George C. Marshall Space Flight Center
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ORGANIZATIONAL WORK INSTRUCTION
EM50

OUTGASSING TEST FOR MATERIALS ASSOCIATED WITH OPTICAL SURFACES

Revision F

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		10-2-97	Initial Release
Revision	A	6-2-99	Revision to incorporate re-organizational changes
Revision	B	2-22-00	Change QMS documents to directives
Revision	C	1-13-03	Revision to update equipment modifications, reference documents title changes, and text clarifications.
Revision	D	2-3-03	Applicable Documents section update.
Revision	E	09-01-04	Revision made due to HQ mandate
Revision	F	04-27-05	Changes made due to reorganization

OUTGASSING TEST FOR MATERIALS ASSOCIATED WITH OPTICAL SURFACES

1. SCOPE

1.1 Scope

This document establishes the standard operating procedure for the CART vacuum test chamber located in Bldg. 4711, Room E112.

1.2 Purpose

The purpose of this document is to outline the steps necessary for analysis of material samples or other items.

1.3 Applicability

This document only applies to the CART vacuum chamber located in Bldg. 4711, Room E112. This operating procedure is not a substitute for formal training in vacuum chamber operation. Untrained personnel shall not attempt to use this document to operate this chamber unless supervised by trained, experienced personnel.

2. APPLICABLE DOCUMENTS

EM50-OWI-002	Work Request Process
EM50-OWI-003	Control of Records
EM50-OWI-004	Control of Customer-Supplied Product
EM50-OWI-012	Operation of Arc VUV Reflectometer with CAMS Software
MPR 8730.5	Control of Inspection, Measuring, and Test Equipment

3. DEFINITION

Optical Witness Sample (OWS): a 1" diameter flat mirror used for Vacuum Ultra-Violet contamination monitoring.

Outgassing: Molecules released by the test sample, considered molecular contamination.

Vacuum Ultra-Violet (VUV): a reflective change test done in the ultra-violet range on OWS after exposure to test sample. See EM50-OWI-012 for test procedure.

4. INSTRUCTIONS

Note - Prior to starting testing record all background information, e.g. program being supported; a contact and phone number; material / hardware description; use and cure conditions (if applicable); bakeout conditions (if applicable); date and time; etc. in the laboratory notebook.

4.1 Receive test sample and obtain Work Request number per EM50-OWI-002.

4.2 Verify that all calibration control stickers are up to date, if required. If any are out of date, refer to MPR 8730.5 on how to bring the out of calibration equipment up to date.

4.3 Verify per chamber log, that chamber is certified clean per OWS vacuum ultraviolet reflectance measurement. If prior test was at or above current sample test temperature, OWS temperature was at or below current OWS test temperature, and VUV reflectance measurements indicated a clean OWS, chamber is ready for this test. Proceed to Section 4.6. If vacuum ultraviolet reflectance measurements from prior test show greater than a 3% change at any tested wavelength, chamber shall be baked out for a minimum of 24 hours at a temperature >20°C above test temperature, using steps outlined in Section 4.4. Once bake out is complete, proceed with Section 4.5. If vacuum ultraviolet reflectance measurements show no contamination, proceed to Section 4.6. If contamination is indicated again, repeat Section 4.4.

4.3.1 Wipe sample area, thermocouple clip and thermocouple wires with a clean, alcohol soaked wipe. Attach clip to thermocouple wire labeled “SAM 1”. Close and secure flange.

4.3.2 Wipe OWS holder base and thermocouple wire with a clean, alcohol soaked wipe. Close and secure flange.

4.3.3 Proceed with bakeout procedure in Section 4.4. When complete and OWS VUV test passes, proceed to standard test procedure in Section 4.6.

4.4 Chamber bakeout.

4.4.1 Verify chamber vent valve is closed.

4.4.2 Open gate valve.

4.4.3 Check fluid level and turn on turbo pump chiller bath. Verify that SP is around 18°C.

4.4.4 Press yellow ON/OFF button on turbo pump controller to turn on roughing and turbo pumps.

4.4.5 Monitor pressure on gauge controller. When pressure is below $1x10^{-3}$ torr, turn on ion gauge filament.

4.4.6 Turn on power to heater control circuit. Adjust controller SP to at least 20°C above test material requirement. Turn heater enable switch to the on position and press the start button on heater controller.

4.4.7 Check fluid level in OWS chiller bath. Verify refrigeration switch is in the off position and turn on bath. Increase bath SP to that of the heater controller, but do not exceed 100°C.

4.4.8 Bakeout system for 24 hours, minimum. Check fluid levels in baths to avoid low level conditions.

4.4.9 When bakeout is completed, record the bakeout conditions, date and time in lab notebook.

4.4.10 Shutdown system per Section 5 instructions.

4.5 Chamber certification.

4.5.1 Remove sample flange and verify that “SAM 1” and “SAM 2” TCs are working. Replace flange.

4.5.2 Remove OWS flange and install OWS onto base. Attach “OWS” TC. Replace flange.

4.5.3 Verify chamber vent valve is closed.

4.5.4 Open gate valve.

4.5.5 Check fluid level and turn on turbo pump chiller bath. Verify that SP is around 18°C.

4.5.6 Press yellow ON/OFF button on turbo pump controller to turn on roughing and turbo pumps.

4.5.7 Monitor pressure on gauge controller. When pressure is below $1x10^{-3}$ torr, turn on ion gauge filament.

4.5.8 Check fluid level in OWS chiller bath. When chamber pressure is below $1x10^{-5}$ torr, verify refrigeration switch is in the on position and turn on bath. Adjust bath SP to test requirement. When OWS TC temperature has stabilized, proceed to next step.

