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ORGANIZATIONAL WORK INSTRUCTION

EM50

OPERATION OF ULTRAVIOLET (UV) SOLAR SIMULATORS

Revision F

APPROVING AUTHORITY	NAME	TITLE	ORG	DATE
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VERIFY THAT THIS IS THE CORRECT VERSION BEFORE USE

DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Canceled)	Document Revision	Effective Date	Description
Baseline		08-14-97	Baselined OWI
Revision	A	05-23-99	Updated for reorganization
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Revision	C	07-06-00	Updated for records management
Revision	D	08-31-04	Mandated HQ rules review action
Revision	E	04-27-05	Changes made due to reorganization
Revision	F	07-30-07	Updated to include all solar simulators under one document

OPERATION OF UV SOLAR SIMULATORS

1. SCOPE

1.1 Scope.

This document establishes the organizational work instruction for the Model X-25 Mark II, Oriel, and McPherson LH153 Ultraviolet (UV) Solar Simulators.

1.2 Purpose.

The purpose of this document is to outline the steps necessary for ultraviolet radiation exposure of material samples or other items by any of the UV Solar Simulators within the organization.

1.3 Applicability.

This document applies to the Model X-25 Mark II, Oriel, and McPherson LH153 UV Solar Simulators. This work instruction is not a substitute for formal training in solar simulator operation. Untrained personnel shall not attempt to use this document to operate any of the solar simulators unless supervised by trained, experienced personnel.

2. APPLICABLE DOCUMENTS

MPD 1280.1 Marshall Quality Management System Manual
EM50-OWI-002 Work Request Process
EM50-OWI-003 Control of Quality Records
EM50-)WI-004 Control of Customer-Supplied Product
Spectrosun Model X-25 Mark II Solar Simulator Instruction Manual
Standard Operating Procedure for the Model X-25 Mark II Solar Simulator
McPherson Model LH153 Light Source System Instruction Manual
Standard Operating Procedure for the McPherson LH153 Light Source System
Oriel UV Lamp Operating Manual

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 for each of the three UV solar simulators used in the organizations are listed in the following section. Select the appropriate sections relative to the particular simulator planned for use in the specific testing being conducted.

INSTRUCTIONS FOR MODEL X25 Mark II

Work performed and data generated within EM50 that affects the quality of products as specified in the scope of MPD 1280.1 must be documented and controlled per EM50-OWI-003.

4.1 **Test Preparation**

4.1.1 Check that the facility ventilation system is active and open to system.

4.1.2 Ensure power connection is secure and active (215 VAC, 3 phase).

4.1.3 Install samples in test chamber. If required, turn on chiller for circulating bath and ensure that sample temperature is being controlled.

4.1.4 Ensure that the water filter on the optical port is operational.

4.2 **Energizing System**

NOTE: If any of the required indications cannot be obtained, suspend the energizing procedure and determine the cause of the malfunction.

WARNING: During operation, the ultraviolet rays generated by the source lamp cannot be seen or felt immediately but can cause permanent, serious skin and eye damage. Wear protective glasses and protective clothing.

WARNING: Before energizing the source lamp, clear the area of all personnel not directly involved in the test or operating sequence. Keep the number of observers or visitors to the absolute minimum.

4.2.1 At the facility breaker panel, set the controls as required to apply 215 volts to the unit.
4.2.2 Verify white LINE POWER indicator is illuminated.
4.2.3 At the ON/OFF push button, verify amber “OFF” legend is illuminated.
4.2.4 Verify red DOUSER CLOSED push button is illuminated.
4.2.5 Depress and release the ON/OFF push button.
4.2.6 After 30 seconds for operation to stabilize, verify green “ON” legend is illuminated.
4.2.7 Verify both upper and lower blowers are active.
4.2.8 Verify red H_2O FLOW indicator is extinguished.
4.2.9 Verify red AIR FLOW indicator is extinguished.
4.2.10 Verify amber LAMP START pushbutton is illuminated.
4.2.11 At the INTENSITY ADJUST control knob, set the desired intensity value, then lock the control.
4.2.12 Verify LAMP VOLTAGE meter reads a minimum of 90 VDC.
4.2.13 Verify LAMP CURRENT meter reads 0 amps.
4.2.14 Verify POWER SUPPLY VOLTAGE METER reads between 40 and 50 volts.
4.2.15 Verify CURRENT METER reads 0 amps.
4.2.16 Push LAMP START button and quickly release.

CAUTION: Do not hold the lamp start button in after lamp has been ignited. Button shall be pressed only for a second. If the lamp does not ignite, check for a malfunction.

