SAE International™ SURFACE VEHICLE STANDARD

SAE J2229 CAN-CELLED JUL2008

Issued 1993-02
Cancelled 2008-07

Superseding J2229 FEB1993

Accelerated Exposure of Automotive Interior Trim Materials Using an Outdoor Under Glass Variable Angle Controlled Temperature Apparatus

1. Scope

1.1 This SAE Standard specifies the operating procedures for the exposure of automotive interior trim materials in an outdoor behind glass apparatus in which the temperature is controlled for part of the day.

1.2 Specimen preparation, test durations, and performance evaluation procedures are covered in material specifications of the different automotive manufacturers.

1.3 **Rationale—**SAE J2229 is being withdrawn as this standard is no longer used by industry. This has also been reported by major outdoor weathering contract testing sites. At one time, certain automotive OEM's were using SAE J2229 but have now chosen to use other outdoor weathering methods for their testing needs.

2. References

2.1 **Applicable Publications—**The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATION—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J1545—Instrumental Color Difference Measurement for Exterior Finishes, Textiles, and Colored Trim

2.1.2 AATCC PUBLICATION—Available from AATCC, P.O. Box 12215, Research Triangle Park, NC 27709.

AATCC Evaluation Procedure 1 (1987)—Gray Scale for Color Change

2.1.3 ASTM PUBLICATION—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM E 824—Standard Method for Transfer of Calibration from Reference to Field Pyranometers

TO PLACE A DOCUMENT ORDER:
Tel: 877-606-7323 (inside USA and Canada)
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

3. *Terminology*

3.1 Black Panel Thermometer, n—A temperature measuring device, the sensing unit of which is a stainless steel panel coated with black material designed to absorb most of the radiant energy encountered in fade/weathering testing.

NOTE—This device provides an estimation of the maximum temperature a specimen may attain during exposure to natural or artificial light.

3.2 Blue Wool Lightfastness Standard, n—One of a group of dyed fabrics which are sensitive to the amount of light, heat, and moisture to which the blue wool material is exposed. Because of their unstable nature, these materials are also sensitive to the heat and moisture conditions which exist before exposure testing, after exposure testing, and prior to measurement.

3.3 Center Wavelength, n—The specified wavelength for bandpass filters; the wavelength midway between the half power points, e.g., 340 nm ± 2 nm.

3.4 Color Change, n—As used in fade/weathering testing, a change in color of any kind (whether a change in hue, saturation, or lightness).

3.5 Half Power Bandpass, n—The interval between wavelengths at which transmittance is 50% of peak. (It should not exceed 20 nm for a narrow bandpass filter.)

3.6 Irradiance Total, n—The rate at which energy is incident on a surface per unit area (W/m^2).

3.7 Irradiance, Ultraviolet, n—Irradiance integrated over wavelengths 295 to 385 nm ($W/m^2/nm$).

3.8 Irradiance, Center Wavelength, n—Irradiance integrated at wavelength 340 nm ± 2 nm ($W/m^2/nm$).

3.9 Irradiation, n—See radiant exposure.

3.10 Radiant Exposure, n—The accumulated amount of irradiance received during a specified time period per unit area (J/m^2). Since irradiance can be measured using a variety of different optical sensors, it is generally recommended that the type of radiant exposure be specified (e.g., radiant exposure from 295 to 385 nm, or radiant exposure at 340 nm ± 2 nm).

3.11 Reference Fabric, n—One or more blue wool lightfastness standards selected for exposure as a check on the test apparatus and operating conditions.

3.12 Reference Plastic, n—A clear polystyrene plastic standard selected for exposure as a check on a test apparatus and operating conditions.

NOTE—It has not been verified that these reference materials can be used as a check on a test cabinet or operating conditions for outdoor exposure tests due to seasonal variations in ultraviolet spectral distribution, temperature, relative humidity, and time of wetness during the uncontrolled portion of the test.

3.13 Sample, Laboratory, n—A portion of material taken to represent the lot sample, the original material, or production lot, and is used in the laboratory as a source of test specimens.

3.14 Specimen, n—A specific portion of a material, laboratory sample, or production lot, upon which a test is performed or which is selected for that purpose.

4. Significance and Use

4.1 This method is designed to simulate extreme environmental conditions encountered inside a vehicle due to sunlight, heat, and humidity for the purpose of predicting the performance of automotive interior trim materials.

