VENDOR CHAMBER VERIFICATION SURVEY

VENDOR NAME	SURVEY NO.	DATE OF SURVEY
VENDOR ADDRESS		NAME OF SURVEYER

CHAMBER IDENTIFICATION	TYPE OF TEST ENVIRONMENT
CHAMBER USEABLE INTERNAL DIMENSIONS	CHAMBER MANUFACTURER
CHAMBER FACILITY MANAGER (Vendor)	JPL (Jet Propulsion Lab) ETL (Environmental Testing Lab) SURVEY FACILITATOR
PROJECT NAME	TEST ARTICLE NAME
JPL SAFETY	JPL QA

All items in this survey shall be addressed by the Manager of the chamber and the ETL Survey Facilitator and marked “YES,” “NO,” or “N/A” (Not Applicable) as appropriate for the scope of the test. Recommendations for each item shall be documented in Section “O” of this survey. Acceptance rationale for items assessed as “NO” shall be documented following each item in bold and italics. This checklist includes areas of concern that should be addressed, but are not necessarily all requirements.

A. LIST OF CHAMBER OPERATORS

NAME	REMARKS

Insert Photos of Chamber

VENDOR CHAMBER VERIFICATION SURVEY

B. DOCUMENTATION FOR ENVIRONMENTAL CHAMBERS

YES	NO	N/A	
☐	☐		1. Has JPL/ETL survey been conducted previously for this chamber? Date of previous survey: _____
☐	☐		2. A Preventative Maintenance Schedule (PMS) is in place; scheduled activities have been performed and documented.
☐	☐		3. A Standard Operating Procedure (SOP) for the specific chamber has been written and has been signed by the Test Agency Manager. The SOP shall include the following:
☐	☐	☐	Procedure number and issue date
☐	☐	☐	Identification of the environmental chamber
☐	☐	☐	Type of test to be performed (i.e. Thermal Vacuum)
☐	☐	☐	Name and Title of procedure signers, which shall include at least Facility Manager.
☐	☐	☐	A description of principal responsibilities regarding test conduct and abort decisions
☐	☐	☐	A description of data requirements such as logs, data sheets, data acquisition systems, and reports to be included in the historical record of the test.
☐	☐	☐	Instructions for chamber pre-operation checkout
☐	☐	☐	Operating procedures for each type of test activity (i.e. Turning on temperature chamber's GN_2 purge prior to starting chamber cooling.)
☐	☐	☐	Operating procedures for shutting down the chamber
☐	☐	☐	Emergency procedures such as what to do in the event of loss of facility power, earthquake, fire, uncontrolled LN_2 venting, loss of facility compressed air supply, loss of GN2 supply, or loss of facility cooling water supply.
☐	☐		4. A separate Detailed Test Procedure (DTP) is prepared so that each type of test article has a unique procedure. Each DTP shall include:
☐	☐	☐	DTP number and issue date of document
☐	☐	☐	Project name
☐	☐	☐	Name of Test Article(s) including Drawing and Serial Numbers
☐	☐	☐	Type of environment (i.e. Thermal - Thermal Vacuum - Vibration)
☐	☐	☐	Name and Title of procedure signers
☐	☐	☐	Identification of document specifying the test requirements
☐	☐	☐	Listing of test requirements, parameters, and sequences
☐	☐	☐	Listing of test tolerances, alarms, and limits for fail-safe devices
☐	☐	☐	Listing of unusual security, safety, and cleanliness requirements
☐	☐	☐	Preparation checks of equipment and services
☐	☐	☐	Instructions to verify calibration status of instruments

☐ ☐ ☐ Emergency shutdown procedures

☐ ☐ ☐ Instructions for handling the Test Articles and for installing and removing test fixtures.

☐ ☐ ☐ Detailed step by step instructions for the performance of the test

☐ ☐ ☐ Provision for Test Data Sheets to record:

(a) Name of person who performed key activities

(b) Date and time key activities are performed

(c) Measurements to be taken and observations to be recorded

☐ ☐ ☐ System shutdown requirements

☐ ☐ ☐ Equipment list: Which will include: Model Number, Serial Number, Identification Number and Calibration Date?

