,2
      (two) – op
   MD(fir) 2. √ EMU O2 02 vlv – OP
   BOTH 3. √ EVA hatch closed, locked
   DCM 4. √ WATER – OFF
   5. Disc waist tethers, attach to EMU
   6. Retrieve, position SCUs; remove DCM covers
   7. Connect SCU to DCM, √ locked
   AW82B 8. √ EV–1, EV–2 O2 vlv (two) – OP
   AW18H 9. PWR/BATT CHGR EMU 1,2 BUS SEL
      (two) – MNA(MNB)
   DCM 10. PWR – SCU, WARN TONE
      (IV1 record MET – )

REPRESS (20 MIN)
   POST EVA–2a/TNL/O/S
   If gauge > 5.0, stop depress, MCC *
   * LEAK CHECK (5 PSI)
   * LEAKAGE HI SUIT P X.X, go to FAILED *
   * LEAK CHECK [3 PSI], reverse side *
   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. √ AIRLKL DEPRESS vlv – CL
   4. Inner hatch Equal vlv (one) – throttle OFF to NORM (as reqd), ALERT TONE
   5. Airlock at 4.0, ALERT TONE
   6. When airlock at 5.0, Equal vlv (two) – OFF, ALERT TONE
   DCM 7. √ Airlock pressure integrity (4 min, ΔP ≤ 0.1 psi)
   WARNING
   If CUFF 1 symp resolve upon repress, report as CUFF 2
   If any DCS, leave O2 ACT – PRESS
   8. O2 ACT – IV
   9. Inner hatch Equal vlv (one) – NORM, ALERT TONE
   10. Airlock dp/dT –0, ALERT TONE
   11. Go to POST EVA
   EVA–2a/TNL/O/S
FAILED LEAK CHECK
### FAILED LEAK CHECK (5 PSI)

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

### FAILED LEAK CHECK (14.7/10.2 PSI)

1. Leaking EMU: O2 ACT – PRESS
2. Rotate lower arm assemblies one rev
3. Suit arms aligned
4. Sizing rings locked
5. Swivel hips from side to side
6. Repeat leak check as follows:
   - Helmet purge vlv – cl, locked
   - 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:
   - Helmet (leave off), Gloves
   - LTA
   - 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:
   - Helmet (leave off), Gloves
   - 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):
    - PURGE vlv – op (up)
    - Contact MCC, go to POST EVA, 9–2
FLIGHT SPECIFIC TIMELINES
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<td>PROGRAM PGT SETTINGS</td>
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<tr>
<td>DOWNLOAD/ERASE EVENT LOG</td>
<td>8–5</td>
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</table>
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 bayonet 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
760XD PGSC–PGT CONNECTION

1. ✓ PGSC equipped with RS422 PCMCIA card and adapters (two)
2. ✓ PGT PWR — OFF
3. ✓ PGT battery installed
4. Ratchet collar — not MTR

**CAUTION**
Do not over-torque cover screw

5. Open PGT serial port cover using 3/32-in Allen Wrench attached to PGT–RS422 cable
6. Connect PGT–RS422 cable to PGT Remote Programming port
7. Connect other end of PGT–RS422 cable to COM 2 or COM 4 adapter box, as desired
8. PGT PWR — ON
9. If PGSC is not powered, PGSC pwr — on
10. Select SHUTTLE APPS icon on PGSC Windows desktop
11. Select PGT icon that corresponds to COM port selected in step 7
12. ✓ Tool Communications Check dialog box appears
13. ✓ Serial Connection Verified
14. ✓ Intool software version 2.2
15. Select CONTINUE

PROGRAM PGT SETTINGS

1. Perform 760XD PGSC–PGT CONNECTION
   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 760XD PGSC–PGT CONNECTION
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
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</table>
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

CAUTION
Hold hatch away from airlock to avoid damaging vent duct (N/A for tunnel adapter, ext A/L)

IV1 □□□□ 1. When ∆P < 0.5, open hatch
MD (flr) □□□□ 2. As reqd, remove diffuser cap at middeck floor, stow
□□□□ 3. As reqd, unstow airlock vent duct, connect end to middeck floor fitting
A/L □□□□ 4. Configure appropriate vent ducts for airflow into airlock
□□□□ 5. As reqd, perform BOOSTER FAN INSTALLATION/ACTIVATION (AIRLOCK CONFIG)
EV □□□□ 6. ✖ Gloves clean
   * If reqd, IV use damp towel to clean Gloves *

IV1 O6 □□□□ 7. UHF MODE – OFF
   ✓ SPLX/EVA XMIT FREQ – 259.7/414.2
   ✓ PWR AMP – OFF
   ✓ SPLX SQUELCH – ON
A1R □□□□ 8. AUD CTR UHF A/G 1 – OFF
   VOICE RCD SEL CH 1 – OFF
   2 – OFF
R10 □□□□ 9. BIOMED CH 1,2 (two) – as reqd
BOTH DCM □□□□ 10. O2 ACT – OFF
□□□□ 11. PURGE vlv – op (up)
□□□□ 12. ✓ COMM mode – HL
IV1 DCM □□□□ 13. Install WATER sw guards (two)
   If EMU TV:
   □□□□ 14. EMU TV power pb – press, ✓ Green LED not illuminated
   If REBA battery:
   □□□□ 15. ✓ Glove heaters sw (two) – OFF
   □□□□ 16. REBA sw – OFF
   □□□□ 17. Disconnect lower arm pwr harness from Gloves
   □□□□ 18. Stow lower arm and Glove pwr harness connectors under TMG
   If EMU TV:
   □□□□ 19. Demate EMU TV power cable, mate to ground plug
   □□□□ 20. STATUS: ✓ SUIT P < 0.4 (compare w/gauge); disconnect Gloves, stow
   □□□□ 21. Disconnect Helmet, stow
PLSS □□□□ 22. AIRLK DEPRESS vlv – install cap

SAFER DOFFING (10 min) (If reqd)
BOTH PM □□□□ 23. MAN ISOL vlv – CL (up)
□□□□ 24. Latch – ENGAGE
□□□□ 25. Rotate latch ccw until release (~90 deg)
□□□□ 26. Demate PLSS from thruster towers
□□□□ 27. Latch – PRELOAD
□□□□ 28. Rotate latch cw until lock markings on latch and tower recess aligned
□□□□ 29. Push in latch, latch – LOCK

Cont next page
30. Fold thruster towers
31. Transfer to middeck
32. Install Inhibitor (N/A if SAFER has been used)
33. Temp stow SAFER
34. Repeat for SAFER 2

PLSS
35. If reqd, unstow REBA jumper cable
36. AAP release handles to 90°
37. Engage HUT in AAP (IV1 assist as reqd)
38. AAP release handles to lock

DCM
39. FAN – OFF (fwd)
40. Disconnect waist ring, LCVG, biomed
41. Doff comm cap
42. Wrist disconnects – op
43. Doff EV glasses
44. Doff HUT
45. Doff LTA, secure to handrail
46. Remove dosimeter from LCVG; insert in inflight garment
47. Doff: Biomed (disc pigtail, stow in EMU Servicing Kit)
   LCVG (secure to HUT)
   MAG (UCD, clamp), stow in wet trash
48. Stow HUT Multiple Water Connector in left arm

R1
50. O2 TK3 HTR A(B) – as reqd

If external airlock:
ML86B:C
51. cb MNC EXT ARLK HTR LINE ZN 1,2 (two) – cl

EMU WATER RECHARGE (5 min) (If reqd) (√MCC for config, if reqd)

If external airlock:
MO13Q
52. √ARLK H2O S/O VLV – OP (tb–OP)
R11L
53. If SPLY H2O XOVR VLV closed (tb–CL or bp) (water transfer config):
   SPLY H2O TKA OUTLET – CL (tb–CL)

CRT
54. Use TKB quantity:
   PARAM ID – ITEM 1 +0 6 2 0 4 2 0 EXEC
R11L
55. If SPLY H2O XOVR VLV open (tb–OP) (nominal config):
   RAD CNTLR OUT TEMP – NORM
   FLASH EVAP CNTLR PRI A,B (two) – OFF
ML31C
56. SPLY H2O TKD OUTLET – CL (tb–CL)
R11L
57. SPLY H2O TKA OUTLET – CL (tb–CL)
   TKB OUTLET – CL (tb–CL)
   TKC OUTLET – OP (tb–OP)
   /INLET – CL (tb–CL)

CRT
58. Use TKC quantity:
   PARAM ID – ITEM 1 +0 6 2 0 5 4 8 EXEC
60. Log value before recharge

<table>
<thead>
<tr>
<th>Recharge #</th>
<th>H2O TKB(C) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
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<tr>
<td>2</td>
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</tr>
</tbody>
</table>

AW82D
59. √EMU 1,2 H2O WASTE tb (two) – CL
   SPLY (two) – OP (tb–OP)
CRT
61. √H2O TKB(C) quantity decreasing
SAFER STOW (10 min) (If reqd)

PM
- □ □ □ 63. □ Inhibitor installed
- □ □ □ 64. □ Thruster towers folded
- □ □ □ 65. Unstow Stowage Straps from EMU Equipment Bag; install
- □ □ □ 66. □ MAN ISOL vlv – CL (up)
- □ □ □ 67. Stow SAFER in Stowage Bag

SUIT DRYING/SEAL WIPE
- □ □ □ 68. Wipe with drying towel:
  - LTA, legs, boots
  - HUT, suit arms
  - Gloves

**WARNING**
Avoid stericide contact with eyes. Wash hands thoroughly after application

- □ □ □ 69. Wipe crotch with stericide (in Maint Kit)
- □ □ □ 70. Lightly wipe seals on LTA waist ring, arm wrist rings, HUT neck ring with lint–free wipe (in EMU Servicing Kit)
- □ □ □ 71. Clean, refurbish biomed
- □ □ □ 72. Remove Drink Bag from HUT and dispose in wet trash

OXYGEN RECHARGE VERIFICATION
DCM □ □ □ 73. STATUS: [O2 P XXX]
□ □ □ 74. Continue charge until O2 P ~850

WATER FILL VERIFICATION (10 min) (If reqd)
DCM □ □ □ 75. STATUS: □ H2O WP 8–15 psi and stable for ~30 sec (indicates charging complete)

**SM 60 TABLE MAINT**

R11L If SPLY H2O XOVR VLV closed (tb–CL or bp) (water transfer config):
CRT □ □ □ 76. Use TKB quantity:
  - PARAM ID – ITEM 1 +0 6 2 0 4 2 0 EXEC

R11L If SPLY H2O XOVR VLV open (tb–OP) (nominal config):
CRT □ □ □ 77. Use TKC quantity:
  - PARAM ID – ITEM 1 +0 6 2 0 5 4 8 EXEC
□ □ □ 78. Log value after recharge

<table>
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</tbody>
</table>

**NOTE**
Full charge = ~6%/EMU

Cont next page
If SPLY H2O XOVR VLV closed (tb–CL or bp) (water transfer config):

- R11L 9
- ML31C 81

If SPLY H2O XOVR VLV open (tb–OP) (nominal config):

- EVA/ALL/GEN G

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

If WCS:

- WCS 83
- EDO WCS 85

If EDO WCS:

- WCS 85
- EDO WCS 85

If last EVA completed:

- X: SM 60 SM TABLE MAINT
- 104

Changes enclosed in [ ]
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WATER RECHARGE

IF EMU NOT ALREADY POWERED UP:

EMU POWERUP

If external airlock:

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)

If external airlock:

MD (flr)

5. √EMU O2 ISOL VLV – OP

AW82B

6. EV1,2 O2 vlv (two) – OP

DCM

7. PWR – SCU

WATER FILL (√MCC for config, if reqd)

If external airlock:

MO13Q

R11L

If SPLY H2O XOVR VLV closed (tb–CL or bp) (water transfer config):

9. √SPLY H2O TKA OUTLET – CL (tb–CL)

SM 60 TABLE MAINT

CRT

10. Use TKB quantity:

    PARAM ID – ITEM 1 +0 6 0 4 2 0 4 2 0 EXEC
R11L

If SPLY H2O XOVR VLV open (tb–OP) (nominal config):

L1

11. √RAD CNTLR OUT TEMP – NORM

12. √FLASH EVAP CNTLR PRI A,B (two) – OFF

ML31C

13. SPLY H2O TKD OUTLET – CL (tb–CL)
R11L

14. √SPLY H2O TKA OUTLET – CL (tb–CL)

TKB OUTLET – CL (tb–CL)
TKC OUTLET – OP (tb–OP)

√ INLET – CL (tb–CL)

SM 60 TABLE MAINT

CRT

15. Use TKC quantity:

    PARAM ID – ITEM 1 +0 6 0 5 4 8 EXEC

16. Log value before recharge

<table>
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</tbody>
</table>

AW82D

17. √EMU 1,2 H2O WASTE tb (two) – CL

SPLY (two) – OP (tb–OP)

CRT

18. √H2O TKB(C) quantity decreasing

NOTE

Full charge requires ~15 min

Cont next page
OXYGEN RECHARGE VERIFICATION
DCM 19. STATUS: [O2 P XXX]
20. Continue charge until O2 P ~850

WATER FILL VERIFICATION
DCM 21. STATUS: √H2O WP 8–15 psi and stable for ~30 sec (indicates charging complete)

SM 60 TABLE MAINT
R11L If SPLY H2O XOVR VLV closed (tb–CL or bp) (water transfer config):
CRT 22. Use TKB quantity:
   PARAM ID – ITEM 1 +0 6 2 0 4 2 0 EXEC
R11L If SPLY H2O XOVR VLV open (tb–OP) (nominal config):
CRT 23. Use TKC quantity:
   PARAM ID – ITEM 1 +0 6 2 0 5 4 8 EXEC
24. Log value after recharge

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

NOTE
Full charge = ~6%/EMU

R11L If SPLY H2O XOVR VLV closed (tb–CL or bp) (water transfer config):
   25. SPLY H2O TKA OUTLET – OP (tb–OP)
   If SPLY H2O XOVR VLV open (tb–OP) (nominal config):
      26. SPLY H2O TKC OUTLET – CL (tb–CL)
      TKB OUTLET – OP (tb–OP)
ML31C 27. SPLY H2O TKD OUTLET – OP (tb–OP)
28. If FES reqd, perform TOPPING FES STARTUP (ORB OPS, ECLS)
   If WCS:
   WSC 29. √FAN SEP same as HOSE BLOCK
   30. MODE – COMMODE/MANUAL/EMU, posn guard over sw (airflow, WCS ON lt on)
   If EDO WCS:
   EDC WCS 31. √URINAL SEL sw same as URN DIV VLVL
   32. Unstow urinal hose; posn guard strap over hose yoke (√airflow)
AW82D 33. EMU 1,2 H2O SPLY (two) – CL (tb–CL)
34. Install SCOFs, lock
DCM 35. O2 ACT – IV
AW82H 36. EMU 1,2 H2O WASTE reg (two) – MAN OP
AW82D 37. EMU 1(2) H2O WASTE (one) – OP (tb–OP) (1 min), then
            – CL (tb–CL)
            – Repeat for other EMU
AW82H 38. EMU 1,2 H2O WASTE reg (two) – REGULATING
DCM 39. O2 ACT – OFF
40. Remove SCOFs, stow
   If WCS:
   WSC 41. MODE – AUTO (√WCS ON lt off)
   If EDO WCS:
   42. Stow urinal hose
   43. If EMU powerup performed, go to EMU POWERDOWN
EMU LiOH CHANGEOUT (20 min)

CAUTION
If 10.2 cabin used, possible ΔP across LiOH cartridge caps. Direct ports away from face

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

<table>
<thead>
<tr>
<th>EVA #</th>
<th>EV 1</th>
<th>EV 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>2</td>
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</tr>
</tbody>
</table>

6. Remove, mark used LiOH cartridge

IF EMU BATTERY TO BE REPLACED:

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

CAUTION
Do not allow battery to impact airlock wall

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

11. Holding new LiOH cartridge with aluminum plate serial number facing self, remove caps (left first), 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
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

<table>
<thead>
<tr>
<th>EVA #</th>
<th>EV 1</th>
<th>EV 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Remove, mark, stow used LiOH cartridge
5. $\sqrt{PWR} \rightarrow SCU$
6. Remove, stow used battery
7. Holding new LiOH cartridge with aluminum plate serial number facing, remove caps (left first), install LiOH (attach Velcro retainer strap)
8. Close thermal cover zipper, stow EMU in middeck
9. Unstow middeck battery charger

10. $\sqrt{DC \ UTIL \ PWR} \rightarrow OFF$
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. $\sqrt{DC \ UTIL \ PWR} \rightarrow ON$
16. $\sqrt{Charge \ light(s)} \rightarrow RED$
   $\sqrt{Ready \ light(s)} \rightarrow GREEN \ (mom), \ OFF$

TERMINATE (15 min)

17. When charge complete:
   $\sqrt{Charge \ light(s)} \rightarrow OFF$
   $\sqrt{Ready \ light(s)} \rightarrow GREEN$
   $\sqrt{DC \ UTIL \ PWR} \rightarrow OFF$
   Disc cable(s) from battery(s)
18. Unzip thermal cover, Velcro to top of EMU
19. Remove LiOH cartridge
20. Open battery latch
21. Install charged battery ($\sqrt{connector \ alignment}$), latch
22. Reinstall LiOH (attach Velcro retainer strap)
23. Close thermal cover zipper
IN–SUIT EMU BATTERY RECHARGE/CHARGE VERIFICATION

INITIATE
If external airlock:
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

If external airlock:
7. Remove SCU; install DCM cover
8. Stow SCU on AAP, Velcro to wall

EMU POWERDOWN
AW18D
1. AIRLK AUD PWR – OFF

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

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

If external airlock:
4. Remove SCU; install DCM cover
5. 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: Battery Pack Charger
   Y–pwr cable
   PGT Battery Adapters (2)
   PGT Batteries (2)
   Helmet Light Batteries (4)

2. ✓ DC UTIL PWR – OFF
3. Plug Y–pwr 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 Y–pwr cable from charger

IFM Pin Kit
   * Change fuse (7.5A)
   * Plug Y–pwr cable into charger
   * DC UTIL PWR – ON

If charging helmet light batteries:
5. Install batteries (four) into charger

If charging PGT batteries, perform for each battery:
   6. Install PGT battery adapter into charger
   7. Release captive screw on PGT battery door using screwdriver
   8. Pry open PGT battery door, rotate away from cavity
   9. Remove battery jumper, temp stow
10. Remove cap from adapter cable, plug into battery
11. ✓ Yellow LED illuminated; temp stow charger
   * If yellow LED not illuminated, see chart below *

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<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 change LED to yellow automatically)</td>
</tr>
<tr>
<td>Red LED illuminated</td>
<td>Hot batt (≥ 113 degF)</td>
<td>Remove batt, let cool to room temp; reinstall batt after cooling and ✓ yellow LED illuminated</td>
</tr>
</tbody>
</table>

TERMINATE (10 min)

NOTE
Refer to REF DATA for specific plug–in location

1. When green LED illuminated, remove batteries
   If helmet light batteries charged:
   2. Install batteries in lights
   3. ✓ EMU light ops
      Velcro to lockers
CAUTION
Do not stow EMU lights in locker with batteries installed

If PGT batteries charged, perform for each battery:

4. Unplug battery from PGT battery adapter, reinstall cap on cable

NOTE
PGT Battery will not function if jumper is not installed

5. Re–install battery jumper
6. Rotate battery door into place, tighten screw using screwdriver
7. Mark batteries “charged”, stow in locker
8. Remove PGT battery adapter from charger
9. DC UTIL PWR – OFF
10. Stow:
    Battery Pack Charger
    Y–pwr cable
    PGT Battery Adapters (2)
    PGT Batteries (2)

REBA BATTERY INSTALLATION

1. Unstow REBA from Locker or charger
2. Remove EMU from AAP
3. Glove heater sw (two) – OFF
4. Remove REBA J1 connector cover
5. Install REBAs on EMUs
6. Route REBA sw pull tabs thru TMG loops
7. REBA sw (one per EMU) – OFF
8. Connect EMU power harness to REBA (P1/J1)
9. Install EMU on AAP
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. Obtain, don Comfort Glove
3. Depress Faceplate; open Faceplate Sliders (two) on affected side of lights
4. Remove Faceplate
5. Remove Reflector Housing by pulling straight out
6. Remove affected bulbs as reqd; replace
7. Mark, stow used bulbs

NOTE
Contacts on Spot Bulb may be difficult to reseat fully into socket

8. Install Reflector Housing; seat Spot Bulb
9. Install Faceplate; lock Sliders (two)
10. Install battery; ✅ EMU light ops
REBA BATTERY RECHARGE

INITIATE (10 min)

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

1. Unstow: REBA Charger
   Y–pwr cable
   REBA Charger extension cable (if reqd)
2. √DC UTIL PWR – OFF
   If in–suit recharge:
   3. Plug Y–pwr cable into charger, REBA Charger extension cable into Y–pwr cable, REBA Charger extension cable into orbiter power supply
   Else:
   4. Plug Y–pwr cable into charger and orbiter power supply
5. DC UTIL PWR – ON
   √Blue LEDs (two) illuminated
      * If blue LED not illuminated:
      * √DC UTIL PWR – ON
      * √cb – cl
      * √Cable connections mated
      * If blue LED still not illuminated:
      * DC UTIL PWR – OFF
      * Unplug Y–pwr cable from charger
      * Change fuse (4.0 Amps)
      * Plug Y–pwr cable into charger
      * DC UTIL PWR – ON

REBA 6. √REBA sw (two) – OFF
7. Demate REBA jumper cables (two)
8. Mate Charge cables (two) to REBA jumper cables
REBA Charger 9. √Yellow LEDs (two) illuminated; temp stow charger on wall

* If yellow LED not illuminated, see chart below *

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<td>Hot batt (≥ 113 degF)</td>
<td>Leave REBA connected to charger (REBA will cool and LED will change to yellow automatically)</td>
</tr>
</tbody>
</table>

TERMINATE (10 min)

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

1. When green LEDs (two) illuminated, disconnect REBAs from Charger
2. Mate REBA jumper cables
3. DC UTIL PWR – OFF
4. Stow: REBA Charger
   Y–pwr cable
   REBA Charger extension cable (if reqd)
POST EVA ENTRY PREP
**POST EVA ENTRY PREP** (45 min if SAFER not flown)  
(55 min if SAFER flown)

