National Aeronautics and
Space Administration

George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

FACILITY OPERATING PROCEDURE
FOR
THERMAL ALTITUDE CHAMBER
TA1

ENVIRONMENTAL TEST FACILITY BRANCH
STRUCTURAL AND ENVIRONMENTAL TEST DIVISION
TEST LABORATORY
ENGINEERING DIRECTORATE

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FACILITY OPERATING PROCEDURE
FOR
THERMAL ALTITUDE CHAMBER
TA1

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1.0 GENERAL INFORMATION

1.1 PURPOSE

This document describes the procedures for the operation of Thermal Altitude Chamber TA1 located at the Environmental Test Facility (ETF) in Marshall Space Flight Center (MSFC) Building 4612.

1.2 SCOPE

The procedures and practices outlined in this document are to be followed in the operation of chamber TA1. This document provides a record copy of chamber TA1 operations.

1.3 APPLICABLE DOCUMENTS

NPR 8715.3	NASA Safety Manual
MPR 8715.1	Marshall Safety, Health, and Environmental (SHE) Program
MWI 8715.1	Electrical Safety Program
ET24-UnattnOps-SOP-001	Unattended Operation of the Environmental Test Facility
MSOP-FA-ETF-413	Control of Hazardous Energy (Lockout/Tagout) Procedure for the Environmental Test Facility (soon to be superseded by ET24-LOTO-SOP-001)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 (ETF) 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 4612 Building Manager Assistant.

The chamber can reach extreme temperatures both hot and cold. The test chamber and test article shall be given sufficient time to return to ambient temperature ±10 degrees C (±18 degrees F) before removing the test article in order to minimize the extreme temperature hazard.

ET24 Safety Assessment, Memorandum of Record ED26 (02-01) delineates the procedures, personal protective equipment (PPE) requirements and job hazard analysis (JHAs) for hazards associated with operation of this chamber. Operators shall follow procedures, implement the risk mitigation methods listed in the JHAs and use the required PPE to minimize risk from potential hazards during chamber operations.

1.5 EMERGENCY TELEPHONE NUMBERS

In case of the following emergencies Call **911**;

Medical	911
Ambulance	911
Fire	911
Security	911
Chemical Spills	911

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

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

1.6 CHECKOUT TEST

When there is time allowed in the test schedule, a "dummy" test article shall be used to determine program set-points for the thermal controllers and safety devices. The checkout test is particularly important for critical qualification tests. The "dummy" test article shall provide an accurate thermal simulation of the actual test article.

1.7 HAZARDS LIST

- 480 and 120 volts AC electrical power
- Extreme temperatures (hot and cold)
- Vacuum pump oil

**********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.

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

Maintenance or operating procedures, techniques, restrictions, etc. may result in severe personnel injury, loss of life or major equipment damage if not followed exactly.

****

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 possible. If this is infeasible, then safety related work practices shall be employed to prevent electrical shock. The safety related work practices shall be documented in accordance with MWI 8715.1 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 shall 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 the chamber when it contains 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 be provided 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 an electrical shock hazard is 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. If tag-out is the method used, two or more 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.

1.7.1.11 All live 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.

1.7.1.12 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.

1.7.1.13 Locking type connectors shall be properly secured after connection.

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

1.7.1.15 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 ambient temperature $\pm$10 degrees C($\pm$18 degrees F) before removing the test article in order to minimize the extreme temperature hazard.

1.7.3 Minimizing Pump Oil Hazards

There is a risk that the test article could be contaminated with vacuum pump oil. The chamber shall only be operated by trained personnel to minimize the risk of oil contamination. The vacuum pump oil can cause skin irritation. Avoid skin contact with the oil. Remove this oil from the skin using soap and water. Remove oil from the eyes by flushing with water for 15 minutes. Wear eye protection and gloves while adding or changing oil. 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 TA1 Thermal Altitude Chamber. The designated operator of the chamber shall be responsible for the safe operation and conduct of the facility. This responsibility includes safety for personnel, the test article, and 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

This ETF temperature/humidity/altitude chamber is designated TA1. The chamber was manufactured by Russells Technical Products, Holland, Michigan. Chamber TA1 is identified as Model No. RDH-64-15-15. Unobstructed, usable internal space of the chamber is approximately a cube measuring 47 inches deep, 48 inches high, and 47 inches wide. One side of the chamber is a front opening door with a 17 inch by 17 inch square viewing window located near the center of the door.