C. ELECTRICAL POWER

YES	NO	N/A	
☐	☐		1. Is there a backup electrical generator to supply power to the chamber and GSE (Ground Support Equipment) in the event that facility power is lost?
☐	☐	☐	2 Has a test been conducted to verify that power from the emergency generators is in correct phase so that motors will spin in the right direction if emergency power comes on?
☐	☐	☐	3. Has a test been conducted to verify that all critical hardware will receive adequate power from the backup generator?
☐	☐	☐	4. Is the emergency generator operated on periodic maintenance schedule to verify that it is in good working order? What is the frequency?

D. FACILITY AIR

YES	NO	N/A	
☐	☐		1. Does the chamber use facility air? (i.e., Valve operation)
☐	☐	☐	2. Is there an alarm to indicate when the supply of facility air drops below the minimum pressure needed for safe chamber operation? At what pressure is it set to trip? _____ PSIG
☐	☐	☐	3. Is there a backup compressor available to supply air to the chamber if the facility air supply drops out? Are there check valves in the system to prevent the loss of emergency air?
☐	☐	☐	4. Is there a check valve in the air supply system to prevent the loss of emergency air if the facility supply line is ruptured?
☐	☐	☐	5. Is the system equipped with a water trap?
☐	☐	☐	6. Does the PMS include periodically bleeding water traps and verifying that water has not collected in the supply lines?

E. COOLING FLUIDS

YES	NO	N/A		
☐	☐		1.	Do any of the chamber systems need a supply of coolant fluids (i.e., water or ethylene glycol)?
☐	☐	☐	2.	Is there a risk to the Test Article if the coolant supply is interrupted?
☐	☐	☐	3.	Is there an alarm set to sound when the coolant supply is interrupted?
☐	☐	☐	4.	Does the DTP have instructions as to what to do to protect the Test Article in the event that the coolant supply is interrupted?
☐	☐	☐	5.	Does the DTP require a leak test on the coolant lines that are inside the chamber?
☐	☐	☐	6.	Does the DTP require capping open coolant lines inside the chamber?

F. LIQUID NITROGEN (LN_2)

YES	NO	N/A		
☐	☐		1.	Does the chamber use LN_2 for cooling? If so, what systems use it? _____
☐	☐	☐	2.	Is there a risk to the Test Article if the LN_2 supply to the chamber is interrupted?
☐	☐	☐	3.	Is the supply of LN_2 adequate to meet the needs of the test without posing a risk of running out before re-supply can be made at reasonable intervals?
☐	☐	☐	4.	Does the SOP have instructions for returning the chamber a safe condition if LN_2 to the chamber is lost?
☐	☐	☐	5.	Are there provisions for monitoring the LN2 supply to prevent running out during the test?
☐	☐	☐	6.	Pressure relief valves must be installed between any two shutoff devices in a cryogenic piping system where it is possible to “trap” liquefied gases.
☐	☐	☐	7.	Are all the LN_2 relief valves currently calibrated?
☐	☐	☐	8.	Is there a calibrated oxygen monitor near the chamber?
☐	☐	☐	9.	Are the LN_2 lines insulated adequately to avoid a potential air condensation hazard?
☐	☐	☐	10.	Is the LN_2 temperature control system equipped with a fail-safe unit and redundant solenoid in series with the control solenoid to shut off the supply of LN_2 in the event that the control solenoid fails in the open position?

G. GASEOUS NITROGEN (GN_2)

YES	NO	N/A		
☐	☐		1.	Does the chamber use GN_2? If so, what systems use it? _____
☐	☐	☐	2.	Is there an alarm to indicate when the supply of GN_2 drops below the minimum pressure needed for safe chamber operation? What is the alarm set point? _____ Psig
☐	☐	☐	3.	Does the SOP have instructions for returning the chamber a safe condition if GN_2 to the chamber is lost?

☐ ☐ ☐ 4. Is the GN_2 supply pressure indicator in a location where the chamber operator can easily observe it?

☐ ☐ ☐ 5. Does the TP require capping open GN_2 lines?

☐ ☐ ☐ 6. Is there a calibrated oxygen monitor near the chamber?

☐ ☐ ☐ 7. Is there a project requirement for verifying the cleanliness/dew point of the chamber nitrogen supply prior to performing a test where clean/dry nitrogen is required?

☐ ☐ ☐ 8. Are all of the chamber's GN_2 valves identified with legible identification tags?