4.2 Variations in results may be expected when operating conditions are varied within the accepted limits of this method, or tests are conducted in different geographical locations. Therefore, no reference shall be made to results from the use of this method unless accompanied by a report detailing the specific operating conditions and location in compliance with Section 9, Exposure Report.

5. Apparatus

5.1 The mounting stand (Figure 1) shall have a means for variable orientation of the cabinet. Orientation shall be facing the Equator at a seasonally-adjusted tilt angle as follows in Table 1:

TABLE 1—ORIENTATION OF SEASONALLY ADJUSTED CABINET (ASTM E 782)

Period	Tilt Angle
Mar. 1 - 31	station latitude
Apr. 1 - Aug. 31	latitude - 20 degrees
Sep. 1 - 30	station latitude
Oct. 1 - Feb. 28	latitude + 20 degrees

5.2 The test cabinet (Figure 1)[1] shall be constructed of corrosion-resistant metal and contain a specimen rack, air circulation fan(s), and a hinged glass cover.

5.3 The glass cover (Figure 1) shall be a single piece of 3 mm (1/8 in) thick clear tempered safety glass, such as Herculite® [2], or equivalent.

5.4 The specimen rack shall be designed and positioned so that the test specimens may be mounted unbacked with the plane of the test surface parallel to, and not less than 75 mm (3 in) below the glass.

5.5 The cabinet shall be equipped with a sensor, heater(s), fan(s), and a control system capable of maintaining a specified black panel temperature to within ± 5 °C at any location within the specimen exposure area during the hours that the control system is in operation. An example of such a system is given in Figure 1.

5.6 An ultraviolet radiometer shall be used to measure irradiance, and connected to an integrator for computing ultraviolet radiant exposure. The ultraviolet radiometer shall be mounted behind glass, such as Herculite®[2], or equivalent, in a ventilated enclosure to avoid overheating the instrument. The enclosure containing the radiometer shall maintain the same orientation as the test cabinet. Two different types of radiometers may be used.

5.6.1 A wide-band ultraviolet radiometer[3], an instrument which measures irradiance at wavelengths 295 to 385 nm.

5.6.2 A narrow-band ultraviolet radiometer[4], an instrument which measures irradiance at 340 nm ± 2 nm.

---

1. Available from William Harrison Company, 4595 E. 10th Court, Hialeah, FL 33013, or equivalent.
2. Available from PPG Industries.
3. Available as model TUVR from Eppley Laboratories, 12 Sheffield Avenue, Newport, RI 02840, or equivalent.
4. Available as model LM3A from Atlas Electric Devices Company, 4114 North Ravenswood Avenue, Chicago, IL 60613, or model NBUVR-340 available from DSET Laboratories, Inc., 45601 N. 47th Avenue, Phoenix, AZ 85027, or equivalent.

