**ET24-V11-FOP-002**
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**George C. Marshall Space Flight Center**
**Marshall Space Flight Center, Alabama 35812**

# FACILITY OPERATING PROCEDURE FOR RAPID DEPRESSURIZATION TESTING IN THERMAL VACUUM CHAMBER V11

**ENVIRONMENTAL TEST FACILITY BRANCH**

**STRUCTURAL AND ENVIRONMENTAL TEST DIVISION**

**TEST LABORATORY**

**ENGINEERING DIRECTORATE**

**CHECK THE MASTER LIST—**

**VERIFY THIS IS THE CORRECT VERSION BEFORE USE**

# FACILITY OPERATING PROCEDURE FOR RAPID DEPRESSURIZATION TESTING IN THERMAL VACUUM CHAMBER V11

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| Release Date: 2 / 18 / 2005 | **Marshall Space Flight Center Specification/Document Change Instruction** | Page 1 of 1 |
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| Change No./Date | Replacement Page Instructions |
|---|---|
| 2-18-2005 | Initial issue for ET24 organization. Supersedes MFOP-FA-ETF-458. |
| Revision A 3-4-2005 | Replace all Pages. Updated operating instruction in Section 3 to improve testing process. Section revised are 3.1.3, 3.1.4.2.1, 3.1.4.2.4 through 3.1.4.2.6, 3.1.4.2.8 through 3.1.4.2.10, 3.1.6, 3.1.7, 3.1.9.6 through3.1.9.8, 3.2.4.8, 3.2.6, 3.2.7.4 through 3.2.7.7, 3.2.9.8, 3.3.9, 3.3.10, 3.3.12, 3.3.13, and 3.3.17. Added Heater Wiring Layout Sheet, Page16. Made minor editorial changes. |
| Revision B 6-7-2005 | Replace all pages. Revised because heart control computed is removed. Backface heaters are not switch on and off from the V11 control computer. Deleted Sections 3.1.4.2.7 through 3.1.4.2.9, 3.1.7.43.1.9.7 through 3.1.9.10.3, 3.2.4.8, 3.2.4.9, 3.2.7.8 and 3.3.9 Method 4 last two lines. Step 3.1.4.2 “all three” changed to “both.” Updated Step 3.1.9.7. Added a step after 3.1.16for cryo box verification. Update component names in Section 3.2.3, 3.2.4, 3.2.9 and 3.3.9. Updated 3.2.6. Added 3.2.8.6 to switch on lamps power. Added step to 3.3.9 Method 4 to switch on backface heaters. Changed 15 torr to 1 torr in Step 3.3.10. Added 3.3.12 to switch off backface heaters. |

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**CHECK THE MASTER LIST—**
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# 1.0 GENERAL INFORMATION

## 1.1 PURPOSE

This document describes the procedures for the operation of Thermal Vacuum Chamber V11 located in the Marshall Space Flight Center (MSFC) Building 4619.

## 1.2 SCOPE

The procedures and practices outlined in this document are to be followed in the operation of chamber V11 for the External Tank (ET) Foam Panel tests. This document provides a record copy of chamber V11 operations.

## 1.3 APPLICABLE DOCUMENTS

| | |
|---|---|
| NPR 8715.3 | NASA Safety Manual |
| MPR 8715.1 | Marshall Safety, Health, and Environmental (SHE) Program |
| MFOP-FA-ETF-405 | Facility Operating Procedure for the Twenty Foot Thermal Vacuum Chamber (soon to be superseded by ET24-V20-FOP-001) |
| MSOP-FA-ETF-413 | Control of Hazardous Energy (Lockout/Tagout) Procedure for the Environmental Test Facility (soon to be superseded by ET24-LOTO-SOP-001) |
| ET24-ETF-OWI-001 | Environmental Test Facility Test Operations |
| ED26 (02-01) | Memorandum for Record, Safety Assessment for the ETF (soon to be issued as an ET24 memo, number unknown) |

## 1.4 SAFETY

All test personnel working in this facility shall be familiar with the safety documents listed above and shall report any safety hazards, unsafe practices, safety incident or near misses to the ETF Branch Chief or the 4619 Building Manager Assistant. In the event of serious personnel injury, do not move the injured person unless necessary to prevent further serious injury. The Emergency telephone number is 911. Other telephone numbers are listed in section 1.5.

