

**Checkout and Standard Use  
 Procedures for the Mark III Space  
 Suit Assembly**

DOCUMENT NUMBER, REV	DATE
CTSD-ADV-197, Rev. I	August 1, 2012

<b>PREPARED BY:</b>	Eng / Kate Mitchell <i>Kate Mitchell</i> 8-2-11
<b>REVIEWED BY:</b>	Eng / Amy Ross <i>Amy Ross</i> 8/2/11
<b>REVIEWED BY:</b>	Tech / Kevin Groneman <i>Kevin Groneman</i> 8-2-11
<b>APPROVED BY:</b>	EC5 / Raul Blanco <i>Raul Blanco</i> 8/2/11

No. Of Pages: 24

REVISIONS

REVISION LETTER/DATE	PREPARER	APPROVALS		AUTHORZIED
		BRANCH	SAFETY	
Baseline/ 10-26-2001	A. Ross	C. Dinsmore		
A/ 6-21-2004	A. Ross	C. Dinsmore		
B/ 8-30-2006	J. Harris	C. Dinsmore		
C/	A. Lesser	C. Dinsmore		
D/ 11-10-2009	L. Aitchison	R. Blanco		
E/ 8-25-2010	K. Mitchell	R. Blanco		
F/ 9-10-2010	K. Mitchell	R. Blanco		
G/ 2-25-2011	K. Mitchell	R. Blanco		
H/ 8-2-2011	K. Mitchell	R. Blanco		
I/ 8-1-2012	D. Valish <i>Dana Valish</i> 7/31/12	R. Blanco <i>R. Blanco</i> 8/2/12		

CTSD-ADV-197, Rev. I (JSC# 33497)	Checkout and Standard Use Procedures for the Mark III Space Suit Assembly
Date: 8-1-2012	Page 2 of 23

<b>Rev/Date</b>	<b>Change Log</b>
E/ 8-25-2010	<ul style="list-style-type: none"> <li>• Added Change Log</li> <li>• Revised the document title.</li> <li>• Updated Scope (removed reduced gravity environments)</li> <li>• Updated to common format for suit procedures</li> <li>• Reworked all out of date sections/steps</li> </ul>
F/ 9-10-2010	<ul style="list-style-type: none"> <li>• Added step to verify attenuator in-line in comm. system if needed. Removed step to record name of CPR certified test support personnel.</li> </ul>
G/ 2-3-2011	<ul style="list-style-type: none"> <li>• Updated Step 1 of Inspection and Assembly Procedure to be applicable for LAB operations only</li> <li>• Updated Step 8 of visual inspection to include verification that hatch pins are fully installed</li> <li>• Added 5 minute wait period between structural and leakage checks</li> <li>• Added additional notes to the pre-test safety briefing</li> <li>• Added steps to Section H per proficiency run redlines</li> <li>• Updated Appendix B per Jan 2011 Emergency Drill redlines</li> <li>• Added Appendix C: Medical Monitor Contact Information</li> </ul>
H/ 8-2-2011	<p>Changes made as part of an effort to sync up all suit procedures.</p> <ul style="list-style-type: none"> <li>• Added suit pressures table in “Notes” section</li> <li>• Added step to verify no open maintenance items which are a constraint to test</li> <li>• Updated Transfer of Equipment section</li> <li>• Made small changes to several sections of the document to sync all suit procedures.</li> </ul>
I/ 8-1-2012	<ul style="list-style-type: none"> <li>• Added information about colored Ortman wires to aid in the verification of correct Ortman wire being installed</li> <li>• Editorial changes</li> <li>• Changed all “Liquid Air Backpack” references to “Portable Air Backpck” because LAB is obsolete</li> </ul>

CTSD-ADV-197, Rev. I (JSC# 33497)	Checkout and Standard Use Procedures for the Mark III Space Suit Assembly
Date: 8-1-2012	Page 3 of 23

## **TABLE OF CONTENTS**

- I. PRE TEST CHECKOUT PROCEDURES
  - A. INSPECTION AND ASSEMBLY OF MARK III SPACE SUIT ASSEMBLY (SSA)
  - B. SYSTEM FUNCTIONAL CHECKOUT
- II. TEST PROCEDURES
  - A. TRANSFER OF EQUIPMENT
  - B. PREPARATION OF DON/DOFF STAND
  - C. PREPARATION OF COMMUNICATION SYSTEM
  - D. PREPARATION OF PRESSURIZATION SYSTEM
  - E. PREPARATION OF COOLING SYSTEM
  - F. FINAL PREPARATION FOR MANNED TEST ACTIVITY
  - G. PRE-TEST SAFETY CHECKLIST
  - H. SUPPORT OF TEST ACTIVITY
  - I. TERMINATION OF TEST ACTIVITY
- III. POST TEST PROCEDURES
  - A. POST TEST INSPECTION

## **APPENDICES**

APPENDIX A – MARK III SSA SIZING RECORD

APPENDIX B – MARK III SUIT EMERGENCY EVENT PROCEDURE

CTSD-ADV-197, Rev. I (JSC# 33497)	Checkout and Standard Use Procedures for the Mark III Space Suit Assembly
Date: 8-1-2012	Page 4 of 23