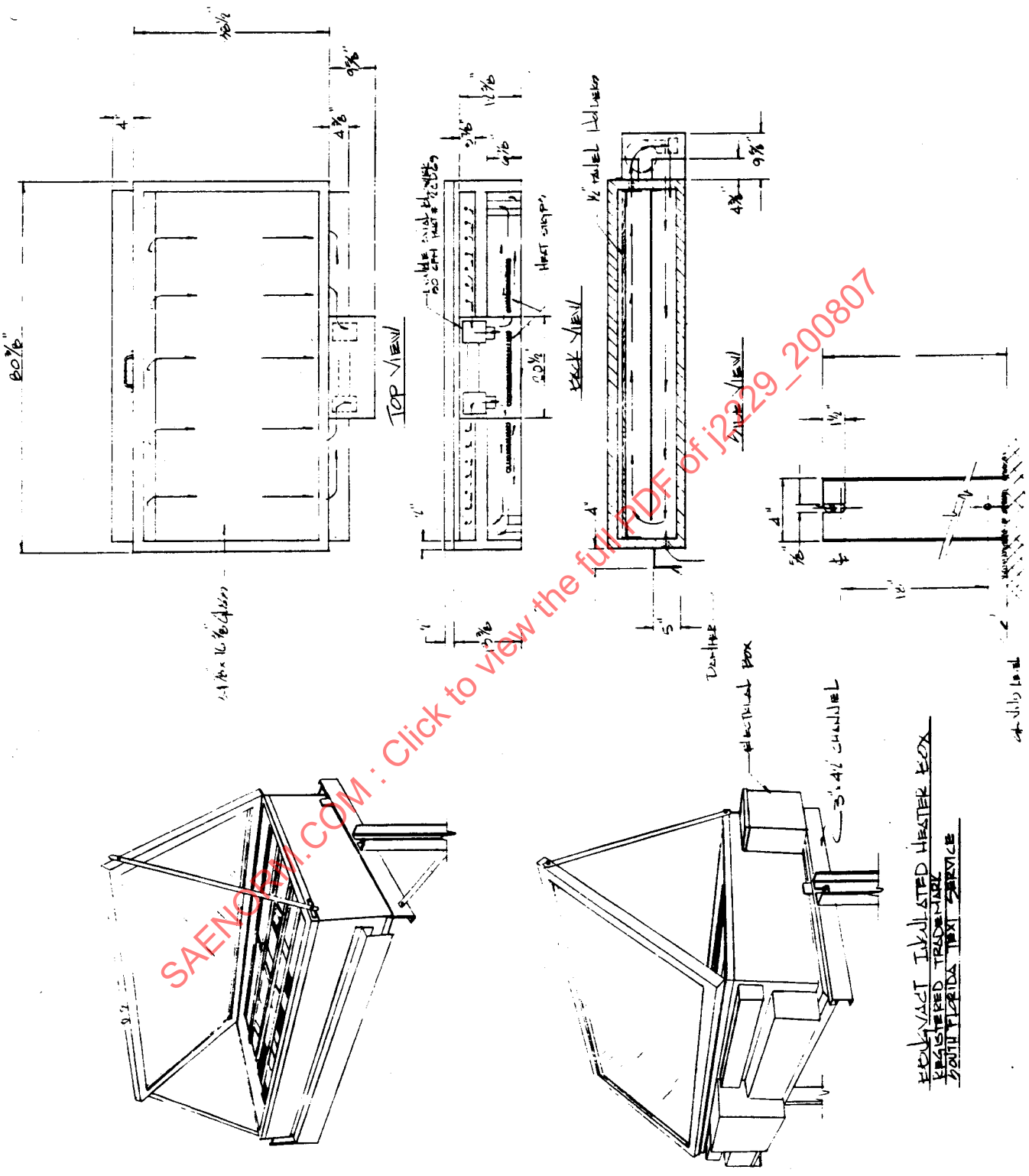

FIGURE 1—EXPOSURE APPARATUS

6. *Apparatus Set-Up*

6.1 To enhance the possibility of repeatability of tests, maintain and calibrate the apparatus as described in Appendices A and B. Appendix A contains maintenance and calibration instructions. Appendix B describes the use of reference materials which may assist in determining the performance of the apparatus, and interpreting exposure results when compared to previous tests.

7. *Test Specimens*

7.1 Unless otherwise specified, test specimens shall be 75 x 150 mm (3 x 6 in), with a maximum thickness of 25 mm (1 in). For specimens over 25 mm (1 in) thick, formed or configured specimens, and large components, specific instructions must be obtained from the responsible material engineer of the different automotive manufacturers or automotive suppliers.

7.2 Replicate specimens are desirable to provide a record of the changes when they are exposed for different radiant exposure levels. An unexposed specimen should be saved for visual comparison with the exposed specimen.

8. *Test Procedure*

8.1 Mount test specimens to the specimen rack. Mask the top and bottom area of the specimen in contact with the mounting strips with white cardboard[5]. To minimize variations in results caused by nonuniform exposure conditions, the specimen exposure area is restricted to the dimensions provided in Figure 2 or 3.