In addition to the above safety precautions, all personnel involved in facilities using cryogenics shall be aware of possible freeze burns by contact with cold surfaces or liquids. Protective clothing including eye protection and gloves shall be worn by all personnel involved in handling of cryogenics or when making repairs/modifications to cryogenic facilities. Only certified cryogenic handlers shall perform repairs/modifications to cryogenic systems. In the event of a cryogenics spill, line ruptures, or similar emergencies, personnel shall first be sure that there is no possibility of

asphyxiation due to oxygen displacement. Use a portable oxygen monitor to verify oxygen is adequate before entering the area.

The chamber can reach extreme temperatures both hot and cold. The test chamber and test article shall be given sufficient time to return to a temperature above 32°F and less than 104°F (40°C) before removing the test article so that the hazard from extreme temperature is minimal. If it is required to work inside the chamber or handle the test article when below 32°F, then cryogenic PPE shall be worn including gloves and eye protection.
The personal protective equipment (PPE) requirements and job hazard analysis (JHAs) for operation of the chamber are listed in the ET24 Safety Assessment, Memorandum ED26 (02-01) (soon to be issued as an ET24 memo, number unknown). Chamber operators shall be familiar with these documents to understand associated hazards and methods to mitigate the risks from these hazards.

## 1.5 EMERGENCY TELEPHONE NUMBERS

Dial **911** for all emergencies, including:

| | |
|---|---|
| Medical | **911** |
| Fire | **911** |
| Ambulance | **911** |
| Security | **911** |
| Chemical Spills | **911** |

Other numbers that can be used to obtain information about emergency, security, safety, and utilities are:

| | |
|---|---|
| Medical Center | 544-2390 |
| Security | 544-4357 |
| Safety | 544-0046 |
| Utilities | 544-3919 |
| Other Assistance | 544-4357 (4-HELP) |

## 1.6 CHECKOUT TEST

Prior to testing an item in the facility, particularly for critical qualification tests, it is recommended that a "dummy" test article be used to determine program set-points of the thermal controllers and safety devices. The "dummy" test article shall provide an accurate thermal simulation of the actual test article.

In addition to the thermal checkout, ascent depressurization or decent pressurization test shall be run before the test article is installed to verify the required pressure change curve can be achieved.

## 1.7 HAZARDS LIST

- 480, 208 and 120 volts AC electrical power

- Extreme temperatures (hot and cold)
- Cryogenic ($LN_2$ and LHe)
- Vacuum pump oil

********** WARNING **********

**Failure to follow maintenance or operating procedures, techniques, restrictions, etc., exactly may result in severe personnel injury, loss of life or major equipment damage.**

**********

**********WARNING**********

**Prior to performing maintenance on any equipment, lockout and tag the equipment in accordance with Lockout/Tagout Procedure MSOP-FA-ETF-413 (soon to be superseded by ET24-LOTO-SOP-001). Maintenance shall be performed by qualified technicians only.**

**********

1.7.1 Minimizing Electrical Shock Hazards

1.7.1.1 All electrical repairs and modifications shall be performed by electrical technicians to minimize the electrical shock hazard.

1.7.1.2 All bare electrical parts inside the chamber with a potential to ground of 50 volts or greater shall remain de-energized when the chamber is open. If this is infeasible, then safety related work practices shall be employed to prevent electrical shock. The safety related work practices shall be documented and approved by a senior ETF electrical engineer. All work near energized bare electrical parts shall be performed by qualified persons.

1.7.1.3 Personnel shall not enter into or reach into a chamber with energized bare electrical parts where there is a lack of illumination or an obstruction of view. Personnel shall never blindly reach into an area that may contain energized bare electrical parts.

1.7.1.4 Personnel shall remove all conductive apparel before working near energized bare electrical parts, including jewelry, watches, key chains, metalized aprons, and metal head gear.

1.7.1.5 Personnel may not perform housekeeping duties at close distances to energized bare electrical parts unless adequate safeguards are provided. Only non-conductive cleaning materials shall be used.

1.7.1.6 Any ladder used to enter chambers containing bare electrical parts energized at 50 volts or greater shall have nonconductive side-rails.

1.7.1.7 Personnel working near bare electrical parts energized at 50 volts or greater shall wear protective equipment adequate to insulate the potential shock hazard. Personnel shall use insulating tools near energized bare electrical parts.

1.7.1.8 Safety signs or tags shall be used to warn personnel that electrical shock hazards are present when there are bare electrical parts energized at 50 volts or greater.

1.7.1.9 Barricades shall be used in conjunction with signs or tags to limit personnel access.

1.7.1.10 Any de-energized electrical parts that are not locked-out, tagged-out, or unplugged shall be considered energized.