AW18D  1. AIRLIK AUD PWR – OFF
AW18H  2. PWR/BATT CHGR EMU 1,2 BUS SEL (two) – OFF  
       MODE (two) – OFF

If external airlock:
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. Stow in EMU Equipment Bag: Comm caps (two)
       8. Stow LCVG in HUT (do not mate to Multiple Water Connector)
       9. Connect LTA to HUT
      10. Install gloves
If heated gloves:
      11. Remove REBA batteries from all EMUs; stow
If EMU TV:
      12. Remove EMU TVs from helmet lights; stow
      13. Transfer EMU lights to middeck
      14. Install helmets (SCOFs), lock
      15. Remove SCU; install DCM cover
DCM  16. Stow SCU on AAP; rebuckle straps
      17. ✓ PURGE vlvs – op (up)
      18. Perform LTA RESTRAINT STRAP INSTALLATION (AIRLOCK  
       CONFIG) as reqd
      19. Attach LTA restraint bags over LTA, suit arms; tighten straps
      20. 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
      21. Deploy HCM
      22. Install pwr sw guard
      23. Stow HCM in foam outside of SAFER
      24. Stow SAFER in Stowage Bag
      25. Install additional EMU(s)/Airlock Stowage Bag(s) in airlock; ✓ bag,  
       strap installed
      26. Install 20–g crash bag on middeck EMUs (if flown)
      27. Remove, mark batteries from lights; stow in lockers

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

Vol H  28. Stow EMU lights, EMU Equipment Bag, EVA Bag in middeck
Inner Hatch  29. Equal vlv (two) – NORM, install caps

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

30. Inform MCC, Post EVA Entry Prep complete
OFF–NOMINAL PROCEDURES
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<tr>
<td>BATTERY REPLACEMENT (MANNED)</td>
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<td>12-5</td>
</tr>
<tr>
<td>SCU SWAP (UNMANNED)</td>
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<tr>
<td>(MANNED)</td>
<td>12-6</td>
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<td>TREATMENT</td>
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<td>BENDS TREATMENT ADAPTER (BTA) INSTALLATION (POST SUIT DOFFING)</td>
<td>12-14</td>
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<td>12-14</td>
</tr>
<tr>
<td>TREATMENT</td>
<td>12-14</td>
</tr>
<tr>
<td>EMU RESIZE</td>
<td>12-17</td>
</tr>
</tbody>
</table>
DISPLAY LOSS DURING POWER TRANSFER (WARM RESTART)

DCM 1. FAN – OFF
   If PWR – SCU:
AW18H 2. PWR/BATT CHGR EMU 1(2) BUS SEL – OFF (7 sec)
DCM 3. PWR – BATT
   4. DISPLAY – ‘O2 POS – XX’
AW18H 5. PWR/BATT CHGR EMU 1(2) MODE – PWR
   BUS SEL – MNA(MNB)
   6. EMU INPUT 1(2) volts = 18.0–20.0
DCM 7. PWR – SCU
   8. DISPLAY – ‘O2 POS – XX’
If PWR – BATT:
AW18H 9. PWR/BATT CHGR EMU 1(2) BUS SEL – OFF (7 sec)
DCM 10. PWR – BATT
   11. DISPLAY – ‘O2 POS – XX’
   12. If reqd, FAN – ON

VACUUM H2O RECHARGE (MANNED)

WARNING
Procedure should be used only if performing a contingency EVA

EV 1. Perform AIRLOCK INGRESS, Cuff C/L, 43 (Close hatch, partially engage latches)
   2. Helmet purge vlv – cl, locked
DCM 3. PURGE vlv – cl (dn)
   4. WATER – OFF
   If external airlock:
IV MO13Q 5. ARLK H2O S/O VLV – OP (tb–OP)
MD(flfr) 6. EMU O2 ISOL VLV – OP
ML86B:C 7. cb MNC EXT ARLK HTR LINE ZN 1,2 (two) – op
EV 8. Remove DCM cover
   9. Connect SCU to DCM
   10. COMM mode – HL
AW82B 11. EV–1(EV–2) O2 vlv – OP
AW18H 12. PWR/BATT CHGR EMU 1(2) BUS SEL – MNA(MNB)
DCM 13. PWR – SCU (fwd), WARN TONE
R11L If SPLY H2O XOVR VLV closed (tb–CL or bp) (water transfer config):
   14. SPLY H2O TKA OUTLET – CL (tb–CL)
   If SPLY H2O XOVR VLV open (tb–OP) (nominal config):
IV L1 15. RAD CNTLR OUT TEMP – NORM
   16. FLASH EVAP CNTLR PRI A,B (two) – OFF
ML31C 17. SPLY H2O TKD OUTLET – CL (tb–CL)
R11L 18. SPLY H2O TKB OUTLET – CL (tb–CL)
   TKA OUTLET – CL (tb–CL)
   TKC OUTLET – OP (tb–OP)
   SPLY – OP (tb–OP)


WARNING
O2 will be off. IV1 stand by inner hatch
Equal vlvs for emergency repress

EV DCM 20. 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

21. 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
If SPLY H2O XOVR VLV closed (tb–CL or bp) (water transfer config):

22. SPLY H2O TKA OUTLET – OP (tb–OP)

If SPLY H2O XOVR VLV open (tb–OP) (nominal config):

23. SPLY H2O TKC OUTLET – CL (tb–CL)
   TKB OUTLET – OP (tb–OP)

24. SPLY H2O TKD OUTLET – OP (tb–OP)

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

26. EMU 1(2) H2O SPLY – CL (tb–CL)
27. COMM mode – PRI(ALT)
28. ✓ COMM freq – LOW(HIGH)

NOTE
Disregard fault msgs until CWS updated with:

O2 ACT – EVA, WATER – ON, and H2O TEMP < 60

Go to DEPRESS/REPRESS Cue Card, DEPRESS, step 10
(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

1. Unstow new LiOH cartridge with aluminum plate serial number facing, remove caps (left first)
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. Restrain LiOH cartridge

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

6. Remove used cartridge
7. Holding new LiOH cartridge with aluminum plate serial number facing, install LiOH (attach Velcro retainer strap)

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

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

13. Close EMU thermal cover zipper
14. Place caps on used LiOH cartridge
15. Mark used cartridge, stow in middeck

When purge time = 2 min:

16. 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)

IV1

1. Unstow new battery

   CAUTION
   Do not allow battery to impact airlock wall

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:
3. √O2 ACT – IV
4. Helmet purge vlv – op
5. FAN – OFF
6. PWR – SCU

If degraded/dead battery:
7. √PWR – SCU
8. √O2 ACT – IV
9. Helmet purge vlv – op
10. FAN – OFF (fwd)
11. Open battery latch
12. Open LiOH cartridge latches

   CAUTION
   Vent loop is pressurized. Hold LiOH cartridge in place

13. Rotate LiOH cartridge outward until limited by Velcro retainer strap
14. Remove used battery
15. Install new battery (√connector alignment), latch
16. √LiOH cartridge seated, rotate downward until latch pins engage
17. Close LiOH cartridge latches

If no SCU power available:
18. PWR – BATT

DCM
19. FAN – ON (aft) (PWR RESTART may occur)
20. Helmet purge vlv – cl, locked
21. Close EMU thermal cover zipper
22. Perform EMU COLD RESTART (EMU CONT PROC)
23. Continue EVA Prep

* If LiOH cartridge seal broken, purge EMU,
* LiOH REPLACEMENT (EMU CONT PROC)
* begin at step 10
WATER DUMP

BOTH
1. Connect SCUs to DCM, \(\checkmark\) locked

DCM
2. PWR – BATT

---

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

---

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

DCM
4. PWR – SCU
   If WCS:
   5. \(\checkmark\) FAN SEP same as HOSE BLOCK
   6. MODE – COMMODE/MANUAL/EMU; posn guard over sw
      (\(\checkmark\) airflow, WCS ON lt on)

WCS
   If EDO WCS:
   7. \(\checkmark\) URINAL SEL sw same as URN DIV VLV
   8. Unstow urinal hose; posn guard strap over hose yoke (\(\checkmark\) airflow)

AW82D
9. \(\checkmark\) EMU 1,2 H2O SPLY (two) – CL (tb–CL)
   10. Remove Helmets, stow
   11. Install SCOFs, lock

DCM
12. O2 ACT – IV

AW82D
13. EMU 1,2 H2O WASTE reg (two) – MAN OP
14. EMU 1(2) H2O WASTE (one) – OP (tb–OP) (until H2O WP < 7
    and stable for \(\sim\) 1 min)
    – CL (tb–CL)
    – Repeat for other EMU

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

DCM
16. O2 ACT – OFF
   If WCS:
   17. MODE – AUTO (\(\checkmark\) WCS ON lt off)

WCS
   If EDO WCS:

EDO WCS
18. Stow urinal hose
SCU SWAP (UNMANNED)

BOTH DCM
1. □ FAN – OFF
2. □ O2 ACT – OFF
3. □ COMM mode – HL
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. BUS SEL (two) – MNA(MNB)
9. □ EMU INPUT 1,2 volts = 18.0–20.0
DCM 10. PWR – SCU

SCU SWAP (MANNED)

BOTH DCM
1. Temp control vlv – Max C
O6:A1R 2. Perform EVA COMM CONFIG (EVA PREP), steps 1,3,5
3. PWR – BATT
AW18H 4. PWR/BATT CHGR EMU 1,2 BUS SEL (two) – OFF
DCM 5. Swap SCUs
AW18H 6. □ PWR/BATT CHGR EMU 1,2 MODE (two) – PWR
7. BUS SEL (two) – MNA(MNB)
8. □ EMU INPUT 1,2 volts = 18.0–20.0
DCM 9. PWR – SCU
10. COMM mode – HL
11. 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 CHEMICAL CHECK/DECONTAMINATION

During EVA
If crew visually detects plume, white crystals, or “snow” coming from payload/vehicle

OR

If payload/vehicle chemical system leak suspected due to steady (not step function) decrease in pressure or temperature

1 If contamination is only suspected, MCC may direct crew to bypass blocks 6,8,9,10.

2 For vapor only leaks, blocks 18 thru 21 are reqd only if contamination test fails

3 During orbit night, the EMU should be in the airlock which is a warm environment. This raises the surface temperature of the EMU which increases the rate of contaminant sublimation

4 Because detection equipment is available for hydrazine and oxidizer, only one bakeout needs to be performed prior to airlock repress and contamination test

---

1. Contamination visually detected on EMU or plume/crystals seen contacting EMU?
   - NO
     - 2 EMU in vicinity of leak detected visually or by payload/vehicle instrumentation
     - YES
     - 3 Confirmed contamination

2. Suspect contamination
   - 5 Notify MCC

3. 6 Brush off crystals (Use hyd brush; leave in Node Bag)

4. 7 Continue EVA tasks not in vicinity of leak
   - As soon as practical, perform following block

5. 8 If orbit day:
   - Bake out in Sun for remainder of orbit day
   - Bakeout ≥ 30 min?
     - NO
       - 9 On MCC call:
         - If ≥ 10 min orbit night left:
           - Perform TERMINATE EVA (Cuff C/L, 7)
         - 10 min prior to orbit day:
           - Perform POST DEPRESS (Cue Card, DEPRESS/REPRESS)
           - Perform EGRESS (Cuff C/L, 42)
     - YES
       - 10 MCC for repeating blocks 8 and 9 based upon EMU consumables

6. Additional bakeout?
   - NO

7. If orbit night:
   - Perform INGRESS (Cuff C/L, 43)
   - Perform PRE DEPRESS (Cue Card, DEPRESS/REPRESS)
   - Perform REPRESS, steps 1 thru 6 only
   - Determine contamination type:
     - Shuttle Thrusters
     - ISS Thruster
     - Ammonia
When \( t = 2 \) hr or cabin PPCO2 = 7–10 mmHg, replace one ATCO can with one LiOH canister. If contamination is from ISS thrusters and contamination tests are inconclusive, perform block 19.
12.1 (Cont)

20
(L1)
• CAB TEMP CNTLR – OFF

(MD44F)
• Pin cab temp cntl act link – FULL COOL

21
(WCS)
• MODE – COMMODE/MANUAL/EMU
• COMMODE CNTL – PULL UP (wait 15 sec)
• COMMODE CNTL – PUSH FWD

22
• Continue REPRESS, steps 7 thru 10
  (DEPRESS/REPRESS Cue Card)
• IV crewmembers don ‘Quick Don’ Masks
• When ΔP < 0.5, open hatch
If hydrazine or ammonia contamination:
• IV crew pass wet towels and Ziploc bags
to EV crew
• Close hatch
• EV crew wipe EMUs and airlock with
towels (avoid electrical panels)
• Seal towels in bags
• Open hatch
• Perform BOOSTER FAN INSTALLATION/
  ACTIVATION (AIRLOCK CONFIG); start
  timer
• Yes MCC

Ammonia contamination?

