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ORGANIZATIONAL WORK INSTRUCTION

EM50

SIMULATED SPACE PLASMA TESTING

Revision D

APPROVING AUTHORITY	NAME	TITLE	ORG	DATE
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**CHECK THE MASTER LIST—
VERIFY THAT THIS IS THE CORRECT VERSION BEFORE USE**

DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Canceled)	Document Revision	Effective Date	Description
Baseline		8/19/99	Initial Release
Revision	A	02/22/00	QMS documents changed to directives
Revision	B	07/06/00	Updated for records management
Revision	C	09/1/2004	Changed wills to shalls and MPG to MPR per NASA Headquarters directive.
Revision	D	04-27-05	Changes made due to reorganization

SIMULATED SPACE PLASMA TESTING

1. SCOPE

1.1 Scope.

This document establishes the organizational work instruction for simulated space plasma testing in the Environmental Effects Group (EM50).

1.2 Purpose.

The purpose of this document is to outline the steps necessary for conducting simulated space plasma tests on material, hardware, and ground test objects.

1.3 Applicability.

This document applies to the space plasma simulation chambers used by EM50.

2. APPLICABLE DOCUMENTS

MPD 1280.1	Marshall Management Manual
MPR 8730.5	Control of Inspecting, Measuring, and Test Equipment
EM50-OWI-002	Document and Data Control
EM50-OWI-003	Control of Quality Records
EM50-OWI-004	Control of Customer-Supplied Product

3. DEFINITIONS

Warning - Warnings are used when failure to observe instructions or precautions could result in injury to personnel.

Caution - Cautions are used when failure to observe instructions could result in damage to equipment.

Note - Information to help clarify multi-person procedures or simultaneous multiple operations.

4. INSTRUCTIONS

Work performed and data generated within EM50 that affects the quality of products as specified in the scope of MPD 1280.1 will be documented and controlled per EM50-OWI-002.

WARNING – Space simulated plasma testing involves lethal voltages. Only trained personnel shall operate the plasma test chamber equipment.

4.1 **Preparation**

4.1.1 Identify item or sample to test. If this is a customer-supplied product, it shall be logged in per EM50-OWI-004.

4.1.2 Determine characteristic voltage levels required for test.

4.1.3 Determine power supply requirements.

4.1.4 Produce an electrical schematic (hand-drawn or computer-generated) to identify electrical wire layout prior to initiating tests. Schematic shall be part of the quality record for this test.

4.2 **Testing Procedure**

4.2.1 Place item or items to be tested in the space plasma simulation chamber. If multiple items are to be tested, write sequence of items in the logbook.

4.2.2 Connect all electrical wires as called for in the schematic.

4.2.3 Pump chamber down, using roughing pumps first then high vacuum pumps. Test may begin once the vacuum chamber has reached 4×10^{-6} Torr.

Caution – Mechanical pumps shall not rough on chamber for an extended period of time.

Caution – When using Cryotraps, they must be filled with liquid nitrogen prior to activation of the diffusion pumps and continually filled during testing. Failure to do this may result in contamination of the test chamber.

4.2.4 Start plasma source. Let plasma source come to equilibrium for 30 minutes before testing. Record plasma source conditions, including keeper current, keeper voltage, chamber pressure, and cathode heater current to ensure plasma condition repeatability.

4.2.5 Start test. Record a Langmuir Probe trace by sweeping Langmuir probe bias voltage and measuring the current collected by the probe as a function of bias voltage to determine the simulated plasma density and average electron temperature.

4.2.6 Expose first test article to the simulated plasma with the appropriate bias voltage. Record test item current and bias voltage.

4.2.7 Repeat 4.2.6 for all items to be tested.

4.2.8 Following test completion shut plasma source off and let cool for 2 hours.
4.2.9 When using diffusion pumps, Turn them off. Stop cryotrap fill and let them come to room temperature.

Note – Cool down of the plasma source and warm-up of the cryotraps may take place at the same time.

4.2.10 Vent vacuum chamber using standard vacuum techniques.
4.2.11 Remove samples from test chamber.

4.3 **Data Analysis**
4.3.1 Analyze Langmuir probe data to determine plasma density and average electron temperature.
4.3.2 Analyze any sample specific data (i.e. current and voltage data analysis to determine coating resistivity).

5. NOTES

In respect to MPR 8730.5, equipment calibration is done in place by operator using calibrated current sources and voltmeters. Also, a calibrated Digital Multi-Meter (DMM) is used to verify any measured voltage and current. Specific equipment is calibrated as necessary for each test as required.

6. SAFETY PRECAUTIONS AND WARNING NOTES

Simulated space plasma testing involves lethal voltages. This work instruction is not a substitute for formal training in the operation of the space plasma simulation chamber. Untrained personnel shall not attempt to use this document to operate the space plasma simulation chamber unless supervised by trained, experienced personnel.

7. APPENDICES, DATA, REPORTS, AND FORMS

Reports on a material’s behavior in simulated space plasma shall include the test item’s current and bias voltage.

8. RECORDS
Records shall be retained in accordance with EM50-OWI-003.

9. TOOLS, EQUIPMENT, AND MATERIALS

As required.

10. PERSONNEL TRAINING AND CERTIFICATION

The leader of the Environmental Effects Group (EM50) shall be responsible for ensuring that all personnel using the space plasma simulation chamber are trained. Training is generally accomplished as on-the-job training by experienced personnel or a manufacturer’s representative. Records of personnel training shall be kept in the group office.