1.7.1.11 If tag-out is the method used, two or more isolation safeguard measures shall be used. Any bare electrical part that is energized at less than 50 volts to ground need not be locked-out or tagged-out provided there is no risk of burns or arcing.

1.7.1.12 All electrical parts located outside the chamber and energized at 50 volts or greater shall be guarded against accidental contact. Guarding methods include approved enclosures or permanent partitions or screens that restrict access by non-qualified personnel.

1.7.1.13 Personnel shall not handle, energize or de-energize, plug-in or unplug any electrical device when the device is wet, the employee is wet, or the floor is wet.

1.7.1.14 Locking type connectors shall be properly secured when connecting.

1.7.1.15 After a circuit has been de-energized by the opening of a protective device, the circuit shall be inspected by an ETF electrical technician before the circuit is re-energized.

1.7.1.16 Over-current protective devices shall not be modified.

1.7.2 Minimizing Extreme Temperature Hazards

The test chamber and test article shall be given sufficient time to return to a temperature above the 32°F and less than 104°F (40°C) before handling the test article in order to minimize the extreme temperature hazard. If infeasible to wait for the test article to warm to 32°F, then cryogenic PPE shall be worn including gloves and eye protection.

1.7.3 Minimizing Cryogenic Hazards

Personnel shall be aware of the possibility of freeze burns by contact with cold surfaces or liquids. Protective clothing including eye protection and gloves shall be worn by all personnel involved in handling of cryogenics or when making repairs/modifications to cryogenic facilities. Only certified cryogenic handlers shall handle cryogenics or perform repairs/modifications to cryogenic systems. In the event of a cryogenics spill, line ruptures, or similar emergencies, personnel shall first ensure that there is no possibility of asphyxiation due to oxygen displacement. Use a portable oxygen monitor to verify the spill area is safe before entering.

1.7.4 Minimizing Vacuum Pump Oil Hazards

The vacuum pump oil can cause skin and eye irritation. Avoid skin and eye contact with the oil. Remove this oil from the skin using soap and water. Wear safety glasses and gloves while adding or changing oil. Remove oil from the eyes by flushing with water for 15 minutes. Avoid breathing vacuum oil mist.

Any spilled oil is a slip hazard. Clean the area of any spilled oil immediately. Use barricades to limit access in the area until the spill is cleaned.

### 1.8 RESPONSIBILITIES

ETF personnel shall be responsible for the operation of the V11 and V20 Chambers. The designated operator of each chamber shall be responsible for the safe operation and conduct of the facility. The operator shall record their name in the chamber logbook.

Other task assignments and responsibilities at the ETF shall be in accordance with ET24-ETF-OWI-001.

## 2.0 FACILITY DESCRIPTION

### 2.1 CHAMBER DESCRIPTION AND DIMENSIONS

Chamber V11 is a stainless steel cylindrical vessel with polished interior surfaces. The inside dimensions are 47 inches diameter by 99 inches length. Installation of infrared lamps or cold plates reduces the space available for a test article. One to two feet of length may be added by installation of domed ends. V11 is connected to a vacuum plenum system consisting of the Chamber V20 and the interconnecting piping. Description of the V20 chamber is in MFOP-FA-ETF-405 (soon to be superseded by ET24-V20-FOP-001).

### 2.2 VACUUM SYSTEM

The V11 vacuum system consists of a chamber, mechanical roughing pump and pneumatic vacuum valves. Equipment to provide rapid depressurization includes a computer controlled butterfly throttling valve at V11and piping connecting V11 to V20.

### 2.3 CONTROL SYSTEM

The control system consists of a personal computer with Microsoft operating system and *Intellution iFIX* control and data acquisition software. A programmable logic control interfaces the computer with chamber feedback transducers and chamber actuators. Pressure monitoring is provided by convectron gauges and an MSK Baratron gauge. The launch depressurization rate is regulated by a computer controlled butterfly valve. The computer controls the butterfly valve with either input from a feedback pressure transducer or by changing valve positioning with respect to time.

### 2.4 THERMAL SYSTEMS

Hot thermal conditioning is provided by infrared lamps mounted on a metal frame with a reflector plate to irradiate the outer surfaces. Additional heat is from heaters mounted on backface of the test article. The lamps are controlled by the iFIX computer to a predetermined power level.

Cold thermal conditioning is provided by $LN_2$ and LHe cryogenic fluids piped into the chamber and through the test article. These Cryogens are controlled by hand valves and by solenoid valves inside the chamber.