## **ACRONYM LIST**

ACFM -	Actual Cubic Feet per Minute
DV -	Designated Verifier
GC-	Generally Clean
GCC-	Ground Cooling Cart
GFCI -	Ground Fault Circuit Interrupted
GP/EP -	Graphite/Epoxy Composite
HUT -	Hard Upper Torso
LCG -	Liquid Cooling Garment
LTA -	Lower Torso Assembly
MAWP -	Maximum Allowable Working Pressure
MPT-	Manned Pressurized Time
PAB -	Portable Air Backpack
PCB -	Portable Cooling Box
PGA-	Pressure Garment Assembly
PLSS -	Portable Life Support System
PSID -	Pounds per Square Inch Differential
RV -	Relief Valve
SPACIS-	Spacesuit Audio Communications Interface System
SSA -	Space Suit Assembly
STE -	Suit Test Engineer
TCU-	Thermal Comfort Undergarment
TDS -	Test Data Sheet
TMG -	Thermal Micrometeoroid Garment
UL -	Underwriters Laboratories
WAD -	Work Authorizing Document

CTSD-ADV-197, Rev. I (JSC# 33497)	Checkout and Standard Use Procedures for the Mark III Space Suit Assembly
Date: 8-1-2012	Page 5 of 23

**SCOPE:** These procedures are standard operating procedures for the Mark III Space Suit Assembly (SSA) to support manned pressurized operations in ambient environments. Procedures include pre-test suit assembly and checkout, test support procedures, and post-test Mark III SSA procedures.

**NOTES:**

The various Mark III suit pressures are as follows:

Suit Component	Operational Pressure Range	Structural Pressure	Proof Pressure	MAWP
Lower Torso Assembly	0 – 6.2 ( $\pm$ 0.1) psid	1.5 x specified test pressure	12.6 psid	11.3 psid
Cast Aluminum HUT	0 – 8.3 ( $\pm$ 0.1) psid		16.8 psid	15.1 psid
Heavy Composite HUT	0 – 6.2 ( $\pm$ 0.1) psid		12.6 psid	11.3 psid
Lightweight Composite HUT	0 – 4.3 ( $\pm$ 0.1) psid		8.8 psid	7.9 psid

The operational pressure range is the range to which the suit can be nominally operated for manned testing. The top end of the nominal operational pressure range is equivalent to 1/2 the proof pressure. Structural pressure is 1.5 times the specified test pressure for any given test. Proof pressure is the maximum unmanned pressure to which the suit was tested by the vendor prior to delivery. The maximum allowable working pressure (MAWP) is 90% of the proof pressure. The pressure systems RVs are set to keep components below their MAWPs. If the suit is pressurized over its MAWP, the suit will be taken out of service and an in-depth inspection/review of the suit will be performed before the suit is put back in service.

The procedures outlined in this document should be followed as written. However, the suit test engineer (STE) may make redline changes real-time, provided those changes are recorded in the anomaly section of the test data sheet.

If technicians supporting suit build-up, check-out, and/or test execution believe that a procedure can be improved, they should notify their lead. If procedures are incorrect to the point of potentially causing hardware damage or affecting safety, bring the problem to the technician lead and/or STE's attention and stop work until a solution (temporary or permanent) is authorized.

Certain steps in the procedure are marked with a 'DV', for Designated Verifier. The Designated Verifier for this procedure is an Advanced Space Suit Technology Development Laboratory technician, not directly involved in performing the procedural steps, who will verify that the step was performed as stated. The steps to be verified by the DV were selected based on one or more of the following criteria: the step was deemed significant in ensuring the safe performance of the test, the data recorded in the step is of specific interest in monitoring the suit system operation, or the step has a strong influence on the successful completion of test objectives.

CTSD-ADV-197, Rev. I (JSC# 33497)	Checkout and Standard Use Procedures for the Mark III Space Suit Assembly
Date: 8-1-2012	Page 6 of 23

**Prior to all manned test activities, Advanced Suit Test Data Sheet (TDS) Parts A - E shall be completed to verify system and team are ready for test. Advanced Suit TDS Parts F-G shall be completed at the end of the suited activity.**

**Appendix B identifies the appropriate Mark III suit emergency event procedures.**

CTSD-ADV-197, Rev. I (JSC# 33497)	Checkout and Standard Use Procedures for the Mark III Space Suit Assembly
Date: 8-1-2012	Page 7 of 23

## **I. PRE-TEST CHECKOUT PROCEDURES**

### **A. INSPECTION AND ASSEMBLY OF MARK III SPACE SUIT ASSEMBLY (SSA)**

1. \_\_\_\_\_ Verify remaining Manned Pressurized Time (MPT) exceeds anticipated test duration.