4.5.9 Turn on power to heater control circuit. Adjust controller SP to test material requirement. Turn heater enable switch to the on position and press the start button on heater controller.

4.5.10 When “SAM 1” TC has reached required SP and has stabilized, begin 24 hour certification period and

record time in log book. Adjust OWS chiller SP as necessary.

4.5.11 At the end of the certification period, shut down system per Section 5. Remove OWS and check reflectance. Record results in logbook.

4.5.12 If OWS reflectance meets requirements, proceed to Section 4.6. If OWS fails requirements, return to Section 4.4.

4.6 Sample test.

4.6.1 Prepare sample as needed to fit in 2 inch diameter test chamber, being careful not to compromise cleanliness, i.e. clean gloves shall be worn. Record sample test #, material information, date, and test temperatures in log book.

4.6.2 Verify TCs are working. Verify that TC “SAM 2” is attached to the inside chamber wall liner. Attach “SAM 1” to the sample, with the clip.

4.6.3 Close and secure sample flange.

4.6.4 Load a clean OWS into OWS holder being careful not to compromise cleanliness, i.e. clean gloves must be worn. Record OWS # in logbook. Attach thermocouple wire labeled “OWS”. Close and secure OWS flange.

4.6.5 Verify chamber vent valve is closed.

4.6.6 Open gate valve.

4.6.7 Check fluid level and turn on turbo pump chiller bath. Verify that SP is around 18°C.

4.6.8 Press yellow ON/OFF button on turbo pump controller to turn on roughing and turbo pumps.

4.6.9 When pressure indicated on the TC gauge is below $1x10^{-3}$ torr, turn on ion gauge filament.

4.6.10 Check fluid level in OWS chiller bath. When chamber pressure is below $1x10^{-5}$ torr, verify refrigeration switch is in the on position and turn on bath. Adjust bath SP to test requirement. When OWS TC temperature has stabilized, proceed to next step.

4.6.11 Turn on power to heater control circuit. Adjust controller SP to test material requirement. Turn heater enable switch to the on position and press the start button on heater controller.

4.6.12 When “SAM 1” TC has reached required SP and has stabilized, begin 24 hour test period and record time in log book. Adjust OWS chiller SP as necessary.

4.5.13 At the end of the test period, shut down system per Section 5. Remove OWS and check reflectance. Record results in logbook.

5. TEST TERMINATION

Prior to shutting down the system, record all pertinent information, e.g. date, time, etc. in the laboratory notebook.

5.1 Turn the heater enable switch off and press STOP on controller. Turn off heater control system.

5.2 Allow the chamber to cool to just above ambient temperature before adjusting OWS bath SP. Adjust OWS bath SP to 22°C to ensure OWS temperature remains above the dew point prior to chamber repressurization.

5.3 Turn off ion gauge filament.

5.4 Close gate valve.

5.5 Press yellow ON/OFF button on turbo pump controller to turn off the turbo and roughing pumps. Turn off both baths.

5.6 Slowly open chamber vent valve, bringing system to ambient pressure. Close vent valve.

5.7 Open and remove the OWS and deliver for VUV reflectance measurements. Remove the material/hardware being careful not to compromise cleanliness, i.e. clean gloves shall be worn.

5.8 When the material/hardware is removed from the oven record any changes in visual appearance or other changes to the test sample. If the vacuum chamber sample area has a deposit, the user has the option of performing a swab or NVR flush and analyzing the residue with FTIR if desired.

6. NOTES

None

7. SAFETY PRECAUTIONS AND WARNING NOTES

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.

7.1 Safety glasses shall be worn during cleaning operations with solvents or liquids that might splash into the users eyes.

7.2 Proper gloves and other protective gear shall be worn during cleaning operations.

7.3 Safety shoes shall be required during system build-up or modifications when system components are handled.

7.4 All mechanical connections for coolant shall be verified as leak free. Verify fluid levels in baths prior to and during system operation.

7.5 System electrical cords shall be periodically inspected to insure all safety requirements, i.e. cord strain relief, frayed insulation, etc. are met. Any unacceptable conditions shall be corrected immediately.

7.6 Prior to initiating any test, all components shall be visually inspected for signs of stress, i.e. cracks. Components of concern include but are not limited to view ports, glass components, tubing, etc. If any defects are noted the component shall be taken out of service immediately.

7.7 If component defects become apparent during a test the system shall be powered down and the component taken out of service.

8. APPENDICES, DATA, REPORTS, AND FORMS

None

9. RECORDS

Electronic Database, lab notebook, VUV printed report, EM50 generated memo, all per EM50-OWI-003, Control of Quality Records.

10. TOOLS, EQUIPMENT, AND MATERIALS

Flat bladed screwdriver, cleanroom compatible gloves, OWS and OWS holder, and test sample.

11. PERSONNEL TRAINING

CART operators shall be trained by a qualified user in all aspects of this system. A qualifier user is defined as an engineer, scientist, technician, or manufactures representative. The team lead certifies, by memorandum that his/her employee have met on the job training requirements for their position. These records are retained in the Group office, for as long as the employee works in this position.