**NOTE**
Maintenance or operating procedures, techniques, restrictions, etc., requires emphasis for safe operation.

## 3.0 FACILITY OPERATION

The operations of chamber V11 varies according to the customer requirements. This procedure provides general instructions on how to operate the chamber but does not cover every possible scenario. Operating personnel shall be thoroughly familiar with vacuum chamber operation and be familiar with the data acquisition software prior to operating this chamber.

Initial procedure steps as completed or complete the As-run Buy-off Sheets when operating the chamber. These sheets are typically provided with the TPS. If none is provided, use a copy of Attachment A.

### 3.1 FACILITY PREPARATION

3.1.1 _____Review the Safety Assessment, Memorandum ED26 (02-01) (soon to be issued as an ET24 memo, number unknown), to determine the JHAs and PPE that apply to operation of this chamber. Implement the risk mitigation methods listed in the JHAs and use the required PPE to minimize risk from potential hazards while operating this chamber.

3.1.2 _____Visually inspect electrical equipment for external damage including flexible cords, connectors, and plugs. An ETF electrical technician shall repair damage before proceeding to the next step.

3.1.3 _____Visually Inspect IR lamp array to ensure there are no damaged or burnt lamps. An ETF technician shall replace bad lamps before proceeding to the next step.

3.1.4 **Date System**

3.1.4.1 _____Switch **ON Daqview** data acquisition computer if it is not already running.

3.1.4.2 Use the Atomic Clock synchronizer software to set the computer clock on both computers used on this test.

3.1.4.2.1 _____Access the Atomic Clock synchronizer on the V11 Control Computer Task Bar and **START** the synchronizer.

3.1.4.2.2 _____Ping for the clock to set.

3.1.4.2.3 _____When synchronization is complete, exit the synchronizer software by selecting File, then Exit. **DO NOT use the X button** on the upper right corner of the synchronizer as this does not really exit the program.

3.1.4.2.4 _____Access the Atomic Clock synchronizer on the Data Acquisition Computer Task Bar and **START** the synchronizer.

3.1.4.2.5 _____Repeat Step 3.1.4.2.2.

3.1.4.2.6 _____Repeat Step 3.1.4.2.3.

### 3.1.5 CALIBRATION

3.1.5.1 _____Verify all instrumentation to be used on the test has current calibration labels where applicable.

3.1.5.2 _____Verify the calibration does not expire before the expected test conclusion date.

3.1.6 _____Remove Old and Install New Gore-Tex gasket onto Cryobox.

3.1.7 Perform Pre-Run Thermocouple Calibration

3.1.7.1 _____Fill 16" tall open face dewar with LN2

3.1.7.2 _____Place dewar in V11 Chamber

3.1.7.3 _____Bundle all internal Cryobox Type 'E' TCs and Dip into LN2 bath for a minimum of 1 minute and while data is being captured.

3.1.7.4 _____Press **print screen** on the HS-DAS computer. Open a blank Powerpoint presentation on HS-DAS computer. Type **Ctrl V** to paste the screen capture into PowerPoint. Under the File Menu, select **Save As**. Select the directory save location (dedicated Test Panel #### Directory), choose name ("TC Cal" + current date), and change file type to JPEG., Hit OK.

3.1.7.5 _____Remove TC Bundle from LN2 and remove LN2 dewar from chamber

3.1.7.6 _____Manually Log Channels 1-15 in Test Panel Traveler.

3.1.8 _____Install the test article and connect its instrumentation.

3.1.9 Verify all thermocouple are reading on the data system and the heater control system is set for operation.

3.1.9.1 _____Verify all thermocouples on the re-rad plate.

3.1.9.2 _____Verify all thermocouples on the foam face.

3.1.9.3 _____Verify all thermocouples on the inside the cryobox.

3.1.9.4 _____Verify all thermocouples on the on the back face of the panel.

3.1.9.5 _____Connect all Test Panel Heaters circuit per Heater Wiring Layout Sheet, Page 16.

3.1.9.6 _____Verify all the heaters control system power supplies are switched **ON** and set at voltage requested by the customer.

3.1.9.7 _____ Manually operate all heaters by turning on backface heaters on the V11 control computer. Observe that the heater voltage and current are displayed, and then switch **OFF** backface heaters.

3.1.9.8 _____Mount Test Panel onto Cryobox.

3.1.10 _____Verify all pressure gauges are switched **ON**, operating and indicating ambient pressure, including the V11 Convectron gauge and Baratron gauges**.** The gauges indicate approximately 750 torr (14.5 psia) if they are operating properly.

3.1.11 _____psi _____gal. Verify there is adequate $LN_2$ and the vessel pressure is 15 to 30 psig. Use 50% as the requirement minimum in the supply vessel until experience is gained. Record the $LN_2$ levels above and in the log book at the beginning and at the end of the test.