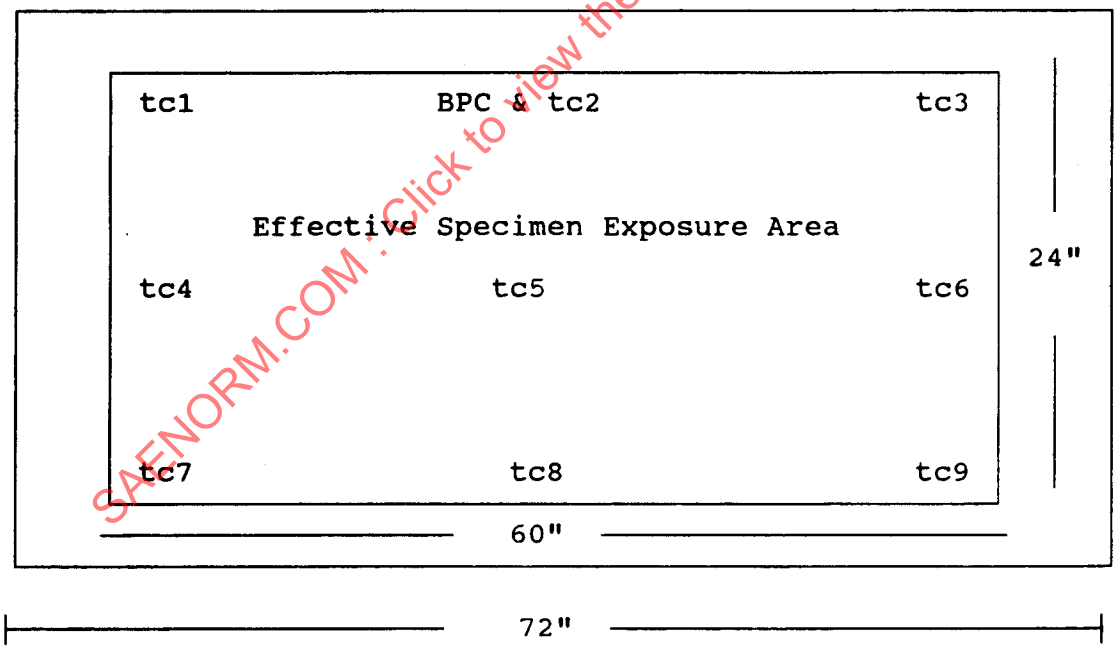

FIGURE 2—EFFECTIVE SPECIMEN EXPOSURE AREA THERMOCOUPLE LOCATIONS FOR TEMPERATURE UNIFORMITY CHECK

5. Franklin, Grain long-felt side up, 110/500 white index made by Union Camp or 9016 White Bristol Card Stock are suitable for this purpose. Franklin white index is usually available from local office supply or art stores, and is also available from Dilliard Paper Company. Any equivalent may be used.

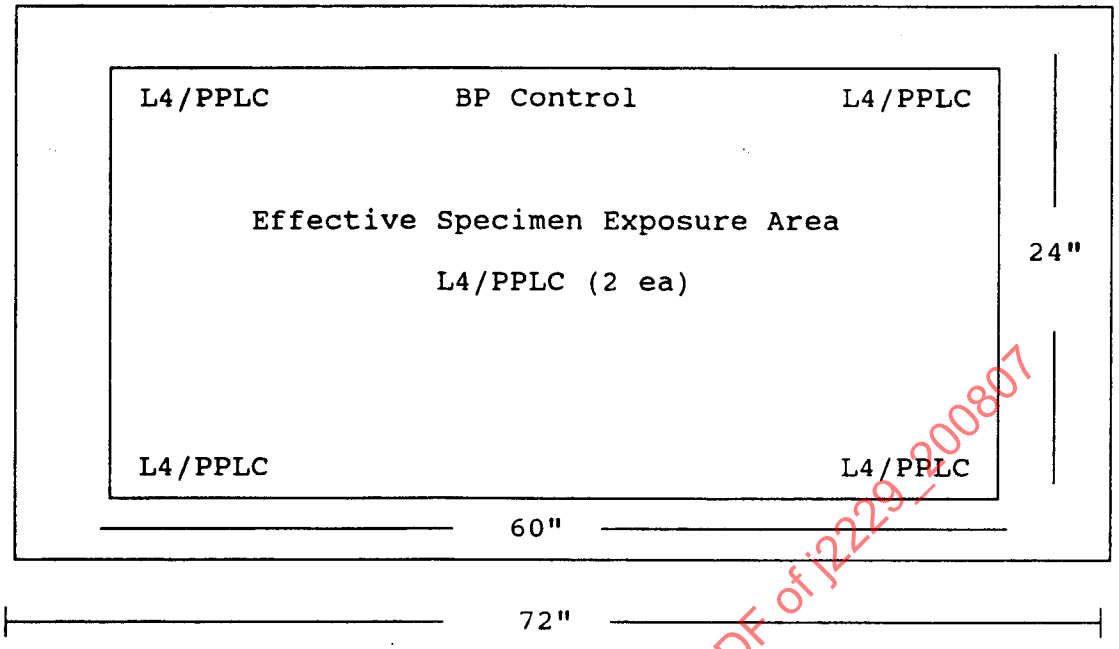

FIGURE 3—EFFECTIVE SPECIMEN EXPOSURE AREA REFERENCE MATERIALS LOCATIONS

8.2 Ensure the timer and temperature set points are correct for the method specified:

a. Timer—0900 to 1500 control system on 1500 to 0900 control system off
b. Temperature—89 °C ± 5 °C black panel

Operate continuously, except for performing maintenance and calibration as specified in Appendix A, inspecting specimens, removing specimens, or starting new tests.