Four feed-through portholes are located in the sidewalls of the chamber (two on each side). These 3 7/8-inch diameter portholes are used for electrical and mechanical connections to the test article and thermocouple feed-through.

Cooling capability is provided by a two-stage cascade refrigeration system using HFC-507 refrigerant in the high temperature system and HFC-508B refrigerant in the low temperature system. Heating is provided by air heaters equipped with electrical resistive heater elements. The heaters have interlocks that switch them off when the chamber's simulated altitude is above 60,000 feet. The chamber is also equipped with a vertical airflow package to regulate the amount of air circulation.
A low-pressure humidity vapor generator provides humidity. The vapor generator is heated and pressurized to generate vapor that is injected into the chamber. Dehumidification is provided by a refrigerated dehumidify coil. The humidity system has interlocks that switch them off when the chamber's simulated altitude is above 15,000 feet.

Chamber altitude is simulated by sealing the chamber and evacuating the volume using a mechanical vacuum pump. The vacuum pump is a Kinney Model KD-30 oil seal rotary piston pump.

2.2 DIMENSION CONTROLLER

Temperature, humidity, and altitude can be maintained at a constant value or continuously varied according to a predetermined program manually entered into the Dimension Model 88705 Multi-Loop Process Controller. The Dimension controller allows the operator to manually enter up to 749 temperature/altitude/humidity profile segments, with segment times from 0.1 seconds up to 99 hours. Segments can be repeated in a programmed loop up to 255 times. The Program is limited to 25 loops. Operating personnel shall be thoroughly familiar with "Dimension User Manual" operating instructions prior to programming the Dimension controller. The manual is available in the ETF Library.

2.3 PERFORMANCE

The chamber has an adjustable temperature range of -95°F to +375°F (-70°C to +190°C). Temperatures within this range can be maintained to ± 2 deg C (dry bulb or wet bulb) of nominal value.

Humidity can be controlled from 10% to 95%, but only within the temperature range of 40°F to 185°F (4°C to 85°C) and under 15,000 feet altitude. The humidity sensor shall be removed if the upper temperature extreme exceeds 300°F (149°C).

Pressure can be controlled to simulate altitudes from local ground level up to 100,000 feet (ground to 30 km).

Heating and cooling rates vary depending on the thermal load presented by the test specimen. Ascending rates can vary dependent on thermal conditions. An empty chamber performs approximately as follows:

Maximum Cooling Rates
- 80°F to -30°F 10 minutes.
- 80°F to -80°F 20 minutes.
- 80°F to -95°F 40 minutes.

Maximum Heating Rates
- 80°F to 125°F 5 minutes
- 80°F to 170°F 10 minutes
- 80°F to 250°F 20 minutes
- 80°F to 320°F 30 minutes
- 80°F to 345°F 35 minutes

Maximum Ascending Rates
- Ground level to 1500 feet 30 seconds
- Ground level to 20,000 feet 5 minutes
- Ground level to 36,000 feet 10 minutes
- Ground level to 60,000 feet 20 minutes
- Ground level to 70,000 feet 30 minutes
- Ground level to 86,000 feet 60 minutes
- Ground level to 100,000 feet 120 minutes

Maximum Descending Rates
- 100,000 feet to 34,000 feet 30 seconds
- 100,000 feet to 23,000 feet 1 minute
- 100,000 feet to 4,000 feet 4 minute
- 100,000 feet to ground level 9 minute

2.4 PANEL SWITCHES AND CONTROLS

The thermal altitude chamber operational controls are located on the right side of the chamber. Switches and controls necessary for operation are listed as follows:

Switch	Switch State in UP Position	Switch State in CENTER Position	Switch State in DOWN Position
Pilot	ON		OFF
Circulation	ON		OFF
Heating	ON		OFF
Cooling	ON		OFF
Light	ON		OFF
Humidity	AUTO	OFF	MANUAL
Dehumidify	ON		OFF
Altitude	AUTO	OFF	MANUAL

Near the switches, facing front is the Dimension controller and Watlow product safeguard temperature-limiting controller.