H. TEMPERATURE CHAMBERS (Convective heating/cooling at room ambient pressure)

YES NO N/A

☐ ☐ 1. Is the chamber a temperature chamber? If yes, record the operating limits.

Max chamber safe operating temp = _____ °C

Min chamber safe operating temp = _____ °C

Maximum test temperature = _____ °C

Minimum test temperature = _____ °C

High failsafe set point temperature = _____ °C

Low failsafe set point temperature = _____ °C

Max instrument design temperature = _____ °C

Min instrument design temperature = _____ °C

☐ ☐ ☐ 2. Does the chamber control within ±2°C at the test temperatures? Has a temperature survey been conducted on the chamber, and does the difference between corner and center point temperatures (ΔT) exceed ±3°C?

☐ ☐ ☐ 3. Is the chamber equipped with a nitrogen purge?

Nitrogen purge flow rate = _____ SCFH

☐ ☐ ☐ 4. Does the DTP require turning the purge on at least 60 minutes prior to starting temperature control?

☐ ☐ ☐ 5. Is the GN_2 purge valve manually controlled?

☐ ☐ ☐ 6. Does the chamber have a vent line plumbed to exhaust outside the building?

☐ ☐ ☐ 7. Is the chamber equipped with wall mounted fans and radiators and not with ceiling mounted fans and radiators which could pose a drip risk to the test article?

☐ ☐ ☐ 8. Are there provisions for sealing the chamber access ports so that air cannot get into the chamber when the nitrogen purge is turned on?

☐ ☐ ☐ 9. Is the chamber's temperature control system equipped with an independent fail-safe device?

☐ ☐ ☐ 10. Has a trial run been conducted to verify that moisture does not condense or drip onto the Test Article when the chamber is operated over the full range of Test temperatures?

☐ ☐ ☐ 11. Does the operation of the chamber comply with OSHA confined space requirements?

☐ ☐ ☐ 13. Does the TP require capping open fluid lines inside the chamber?

☐ ☐ ☐ 14. Are the calibrations current for the temperature controller and fail-safe?

I. THERMAL VACUUM CHAMBERS

YES NO N/A

☐ ☐ 1. Is the chamber a vacuum chamber?

2. Check off the applicable chamber control systems:

☐ Temperature control with radiant shrouds using nitrogen flow temperature control unit.

Max chamber safe operating temp = _____ °C

Min chamber safe operating temp = _____ °C

Maximum test temperature = _____ °C

Minimum test temperature = _____ °C

High failsafe set point temperature = _____ °C

Low failsafe set point temperature = _____ °C

Max instrument design temperature = _____ °C

Min instrument design temperature = _____ °C

☐ Temperature control with IR lamps

Max chamber safe operating temp = _____ °C

Min chamber safe operating temp = _____ °C

Maximum test temperature = _____ °C

Minimum test temperature = _____ °C

High failsafe set point temperature = _____ °C

Low failsafe set point temperature = _____ °C

Max instrument design temperature = _____ °C

Min instrument design temperature = _____ °C

☐ Temperature control with electric strip heaters

Max chamber safe operating temp = _____ °C

Min chamber safe operating temp = _____ °C

Maximum test temperature = _____ °C

Minimum test temperature = _____ °C

High failsafe set point temperature = _____ °C

Low failsafe set point temperature = _____ °C

Max instrument design temperature = _____ °C

Min instrument design temperature = _____ °C

☐ Temperature control using conductive heat exchanger(s)

Max chamber safe operating temp = _____ °C

Min chamber safe operating temp = _____ °C

Maximum test temperature = _____ °C

Minimum test temperature = _____ °C

High failsafe set point temperature = _____ °C

Low failsafe set point temperature = _____ °C

Max instrument design temperature = _____ °C

Min instrument design temperature = _____ °C

☐ ☐ Solar simulation

Maximum irradiance _____ W/m2 Source _____ °C

☐ Cold Finger/Contamination Plate

☐ Cold trap on rough pumping system

☐ Vibration Isolation

☐ Thermo Quartz Crystal Microbalance (TQCM)

☐ Cryo Quartz Crystal Microbalance (CQCM)

☐ Video Camera(s)

☐ Other:_____

☐ ☐ ☐ 3. Are all the chamber's temperature control systems equipped with independent temperature fail-safe devices with audible alarms? A manual reset of the fail-safe alarm must be performed before heating or cooling can be resumed (fail-safe setup with a latching relay).