**NOTE:** MPT shall not exceed 40 hrs between detailed inspections and maintenance.

2. \_\_\_\_\_ Verify that there are no open maintenance items which are a constraint to test and record on TDS.
3. \_\_\_\_\_ Record the M # and calibration due date of the torque driver to be used on the TDS. N/A step if not required for PAB installation or re-size.
4. \_\_\_\_\_ Gather Mark III components and subassembly elements, including gloves, based on suit components identified on subject's sizing record (Appendix A).
5. \_\_\_\_\_ Verify all exposed mating and interfacing surfaces are clean, lip seals properly installed with no twists or cuts.
6. \_\_\_\_\_ Verify that the suit and suit hardware are Generally Clean (GC) per the latest revision of JPR 5322.1, and clean the suit and suit hardware to the GC level if necessary.
7. \_\_\_\_\_ Visually inspect, clean, and lubricate (as necessary) all exposed Lip Seals and "O" rings using Krytox 240AC as follows:
  - a. \_\_\_\_\_ Right and Left wrist adapters
  - b. \_\_\_\_\_ Right and Left suit side wrist disconnects (BLUE-LEFT/RED-RIGHT)
  - c. \_\_\_\_\_ Right and Left lower leg to boot interface and sizing rings
  - d. \_\_\_\_\_ Right and Left lower leg to hip interface and sizing rings
  - e. \_\_\_\_\_ Right and Left lower arm to shoulder interface and sizing rings
  - f. \_\_\_\_\_ Waist joint ring assembly, HUT adapter ring assembly, and sizing rings
  - g. \_\_\_\_\_ Helmet neck Ring (suit side)
  - h. \_\_\_\_\_ Gas and LCG connectors

CTSD-ADV-197, Rev. I (JSC# 33497)	Checkout and Standard Use Procedures for the Mark III Space Suit Assembly
Date: 8-1-2012	Page 8 of 23

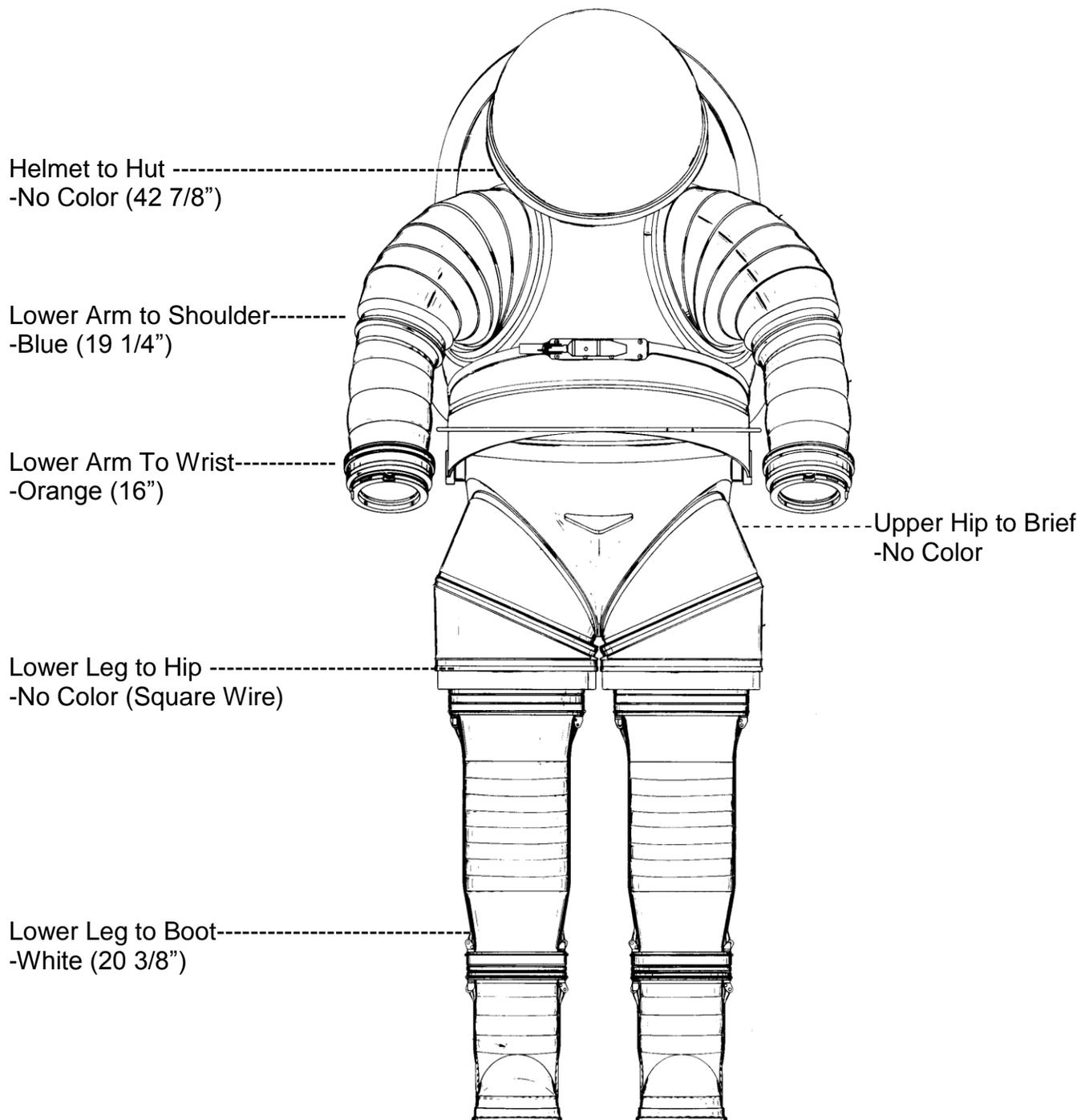
- i. \_\_\_\_\_ Rear entry hatch seal
  - j. \_\_\_\_\_ Hatch pins fully installed (ball detents visible)
8. \_\_\_\_\_ Ensure that correct Ortman wires are installed as shown on Figure 1.