23
When atmosphere mixing time complete:
• IV crewmembers remove QDMs attempt to
detect ammonia odor
• Notify MCC

24
On MCC call:
• Perform POST EVA

(L1)
• H2O PUMP LOOP 1 – GPC
• H2O LOOP 2 BYP MODE – AUTO

(MD44F)
• Pin cab temp cntl act link – PRI(SEC) ACT

(L1)
• CAB TEMP CNTLR – 1(2)
• CAB TEMP sel – adj rotary as desired

(WCS)
• COMMODE CNTL – OFF (BACK/ON)
• MODE – AUTO

(AW82A)
• Remove detector if reqd; stow in EVA Bag

5 IV crew must remain on the QDMs and EV crew must remain in EMU for as long as cabin PPO2 and EMU PPCO2 levels will allow. The minimum time breathing O2 should be 20 min following booster fan activation to allow for the two atmospheres to mix and to allow any localized pockets of contaminants to dissipate.
CONTAMINATION TEST

To be performed after airlock ingress and partial airlock repress following suspected hydrazine or oxidizer contamination

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

AW82B
2. Attach hydrazine detector cap over depress valve
3. ✓Helmet lights – OFF

AW18A
4. ✓LTG FLOOD (four) – ON

For suspected oxidizer contamination:
5. Tear open Dräger pouch
   ✓Initial tube color pale green

   * Use new tube if not proper color *

6. Insert arrow end of Dräger tube into detector holder

For suspected hydrazine contamination:
7. Tear open Gold Salt pouch
   ✓Initial coupon color white

   * Use new coupon if not proper color *

8. Insert indicator into detector holder

NOTE
Test performed at 5 psi. For oxidizer, depress for 1.5 min. For MMH and UDMH, depress for 10 min

9. AIRLK DEPRESS vlv – 5 (ALERT TONE may occur)

10. Wave detector near EMUs

11. After specified depress time, AIRLK DEPRESS vlv – CL
    (ALERT TONE may occur)

12. ✓Detector for color change. Determine if test failed based upon following criteria and inform MCC:
    Oxidizer – any gray/blue reacted crystals
    MMH – > 25 ppb
    UDMH – > 50 ppb

13. Continue 12.1 CHEMICAL CHECK/DECONTAMINATION
SAFER BATTERY CHANGEOUT (15 min)

PM
1. Install Inhibitor
2. MAN ISOL vlv – CL (up)
3. PWR – OFF

HCM
4. Loosen screws (eight) using 9/64–in Hex Wrench
5. Remove battery; disconnect battery umbilical connector
6. Mark, stow used battery
7. Obtain new battery
8. Record new battery serial number (SAFER CHECKOUT RESULTS Cue Card)
9. Connect battery umbilical connector; install battery
10. Tighten screws (eight)
11. 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 12–16)
3. Unzip PLSS TMG (avoid pulling on antenna cable)
4. Remove Impact Shield
5. Disconnect hatch marked cable P3 (see 12–16); 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 12–16) on BTA
8. Unstow poppet keeper screw from BTA, temp stow (in EMU Servicing Kit)

BTA TREATMENT
9. SCU connected to DCM
10. Connect BTA to PPRV (cw), locked

AW82B
11. EV–1(EV–2) O2 vlv – OP

MD (flr)
12. If external airlock: EMU O2 ISOL vlv – OP

DCM
13. PWR – SCU
14. FAN – ON
15. COMM MODE – HL, vol as reqd (for biomed downlink, COMM MODE – PRI(ALT))

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

If EDO WCS:
18. URINAL SEL sw same as URN DIV VLV
19. Unstow urinal hose; posn guard strap over hose yoke (√ airflow)

AW82D
20. EMU 1(2) H2O SPLY – CL (tb–CL)

AW82H
21. WASTE reg – MAN OP

AW82D
22. EMU 1(2) H2O WASTE – OP (tb–OP) (until H2O WP < 7 and stable for ~ 1 min)

AW82H
23. EMU 1(2) H2O WASTE – CL (tb–CL)
24. SPLY WASTE reg – REGULATING

If WCS:
25. MODE – AUTO (√ WCS ON lt off)
If EDO WCS:
26. Stow urinal hose
27. √ SUIT P = 4.2–4.4
28. O2 ACT – OFF (until SUIT P stabilizes)

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>If BTA gauge pressure increases while O2 ACT – PRESS, set O2 ACT – OFF immediately to prevent a hazardous condition; contact MCC. Note that the BTA gauge increases nominally when O2 ACT – OFF. Actual Suit P = 4.7–5.5 psi above BTA gauge pressure</td>
</tr>
</tbody>
</table>

29. O2 ACT – PRESS (for 15 sec), √ BTA gauge not increasing when O2 ACT – PRESS
30. O2 ACT – OFF, status to H2O GP, √ stable
31. 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:
32. Repeat steps 29,30

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>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</td>
</tr>
</tbody>
</table>

33. 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 12–16)
3. Unzip PLSS TMG (avoid pulling on antenna cable)
4. Remove Impact Shield
5. Disconnect or cut hatch marked cable P3 (see 12–16)
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 12–16) on BTA

If LiOH replacement reqd by MCC:
8. Unstow new LiOH cartridge
9. Remove, mark used LiOH cartridge
10. Holding new LiOH cartridge w/aluminum plate serial number facing self, remove caps (left first), install LiOH (attach Velcro retainer strap)
11. Install caps on used cartridge

BTA TREATMENT

12. \(\checkmark\) 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 12–16)
15. Connect BTA to PPRV (cw), \(\checkmark\) 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

CAUTION

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

AW82B 19. \(\checkmark\) EV–1(EV–2) O2 vlv – OP
MD (flr) 20. If external airlock: \(\checkmark\) EMU O2 ISOL vlv – OP
DCM 21. PWR – BATT

AW18H 22. PWR/BATT CHGR EMU 1(2) MODE – PWR
23. BUS SEL – MNA(MNB)
DCM 24. PWR – SCU
25. \(\checkmark\) Waist ring – op
26. Don lower torso; as reqd, attach donning handles
27. \(\checkmark\) Suit arms aligned
28. \(\checkmark\) Wrist disconnects – op
29. Remove cooling garment connector jumper
30. Don thumb loops
31. \(\checkmark\) Biomed connector outside of HUT
32. Don upper torso
33. Release thumb loops
34. \(\checkmark\) Suit arms aligned
35. Don comm cap
36. √COMM MODE – HL, vol as reqd (for biomed downlink, perform EVA COMM CONFIG (EVA PREP))
37. Connect biomed to elec harness
38. Connect cooling garment, √locked
39. √Thermal cover clear of waist ring
40. Waist ring – engage posn
41. Connect waist ring, √locked
42. Wrist rings – engage posn
43. Don EV Gloves, √locked
44. √Elec harness clear of neck ring
45. √Mike boom posn

DCM

36. FAN – ON
37. Don helmet, √locked
38. Helmet purge vlv – cl, locked
49. PURGE vlv – op
50. O2 ACT – PRESS, begin purge clock (12 min)

If WCS:

WCS

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

If EDO WCS:

53. √URINAL SEL sw same as URN DIV VLV
54. Unstow urinal hose; posn guard strap over hose yoke (√airflow)

AW82D

55. √EMU 1(2) H2O SPLY – CL (tb–CL)

AW82H

56. WASTE reg – MAN OP

AW82D

57. WASTE – OP (tb–OP)

When N2 purge time = 12 min:

58. EMU 1(2) H2O WASTE – CL (tb–CL)

AW82H

59. SPLY WASTE reg – REGULATING

If WCS:

WCS

60. MODE – AUTO (√WCS ON lt off)

If EDO WCS:

61. Stow urinal hose

DCM

62. PURGE vlv – cl (dn)
63. √Suit P = 4.2–4.4
64. O2 ACT – OFF (until Suit P incr stabilizes)
65. – PRESS (for 15 sec)
66. Repeat steps 64,65 until Suit P = 6.0 psig on BTA gauge

NOTE

BTA relief valve relieves at 8.04–8.45 psig

As reqd to maintain Suit P = 6.0 psig:

67. Repeat steps 64,65
68. Contact Surgeon for treatment length and changes in treatment pressure
Nut

Poppet keeper screw w/o BTA (install in PPRV for POST SUIT DOFFING proc only)

Positive pressure relief valve

Gauge

Relief valve

Test port F plug stow port

Black alignment stripe

P3 connector

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 on 12–18 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

4. Disconnect lower arm power harness from gloves and upper arm

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 (Prep Kit)

13. Lock 1 – OPEN (on arm, lock may reengage due to bladder)

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.
DAP/EVA RESCUE/RETRIEVE

EVA ORBITER CONFIGURATION ......................................................... 13–2
RESCUE/RETRIEVE ................................................................. 13–4
EVA ORBITER CONFIGURATION

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 +0.1
  √ITEM 37 +0.0 5

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.