☐ ☐ ☐ 4. Has a temperature survey been conducted on the chamber? The test chamber and control system must show a capability of uniform temperature distribution within the space occupied by the Test Article.

☐ ☐ ☐ 5. Has a temperature survey been conducted on the heat exchanger(s)? The test chamber and control system must show a capability of uniform temperature distribution within the space occupied by the Test Article.

6. Check off the applicable chamber vacuum pumping systems:

☐ Oil-free roughing pump

☐ Roughing pump using oil

☐ Cryo pump

☐ Ion pump

☐ Oil diffusion pump (DP) with an LN2 cold trap

☐ Turbomolecular pump

☐ Contamination Plate/Cold Finger

☐ ☐ ☐ 7. Does the chamber have a vent line(s) plumbed to exhaust hazardous gasses (GN2 and/or GN2 outside the building?

☐ ☐ ☐ 8. Is the chamber equipped with an isolation valve and vacuum fail-safe unit to automatically isolate the chamber from the pumping system in the event of an unexpected rise in chamber pressure or loss of power?

☐ ☐ ☐ 9. Is the chamber equipped with an audible alarm to sound in the event that the chamber pressure rises above acceptable tolerances?

☐ ☐ ☐ 10. Is the chamber equipped with a relay to turn off high voltage in the chamber in the event that the chamber pressure rises above acceptable tolerances?

☐ ☐ ☐ 11. Is the chamber equipped with a nitrogen backfill?

☐ ☐ ☐ 12. Is there an adequate pressure relief valve, such as a hat valve, on the chamber to avoid the possibility of over pressurizing the chamber during backfill? If it is a spring-loaded relief valve, is it set to release at less than 10 psig and is it calibrated?

☐ ☐ ☐ 13. Does the SOP have instructions for unlatching the chamber door prior to backfill?

☐ ☐ ☐ 14. Does the Process require a chamber cleanliness certification?

- ☐ Sample wipes collected from chamber walls and DRIFT/FTIR spectroscopy analysis performed by Analytical Chemistry Lab
- ☐ Witness plate or witness mirror
- ☐ TQCM sample collected to characterize chamber baseline cleanliness
- ☐ Other_____

☐ ☐ ☐ 15. Is there a calibrated oxygen monitor/alarm in close proximity to the chamber?

☐ ☐ ☐ 16. Does the operation of the chamber comply with OSHA confined space requirements?

☐ ☐ ☐ 17. Does the Chamber Operating SOP include a confined space entry warning?

☐ ☐ ☐ 18. Does the DTP require capping open fluid and nitrogen lines inside the chamber?

J. HUMIDITY CHAMBERS

YES NO N/A

☐ ☐ 1. Is the chamber a humidity chamber?

2. Check off the applicable chamber control systems:

- ☐ Temperature control with circulating air

  Maximum safe operating temperature = _____°C

  Minimum safe operating temperature = _____°C

  Maximum test temperature = _____°C

  Minimum test temperature = _____°C
- ☐ Humidity control with a steam generator

  Maximum humidity _____%RH

  Minimum humidity _____%RH

☐ ☐ ☐ 3. Are there provisions to position the Test Article within the humidity chamber in such a manner, and with suitable shielding, to prevent moisture from impinging directly on the Test Article?

☐	☐	☐	4.	Has a trial run been conducted prior to installing the Test Article to verify that moisture does not drip on the Test Article?
☐	☐	☐	5.	Is the chamber's temperature control system equipped with an independent temperature fail-safe device with audible alarms?
☐	☐	☐	6.	Does the TP have instructions to purge the chamber of moist vapor with dry laboratory air or dry nitrogen gas at the end of the process operation to prevent moisture from forming or impinging on the Test Article or the chamber walls?
☐	☐	☐	7.	If GN_2 is used to purge the chamber, is there an oxygen monitor in close proximity to the chamber?