**NOTE:** For each sizing ring used, an additional Ortman wire is required

9. \_\_\_\_\_ If requested on WAD, install Portable Air Backpack (PAB) or Portable Life Support System (PLSS) Mock-up onto hatch. Torque screws (4) to 50 in-lbs in a diagonal sequence.
10. \_\_\_\_\_ Visually examine all exposed soft goods/hardware for sharp edges and damage, including tears, cuts, abrasions, and defective component elements. Record damage in the maintenance log.
- a. \_\_\_\_\_ HUT (Examine locking segments on rear hatch and HUT adapter ring assembly, verify locking segments move freely)
  - b. \_\_\_\_\_ Bladder/Restraint (Tears, cuts, excessive wear or damage)
  - c. \_\_\_\_\_ Scye, Arm, Waist, and Hip Bearings (Smooth operation/rotation)
  - d. \_\_\_\_\_ Shoulder, Waist and Thigh Rolling Convolutes
  - e. \_\_\_\_\_ Boots (Sole, composite disconnect/bearing, primary and secondary restraint)
  - f. \_\_\_\_\_ Helmet
  - g. \_\_\_\_\_ Sizing Rings
  - h. \_\_\_\_\_ Gloves (TMG, restraint, and bladder condition, bearing operation)
  - i. \_\_\_\_\_ Screw heads for sharp edges, burrs
11. \_\_\_\_\_ Visually inspect and verify that internal LCG lines are secure and no damage is evident.
12. \_\_\_\_\_ Visually inspect internal communication wires and connection/connectors for damage (bent or broken pins, broken clips, debonded potting, etc.)
13. \_\_\_\_\_ Visually verify the cover layer is installed, per WAD request. (Tests can be performed without the cover layer to allow better observation of joint performance)

CTSD-ADV-197, Rev. I (JSC# 33497)	Checkout and Standard Use Procedures for the Mark III Space Suit Assembly
Date: 8-1-2012	Page 9 of 23

14. \_\_\_\_\_ As needed, sparingly apply anti-fog to the interior of the helmet and spread over the entire surface with a soft (non-abrasive), lint free cloth.
  
15. \_\_\_\_\_ Complete necessary suit component assembly per provided sizing sheet prior to system functional checkout.
  - a. \_\_\_\_\_ Arm sizing rings plus Ortman wires
  - b. \_\_\_\_\_ Leg sizing rings plus Ortman wires
  - c. \_\_\_\_\_ Fabric arm and leg assemblies
  - d. \_\_\_\_\_ Boots
  - e. \_\_\_\_\_ Waist Sizing Ring installed



**Figure 1: Ortman Wire Installation**

CTSD-ADV-197, Rev. I (JSC# 33497)	Checkout and Standard Use Procedures for the Mark III Space Suit Assembly
Date: 8-1-2012	Page 11 of 23

## B. SYSTEM FUNCTIONAL CHECKOUT

**NOTE:** If in-suit communications are not required for the test, N/A steps 1, 2, and 3.

1. \_\_\_\_\_ Verify comm. system plugged into GFCI outlet or power cord.
2. \_\_\_\_\_ Visually verify physical communication connections at:
  - a. \_\_\_\_\_ Umbilical to PLSS or HUT
  - b. \_\_\_\_\_ PAB or PLSS to HUT
  - c. \_\_\_\_\_ HUT to speakers/microphones
3. \_\_\_\_\_ Verify good transmit and receive with a voice check (5-count)
4. \_\_\_\_\_ Perform Liquid Cooling Garment (LCG) check per the following steps:
  - a. \_\_\_\_\_ Connect water connector to HUT external LCG connector.
  - b. \_\_\_\_\_ Connect LCG connector to suit side connector.
  - c. \_\_\_\_\_ Start water flow and verify no leaks at the LCG and external HUT connector.

**NOTE:** If the test is unpressurized, N/A steps 5 - 7.

5. \_\_\_\_\_ Perform a structural pressure check per the "Building 34 Structural Test of CEI Using the PGA Test Stand", CTSD-ADV-822.
6. \_\_\_\_\_ Pause for 5 minutes after the structural pressure check before continuing with Step 7 (leakage test).
7. \_\_\_\_\_ Perform a leak check per the "B34 Leakage Test of CEI/TARE of the PGA Test Stand", CTSD-ADV-823.