   ![Initial Configuration Actions Table]

3. **POST–EVA RECONFIGURATION**
   Return orbiter to desired/required systems configs.
EVA RESCUE/RETRIEVE

NOTE
Assumes that EVA ORBITER CONFIGURATION 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 ✓ 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
ORBITER CONTINGENCY EVA

PAYLOAD BAY EVA NOMENCLATURE ........................................ 14–2
RMS/PRLA CONTINGENCY EVA ...................................................... 14–3
96 BOLT PRE-EVA TOOL CONFIG ............................................... 14–13
   EVA TIMELINE ............................................................... 14–14
CAPTURE LATCH MANUAL RELEASE (ODS/PMA) ............................ 14–19
96 BOLT EVA LAYOUT ............................................................. 14–21
RMS/PRLA CONTINGENCY EVA

FOR RMS/PRLA FAILURES:

### PRE EVA RMS CONFIG

1. **If MRL fails to latch:**
   - A8L: RMS R–F–L tb (three) – gray
   - RMS tb – STO
     - Go to RMS TIEDOWN

2. **If MPM fails to stow(deploy):**
   - A8L: RMS RETEN LAT – LAT (tb–LAT)
   - MPMs stowed(deployed) as far as possible
     - Go to MPM STOW/DEPLOY

3. **If Joint fails:**
   - Position RMS for easy striker bar access
   - Go to RMS JOINT ALIGN

### PRE EVA EE/GF CONFIG

2. **BRAKES** – ON (tb–ON)
   - EE MODE – OFF
   - A8L RMS SEL – OFF
     - Go to RMS FLIGHT RELEASABLE GRAPPLE FIXTURE RELEASE

### PRE EVA PRLA CONFIG

3. **cb MCA PWR AC1 3Φ MID 1 – op**
   - 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
FOR RMS/PRLA FAILURES (Cont):

**RMS TIEDOWN**

**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 PM, 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

**MPM STOW/DEPLOY**

**IV** 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, $X_0=693$
RMS/PRLA CONTINGENCY EVA (Cont)

RMS TIEDOWN

NOTE: DO NOT REMOVE BLANKET AT THIS JOINT

9467. ART; 3

EVA/ALL/GEN G
RMS/PRLA CONTINGENCY EVA (Cont)

FOR RMS/PRLA FAILURES (Cont):

RMS JOINT ALIGN

IV

- If Joint Fail – reposition RMS as reqd for
  RMS rope attachment
- monitor EV1 and EV2

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
IV1

3. Reposition RMS as required for cradling
4. Pull RMS down into MPMs
5. Perform final positioning by hand to allow MRLs to
   latch

EVA CUFF C/L 34 10/29/93

IV

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):

<table>
<thead>
<tr>
<th><strong>RMS FLIGHT RELEASABLE GRAPPLE FIXTURE RELEASE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RMS FLIGHT RELEASABLE</strong></td>
</tr>
<tr>
<td><strong>GRAPPLE FIXTURE RELEASE</strong></td>
</tr>
<tr>
<td>AIRLOCK – JETTISON STOWAGE BAG</td>
</tr>
<tr>
<td>TOOL BOX – 1/2-in BOX RATCHET, VELCRO/TAPE</td>
</tr>
</tbody>
</table>

**EV**

1. Rotate white release rod ccw to hard stop (32 strokes of 90 deg)
2. Rotate black release rod cw to hard stop (32 strokes of 90 deg – shaft will release from grapple fixture)
3. Clear worksite for RMS powerdown:
   - RMS SEL – PORT
   - Perform **RMS POWERDOWN** (PDRS OPS)

**IV A8**

4. Tape end of shaft to restrain slug within shaft
5. Cover end effector with jettison stowage bag to restrain grapple shaft

**EVA CUFF C/L**

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**VISUAL AID**

- **RELEASE ROD**
  - **POSITIONING LINES**
    - **WHITE**
- **10 O’CLOCK POSITION**
- **4 O’CLOCK POSITION**
- **WRENCH ACCESS CUTOUT** *(TYP)*
- **COLOR DARK GRAY**
- **BLACK RELEASE ROD**

---

**RMS FLIGHT RELEASABLE GRAPPLE FIXTURE RELEASE**

**IV A8 RMS SEL – PORT**

**Perform RMS POWERDOWN** *(PDRS OPS)*

---

**EVA CUFF C/L**

37 | 09/30/96
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

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

FOR RMS/PRLA FAILURES (Cont):

<table>
<thead>
<tr>
<th>PRLA OPEN/CLOSE</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refer to EVA RELEASABLE PAYLOAD RETENTION LATCHES figures, 14–11, 14–12, as reqd</td>
<td></td>
</tr>
</tbody>
</table>

**PRLA OPEN/CLOSE**

**AIRLOCK–RATCHET WITH 7/16 SOCKET**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>√PRLA PWR OFF</td>
</tr>
<tr>
<td>EV</td>
<td>1. Rotate ratchet in release direction (as marked above EVA drive) to shear pin</td>
</tr>
<tr>
<td></td>
<td>2. View yellow indicator as applicable</td>
</tr>
<tr>
<td></td>
<td>3. Continue to rotate drive 4–1/2 revs to disc gear train from drive shaft</td>
</tr>
<tr>
<td></td>
<td>To open latch:</td>
</tr>
<tr>
<td></td>
<td>4. Continue rotation in release direction (as marked above EVA drive) until latch open against stop</td>
</tr>
<tr>
<td></td>
<td>To close latch:</td>
</tr>
<tr>
<td></td>
<td>5. Rotate EVA drive in opposite direction of release (as marked above EVA drive) until latch closed against hardstop and over center</td>
</tr>
<tr>
<td>IV</td>
<td>√PRLA tb LAT</td>
</tr>
</tbody>
</table>

Cont next page

| EVA CUFF C/L | 38 | 07/20/00 |

**PRLA OPEN/CLOSE (CONT)**

| EV | 6. Apply PRLA locking feature if applicable |
|    | To lock: |
|    | 7. Rotate each bolt (2) cw 1/2 turn |
|    | For subsequent PRLA ops, release locking feature before operating EVA drive (2 bolts ccw 1/2 turn); relock after operation |

| EVA CUFF C/L | 39 | 07/20/00 |

| IV | MA73C:C cb MCA PWR AC1 3Φ MID 1 – cl |
| :D | AC2 3Φ MID 3 – cl |
| A6U | √PL RETEN LAT 1(2,3,4,5) tb – LAT(REL) |

**POST EVA RMS CONFIG**

| IV | A8U | √BRAKES – ON (tb–ON) |
|    | Complete RMS POWERDOWN (PDRS OPS) |

| 10 |

EVA CUFF C/L 38 07/20/00

EVA CUFF C/L 39 07/20/00
RMS/PRLA CONTINGENCY EVA (Cont)

In-board end of shaft has yellow marks. Not aligned indicates motor disengaged.

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

MMWL
MODIFIED MIDDLEWEIGHT LATCH

EVA RELEASABLE PAYLOAD RETENTION LATCHES

EVA/ALL/GEN G
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:**
- PGT Spare Battery
- Socket Caddies w/6-in Exts (2), RAD (Spare)

**Configure Crewlock EVA Bag:**
- GP Caddies (2)
- PGTs w/Batteries (2)

**Configure Adj Fuse Tether with one of following:**

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

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

**Fwd Bulhead:**
- PFR

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

**Stow Adj Fuse Tether 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></td>
<td></td>
<td>1. Perform DEPRESS (DEPRESS/REPRESS)</td>
<td>2. Perform DEPRESS (DEPRESS/REPRESS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Perform POST DEPRESS (DEPRESS/REPRESS)</td>
<td>4. Perform POST DEPRESS (DEPRESS/REPRESS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Perform AIRLOCK EGRESS (CUFF C/L, 42)</td>
<td>6. Perform AIRLOCK EGRESS (CUFF C/L, 42)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Add the following steps to AIRLOCK EGRESS:</td>
<td>Add the following steps to AIRLOCK EGRESS:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6a. Translate to GO2 ISOLATION VALVE on outside of airlock (aft port side)</td>
<td>6e. ∆ODS hatch ∆P &lt; 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6b. Open thermal cover; remove pip pin</td>
<td>6f. Open ODS Hatch per decal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6c. GO2 XFER ISO VLV – CL AW64L(E)</td>
<td>6g. Remove docking lights (two):</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6d. Re–install pip pin; close thermal cover</td>
<td>Release elec connector (one) at each light pip pin (one) on each light boom; stow in bag</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6h. Remove Cross–Hair assembly; stow in bag</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6i. VENT – OP; FLOW – OP GN2 XFER PANEL</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6j. VENT – OP; FLOW – OP GO2 XFER PANEL</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6k. Pressure gauges (two) – zero</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6l. Close ODS hatch per decal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6m. ODS Equal vlvs (two) capped</td>
</tr>
</tbody>
</table>

-00:25 ML86B:D 1. cb MNA MMU GN2 SPLY ISOL VLV A – cl
R13L 2. MMU GN2 SPLY ISOL VLV A – CL (tb–CL)
ML86B:D 3. cb MNA MMU GN2 SPLY ISOL VLV A – op

-00:20 √DOCKING MECHANISM POWERDOWN (RNDZ, APDS) before start of EVA
Confirm TCS powerdown

00:00 MET at PWR – BATT

00:15 5. Perform AIRLOCK EGRESS (CUFF C/L, 42)
Add the following steps to AIRLOCK EGRESS:

00:30 √ODS powered down

AW64L(E)

GN2 XFER PANEL
GO2 XFER PANEL
### 96 BOLT EVA TIMELINE (Cont)

<table>
<thead>
<tr>
<th>PET</th>
<th>IV/RMS</th>
<th>EV1</th>
<th>EV2</th>
</tr>
</thead>
<tbody>
<tr>
<td>01:00</td>
<td></td>
<td>PAYLOAD BAY SETUP</td>
<td>PAYLOAD BAY SETUP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Retrieve 96 Bolt Bag from Node Bag</td>
<td>1. Retrieve following items from port TSA:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Attach 96 Bolt Bag to Ext A/L Truss near port TSA</td>
<td>PRDs (2)</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>Large Cutter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Retrieve GP Caddy from Adj Fuse Tether; attach to MWS</td>
<td>2. Close and latch TSA door</td>
</tr>
<tr>
<td>01:20</td>
<td></td>
<td>TOOL CONFIG</td>
<td>3. Temp stow PRDs (two) on Truss</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Retrieve Right Angle Drives from 96 Bolt Bag and meet EV2 at Adj Fuse Tether</td>
<td>4. Temp stow Large Cutter on stbd ODS using Adj Equip Tether</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>5. Retrieve Adj Fuse Tether from A/L; temp stow on Truss</td>
</tr>
<tr>
<td></td>
<td>PGΤ: 25.5 ft–lb, CCW2,30.5</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>6. Remove thermal blanket covering ODS bolts; temp stow in A/L with Adj Equip Tether</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>7. Retrieve GP Caddy from Adj Fuse Tether; attach to MWS</td>
</tr>
<tr>
<td>01:45</td>
<td></td>
<td>CAUTION</td>
<td>CAUTION</td>
</tr>
<tr>
<td></td>
<td></td>
<td>During clamp installation, do not apply any sideload on ODS gusset (may puncture A/L)</td>
<td>During clamp installation, do not apply any sideload on ODS gusset (may puncture A/L)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>INSTALL CLAMP – STBD</td>
<td>INSTALL CLAMP – PORT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Tether ODS Clamp to handrail at worksite</td>
<td>1. Tether ODS Clamp to handrail at worksite</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Release bolts 35 to 38 (four); pull to lock up</td>
<td>2. Release bolts 83 to 86 (four); pull to lock up</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Retract Clamp pip pin</td>
<td>3. Retract Clamp pip pin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Install clamp between bolts 36,37</td>
<td>4. Install clamp between bolts 84,85</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Set clamp</td>
<td>5. Set clamp</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Turn bolt at top of clamp until upper jaws contact vestibule ring, then add‘l 3/4 turn; insert pip pin</td>
<td>Turn bolt at top of clamp until upper jaws contact vestibule ring, then add‘l 3/4 turn; insert pip pin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. √ Clamp Handle locked</td>
<td>6. √ Clamp Handle 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>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>02:05</td>
<td>Record Cables cut at following locations:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bolt 32 – 1 cable</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bolt 24 – 7 cables</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bolt 21 – 1 cable</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bolt 19 – 1 cable</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bolt 1 – 1 cable</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bolt 95 – 2 cables</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bolt 74 – 2 cables</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bolt 69 – 3 cables</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Line 69 – 1 line N2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Line 66 – 1 line O2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bolt 51 – 1 cable</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bolt 47 – 2 cables</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PGT: 25.5 ft–lb, CCW2, 30.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**IF PFR REQUIRED:**
1. Retrieve Art Socket and Bridge Rail Clamp from 96 Bolt Bag
2. Install bridge rail clamp and art socket on stbd bridge rail in aft–most available half–hole, knob inboard
3. Retrieve PFR from port side