K. ACOUSTIC NOISE CHAMBERS

YES	NO	N/A		
☐	☐		1.	Is the chamber a reverberation chamber?
☐	☐	☐	2.	If the chamber uses transducer driven horns to generate the noise spectrum, is the chamber equipped with a clean/dry gas supply to operate the horns? GN_2 is the preferred supply gas, but air may be used if it can be shown to be dry and clean and meet the contamination control requirements.
☐	☐	☐	3.	Are provisions available to soft mount the Test Article with a low frequency suspension system with a natural frequency that is less than 20 Hz. Note: Large Test Articles may be installed in the chamber on rubber-tired transport dollies or on vibration isolators.
☐	☐	☐	4.	Is the acoustic noise control system set up for 1/3 octave band spectrum control and analysis?
☐	☐	☐	5.	Is the chamber equipped with an automatic computerized equalization system? (If the controller is not automated, provisions will be necessary for equalizing with either a dummy mass or at reduced levels as per project specification requirements.)
☐	☐	☐	6.	Is the control system equipped with an independent fail-safe unit to shut down the noise output in the event that the acoustic spectrum exceeds the specified high limit tolerances?
☐	☐	☐	7.	Does the DTP require continuous recording of the individual microphone signals?
☐	☐	☐	8.	Is the chamber cleanliness adequate to meet the project's cleanliness control requirements?
☐	☐	☐	9.	Is the chamber subject to confined space entry safety requirements, and if so, are confined space procedures, training, and permits in order?
☐	☐	☐	10.	Does the Chamber Operating SOP include a confined space warning?
☐	☐	☐	11.	Is the chamber equipped with an oxygen monitor and alarm system?
☐	☐	☐	12.	Is the personnel door into the chamber locked during periods when the oxygen in the chamber is not safe for breathing?
☐	☐	☐	13.	Is the control console locked to prohibit operation of the acoustic noise horns during periods when personnel have access to the chamber?
☐	☐	☐	14.	Are there any known problems from past chamber operations which have not been resolved?
☐	☐	☐	15.	Does the DTP require capping open fluid and nitrogen lines inside the chamber?

L. PRESSURE CHAMBERS

YES	NO	N/A		
☐	☐		1.	Is the chamber a pressure vessel as designated by the Occupational Safety Program Office (i.e. a vessel having a design pressure exceeding 15 psig and an internal cross sectional diameter, width, height, or diagonal greater than 6 inches. Reference: Pressure Vessels and Systems, JPL Rules! DocID 42472).
☐	☐	☐	2.	Is the pressure vessel's certification current? The vessel shall be stamped with the maximum allowable working pressure (MAWP). Certification Date _____ Certified by _____ Recertification Due Date _____ Maximum Allowable Working Pressure _____
☐	☐	☐	5.	Does the chamber have a temperature control system? If so, what type of system is it, and what are its temperature limits? Type of temperature control system _____ Maximum safe operating temperature = _____ °C Minimum safe operating temperature = _____ °C Maximum test temperature = _____ °C Minimum test temperature = _____ °C
☐	☐	☐	6.	Are all the chamber's temperature control systems adequately equipped with independent temperature fail-safe devices with audible alarms?
☐	☐	☐	7.	Has a temperature survey been conducted on the chamber? The test chamber and control system must show a capability of uniform temperature distribution within the space occupied by the Test Article.
☐	☐	☐	8.	Are the primary pressure gauges and switches in current calibration? All pressure vessels and systems shall be equipped with pressure gauges or other direct reading pressure-indicating devices that have a range at least 1.25 times but no greater than twice the maximum allowable working pressure of the vessel or twice the maximum operating pressure of the system. Primary pressure gauges, and pressure switches shall be calibrated periodically to ensure accuracy.

M. DATA RECORDING

YES	NO	N/A		
☐	☐		1.	Are all key test parameters recorded continuously during the test?
☐	☐	☐	2.	Are all measurements necessary to control and measure the test environment and performance of the test system made with instruments and transducers calibrated in accordance with the requirements in ISO 10012, Quality Assurance Requirements for Measurement Equipment?
☐	☐	☐	3.	Is the data acquisition system equipped with an Uninterrupted Power Supply (UPS) so that data recording will not get interrupted during a loss of facility power or during the transition from facility power to emergency generator power?

N. LIST OF ATTENDEES

NAME	FUNCTION	EMAIL ADDRESS

O. RECOMMENDATIONS

AI NO.	LINE ITEM	ACTION	RESPONSIBILITY	ETL VERIFY Date/Initial