**NOTE:** Operational checklist to be completed by DV, a qualified suit technician not involved with the build-up of the Mark III suit for this test.

8. \_\_\_\_\_ DV perform a Mark III operational check to verify the following:
  - a. \_\_\_\_\_ Normal operation of all disconnects and hatch locking mechanisms, including locks/lock-locks.
  - b. \_\_\_\_\_ Proper orientation of suit side wrist disconnects (BLUE-LEFT/RED-RIGHT)
  - c. \_\_\_\_\_ Free and smooth rotation of all bearings.

CTSD-ADV-197, Rev. I (JSC# 33497)	Checkout and Standard Use Procedures for the Mark III Space Suit Assembly
Date: 8-1-2012	Page 12 of 23

- d. \_\_\_\_\_ Correct Ortman wires properly installed. (Refer to Figure 1)
- e. \_\_\_\_\_ Ad/Ab stop-straps on thigh
- f. \_\_\_\_\_ Internal comm. system secured and properly routed (N/A if not required)
- g. \_\_\_\_\_ Arm and LTA bladders properly aligned and not twisted.
- h. \_\_\_\_\_ Structural, RV, and leak checks completed successfully, if applicable.
- i. \_\_\_\_\_ Suit, including gloves, are the correct configuration and size.
- j. \_\_\_\_\_ Screw heads smooth and free of burrs.
- k. \_\_\_\_\_ DV initial the TDS

CTSD-ADV-197, Rev. I (JSC# 33497)	Checkout and Standard Use Procedures for the Mark III Space Suit Assembly
Date: 8-1-2012	Page 13 of 23

## **II. TEST PROCEDURES**

### **A. TRANSFER OF EQUIPMENT**

**NOTE:** N/A this section if equipment transfer is not required. If transferring equipment, N/A items not required for test support

1. \_\_\_\_\_ Transfer the following equipment to the test area, per the specifications in the WAD/Daily Details Summary Sheet:
  - a. \_\_\_\_\_ Mark III suit hardware assembled per subject sizing record (Appendix A)
  - b. \_\_\_\_\_ Any ancillary support or preference equipment as listed on the WAD (e.g. TCU, LCG, socks, etc.)
  - c. \_\_\_\_\_ Protective booties
  - d. \_\_\_\_\_ Mark III Don/Doff stand, Don/Doff stairs and power cord
  - e. \_\_\_\_\_ UL rated GFCI power cord
  - f. \_\_\_\_\_ Portable cooling unit, cooling lines, power supply and ice as needed
  - g. \_\_\_\_\_ LCG Jumper Loop (as needed) and Burrito
  - h. \_\_\_\_\_ Towels
  - i. \_\_\_\_\_ Technician's tool kit with accessories
  - j. \_\_\_\_\_ LPO Manifold (Record pertinent information on TDS) and air hose
  - k. \_\_\_\_\_ Back Pressure Regulator (Record pertinent information on TDS)
  - l. \_\_\_\_\_ Portable comm. system with external speaker and headsets

### **B. PREPARATION OF DON/DOFF STAND**

1. \_\_\_\_\_ Install power cord and plug into power source.
2. \_\_\_\_\_ Install and lock Mark III in don/doff stand.
3. \_\_\_\_\_ Raise or lower don/doff stand until boot heel is touching the ground and the slack is out of the leg.
4. \_\_\_\_\_ Place don/doff stairs in position against hatch opening and lock in place.
5. \_\_\_\_\_ Adjust seat height on stairs to be level with the bottom of the hatch opening.

CTSD-ADV-197, Rev. I (JSC# 33497)	Checkout and Standard Use Procedures for the Mark III Space Suit Assembly
Date: 8-1-2012	Page 14 of 23

### **C. PREPARATION OF COMMUNICATION SYSTEM**

**NOTE:** N/A Section C for unpressurized testing.

1. \_\_\_\_\_ Plug comm. system into a UL rated GFCI power cord as required.
2. \_\_\_\_\_ Connect comm. system to PAB/PLSS/HUT connector.
3. \_\_\_\_\_ Verify proper internal comm. connections are made.
4. \_\_\_\_\_ Verify attenuator in-line when not using in-suit speaker system to receive comm.
5. \_\_\_\_\_ Perform communications check. Record on TDS.

### **D. PREPARATION OF PRESSURIZATION SYSTEM**

**NOTE:** N/A Section D for unpressurized testing.

1. \_\_\_\_\_ When using the PGA test stand, follow the steps in “Manned Testing Using the Building 34 PGA Test Stand”, CTSD-ADV-821 to prepare the pressurization system and record the specified information on the TDS. (N/A if using a pressurization system other than the PGA test stand.)
2. \_\_\_\_\_ When using the B34 LPO Manifold, follow the steps in “Operating Procedures for the Building 34 Low Pressure Outlet 6 K-Bottle Manifold”, CTSD-ADV-908 to prepare the pressurization system and record the specified information on the TDS. (N/A if using a pressurization system other than the LPO Manifold.)
3. \_\_\_\_\_ When using an alternate approved pressurization system, follow the steps in the operating procedure specific to the pressurization system, and record the procedure name and document number along with specified information on the TDS. (N/A if using the PGA test stand or LPO Manifold.)
4. \_\_\_\_\_ Complete air supply connections to the suit.
5. \_\_\_\_\_ Ensure that inlet/outlet connectors are fully seated and lock-locks are engaged.
6. \_\_\_\_\_ Verify positive air flow through the vent port.