**PFR SETUP FOR CLAMP INSTALL**
1. Art Socket: P = 2, Y = 6
2. PFR: P = 10, R = A, Y = 8

**WARNING**
Cut ends of O2 and N2 lines present sharp edge hazard

**USE BRT FOR BOLT RELEASE**
1. Release bolts 1–33, 40–48 and grounding strap between bolts 9 and 10

**SURVEY VESTIBULE**
1. All bolts except 34,39,82,87 locked up
2. All cables cut (21), all gas lines cut (two), and ground strap removed
3. All tools, tethers removed from vestibule
4. Separation plane clear of all cables and lines

<p>| | | | |</p>
<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>03:15</td>
<td>USE BRT FOR BOLT RELEASE</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Release bolts 49–81, 88–96</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SURVEY VESTIBULE**
1. All bolts except 34,39,82,87 locked up
2. All cables cut (21), all gas lines cut (two), and ground strap removed
3. All tools, tethers removed from vestibule
4. Separation plane clear of all cables and lines

**CUT CABLES AND LINES**
1. Use Large Cutter to cut all cables at 96 bolt interface
2. Bend cables w/cutter to verify cables separated
3. Stow Large Cutter on available handrail

**WARNING**
Cut ends of O2 and N2 lines present sharp edge hazard

**USE BRT FOR BOLT RELEASE**
1. Release bolts 49–81, 88–96

**SURVEY VESTIBULE**
1. All bolts except 34,39,82,87 locked up
2. All cables cut (21), all gas lines cut (two), and ground strap removed
3. All tools, tethers removed from vestibule
4. Separation plane clear of all cables and lines

### 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 66 – 1 line O2
- Bolt 51 – 1 cable
- Bolt 47 – 2 cables

**PGT:** 25.5 ft–lb, CCW2, 30.5
<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><strong>FREE DRIFT</strong>&lt;br&gt;PGT: 25.5 ft-lb, CCW2, 30.5</td>
<td><strong>PREP FOR RELEASE</strong>&lt;br&gt;1. Receive PRD from temp stow on Truss&lt;br&gt;2. Attach PRD fixed end to handrail, retractable end to Clamp Handle&lt;br&gt;3. Before releasing last two bolts, <strong>FREE DRIFT</strong>&lt;br&gt;4. Release bolts 34,39; pull to lock up&lt;br&gt;5. Notify IV, GO for Clamp Release</td>
<td><strong>PREP FOR RELEASE</strong>&lt;br&gt;1. Receive PRD from temp stow on Truss&lt;br&gt;2. Attach PRD fixed end to handrail, retractable end to Clamp Handle&lt;br&gt;3. Before releasing last two bolts, <strong>FREE DRIFT</strong>&lt;br&gt;4. Release bolts 82,87; pull to lock up&lt;br&gt;5. Notify IV, GO for Clamp Release</td>
</tr>
<tr>
<td>03:50</td>
<td>Give EV GO for Clamp Release</td>
<td><strong>CLAMP RELEASE</strong>&lt;br&gt;1. Retract Clamp Handle pip pin; <strong>green stripe visible</strong>&lt;br&gt;2. Coordinate with IV and give EV2 short count for simo release&lt;br&gt;3. Simo with EV2, pull on PRD strap to open clamp&lt;br&gt;4. After clamp open, inform IV, “Clamp open and EV1 clear”</td>
<td><strong>CLAMP RELEASE</strong>&lt;br&gt;1. Retract Clamp Handle pip pin; <strong>green stripe visible</strong>&lt;br&gt;2. Simo with EV1, pull on PRD strap to open clamp&lt;br&gt;3. After clamp open, inform IV, “Clamp open and EV2 clear”</td>
</tr>
<tr>
<td>04:00</td>
<td><strong>SEPARATION BURN</strong></td>
<td><strong>CLEANUP</strong>&lt;br&gt;1. Translate to TSA w/96 Bolt Bag&lt;br&gt;2. Remove Right Angle Drives (two) from PGTs (two) using pip pin on 96 Bolt Bag; stow in 96 Bolt Bag&lt;br&gt;3. Remove ODS Clamp and Handle from ODS gusset; stow Clamp, Handle, 7/16-in Box End Wrench in 96 Bolt Bag&lt;br&gt;4. Stow Waist Tether on EMU&lt;br&gt;5. Remove and stow 96 Bolt Bag in airlock&lt;br&gt;6. Stow PRD, Trash Bag in Port TSA&lt;br&gt;7. Close TSA door, close all latches&lt;br&gt;IF USED:&lt;br&gt;6. Configure stbd PFR assy for landing:&lt;br&gt;   Bridge Rail Clamp: second to aft–most available half-hole; <strong>knob locked</strong>&lt;br&gt;7. Art Socket: <strong>P = 11.5, Y = 3; locked</strong>&lt;br&gt;8. PFR to EV2 port side</td>
<td><strong>CLEANUP</strong>&lt;br&gt;1. Translate to TSA&lt;br&gt;2. Stow PGTs (two) on Adj Fuse Tether&lt;br&gt;3. Stow Adj Fuse Tethers in airlock&lt;br&gt;4. Remove ODS Clamp and Handle from ODS gusset; stow Clamp, Handle, 7/16-in Box End Wrench in 96 Bolt Bag&lt;br&gt;5. Stow Waist Tether on EMU&lt;br&gt;6. Stow Large Cutter, Trash Bag, PRD in Port TSA&lt;br&gt;7. Close TSA door, close all latches&lt;br&gt;IF USED:&lt;br&gt;8. Configure port PFR socket assy for landing:&lt;br&gt;   Bridge Rail Clamp: second to fwd–most available half-hole; <strong>knob locked</strong>&lt;br&gt;9. Art Socket: <strong>P = 11.5, Y = 3; locked</strong>&lt;br&gt;10. PFR: <strong>P = 10, R = A, Y = 6; locked</strong></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>
<tbody>
<tr>
<td>04:40</td>
<td></td>
<td>VERIFY 96 BOLT BAG STOWAGE</td>
<td>VERIFY AIRLOCK STOWAGE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ODS Clamps (2)</td>
<td>Adj Fuse Tethers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ODS Clamp Handles (2)</td>
<td>PGTs w/batteries (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Right Angle Drives with 7/16–in Socket (2)</td>
<td>GP Caddies (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7/16–in Box End Wrenches (2)</td>
<td>ODS Thermal Blankets with Adj Equip Tethers (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>96 Bolt Bag</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Crewlock Bag:</td>
</tr>
<tr>
<td>05:15</td>
<td></td>
<td>PERFORM AIRLOCK INGRESS, CUFF C/L, 43</td>
<td>PERFORM AIRLOCK INGRESS, CUFF C/L, 43</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ EMU equipment:</td>
<td>✓ EMU equipment:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MWS w/swing arm</td>
<td>MWS w/swing arm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BRT</td>
<td>BRT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Retractable Tethers (2)</td>
<td>Retractable Tethers (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adj Equip Tethers (2)</td>
<td>Adj Equip Tethers (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Waist Tethers (2)</td>
<td>Waist Tethers (2)</td>
</tr>
<tr>
<td>05:30</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### CAPTURE LATCH MANUAL RELEASE (ODS/PMA)

<table>
<thead>
<tr>
<th>IV</th>
<th>EV</th>
</tr>
</thead>
</table>
| If APDS powered: | **TOOLS REQD**  
Jettison Stowage Bag  
Russian Capture Latch Tool (if reqd, in Node Bag) |
| A7  
pb PWR OFF – push  
✓ STATUS It (eighteen) – off  
Perform DOCKING MECHANISM POWERDOWN (RNDZ, APDS) | BOTH 1. Configure Waist Tethers as safety line inside ODS |
| | EV1  
Attach at ODS Hatch D–ring nearest capture latches |
| | EV2  
Attach at A/L D–ring behind EV1 |
| | EV2 2. Open outer hatch to improve EMU sublimator performance |
| | EV1 3. ODS/PMA interface:  
Open ODS hatch  
Remove docking lights (two):  
Release elec connector (one) at each light  
pip pin (one) on each light boom  
Stow lights and booms in bag  

**NOTE**  
EV2 restrain/aid EV1 as reqd |
| | EV1 4. Remove Cross–Hair assembly  
Stow in bag |
| | 5. ✓ IV GO for release |
| | 6. Release capture latch |

Cont next page

Cont next page
<table>
<thead>
<tr>
<th>IV</th>
<th>EV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NOTE</td>
</tr>
<tr>
<td></td>
<td>If reqd, EV2 retrieve Russian Capture Latch Tool from Node Bag (requires safety tether reel ops)</td>
</tr>
<tr>
<td></td>
<td>7. Notify IV when capture latch released</td>
</tr>
<tr>
<td></td>
<td>8. Close hatch at capture latch interface</td>
</tr>
<tr>
<td>EV2</td>
<td>9. If used, temp stow Russian Capture Tool in A/L and perform AIRLOCK INGRESS (CUFF C/L, 43)</td>
</tr>
<tr>
<td>BOTH</td>
<td>10. Close outer hatch</td>
</tr>
<tr>
<td></td>
<td>11. Go to A/L REPRESS</td>
</tr>
</tbody>
</table>
96 BOLT EVA LAYOUT

- GAS LINES
- WIRE BUNDLES
* - BRIDGE CLAMP LOCATION IS FWD-MOST OR AFT-MOST HALF-HOLE AVAILABLE
○ - LAST BOLTS BEFORE CLAMP RELEASE