3.1.12 _____psi _____inch $H_2O$ Verify there is adequate LHe and the vessel pressure is 15 psig. Use 2 inches or greater as the requirement minimum in the supply vessels. Record LHe levels above and in the logbook at the beginning and at the end of the test.

3.1.13_____Ensure that all connections to the chamber are compatible with proper operation of the chamber. Determine that the test is ready to start.

**Prior to performing maintenance on any equipment, lockout and tag the equipment in accordance with Lockout/Tagout Procedure MSOP-FA-ETF-413. Maintenance shall be performed by qualified technicians only.**

**********

3.1.14 _____Photograph the test article inside the test chamber before the chamber is sealed. Take as many photographs as considered necessary dependent on the complexity of the test. Submit the photograph(s) to the ETF Test Data Administrator.

3.1.15_____**START** the V11 control computer and iFIX software if it has been shut down.

3.1.16_____Verify all switches on the V11 control screen are gray except V20 Stopped and Emergency Lamp OFF.

3.1.17 _____ Verify the V11 Cryo Box Press Control is in AUTO.

3.1.18_____Visually inspect the level and condition of the oil in V20 pumps used in rapid depressurization. Add or change oil as needed. Oil shall be changed whenever it is darkened, contaminated, milky, or if the pump performance has degraded. Wear eye protection and gloves while adding or changing oil. Remove oil from the eyes by flushing with water for 15 minutes. Avoid breathing vacuum oil mist. Any spilled oil is a slip hazard. Clean the area of any spilled oil immediately. Use barricades to limit access in the area until the spill is cleaned.

3.1.19_____Verify cooling water is flowing at the V20 roughing pumps. **OPEN** the cooling water inlet hand valves (V201 & V202) at the pumps if water is not flowing.

3.1.20_____**CLOSE** the roughing pump vent valve.

3.1.21_____Maintain a portable oxygen monitor operating within 10 feet of the V11 door until the end of test.

3.1.22 _____**OPEN** the overhead door.

3.1.23 _____Verify VJ Supply Line is connected to liquid helium trailer.

3.1.24 _____Verify VV7 Hot Gas Supply Valve is **CLOSED**.

3.1.25 _____Verify VV6 Hot Gas Bypass Valve is **OPEN**.

3.1.26 _____Verify the lamp array position using lamp array template.

3.1.27 _____Start Low Resolution Video recording on both VHS tape and digital recorders.

**********WARNING: CRYOGENICS**********

**The V20 and V11 chambers have numerous cryogenic lines. Any liquid leaking shall be assumed to be cryogenic until established otherwise. The area of a cryogen leak shall be roped-off to prevent personnel from inadvertently entering this area. Personnel shall comply with safety precautions of Sections 1.4 and 1.7 and wear adequate personnel protective gear when entering the leak area.**

**********

## 3.2 V11 VACUUM SYSTEM OPERATION

3.2.1 _____Select the TC display window on the data acquisition computer

3.2.2 Start HSDAS and Record Date and Time here.

_____ Date _____ Time.

3.2.3 **Flow $LN_2$ to the Test Article.**

3.2.3.1 _____**OPEN** the GHe vent valve VV2.

3.2.3.2 _____**OPEN** the Cryo Box Vent on the V11 control computer.

3.2.3.3 _____**OPEN** the $LN_2$ vent valve VV5.

3.2.3.4 _____**OPEN** the LN2 Supply valve on the V11 control computer**.**

3.2.3.5 _____**OPEN** the $LN_2$ bypass valve on the V11 control computer.

3.2.3.6 _____**OPEN** the $LN_2$ supply hand valve VV4.

3.2.3.7 _____Chill Panel; Tighten flange bolts as needed.

**Note:** After all panel temps are below -315 F Start GHE flow.

3.2.4 **Flow LHe to the Test Article.**

3.2.4.1 _____ **OPEN** the GHe bypass hand valve VV3.

3.2.4.2 _____**OPEN** the LHe Trailer supply hand valve one turn.

3.2.4.3 _____**OPEN** the GHe supply hand valve after liquid is visible through the bypass.

3.2.4.4 _____**CLOSE** GHe bypass hand valve.

3.2.4.5 _____ **OPEN** LHe Trailer Supply valve at least one more full-turn and up to fully open as needed and soak panel for required time.

3.2.4.6 Record soak time begins _____ Calculate completion time_____

Actual completion time_____.