### **E. PREPARATION OF COOLING SYSTEM**

1. \_\_\_\_\_ When using the portable cooling box (PCB) (N/A if using the ground cooling cart (GCC) or chiller):
  - a. \_\_\_\_\_ Visually inspect the 12 V power supply and verify it is free from damage, defects, sharp edges, and burrs.

CTSD-ADV-197, Rev. I (JSC# 33497)	Checkout and Standard Use Procedures for the Mark III Space Suit Assembly
Date: 8-1-2012	Page 15 of 23

- b. \_\_\_\_\_ Place no less than 1 gallon of water in cooling system container or until water level is midway up pump body (avoid dry pump operation).
  - c. \_\_\_\_\_ Fill cooling system with ice.
  - d. \_\_\_\_\_ Connect to UL rated GFCI power source.
  - e. \_\_\_\_\_ Connect water connector to HUT external LCG connector
  - f. \_\_\_\_\_ Connect LCG connector to suit side connector.
  - g. \_\_\_\_\_ Start water flow and verify no leaks at the LCG and external HUT connector.
2. \_\_\_\_\_ When using an approved alternate cooling system, reference applicable approved procedures.

#### **F. FINAL PREPARATION FOR MANNED TEST ACTIVITY**

1. \_\_\_\_\_ Install breathing air line, water line, comm. line and other lines as needed into an umbilical sheath.
2. \_\_\_\_\_ Verify work space/test area is free, if possible of all tripping hazards and sharp edges, and condensation from the portable cooling box. Continue to inspect for condensation and wipe up if required.
3. \_\_\_\_\_ Place LCG, protective booties, and preference items in the dress/changing area.
4. \_\_\_\_\_ Place gloves, comfort gloves, wristlets, and helmet by don/doff stand.
5. \_\_\_\_\_ Suit test personnel sign the TDS to verify hardware readiness for test.

#### **G. PRE-TEST SAFETY CHECKLIST**

**NOTE:** Verify that suit technicians are trained and familiar with the Emergency Event Procedure for manned activities as defined in Appendix B of this document. A minimum of two certified suit personnel are required to perform emergency extraction.

**NOTE:** This section is to be completed by the Suit Test Engineer.

1. \_\_\_\_\_ Verify that supporting suit test personnel have signed the Test Data Sheet indicating hardware is acceptable for test (TDS, Part E).
2. \_\_\_\_\_ Verify subject has reviewed and signed the summary and consent form.
3. \_\_\_\_\_ Conduct pre-test briefing:

CTSD-ADV-197, Rev. I (JSC# 33497)	Checkout and Standard Use Procedures for the Mark III Space Suit Assembly
Date: 8-1-2012	Page 16 of 23

- a. \_\_\_\_\_ The test director is in charge of the test and will direct all activities.
- b. \_\_\_\_\_ Test termination criteria:
  - i. At subject's request
  - ii. Suit technician/engineer monitoring the subject believes there's a reason
  - iii. Low airflow problem – if airflow drops below 5 ACFM, verify:
    - (a) The period of time does not exceed 5 minutes.
    - (b) The suited personnel be informed of the situation and directed to minimize activity
    - (c) Suit test team to be informed of the reduced air flow and appropriate individuals begin monitoring for high CO2 symptoms, including headache, flushed feeling, dizziness, blurred vision, light-headedness
    - (d) The test will be terminated if the flow falls below 4 ACFM.
    - (e) Discuss sound changes associated with drop in airflow with test subject.
  - iv. Loss of communication
    - (a) Determine basic hand signals for communication with test subject should there be a loss of communication.
- c. \_\_\_\_\_ Response to fire alarm or other facility emergency (emergency escape routes and procedures to be followed).
- d. \_\_\_\_\_ Emergency phone numbers, location of phone. Verify that STE has emergency numbers in phone if testing at the rock yard or off-site.
- e. \_\_\_\_\_ Verify that the test subject has a current and appropriate physical. Mark "N/A" for crewmember.
- f. \_\_\_\_\_ Verify that the test subject is physically and mentally prepared to participate in test today (rested, hydrated, fed, no current/recent injuries, etc.).
- g. \_\_\_\_\_ Discuss test specific suit and non-suit hazards (exhaustion, heat stress, slip/trip/fall, sharp edges, etc).
- h. \_\_\_\_\_ Discuss the hazards involved with breath holding and the excessive use of the valsalva maneuver (can damage ear drums). Offer use of valsalva block.
- i. \_\_\_\_\_ Instruct subject on hazards associated with the aspiration of vomit and how to avoid it.