NOTE: 8-9 TURNS CCW TO LOOSEN BOLTS (16-2 TURNS ON RIGHT ANGLE DRIVE)
# EVA Cuff Checklist

<table>
<thead>
<tr>
<th>Description</th>
<th>Page</th>
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<tbody>
<tr>
<td>Normal EVA Status</td>
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<tr>
<td>EVA Comm Frequencies</td>
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<td>EMU Mal Index</td>
<td>15–2</td>
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<tr>
<td>Decompression Sickness (DCS)</td>
<td>15–3</td>
</tr>
<tr>
<td>Abort EVA</td>
<td>15–3</td>
</tr>
<tr>
<td>Terminate EVA</td>
<td>15–3</td>
</tr>
<tr>
<td>SOP O2 ON</td>
<td>15–4</td>
</tr>
<tr>
<td>Batt Amps High</td>
<td>15–4</td>
</tr>
<tr>
<td>VDC Low</td>
<td>15–4</td>
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<tr>
<td>Suit P Low</td>
<td>15–5</td>
</tr>
<tr>
<td>High</td>
<td>15–5</td>
</tr>
<tr>
<td>SOP P Low</td>
<td>15–5</td>
</tr>
<tr>
<td>O2 Use High</td>
<td>15–5</td>
</tr>
<tr>
<td>Sublim Press</td>
<td>15–5</td>
</tr>
<tr>
<td>H2O GP Low</td>
<td>15–6</td>
</tr>
<tr>
<td>Resrv H2O ON</td>
<td>15–6</td>
</tr>
<tr>
<td>No Vent Flow</td>
<td>15–6</td>
</tr>
<tr>
<td>CO2</td>
<td>15–6</td>
</tr>
<tr>
<td>Comm Failure</td>
<td>15–7</td>
</tr>
<tr>
<td>Misc Msgs</td>
<td>15–7</td>
</tr>
<tr>
<td>Air Flow Contamination</td>
<td>15–7</td>
</tr>
<tr>
<td>Radiator Actuator Disconnect</td>
<td>15–8</td>
</tr>
<tr>
<td>PLBD Drive Cut</td>
<td>15–8</td>
</tr>
<tr>
<td>Door Drive Restraint</td>
<td>15–8</td>
</tr>
<tr>
<td>Disconnect</td>
<td>15–9</td>
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<tr>
<td>Winch Operations</td>
<td>15–9</td>
</tr>
<tr>
<td>3–PT Tool Installation</td>
<td>15–9</td>
</tr>
<tr>
<td>CL Latch Tool</td>
<td>15–10</td>
</tr>
<tr>
<td>Tool Reset</td>
<td>15–10</td>
</tr>
<tr>
<td>Airlock Latch Disconnect</td>
<td>15–10</td>
</tr>
<tr>
<td>Hinge Disconnect</td>
<td>15–10</td>
</tr>
<tr>
<td>RMS Joint Align</td>
<td>15–10</td>
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<tr>
<td>Shoulder Brace Release</td>
<td>15–10</td>
</tr>
<tr>
<td>MPM Stow/Deploy</td>
<td>15–10</td>
</tr>
<tr>
<td>RMS Tiedown</td>
<td>15–11</td>
</tr>
<tr>
<td>Flight Releasable Grapple Fixture Release</td>
<td>15–11</td>
</tr>
<tr>
<td>PRLA Open/Close</td>
<td>15–11</td>
</tr>
<tr>
<td>Ku Antenna Stow</td>
<td>15–12</td>
</tr>
<tr>
<td>Airlock Egress</td>
<td>15–12</td>
</tr>
<tr>
<td>Ingress</td>
<td>15–12</td>
</tr>
</tbody>
</table>
EVA CUFF C/L

EVA NORMAL EVA STATUS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>O2 POS</td>
<td></td>
</tr>
<tr>
<td>TIME EV</td>
<td>HR:MIN since PWR-BATT</td>
</tr>
<tr>
<td>TIME LF/</td>
<td>HR:MIN remaining at present use rate</td>
</tr>
<tr>
<td>Limit consum</td>
<td>INDEX</td>
</tr>
<tr>
<td>O2 (PWR) LF</td>
<td>Displayed if not limiting consumable</td>
</tr>
<tr>
<td>SUIT P</td>
<td>4.2-4.4 psid</td>
</tr>
<tr>
<td>O2 P</td>
<td>60-900 psia</td>
</tr>
<tr>
<td>SOP P</td>
<td>5800-6800 psia</td>
</tr>
<tr>
<td>SUBLM P</td>
<td>2.0-4.2 psia</td>
</tr>
<tr>
<td>BAT VDC</td>
<td>16.3-17.0</td>
</tr>
<tr>
<td>BAT AMP</td>
<td>3.0-4.0</td>
</tr>
<tr>
<td>RPM</td>
<td>19.0-20.0 K</td>
</tr>
<tr>
<td>CO2</td>
<td>0.2-0.5 mm</td>
</tr>
<tr>
<td>H2O TEMP</td>
<td>32-75 degF</td>
</tr>
<tr>
<td>H2O GP/WP</td>
<td>14.0-16.0 psid</td>
</tr>
<tr>
<td>GAUGE</td>
<td>4.2-4.4 psid</td>
</tr>
</tbody>
</table>

DCM | LOCK-LOCK | 02 ACT | INCR | ALT |

EMU MAL INDEX

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABORT EVA</td>
<td>6</td>
</tr>
<tr>
<td>AIR FLOW CONT</td>
<td>23</td>
</tr>
<tr>
<td>BATT AMPS HI</td>
<td>9</td>
</tr>
<tr>
<td>BATT VDC LOY</td>
<td>10</td>
</tr>
<tr>
<td>BITE light</td>
<td>21</td>
</tr>
<tr>
<td>COMM FAIL</td>
<td>20</td>
</tr>
<tr>
<td>CO2 HIGH</td>
<td>19</td>
</tr>
<tr>
<td>DCS</td>
<td>4</td>
</tr>
<tr>
<td>FAN SW OFF</td>
<td>22</td>
</tr>
<tr>
<td>H2O GP LOW</td>
<td>16</td>
</tr>
<tr>
<td>H2O IS OFF</td>
<td>22</td>
</tr>
<tr>
<td>LIMITS BAD</td>
<td>21</td>
</tr>
<tr>
<td>MONITOR CO2</td>
<td>19</td>
</tr>
<tr>
<td>NO VENT FLOW</td>
<td>18</td>
</tr>
<tr>
<td>O2 IS OFF</td>
<td>22</td>
</tr>
<tr>
<td>O2 USE HIGH</td>
<td>14</td>
</tr>
</tbody>
</table>

NOTE: BOLDFACE ind detailed proc
DECOMPRESSION SICKNESS (DCS)

Class 1
Symp: Mild pain (single/multiple sites) and/or single extremity numbness/tingling. Difficult to discern from suit P points. Symp do not interfere with performance.
Action: Report in POST EVA PMC

Class 2
Symp: Moderate Class 1 symp that interfere with performance or symp that resolve upon repress.
Action: Perform worksite cleanup, minimize activity of affected crewmember. TERM EVA; REPRESS

DECOMPRESSION SICKNESS (DCS) (CONT)

Class 3
Symp: Severe Class 1 symp or migratory, trunkal/multiple site numbness/tingling, unusual headache
Action: Assist affected crewmember to A/L, safe PLB, TERM EVA; REPRESS

Class 4
Symp: Serious symp - 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

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

AW18H 3. PWR/BATT CHGR EMU 1(2) BUS SEL - MNA(MNB)
IV 1. If EXT A/L: EMU O2 ISOL VLV - OP
AW82B 4. EV-1(EV-2) 02 VLV - OP

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

DCM 5. Power - SCU (fwd)
6. WATER - OFF (fwd)
7. SUIT P ≥ 3.3 and stable
8. Monitor EMU status
9. Coordinate ingress with EVI(2)

TERM EVA

6 07/20/97
7 04/01/99

EVA/ALL/GEN G
SOP 02 ON

1. Go to ABORT EVA, 6 >>

NOTE
Msg triggered when:
- SUIT P < 4.05 and
- SOP RATE > 36.0 psi/min

BATT VDC LOW

If fan RPMs degraded and/or comm lost:
1. Go to TERM EVA, 7 >>
If comm and fan normal (sensor fail):
2. Continue EVA

NOTE
Msg triggered when VOLTS < 15.7
Normal BATT VDC = 16.3-17.0
Normal Fan RPM = 19.0-20.0 K

BATT AMPS HIGH

If BATT VDC < 16.3:
1. Helmet purge vlv - op
2. FAN - OFF
3. WATER - OFF
   - If BATT AMP w/o fan 0.7-1.3 (fan short):
     4. Go to TERM EVA, 7 >>
   - If BATT AMP w/o fan > 1.3 (system short):
     5. Notify IV/EV of impending COMM loss
     6. PWR - SCL, do not activate airlock power
     7. Go to TERM EVA, 7 >>
If BATT VDC > 16.3 (amp sensor fail):
8. Fan RPM 19.0-20.0 K
9. Continue EVA, monitor BATT VDC, RPM

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

SUIT P LOW

If 02 USE HIGH msg present:
1. Go to ABORT EVA, 6 >>
If 02 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 02 Rate XX.X  SOP Rate XXX

If 02 Rate > 7.0 or SOP Rate > 8 :
1. Go to TERM EVA, 7 >>
If 02 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 02 Rate = 1.7 psi/min

SOP P LOW

SOP P Low  SOP P XXXQ  SOP Rate XXX

1. Go to TERM EVA, 7 >>

NOTE
Msg triggered when SOP P < init SOP P - 600
(SOP P initialized at EMU powerup)

02 Use
SUBLM Press

02 USE HIGH

02 Use High 02 Rate XX.X

If SUIT P Low msg present :
1. Go to ABORT EVA, 6 >>
If 02 P erratic or ~0 :  
2. Continue EVA
3. Recharge 02 periodically >>
If 02 RATE > 7.0 x:
4. Go to TERM EVA, 7 >>

Otherwise:
5. Recharge 02 as reqd
6. Continue EVA

NOTE
Msg triggered when:
02 RATE > 10.2 psi/min or
02 P < 150 and TIME EV < 5 hr
Normal 02 RATE = 1.7 psi/min

SUBLM PRESS

SUBLM XX.X  SET H2O OFF

1. WATER - OFF (fwd)
   If SUBLM P < 1.0 and stable:
   When cooling desired, then:
   2. Temp control vlv - Max H
   3. WATER - ON (aft)
   4. Temp control vlv - as reqd
      if cooling Insufficient:
      5. Go to TERM EVA, 7 >>
      if cooling sufficient:
      6. Continue EVA, monitor SUBLM P
         and cooling >>
   If SUBLM P > 1.0 and stable (sensor fail):
   7. Perform steps 2-4, continue EVA, monitor
      H2O GP/ WP and cooling
      NOTE
      Msg triggered when SUBLM P < 1.5 or > 5.3
      Normal SUBLM P = 2.0-4.2

   10/11/96
H2O GP LOW

1. Monitor SUBLM P and H2O TEMP (WP xdc fai).
2. Monitor H2O WP.
3. Go to TERM EVA, 7.

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

16 12/06/96

RESRV H2O ON

1. Monitor SUBLM P and H2O TEMP (WP xdc fai).
2. Monitor H2O WP.
3. Go to TERM EVA, 7.
4. Reserve H2O on.

NOTE:
Msg triggered when GP minus WP > 2.1 psig
Normal SUBLM P = 2.0-4.2 psig
H2O TEMP = 32-75 degF
WP = 14.0-16.0

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NO VENT FLOW

1. Cycle FAN sw OFF, ON
2. Continue EVA
3. Helmet purge vlv - op
4. Go to TERM EVA, 7

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

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CO2

1. Minimize physical activity
2. Assess phys condition then go to step 3 below

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

19 04/20/99
**COMM FAILURE**

**ALL**

1. Proper config, EMU & orbiter (Mode, Vol, Freq)
   Perform following sequence until comm restored

**COMM FAIL 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 ALTI(PRI)(notify MCC)

**IV**

If IV no comm with EV1 and EV2:

4. IV select STRING 2(1)

**ALL**

If unresolved:

5. Perform coordinated freq change
   If unable to restore minimum of relay comm
   6. Go to TERM EVA, 7

20 04/23/99

---

**MISC MSGS**

**SUITE P EMERG**

CLOSE PURLGE V - SUIT P < 3.1

**RLF V FAIL**

STOP DEPRESS - stop DEPRESS, contact MCC,
SUIT P > 5.7

**Built-in tests**

BITE light illuminated - CWS unreliable,
contact MCC

**LIMITS BAD** - Warnings unreliable, monitor status
list, continue EVA

**VENT SW FAIL** - Vent flow sensor unreliable

**AIR CONT**

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---

**MISC MSGS (CONT)**

**Consumables**

XXX 02 LF TIME LF : XX

Triggered w/30 min remaining

XXX PWR LF TIME LF : XX

Verify proper config

**MISC**

SET 02 EVA

SET 02 PRESS

SET H2O OFF

FAN SW OFF

SET PWR SCU

O2 IS OFF

H2O IS OFF

22 07/30/84

---

**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

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---

RAD DISC

15–7 EVA/ALL/GEN G
DOOR DRIVE DISCONNECT

TOOL BOX - PDU DISC TOOL, TRASH BAG

IVI / Pwr off
1. Perform WINCH OPS, 29, 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, 30, steps 3-7
7. If reqd for other door, rotate tool CW
   60 deg and remove from PDU