3.2.4.7 _____ During the soak period, adjust the $LN_2$ Vent Hand Valve to produce approximately 2.0 psi delta pressure in the Cryo Box as displayed on the V11 control computer. Adjust $LN_2$ Vent Valve as needed to minimize overpressure of venting.

3.2.5 _____ Switch ON **START V20** on the V11 control screen 1 hour before soak time is complete.

3.2.6 _____ Verify the V11 Start Light Control is in AUTO.

3.2.7 _____ Install the lamp array 10 minutes before soak time completes.

3.2.7.1 _____ Install lamp array in front of chamber.

3.2.7.2 _____ Connect the lamp array power leads.

3.2.7.3 _____ Verify buss breaker #67 located overhead on the south wall is **ON**.

3.2.7.4 _____ Verify V11 phaser power knife switch located on north wall behind the V20 phasers is ON.

3.2.7.5 _____ Verify V11 phaser power knife switch located on Blue phaser box is ON.

3.2.7.6 _____ Verify phaser power plug on Gray phaser box is connected to power outlet on side of Sunspot Chamber.

3.2.7.7 _____ Verify all power wiring is connected between both phaser boxes and the chamber.

### 3.2.8 Prepare for $LN_2$ Drain and Chamber Pumpdown

3.2.8.1 _____ Verify Test Panel Soak is complete.

3.2.8.2 _____ Switch **ON** and **ADJUST** Chamber Lights to 100Vdc

3.2.8.3 _____ Fit check chamber door height.

3.2.8.4 _____Verify HS video is ready.

3.2.8.5 _____Push the lamp array into position.

3.2.8.6 _____Switch **ON** the Lamp Power.

### 3.2.9 Cryogenic Shutdown and Rapid Pumpdown.

3.2.9.1 _____**START** the HS video.

3.2.9.2 _____**OPEN** fully the $LN_2$ vent hand valve.

3.2.9.3 _____**CLOSE** the $LN_2$ Supply hand valve**.**

3.2.9.4 _____**OPEN** the Cryo Box Drain on the control computer.

3.2.9.5 _____**CLOSE** the LHe Trailer Supply hand valve.

3.2.9.6 _____**OPEN** the GHe Bypass hand valve.

3.2.9.7 _____ **CLOSE** the GHe Supply hand valve on V11 control computer.

3.2.9.8 _____**CLOSE** LN2 supply valve on V11 control computer.

3.2.9.9 _____**CLOSE** $LN_2$ bypass valve on V11 control computer.

3.2.9.10 _____After $LN_2$ has drained, **PLACE** the drain hose in chamber and then **CLOSE** the chamber door. Wear cryo PPE when handling the $LN_2$ Drain hose.

3.2.9.11 _____**CLOSE** the $LN_2$ Vent hand valve.

3.2.9.12 _____**START** RPD.

**Note:** After 510 Seconds a Test Completion Buzzer will sound.

## 3.3 VACUUM SYSTEM SHUTDOWN

3.3.1 _____Wait for the chamber pressure to reach 14 psia and observe that the chamber vent stops.

3.3.2 _____Prepare to remove the chamber door, and then **OPEN** the Chamber Vent until chamber reaches atmosphere pressure.

3.3.3 _____When the chamber door is loose, pull it away from the chamber.

3.3.4 _____Record LN2 and LHe vessel levels in the V11 chamber log book.

3.3.5 _____Verify all electrical circuits in the chamber are switched off and de-energized, including IR lamp circuits and all of the customer's circuits. After the door is opened, and before other activities, an ETF electrical technician shall check for potential on all of the ETF's bare electrical parts energized at 50 volts or greater. The customer shall check for potential on the test article's bare electrical parts energized at 50 volts or greater. If it is infeasible to de-energize all electrical circuits, comply with all requirements of Section 1.7.1 Minimizing Electrical Shock Hazards. If it is infeasible to de-energize all electrical circuits on the test article, provide the customer with a copy of Section 1.7.1 Minimizing Electrical Shock Hazards.

3.3.6 _____Verify the lamp array is cool enough to handle and then remove the lamp array.

3.3.7 _____Take post test photographs of the test article.

3.3.8 _____Wait for Test Conductor's direction then STOP DATA RECORDING

then record date and time here _____Date _____Time.

3.3.9 _____Notify Test Customer that the Test panel is ready for warm-up process and verify desired test panel heating method.

_____Method 1 (No active Heating):
- _____Open LN2 Vent hand valve
- _____Close Cryo Box Vent on V11 control computer.
- _____Close Cryo Box Drain on V11 control computer.