4.2.17 Verify LAMP START legend extinguishes.
4.2.18 Verify xenon source lamp is energized.
4.2.19 Verify LAMP VOLTAGE meter drops to 30 VDC.
4.2.20 Verify LAMP CURRENT meter reads 83 to 95 amps.
4.2.21 Verify LAMP INTENSITY meter reads desired intensity value, adjust if necessary.
4.2.22 Verify LAMP STARTS is incremented.
4.2.23 Verify LAMP TIME meter is active.
4.2.24 Verify all fuse indicators are extinguished.
4.2.25 Depress and release the DOUSER CLOSED push button.
4.2.26 Verify douser is positioned out of the optical path and light is emitted from the unit.
4.2.27 Verify CLOSED legend is extinguished and OPEN legend is illuminated.
4.2.28 Use the ELEV UP and ELEV DOWN push buttons to achieve desired positioning of the light beam at the target plane.
4.2.29 Start timer.
4.2.30 Use the radiometer to determine the equivalent sun level to the samples. Use INTENSITY ADJUST control knob for desired sun level. Record the radiometer reading in the lab notebook or customer-provided data sheet.

4.2.31 Using the equivalent sun level, calculate the length of time required for exposure. (i.e., the desired exposure is 100 equivalent sun-hours, the radiometer indicates an equivalent sun level of 2, therefore, the samples shall be exposed for 50 hours.)

4.2.32 Periodically repeat radiometer readings and record. Adjust lamp intensity or exposure time as needed. (i.e., cut back the exposure time if radiometer readings indicate 2.1 equivalent suns instead of 2.0.) Record all operational parameters as applicable.

4.3 **Deenergizing System**

4.3.1 Depress and release the DOUSER CLOSED push button.

4.3.2 Verify red DOUSER CLOSED legend is illuminated and light is no longer emitted from the unit.

4.3.3 Depress the ON/OFF push button twice in slow sequence.

4.3.4 Verify amber LAMP START button is illuminated.

4.3.5 Verify red H_2O FLOW indicator is extinguished.

4.3.6 Verify red AIR FLOW indicator is extinguished.

CAUTION: Failure to follow the cool-down instructions could result in serious damage to the unit.

4.3.7 Allow unit to cool down for a minimum of 15 minutes.

4.3.8 Depress and release the ON/OFF push button.

4.3.9 Verify amber OFF legend is illuminated and green ON legend is extinguished.

4.3.10 Verify white LINE POWER indicator is illuminated.

4.3.11 At the facility breaker panel, set controls as required to cut power to the unit.

4.3.12 Verify all X-25 indicator lamps are extinguished and all meters read zero.

4.3.13 Remove samples from chamber.

INSTRUCTIONS FOR ORIEL

Work performed and data generated within EM50 that affects the quality of products as specified in the scope of MPD 1280.1 must be documented and controlled per EM50-OWI-003.

4.1 **Test Preparation**

4.1.1 Check that the facility ventilation system is active and open to system.

4.1.2 Ensure power connection is secure and active (215 VAC, 3-phase power).

4.1.3 Install samples in test chamber. If required, turn on chiller for circulating bath and ensure that sample temperature is being controlled.

4.2 **Energizing System**

NOTE: If any of the required indications cannot be obtained, suspend the energizing procedure and determine the cause of the malfunction.

WARNING: During operation, the ultraviolet rays generated by the source lamp cannot be seen or felt immediately but can cause permanent, serious skin and eye damage. Wear protective glasses and protective clothing.

WARNING: Before energizing the source lamp, clear the area of all personnel not directly involved in the test or operating sequence. Keep the number of observers or visitors to the absolute minimum.

4.2.1 At the Oriel 68820 Universal Power Supply, flip power switch to “on”.
4.2.2 Push lamp start button until lamp ignites.

CAUTION: Do not hold the lamp start button in after lamp has been ignited. Button shall be pressed only for a few seconds. If the lamp does not ignite, check for a malfunction.

4.2.3 Check the meter on the power supply - it must not read more than 1 KW.
4.2.4 Start timer.
4.2.5 Use the radiometer to determine the equivalent sun level to the samples. Adjust the current for desired sun level. Record the radiometer reading in the appropriate lab notebook or customer-provided data sheet.
4.2.6 Using the equivalent sun level, calculate the length of time required for exposure. (i.e., the desired exposure is 100 equivalent sun-hours, the radiometer indicates an equivalent sun level of 2, therefore, the samples shall be exposed for 50 hours.)
4.2.7 Periodically repeat radiometer readings and record. Adjust lamp intensity or exposure time as needed. (i.e., cut back the exposure time if radiometer readings indicate 2.1 equivalent suns instead of 2.0.) Record vacuum level and sample temperature, if applicable.

4.3 **Deenergizing System**

4.3.1 Flip power switch to “off”, wait 5 seconds, then turn the power switch back to “on”. This activates the fans to cool the bulb.

4.3.2 Remove samples from chamber.

4.3.3 Allow the lamp a minimum of 15 minutes cool-down time, then turn power switch to “off”.

INSTRUCTIONS FOR MCPHERSON LH153

Work performed and data generated within EM50 that affects the quality of products as specified in the scope of MPD 1280.1 must be documented and controlled per EM50-OWI-003.