SILL

Looking Outboard 5 3 Turns

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WINCH OPERATIONS

IVI / Pwr off
1. Winch
   CONTROL - REEL OUT
   Handle ratchet - blue (center)
   Attach rope to wrist tether
   Rope: Fwd - in clip & over rollers
   Aft - in guide, under handrail & over rollers
   Winch hook - under #4 latch bellcrank
   CONTROL - IN
   Handle ratchet - green (cw)
2. Ratchet in rope slack only

Cont next pg

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WINCH OPERATIONS (CONT)

IVI / Pwr off
3. PLBD(s) - close with winch
   If aft not READY TO LATCH, repeat steps 1 & 3
   at aft winch

IVI / Pwr on

IVI 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

IVI / Pwr off
1. Position installation handles as reqd
2. Tools - install in sequence
   Fwd-2, 4
   Aft-2, 3
   Fwd-1, 2, 3, 4
   Aft-1, 2, 3
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

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15–9 EVA/ALL/GEN G
CL LATCH TOOL

1. Tools - install
   1st gang - 1.3
   2nd gang - 6.8
   3rd gang - 9.11
   4th gang - 14.16
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
   - stow
3. Tool - compress to latch

RMS JOINT ALIGN

1. Attach RMS rope around and 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

1. Fold aside rub strip and thermal blankets
2. Insert tool and move handle down
3. Remove tool and reconfigure blankets

AIRLOCK LATCH DISCONNECT

1. Remove bolt A, stow in trash bag
2. Rotate actuator handle
   If no rotation - jammed actuator:
   1. Force latches open
   2. Seal hatch w/repress & secure for ldg (IV)
   If free rotation - jammed latch:
   3. Locate & remove jam
   4. Reconnect actuator

HINGE DISCONNECT

1. Remove hinge pin pins, as reqd
2. Restrainless hinge arm(s)
   & pin pins clear of opening, ingress airlock, posh hatch for closing
3. Close, lock hatch

MPM STOW/DEPLOY

1. Rotate torque shaft (8 revs) until MPMs are stowed/deployed, X0=693

EVA/ALL/GEN G
RMS TIEDOWN

TOOL BOX - PRDs (2), EVA TRASH BAG
LM - 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 for 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 l/f), adjust strap under bolt studs
1. Figure eights 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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RMS FLIGHT RELEASABLE GRAPPLE FIXTURE RELEASE

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

EV 1. Rotate white release rod ccw to hard stop (32 strokes of 90 deg)
2. Rotate block release rod cw to hard stop (32 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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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
PRLA 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 to LAT

Cont next pg

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PRLA OPEN/CLOSE (CONT)

EV 6. Apply PRLA locking feature if applicable
To lock:
7. Rotate each bolt (2) cw 1/2 turn
For subsequent PRLA ops, release locking feature before operating EVA drive (2 bolts ccw 1/2 turn); relock after operation

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EVA/ALL/GEN G
**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 & black painted surfaces

2. Align α (dish roll) and β (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)

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**AIRLOCK EGRESS**

- **A/L EGRS**
  - EV1 1. Thermal cover - open
  - 2. Egress airlock
  - 3. EV1's reel - remove from container, attach to EMU D-ring, unlock
  - 4. EV2's reel - remove from container, transfer to EV2

- **A/L INGRS**
  - EV2 5. Attach reel to EMU D-ring, unlock
  - BOTH 6. Waist tethers - attach to self, stow extra in A/L clear of hatch
  - EV2 7. Egress airlock
  - 8. If external A/L, close thermal cover

- **BOTH 9. Tether line - unsnap strap (1)
  - remove from Velcro straps
  - release fastener on slidewire cover (1), hook guard

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**KU ANTENNA STOW (CONT)**

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**AIRLOCK INGRESS**

1. TOOL BOX - closed, latched

- BOTH 2. Secure Velcro on slidewire cover

- 3. Secure tether line thru Velcro straps:
  - ODS Routing - sill, FWD truss, ree box
  - BHD Routing - slidewire link, cabin attach fitting

- EV2 4. Ingress airlock, attach waist tether(s) to A/L D-ring

- 5. Attach EV1's waist tether(s) to A/L D-ring

- 6. Lock tether reel, transfer to EV1

- EV1 7. Reels (both) - retract cable sock, stow in container, locked

- 8. Ingress airlock

- BOTH 9. WATER - OFF (fwd)

- 10. Thermal cover - close

- 11. Outer (EVA) hatch - close and lock

- 12. Go to PRE REPRESS

   (DEPRESS/REPRESS Cue Card)

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FLIGHT SPECIFIC REFERENCE
UNSCHEDULED/CONTINGENCY EVA TASKS
Replace this page with page(s) from Flight Supplement
EVA EMERGENCY
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

For affected crewmember:
DCM 1. PURGE vlv – op (up)
  2. O2 ACT – OFF, FAN – OFF
  3. Suit P < 0.4; disconnect gloves, helmet
  4. Connect SCU to DCM

AW18H 5. PWR/BATT CHGR EMU 1(2) BUS SEL – MNA(MNB)

DCM 6. PWR – SCU

For unaffected crewmember:
DCM 7. O2 ACT – IV
  8. Connect SCU to DCM

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

DCM 10. PWR – SCU

If single crewmember aborting EVA:
  11. Outer (EVA) hatch Equal vlv caps (two) – remove, stow
  12. √MCC
SAFER RESCUE

1. Deploy SAFER HCM
2. PWR – ON
3. Fly back
   Monitor GN2% and PWR%
   IV/other EV GCA as reqd

   * If no gas flow: *
   * √MAN ISOL vlv – OP (dn) *

4. Tether to nearest structure; √connection
5. PWR – OFF
6. MAN ISOL vlv – CL (up)
7. Tether to available safety tether or other EV crewmember; √connection
8. √MCC
19.1 DCS TREATMENT

DCS Signs and Symptoms Associated with Each Cuff Class Defined in Cuff C/L

1. Determine Cuff Class
   - Cuff Class 1
   - Cuff Class 2 or 3 (Report to MCC)
   - Cuff Class 4 (Report to MCC)

2. Continue EVA
   - If symptoms resolve upon REPRESS, go to Cuff Class 2, block 5
   - Report to Surgeon next PMC

3. Terminate EVA (Cuff C/L, 7)
   - Unaffected crewmember stow safety tether
   - MCC for PLB config
   - Perform INGRESS (Cuff C/L, 43)

   If terminating for Cuff Class 3:
   - PMC on A/G 1
   - COMM Mode – HL (A1R)
   - AUD CTR UHF A/G 1 – T/R
   - AUD CTR UHF A/G 2 – OFF

4. NOTE
   DO NOT perform POST EMERGENCY AIRLOCK REPRESS
   - Abort EVA (Cuff C/L, 6) with ingress assist from unaffected crewmember
   - Unaffected crewmember perform PLB safing

   If single crewmember abort
   - Outer hatch Equal vlv caps (two) – remove
   - Unstow resuscitator from SOMS (MED C/L, CPR STATION, OXYGEN SUPPLEMENTAL)

   Crewmember conscious?
   - YES
   - No

9. Can crewmember speak in full sentences w/o respiratory distress?
   - YES
   - NO

10. Leave O2 ACT – PRESS for 20 min (20 min check starts at 10.2 psi)
    - Perform BTA PREP, BENDS TREATMENT ADAPTOR (BTA) INSTALLATION (IN–SUIT) (EMU CONT PROC)
    - DCS signs or symptoms resolved?
    - YES
    - NO

11. Cab P <= 11.0 ?
    - YES
    - NO

12. Leave O2 ACT – PRESS for add’l 160 min
    - CMO report changes in DCS symptoms per DCS exam criteria to Surgeon as requested

13. Does MCC require EMU LiOH changeout?
    - YES
    - NO

14. Perform LiOH REPLACEMENT (MANNED) (EMU CONT PROC), omitting steps 3, 17, 18

15. Cab P <= 10.2, perform 10.2 PSI MAINTENANCE (10.2 PSI CABIN)

16. Unaffected crewmember perform POST EVA per FLIGHT PLAN, omitting steps 7–9

17. Perform DCS exam (MED C/L)

18. PMC (expect A/G 1–private, A/G 2–open)

19. Leave O2 ACT - PRESS for 20 min (20 min check starts at 10.2 psi)

20. CMO report changes in DCS symptoms per DCS exam criteria to Surgeon as requested

21. 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

22. 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

23. For Cuff Class 3 only, affected crewmember waiting in A/L needs to be in contact with Surgeon via PMC due to severity and potential progression of symptoms

24. 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 a Class 4 quickly, this may result in a one crewmember repress

25. 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

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EVA/ALL/GEN G,2
19.1 (Cont)

7 8

11

- If reqd, perform CABIN REPRESS TO 14.7 PSI (10.2 PSI CABIN) with following change to step 4:
  (L2) O2/N2 CNTLR VL V 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?

12

- Incr CAB PRESS 15.56 psia max as follows:
  (C5)
- DIRECT O2 – OP
- When CAB PRESS = 15.56 psia,
- DIRECT O2 – CL
- Perform BTA treatment at 8 psi for 2 hr
- CMO report changes in DCS symptoms per DCS exam criteria to Surgeon as requested

DCS signs or symptoms resolved?

13

- Leave BTA installed add’l 20 min

DCS signs or symptoms resolved?

14

- Continue at 6 psi for 2 hr
- CMO report changes in symp to Surgeon as requested

15

- Leave BTA installed add’l 20 min

DCS signs or symptoms resolved?

16

- 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?

17

- 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)

18

- MCC for further DCS treatment
19.1 (Cont)

19
- 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

When 14.7 REPRESS complete,
- Incr CAB PRESS to 15.56 psia max as follows:
  (C5)
- DIRECT O2 – OP
When CAB PRESS = 15.56 psia,
- DIRECT O2 – CL

DCS signs or symptoms resolving?

20
- Perform POST EVA
- Treat affected crewmember per CPR STATION (MED, CPR STATION)
- MCC for deorbit of incapacitated crewmember
- If CAB P < 15.56 psia,
  - 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

When 14.7 REPRESS complete,
- Incr CAB PRESS to 15.56 psia max as follows:
  (C5)
- DIRECT O2 – OP
When CAB PRESS = 15.56 psia
- DIRECT O2 – CL

21
- Perform BENDS TREATMENT ADAPTER (BTA) INSTALLATION (IN-SUIT) (EMU CONT PROCs)
- Perform BTA treatment at 8 psi for 2 hr
- Perform DCS EXAM (MED C/L) and report changes in DCS symptoms to Surgeon every 15 min

22
- Remain on SCU with O2 ACT – PRESS and BTA installed as determined by MCC

23
- MCC for DCS pharmacy treatment
  If DCS pharmacy 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?

24
- MCC for deorb to PLS/ELS with hyperbaric facilities
- MCC for delayed EMU doff, stow

25
- 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

MCC for deorb to PLS/ELS with hyperbaric facilities
- MCC for delayed EMU doff, stow
CUE CARD CONFIGURATION
Refer to the following pages for cue cards and decals in this document:

CC 3–9  SAFER CHECKOUT RESULTS Cue Card
CC 3–10  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