CTSD-ADV-197, Rev. I (JSC# 33497)	Checkout and Standard Use Procedures for the Mark III Space Suit Assembly
Date: 8-1-2012	Page 17 of 23

- j. \_\_\_\_\_ Instruct subject to avoid “hanging” in the suit (since suspension may increase risk of fainting).
- k. \_\_\_\_\_ Remind test subject that it is their responsibility to request cooling and audio volume adjustments as needed during the test.
- l. \_\_\_\_\_ Inform test subject to notify STE or technician in event of ear or sinus problems during testing.
- m. \_\_\_\_\_ Note medical monitor’s name and phone number on list in MKIII binder.
- n. \_\_\_\_\_ Test subject signs Test Data Sheet verifying they have been briefed, understand, and accept the suit and non-suit equipment hazards involved with the test.

## H. SUPPORT OF TEST ACTIVITY

1. \_\_\_\_\_ At test director/STE direction, the test subject will perform the following:
  - a. \_\_\_\_\_ Don ancillary (e.g. LCG, TCU, socks)
  - b. \_\_\_\_\_ Climb don/doff stairs and sit on top of platform with feet in hip/brief area of lower torso.
  - c. \_\_\_\_\_ Don LCG thumb loops
  - d. \_\_\_\_\_ Connect LCG connector; initiate water flow and verify no leaks. Install burrito. Adjust water flow as required.
2. \_\_\_\_\_ Complete suit donning by lowering into the lower torso and arms.
3. \_\_\_\_\_ Connect shoulder straps.
4. \_\_\_\_\_ Install ear bud as required.
5. \_\_\_\_\_ Remove the donning stairs.
6. \_\_\_\_\_ Close rear hatch. Verify locked.
7. \_\_\_\_\_ Don comfort gloves and wristlets as required.
8. \_\_\_\_\_ Assist test subject with donning gloves.
9. \_\_\_\_\_ Conduct comm. check and verify at minimum test subject, suit safety technician, and test conductor are online.
10. \_\_\_\_\_ Verify all suit connections are locked and secure.
11. \_\_\_\_\_ Adjust breathing air inlet controller to initiate flow. Verify airflow at vent port.

CTSD-ADV-197, Rev. I (JSC# 33497)	Checkout and Standard Use Procedures for the Mark III Space Suit Assembly
Date: 8-1-2012	Page 18 of 23

**NOTE:** A technician will be in visual contact and audio contact with test subject at all times to watch for indications of stress, CO2 build-up, extreme fatigue or other conditions that may require immediate attention.

12. \_\_\_\_\_ Install helmet. Verify Ortman wire fully installed.

13. \_\_\_\_\_ STE start time for manned pressurized use.

Start time: \_\_\_\_\_

14. \_\_\_\_\_ Pressurize suit. Communicate with the subject while pressurizing to ensure subject's ears are clear. Hold, as necessary, per test subject feedback. Pressurization rate not to exceed 1 pound for every 15 seconds.

**NOTE:** Specific procedures for the operation of the breathing air system provide explicit instructions for the operator during pressurization.

15. \_\_\_\_\_ When suit reaches pressure, remove the waist pin.

16. \_\_\_\_\_ Transfer control of the test to the Test Director and begin using test specific procedures.

**NOTE:** Maintain a minimum of 5 ACFM airflow rate at all times.

**NOTE:** Monitor breathing air and cooling at all times.

**NOTE:** Manage test subject's umbilicals throughout the test to ensure that they do not create a trip hazard.

**NOTE:** Control of the test is returned to the suit test team at the completion of the test specific procedures.

## I. TERMINATION OF ACTIVITY

1. \_\_\_\_\_ Once the subject is back in the donning stand, install the waist pin.

2. \_\_\_\_\_ Notify suit subject of depressurization and to not hold their breath.

3. \_\_\_\_\_ Reduce suit pressure to less than 0.5 psid.

4. \_\_\_\_\_ Remind subject to exhale. Remove Glove.

5. \_\_\_\_\_ STE Stop time for manned pressurized use.

Record duration: \_\_\_\_\_

6. \_\_\_\_\_ Remove Helmet.

7. \_\_\_\_\_ Shut off and secure airflow, water flow and comm.

CTSD-ADV-197, Rev. I (JSC# 33497)	Checkout and Standard Use Procedures for the Mark III Space Suit Assembly
Date: 8-1-2012	Page 19 of 23

8. \_\_\_\_\_ Open rear hatch and roll and lock don/doff stairs in place.
9. \_\_\_\_\_ Disconnect LCG connector.
10. \_\_\_\_\_ Assist test subject in doffing suit.
11. \_\_\_\_\_ Transfer all equipment to the Advanced Suit Lab (N/A if not required).

CTSD-ADV-197, Rev. I (JSC# 33497)	Checkout and Standard Use Procedures for the Mark III Space Suit Assembly
Date: 8-1-2012	Page 20 of 23

### **III. POST-TEST PROCEDURES**

#### **A. POST TEST INSPECTION**

**NOTE:** This section is to be completed by the STE.

1. \_\_\_\_\_ Inspect suit and components for damage.
2. \_\_\_\_\_ Transfer any out of family comments to the TDS.
3. \_\_\_\_\_ Update Suit Use and Maintenance logs as appropriate.
4. \_\_\_\_\_ Sign TDS to indicate all post-test activities were completed.
5. \_\_\_\_\_ Add completed TDS to Mark III binder.
6. \_\_\_\_\_ Notify technicians that inspection is complete and hardware may be returned to storage.