4.1 **Test Preparation**

4.1.1 Check that the facility ventilation system is active and open to system.

4.1.2 Ensure power connection to LPS225HR power supply is secure and active (120 VAC).

4.1.3 Ensure high voltage cable from the power supply to the lamp housing is mated properly and secure.

4.1.4 Ensure safety interlock cable is secure to the rear of the power supply.

4.1.5 Ensure ground cable ground is secure from the power supply to the lamp housing.

4.1.6 Ensure the white patch plug on the power supply is affixed to the rear of the unit and that the Xe/Hg switch is set to the down position.

4.1.7 Install samples in test chamber. If required, turn on chiller for circulating bath and ensure that sample temperature is being controlled.

4.1.8 Ensure that the water filter on the optical port is operational.

4.2 **Energizing System**

NOTE: If any of the required indications cannot be obtained, suspend the energizing procedure and determine the cause of the malfunction.

WARNING: During operation, the ultraviolet rays generated by the source lamp cannot be seen or felt immediately but can cause

permanent, serious skin and eye damage. Wear protective glasses and protective clothing.

WARNING: Before energizing the source lamp, clear the area of all personnel not directly involved in the test or operating sequence. Keep the number of observers or visitors to the absolute minimum.

4.2.1 At the LPS225HR power supply, turn power switch to “on”.
4.2.2 Adjust the power supply range to half-way full scale.
4.2.3 Push lamp start button and quickly release.

CAUTION: Do not hold the lamp start button in after lamp has been ignited. Button shall be pressed only for a second. If the lamp does not ignite, check for a malfunction.

4.2.4 Check the LAMP VOLTAGE meter - it shall drop to 40-60 VDC.
4.2.5 Check the LAMP CURRENT meter - it shall indicate 15-30 amps.
4.2.6 Start timer.
4.2.7 Use the radiometer to determine the equivalent sun level to the samples - either a reading at the optical port if the samples are in vacuum or a reading directly in front of the samples if they are in air. Adjust the current for desired sun level. Record the radiometer reading in the appropriate lab notebook or customer-provided data sheet.
4.2.8 Using the equivalent sun level, calculate the length of time required for exposure. (i.e., the desired exposure is 100 equivalent sun-hours, the radiometer indicates an equivalent sun level of 2, therefore, the samples shall be exposed for 50 hours.)
4.2.9 Periodically repeat radiometer readings and record. Adjust lamp intensity or exposure time as needed. (i.e., cut back the exposure time if radiometer readings indicate 2.1 equivalent suns instead of 2.0.) Record vacuum level and sample temperature, if applicable.

4.3 **Deenergizing System**
4.3.1 Turn power switch on the LPS225HR power supply to “off”, wait 5 seconds then turn the power switch back to “on”.
4.3.2 Allow unit to cool down for a minimum of 15 minutes.
4.3.3 Turn power switch on the LPS225HR power supply to “off”.
4.3.4 Remove samples from chamber.

5. NOTES

None.

6. SAFETY PRECAUTIONS AND WARNING NOTES

This work instruction is not a substitute for formal training in Solar Simulator operation. Untrained personnel shall not attempt to use this document to operate the solar simulators in Bldgs. 4605 and 4711 unless supervised by trained, experienced personnel.

Hazards associated with this system include ozone fumes from exhaust, lethal voltages present within the enclosure, the high pressure lamp, and the ultraviolet light produced. Facility ventilation must be active and open to the system during lamp operation. The UV lamp is fragile and highly pressurized; it may explode if subjected to any form of rough handling, shock, or impact. Protective clothing, face mask, and gloves must be worn during lamp removal and replacement. (Refer to Spectrosun Model X-25 Mark II Solar Simulator Instruction Manual Section 4.3.2. and the SOP for lamp removal and replacement procedures; Oriel operator’s manual and the SOP for lamp removal and replacement procedures; or, McPherson Model LH153 Light Source System Instruction Manual Section 3.2 and the SOP for lamp removal and replacement procedures as appropriate.) Ultraviolet radiation can cause permanent, serious skin and eye damage. Minimize exposure to the UV light, and wear appropriate protective glasses, clothing and gloves.

7. APPENDICES, DATA, REPORTS, AND FORMS

All activities with any of the UV Solar Simulators shall be noted in the appropriate lab notebook or customer-provided data sheet. This shall include UV system used, location of samples in the sample holder, radiometer readings, sample temperature, and time of exposure.

When qualifying a material for spacecraft use, a data sheet shall be filled out with significant properties (mass, solar absorptance, conductivity, etc.) as measured for each sample before and after ultraviolet radiation exposure. The ultraviolet radiation exposure shall be calculated based on radiometer readings and time of exposure. If required by the customer, this data sheet shall be presented to quality personnel for stamping. MSFC Quality, if required, may choose whether or not to be present for the ultraviolet radiation exposure and sample characterization.

8. QUALITY RECORDS

Quality records must be retained in accordance with EM50-OWI-003. Copies are to be maintained on file in EM50 for a period not less than five years.

9. TOOLS, EQUIPMENT, AND MATERIALS

As required.

10. PERSONNEL TRAINING AND CERTIFICATION

The leader of the Environmental Effects Branch shall be responsible for ensuring that all personnel using the UV Solar Simulators 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 Branch office.

11. FLOW DIAGRAM

Not Applicable.