At the rear of the chamber there is a mercury manometer and two limiting relay resets with indicator lights for the chamber high limit safety (HLS) and the refrigeration system (REFRIG). The HLS switches off the chamber heaters if the chamber temperature exceeds 350^0F (177^0C). The chamber has the capability to operate to 375^0F, but the humidity sensor shall be removed and the HLS reset. The REFRIG switches off the refrigeration system if it is in an overload condition.

3.0 FACILITY OPERATION

The operations of chamber TA1 varies according to the temperature range, humidity range, altitude range and whether steady state or cycling conditions are required. The procedure provides sufficient detail to operate the chamber in manual or steady state mode. This procedure provides general information about programming for varying environments but does not cover details for every feasible scenario. Operating personnel shall be thoroughly familiar with "Dimension User Manual" operating instructions prior to programming a varying environment profile in the Dimension controller.

Complete the As-run Buy-off Sheets when operating the chamber. These sheets are typically provided with the test preparation sheets (TPS). If none is provided, use a copy of Attachment A. Additional As-run Buy-off sheets shall be used if the test is required to restart.

NOTE

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

3.1 FACILITY PREPARATION

3.1.1. Review the safety assessment, Memorandum of Record ED26 (02-01), to determine the JHAs and PPE that applies 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 Ensure that all connections to the chamber are compatible with proper operation of the chamber. Determine that the test is ready to start.

NOTE: Use only deionized or distilled water in the humidification system. The use of untreated water causes a build up of scale in the vapor generator and wet bulb trough.

3.1.3 Visually inspect the level and condition of the pump oil. Add or change oil as needed. Oil shall be changed whenever it is darkened, contaminated, milky, or if the pump performance has degraded.

CAUTION: Wear gloves and eye protection when handling the vacuum pump oil. Avoid skin contact. Wash any oil contaminated skin with soap and water. Avoid breathing mist of this oil. Remove oil from the eyes by flushing with water for 15 minutes. Keep oil stored in a cool dry place.

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.

3.1.4 If the chamber main power has been off for 6 hours or more, the crankcase heater shall be allowed to warm the crankcase for 24 hours prior to proceeding. Record any power outages of one hour or longer in the chamber log.

WARNING: **Failure to allow the crankcase heaters to warm the compressor crankcase before reactivating the chamber may result in serious damage to the compressor due to refrigerant slugging and lack of lubrication.**

3.1.5 Calibration

3.1.5.1 Verify all instrumentation to be used to record data on the test have current calibration labels.

3.1.5.2 Verify that calibrations shall not expire before the expected test conclusion date.

3.1.6 Place all switches on the control panel to the "OFF" position.

3.1.7 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.

3.2 TEST ARTICLE INSTALLATION

3.2.1 Install the test article. Test article configuration shall be in accordance with its test procedure or TPS requirements. Test article configuration shall simulate service usage as closely as reasonable. The test article shall be spaced in the chamber so as to provide free air circulation between it and the chamber walls.

3.2.2 Photograph the test article and test setup. Take as many photographs as necessary dependent on the complexity of the test setup. Copies of these photographs shall be given to the ETF Test Data Administrator before or immediately following the end of testing.

3.3 THERMAL ALTITUDE TESTING

3.3.1 Switch **ON** the PILOT switch.

3.3.2 Ensure that thermocouples are operating correctly. The thermocouples should indicate the ambient temperature and be stable within $\pm$2 deg F. This includes the temperature and control sensors, and the thermocouples used for the data acquisition and recording systems.