_____Method 2 (Air flow):
- _____Open LN2 Vent hand valve.
- _____Close Cryo Box Vent on V11 control computer.
- _____Close Cryo Box Drain on the V11 control computer.
- _____Verify air pressure regulator is set for 20psig.
- _____Open the air supply hand valve H1 to the hot gas cart.
- _____Open the Hot Gas Supply hand valve.
- _____Close the bypass hand valve.

_____Method 3 (Heated Air Flow)
- _____Open LN2 Vent hand valve.
- _____Close Cryo Box Vent on the V11 control computer.
- _____Close Cryo Box Drain on the V11 control computer.
- _____Verify air pressure regulator is set for 20psig.
- _____Open the air supply hand valve H1 to the hot gas cart.
- _____Open the Hot Gas Supply hand valve.

_____Close the bypass hand valve.
_____Turn on Heater Cart Controls.
_____Verify Heater Cart Controls are set to 100 deg F. If not, adjust set point.

_____Method 4 (Heated Air Flow and Backface Heating)
_____Open LN2 Vent hand valve.
_____Close Cryo Box Vent on V11 control computer.
_____Close Cryo Box Drain on V11 control computer.
_____Verify air pressure regulator is set for 20psig
_____Open the air supply hand valve H1 to the hot gas cart
_____Open the Hot Gas Supply hand valve.
_____Close the bypass hand valve.
_____Turn on Heater Cart Controls.
_____Verify Heater Cart Controls are set to 100 deg F. If not, adjust set point.
_____Switch **ON** the Backface Heater on the V11 control computer

3.3.10_____Select **STOP V20** on the V11 control screen after V20 chamber pressure has reached a low of 1 torr.

3.3.11_____Ensure that all temperatures are at $0^{o}$C to $40^{o}$C ($32^{o}$ F to $104^{o}$ F) and above the dew point. If infeasible to wait for the test article warm to $0^{o}$C then cryogenic PPE shall be worn by personnel working inside the chamber and/or handling test article. The PPE shall include but not limited to eye protection and gloves.

3.3.12 _____If the Backface Heaters are on switch them **OFF**.

3.3.13 _____Turn OFF Hot gas cart controls.

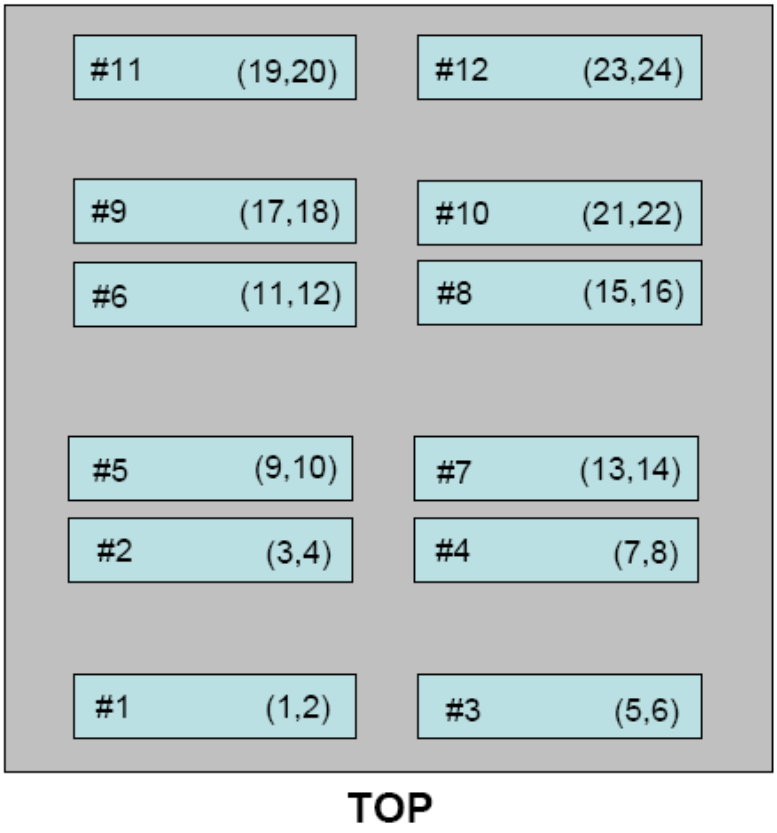
3.3.14_____**CLOSE** the air supply hand valve H1 to the hot gas cart.

3.3.15_____**CLOSE** the Hot Gas Supply hand valve.

3.3.16_____**OPEN** the bypass hand valve.

3.3.17_____Test article may now be removed from the chamber.