**NOTE:** When manned pressurized time reaches 40 hours as recorded on the Mark III Suit Use Log or as required by harsh environment usage, perform component maintenance per the "Mark III Space Suit Assembly Maintenance and Repair Manual", CTSD-ADV-298.

CTSD-ADV-197, Rev. I (JSC# 33497)	Checkout and Standard Use Procedures for the Mark III Space Suit Assembly
Date: 8-1-2012	Page 21 of 23

**APPENDICES**

## APPENDIX A: MARK III SSA SIZING RECORD SHEET

**Subject:** \_\_\_\_\_ **Date:** \_\_\_\_\_

**HUT Size:** \_\_\_\_\_ **Brief Size:** \_\_\_\_\_

Gloves		<i>Size</i>
<b>David Clark:</b>	Phase V _____	_____
<b>Other:</b>	_____	_____
<b>ILC:</b>	Phase VI _____ 4000 _____	_____ _____
Waist Sizing		
<b>Breech Lock Rings</b>	None _____ 0.75" _____ 1.25" _____ 2.5" _____	_____
Boots		
<b>David Clark, ILC or Modified EMU</b>	_____	
<b>Shoe Size:</b>	_____	
LCVG		
<b>TCU's:</b>	Large _____ Med _____ Small _____	_____ _____ _____
Comfort Pads		
<b>Shoulder Straps:</b>	_____	
<b>Padding:</b>	_____	

Arms	
<b>Soft Good Size:</b>	Lng _____ Med _____ Sht _____ XSht _____
Sizing Rings	
<b>Upper Arm Left:</b>	<b>Upper Arm Right:</b>
None _____	None _____
01 (.304) _____	01 (.304) _____
02 (.604) _____	02 (.604) _____
<b>Lower Arm Left:</b>	<b>Lower Arm Right:</b>
None _____	None _____
06 (.304) _____	06 (.304) _____
07 (.604) _____	07 (.604) _____
Legs	
<b>Soft Good Size:</b>	Lrg XLng _____ Lrg Lng _____ Lrg Med _____ Lrg Sht _____
<b>Upper Leg Left:</b>	<b>Upper Leg Right:</b>
None _____	None _____
-11 (.304) _____	-11 (.304) _____
-12 (.604) _____	-12 (.604) _____
-14 (1.204) _____	-14 (1.204) _____
<b>Lower Leg Left:</b>	<b>Lower Leg Right:</b>
None _____	None _____
-01 (.301) _____	-01 (.301) _____
-02 (.601) _____	-02 (.601) _____
-04 (1.201) _____	-04 (1.201) _____

Comments
<p><b>Was the Liquid Air Backpack Used? Circle Yes/No</b></p>          <p style="text-align: right;"><b>Data Recorded By:</b> _____</p>

CTSD-ADV-197, Rev. I (JSC# 33497)	Checkout and Standard Use Procedures for the Mark III Space Suit Assembly
Date: 8-1-2012	Page 23 of 23

## **APPENDIX B: MARK III EMERGENCY EVENT PROCEDURES FOR ONE-G MANNED ACTIVITIES**

**NOTE:** The suit engineer/test director shall direct appropriate emergency personnel as required.

**NOTE:** A minimum of two certified suit personnel are required to perform the following procedures.

**NOTE:** If spinal injury suspected, do not move subject until qualified medical personnel arrives.

1. Verify emergency extraction condition exists.
2. Verify/clear all non-essential personnel from the test area and verify medical personnel are called. (On-site x33333, Ellington x44444)
3. Place suited subject on the floor, in a semi-sitting position, and remove all obstructions from the suit.
4. Reduce suit pressure. Verify pressure is less than 0.5 psid.
5. Remove gloves and helmet.

	<b>If spinal injury NOT suspected:</b>	<b>If spinal injury suspected:</b>
6.	Assist subject as required and wait for medical personnel.	Maintain subject in stable position until qualified medical personnel arrive.

**NOTE:** Perform Steps 7-11 only if chest access is required to perform CPR or at the direction of qualified medical personnel.

	<b>If working from UMBILICALS:</b>	<b>If working from LAB:</b>
7.	Unlock waist connection (safety tab on right side of MK-III waist bearing) and lift up on HUT.	Remove rear hatch pins and lift hatch off of suit with LAB attached.
8.	Disconnect Liquid Cooling Garment connector.	Disconnect Liquid Cooling Garment connector.
9.	Continue to lift HUT off of subject while cradling head and neck to prevent further injury.	Pull subject's arms and head out of upper torso while cradling head and neck to prevent further injury.

10. Undo boot straps
11. Remove the subject from the lower part of the suit and transfer to a predetermined emergency medical pick up point.
12. Secure the test area as required.
13. Notify appropriate management, NASA medical, and safety personnel.