3.3.3 High temperature alarm check and set:

3.3.3.1 Press the MODE button until AHI appears on the Product Safeguard LED readout.

3.3.3.2 Gradually lower the set point until it passes the chamber temperature. The alarm buzzer shall become audible.

3.3.3.3 Raise the set-point temperature 30°F above the chamber temperature and reset the alarm.

3.3.3.4 Adjust the set point to 15°F above the maximum test profile temperature.

3.3.4 Low temperature alarm check:

3.3.4.1 Press the MODE button until ALO appears on the LED readout.

3.3.4.2 Gradually raise the set point until it is above the chamber temperature. The alarm buzzer should become audible.

3.3.4.3 Lower the set point to a temperature 30°F below the chamber temperature and reset the alarm.

3.3.4.4 Adjust the set point to 15°F below the minimum test profile temperature.

NOTE: Do not continue with test if the alarms do not operate properly.

3.3.5 If a humidified environment is required, ensure the water supply is available.

3.3.6 If the chamber is to be manually controlled, enter the required settings for the required temperature, altitude, and/or humidity into the Dimension controller.

3.3.6.1 Press the diamond button up or down to highlight the loop icon. 

3.3.6.2 Set the Set-point Source 1 to OPERATOR by turning the multifunction button to highlight SptSrc01, pressing the multifunction button, turning to OPERATOR and pressing the multifunction button again.

3.3.6.3 Set the Loop-mode 1 to AUTO by turning the multifunction button to highlight LpMode01, pressing the multifunction button, turning to AUTO and pressing the multifunction button again.

3.3.6.4 Press the diamond button left or right until SptSrc01 changes to SptSrc02.

3.3.6.5 Set the Set-point Source 2 to OPERATOR by turning the multifunction button to highlight SptSrc02, pressing the multifunction button, turning to OPERATOR and pressing the multifunction button again.

3.3.6.6 Set the Loop-mode 2 to AUTO by turning the multifunction button to highlight LpMode02, pressing the multifunction button, turning to AUTO and pressing the multifunction button again.

3.3.6.7 Press the diamond button left or right until SptSrc02 changes to SptSrc03.

3.3.6.8 Set the Set-point Source 3 to OPERATOR by turning the multifunction button to highlight SptSrc03, pressing the multifunction button, turning to OPERATOR and pressing the multifunction button again.

3.3.6.9 Set the Loop-mode 3 to AUTO by turning the multifunction button to highlight LpMode03, pressing the multifunction button, turning to AUTO and pressing the multifunction button again.

3.3.6.10 Press the diamond button up or down to highlight the overview icon.

3.3.6.11 Set the temperature set point by turning the multifunction button to highlight SP1. Press the multifunction button, turning it to the required temperature, and pressing the multifunction button again.

3.3.6.12 Set the humidity set point by turning the multifunction button to highlight SP2. Press the multifunction button, turning it to the required humidity, and pressing the multifunction button again.

3.3.6.13 Set the altitude set point by turning the multifunction button to highlight SP3. Press the multifunction button, turning it to the required altitude, and pressing the multifunction button again.

3.3.7 If the chamber is to be automatically controlled for variable temperature, humidity, and/or altitude, enter the required profiles for temperature, altitude, and/or humidity into the Dimension controller.

3.3.7.1 Press the diamond button up or down to highlight the loop icon.

3.3.7.2 Set the Set-point Source 1 to PROGRAM by turning the multifunction button to SptSrc01, pressing the multifunction button, turning to PROGRAM and pressing the multifunction button again.

3.3.7.3 Set the Loop-mode 1 to AUTO by turning the multifunction button to LpMode01, pressing the multifunction button, turning to AUTO and pressing the multifunction button again.

3.3.7.4 Press diamond button left or right until SptSrc01 changes to SptSrc02.

3.3.7.5 Set the Set-point Source 2 to PROGRAM by turning the multifunction button to SptSrc02, pressing the multifunction button, turning to PROGRAM and pressing the multifunction button again.

3.3.7.6 Set the Loop-mode 2 to AUTO by turning the multifunction button to LpMode02, pressing the multifunction button, turning to AUTO and pressing the multifunction button again.