## Heater Wiring Layout Sheet



## 4.0 EMERGENCY SHUTDOWN

_____4.1 Select EMERGENCY **LAMPS OFF** on the V11 control screen if there is a fault with the IR heaters. Then **OPEN** overhead buss Breaker 67.

_____4.2 **UNPLUG** the control circuit from the orange 120v outlet if there is a dangerous electrical fault in the computer or data acquisition system.

_____4.3 **OPEN** breakers 19 through 24 in Panel LP on the south wall of the Sunspot pit near the southwest corner for other electrical faults or for dangerous electrical faults from an unknown source.

_____4.4 **CLOSE** the $LN_2$ supply valve VV4 if leaking $LN_2$ causes an unsafe condition. If a $LN_2$ leak continues, **CLOSE** the Sunspot $LN_2$ supply on the $LN_2$ control panel in the control room.

_____ 4.5 **CLOSE** the LHe trailer supply valve if LHe is leaking and may cause an unsafe condition. If LHe trailer supply valve fails to close and the leaking helium is causing a dangerous condition, **OPEN** the blow off valve located in the left back panel of the LHe trailer.

_____4.6 Vent chamber and remove test article only when there is no significant risk of injury to personnel and no risk of damage to test article.

# V11 **As-run Buy-off Sheet**

Test Number _____ Customer Contact _____

Calling TPS or Work Instructions _____Start Time & Date _____

Test Description_____ End Time & Date _____

Verify no open item TPS, ETF Signature _____

QA signature for Category 1 or 2 testing_____

**3.1 Facility Preparation**

3.1.1 _____

3.1.2 _____

3.1.3 _____

3.1.4.1 _____

3.1.4.2.1 _____

3.1.4.2.2 _____

3.1.4.2.3 _____

3.1.4.2.4 _____

3.1.4.2.5 _____

3.1.4.2.6 _____

3.1.5.1 _____

3.1.5.2 _____

3.1.6 _____

3.1.7.1 _____

3.1.7.2 _____

3.1.7.3 _____

3.1.7.4 _____

3.1.7.5 _____

3.1.7.6 _____

3.1.8 _____

3.1.9.1 _____

3.1.9.2 _____

3.1.9.3 _____

3.1.9.4 _____

3.1.9.5 _____

3.1.9.6 _____

3.1.9.7 _____

3.1.9.8 _____

3.1.10 _____

3.1.11 _____

3.1.12 _____

3.1.13 _____

3.1.14 _____

3.1.15 _____

3.1.16 _____

3.1.17 _____

3.1.18 _____

3.1.19 _____

3.1.20 _____

3.1.21 _____

3.1.22 _____

# V11 **As-run Buy-off Sheet**

3.1.23 _____

3.1.24 _____

3.1.25 _____

3.1.26 _____

3.1.27 _____

**3.2 Vacuum Sys Operation**

3.2.1 _____

3.2.2 _____

3.2.3.1 _____

3.2.3.2 _____

3.2.3.3 _____

3.2.3.4 _____

3.2.3.5 _____

3.2.3.6 _____

3.2.3.7 _____

3.2.4.1 _____

3.2.4.2 _____

3.2.4.3 _____

3.2.4.4 _____

3.2.4.5 _____

3.2.4.6 _____

3.2.4.7 _____

3.2.5 _____

3.2.6 _____

3.2.7 _____

3.2.7.1 _____

3.2.7.2 _____

3.2.7.3 _____

3.2.7.4 _____

3.2.7.5_____

3.2.7.6_____

3.2.7.7_____

**3.2.8 LN2 drain & Pumpdown**

3.2.8.1 _____

3.2.8.2 _____

3.2.8.3 _____

3.2.8.4 _____

3.2.8.5 _____

3.2.8.6 _____

**3.2.9 Cryo Shutdown &RPD**

3.2.9.1 _____

3.2.9.2 _____

3.2.9.3 _____

3.2.9.4 _____

3.2.9.5 _____

3.2.9.6 _____

3.2.9.7 _____

3.2.9.8 _____

3.2.9.9 _____

3.2.9.10 _____

3.2.9.11 _____

3.2.9.12 _____

**3.3 Vac Sys Shutdown**

3.3.1. _____

3.3.2 _____

3.3.3 _____

3.3.4 _____

3.3.5 _____

3.3.6_____

3.3.7 _____

3.3.8 _____

3.3.9 _____

# V11 **As-run Buy-off Sheet**

3.3.10 _____

3.3.11 _____

3.3.12 _____

3.3.13 _____

3.3.14 _____

3.3.15 _____

3.3.16 _____

3.3.17 _____

QA _____

NA if not applicable