3.3.7.7 Press diamond button left or right until SptSrc02 changes to SptSrc03.

3.3.7.8 Set the Set-point Source 3 to PROGRAM by turning the multifunction button to SptSrc03, pressing the multifunction button, turning to PROGRAM and pressing the multifunction button again.

3.3.7.9 Set the Loop-mode 3 to AUTO by turning the multifunction button to LpMode03, pressing the multifunction button, turning to AUTO and pressing the multifunction button again.

3.3.7.10 Press the diamond button up or down to highlight the Program icon.

3.3.7.11 Turn the multifunction button to Build and press it to enter the program screen.

3.3.7.12 Enter the time segment number by turning the multifunction button to the Segment. Press the multifunction button, turn it to 01, and press the multifunction button again. Segments are the steps of the profile that are typically numbered sequentially

3.3.7.13 Set the profile segment time by turning the multifunction button to the Seg Time, press the multifunction button, turn it to enter the required time duration hours, and press the multifunction button again. Press the multifunction button, turn it to the required minutes, and pressing the multifunction button again. Repeat to enter the time segment seconds.

3.3.7.14 Set Event 1 ON if humidity is required and Event 2 ON if altitude is required. Turn the multifunction button to Events, pressing it, turning the multifunction button to show 1 in the first space, and press the multifunction button again. Repeat these steps to show 2 in the second space. Turn the multifunction button till the Recycles is highlighted.

3.3.7.15 Turn the multifunction button to highlight the Next Segment. Press the multifunction button, turn to 02, and then press it again. This sets the next segment in the profile that is typically programmed sequentially.

3.3.7.16 Turn the multifunction button to Pg1Spt01and press the multifunction button. Another screen appears with Pg1Spt01 highlighted. Press the multifunction button, turn the multifunction button to the required temperature, and press the multifunction button again.

3.3.7.17 Turn the multifunction button to Pg1Spt02. Press the multifunction button and turn the multifunction button to the required humidity, and press the multifunction button again.

3.3.7.18 Turn the multifunction button to Pg1Spt03. Press the multifunction button, turn the multifunction button to the required altitude, and press the multifunction button again.

3.3.7.19 Turn the multifunction button to Close_Wn then press the button.

3.3.7.20 Repeat 3.3.7.12 to 3.3.7.19 for all steps of the profile except sequence the Segment and Next Segments for each step. When the last step is programmed, set the Next Segment to the same number as the Segment.

3.3.7.21 Turn the multifunction button to Close Wn then press the button.

Note: Humidity and altitude controls operate only when both the HUMID and ALTITUDE switches are in automatic and Dimension Controller Events 1 and 2 are ON. Dimension controller Events 1 and 2 can switched on from the program mode.

3.3.8 If using PACRATS, switch **ON** the data acquisition computer and start data acquisition.

3.3.9 Switch **ON** the CIRCULATION.

3.3.10 Switch **ON** HEAT and switch **ON** COOL if a thermal environment is required.

3.3.11 The humidity sensor shall be removed if the maximum chamber temperature is to exceed 300°F.

3.3.12 Switch **ON** the LIGHT whenever viewing inside the chamber. Normally the LIGHT shall be switched **OFF**.

3.3.13 If a variable humidity environment is programmed, switch HUMIDIFY to **AUTO** and switch DEHUMIDIFY to **ON**. If the humidity environment is to be set manually using the Operator Mode, switch HUMIDIFY to **MANUAL** and switch DEHUMIDIFY to **ON**.

3.3.14 If a variable altitude environment is programmed, switch ALTITUDE to **AUTO**. If the altitude is to be set manually using the Operator Mode, switch ALTITUDE to **MANUAL**.

3.3.15 If the Dimension controller is in the program mode, start the program. Press the diamond button up or down to highlight the Program icon. 

3.3.16 Turn the multifunction button to highlight Strt_Pgr. Press the multifunction button. On the new screen that appears turn the multifunction button to Start_Prgr. Press the multifunction button. Turn the multifunction button to Close_Wn and press the button again. If the program starts, Pg_Mode01 indicates Run and T_Left starts a countdown.

3.4 UNATTENDED OPERATIONS

The thermal altitude chamber is designed for continuous automatic operation. To preclude inadvertent automatic shutdown of the chamber or anomalies in the test environment and/or test data, complete the following steps before leaving the operating equipment unattended.

3.4.1 Verify that all facility expendable sources are available for the unattended period.

3.4.2 Verify that the deionized water supply is available.

3.4.3 Complete applicable sections of the procedure ET24-UnattnOps-SOP-001, Unattended Operation of the Environmental Test Facility.

3.5 SYSTEM SHUTDOWN

3.5.1 Set altitude to zero.

3.5.2 Position all control panel switches **OFF**.

3.5.3 Verify the test article has returned to a temperature approximately at ambient ±10 degrees C (±18 degrees F) and above the dew point.

3.5.4 Verify all circuits in the chamber are switched off and de-energized, including all of the customer's circuits. If it is infeasible to de-energize all circuits, comply with all requirements of Section 1.7.1 Minimizing Electrical Shock Hazards. If it is infeasible to de-energize all circuits on the test article, provide the customer with a copy of Section 1.7.1.

3.5.5 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.

3.5.6 Remove all test articles.

4.0 EMERGENCY SHUTDOWN

4.1 Position all control panel switches **OFF.**

4.2 Repressurize the chamber if there is a fault due to vacuum.

4.2 If there is an electrical fault, **OPEN** Breaker 3 to environmental chamber A in Panel PPQG located to the right rear of the chamber.

4.4 Remove all test articles only when there is no significant risk of injury to personnel.

TA1 As-run Buy-off Sheet

Test Number _____ Customer Contact _____

Calling TPS or Work Instructions _____ Start Time & Date _____

Test Description_____ End Time & Date _____

Data Process Rate _____

3.1 FACILITY PREPARATION

3.1.1 _____

3.1.2 _____

3.1.3 _____

3.1.4 _____

3.1.5.1 _____

3.1.5.2 _____

3.1.6 _____

3.1.7 _____

3.2 TEST ARTICLE INSTALLATION

3.2.1 _____

3.2.2 _____

3.3 THERMAL ALTITUDE TESTING

3.3.1_____

3.3.2 _____

3.3.3_____

3.3.3.1 _____

3.3.3.2 _____

3.3.3.3 _____

3.3.3.4 _____

3.3.4.1 _____

3.3.4.2 _____

3.3.4.3 _____

3.3.4.4 _____

3.3.5 _____

3.3.6.1 _____

3.3.6.2 _____

3.3.6.3 _____

3.3.6.4 _____

3.3.6.5_____

3.3.6.6_____

3.3.6.7 _____

3.3.6.8 _____

3.3.6.9 _____

3.3.6.10 _____

3.3.6.11 _____

3.3.6.12 _____

3.3.6.13 _____

3.3.7.1 _____

3.3.7.2 _____

3.3.7.3 _____

3.3.7.4 _____

3.3.7.5 _____

3.3.7.6 _____

3.3.7.7 _____

3.3.7.8 _____

3.3.7.9 _____

3.3.7.10 _____

3.3.7.11 _____

CHECK THE MASTER LIST.
VERIFY THAT THIS IS THE CORRECT VERSION BEFORE USE.

TA1 As-run Buy-off Sheet

3.3.7.12 _____

3.3.7.13 _____

3.3.7.14 _____

3.3.7.15 _____

3.3.7.16 _____

3.3.7.17 _____

3.3.7.18 _____

3.3.7.19 _____

3.3.7.20 _____

3.3.7.21 _____

3.3.8 _____

3.3.9 _____

3.3.10 _____

3.3.11 _____

3.3.12 _____

3.3.13 _____

3.3.14 _____

3.3.15 _____

3.3.16 _____

3.4 UNATTENDED OPERATION

3.4.1 _____

3.4.2 _____

3.4.3 _____

3.5 SYSTEM SHUTDOWN

3.5.1 _____

3.5.2 _____

3.5.3 _____

3.5.4 _____

3.5.5 _____

3.5.6 _____

QA _____ NA
if not applicable