8.3 Use one of the following methods for timing the exposure:

8.3.1 Expose specimens for the specified radiant exposure measured in MJ/m^2 total ultraviolet, 295 to 385 nm.

8.3.2 Expose specimens for the specified radiant exposure measured in $kJ/m^2/nm$ at 340 nm ± 2 nm.

9. Evaluating and Reporting Degree of Fade

9.1 The degree of fade shall be evaluated and reported as specified between the contractual parties. Instrumental values are recommended:

9.1.1 INSTRUMENTAL MEASUREMENT

9.1.1.1 Color difference values in CIELAB units are obtained by instrumentally measuring the specimen before and after a specified amount of radiant exposure. The instrument used for specimen measurement shall conform to that specified in Appendix B.

9.1.2 VISUAL ASSESSMENT

9.1.2.1 *Rating Method A*—Assign colorfastness ratings using the AATCC Gray Scale for Color Change in accordance with AATCC Evaluation Procedure 1 (1987).

9.1.2.2 *Rating Method B*—Using the viewing conditions specified in AATCC Evaluation Procedure 1 (1987), quantify the color change using the following terminology:

a. NONE—No change in hue, lightness, or saturation (chroma).
b. SLIGHT—A change in lightness and/or saturation (chroma) which can be determined only upon close examination but no change in hue.
c. NOTICEABLE—A change in lightness and/or saturation (chroma) which can easily be seen and/or a change in hue.
d. SEVERE—An extreme change in lightness, saturation (chroma), and/or hue.

10. Exposure Report

10.1 The final report shall contain the following:

10.1.1 Laboratory and location

10.1.2 Type and serial number of exposure apparatus

10.1.3 Test method

10.1.4 Specimen identification

10.1.5 Total radiant exposure (MJ/m^2/295 to 385 nm) or ($kJ/m^2 \cdot nm$ at 340 nm).

10.1.6 Date specimen exposure was initiated

10.1.7 Date specimen exposure was completed

10.1.8 Special conditions which may have existed during a specific test period, such as control failure, unusual atmospheric conditions, etc.

11. Precision and Bias

11.1 Neither repeatability (precision of multiple determinations at one site) nor reproducibility (precision of multiple determinations at different sites) have been established. Therefore, it is inappropriate to compare results from different sites or results obtained at different times at the same site. It is strongly recommended that a control material having a known history be exposed simultaneously with test specimens if it is desirable to compare results obtained at different times and/or sites.

PREPARED BY THE SAE TEXTILES AND FLEXIBLE PLASTICS COMMITTEE

APPENDIX A

A.1 Maintenance

A.1.1 Specimen Mounting—Check specimens daily to ensure they are properly mounted.

A.1.2 Glass Cover—The glass cover shall be inspected weekly, and both surfaces shall be cleaned whenever there is visual evidence of dirt accumulation or other undesirable deposits.

A.1.3 Ultraviolet Radiometer—The glass cover and the diffusing lens shall be cleaned daily with deionized water. The desiccant visible through the sight glass shall be replaced whenever the color changes from dark blue to light pink.

A.1.4 LM3A Light Monitors—The diffusing lens shall be cleaned daily with deionized water.

A.1.5 Thermocouples—Check readouts monthly during temperature uniformity check to ensure thermocouples are operating properly.

A.1.6 Black Panel Thermometer—Check readouts daily to ensure black panel thermometers are operating properly. Polish monthly using a good quality automotive polish. Replace the black panel when surface luster can no longer be maintained, or when bare metal can be seen.

A.1.7 Heating System—Check temperature readouts daily to ensure proper heating. Check monthly for integrity of electric wiring, loose connections, and all other safety features.

A.1.8 Air Circulation System—Check temperature readouts daily to ensure proper air circulation. Check monthly for integrity of electric wiring, loose connections, and all other safety features.

A.1.9 Temperature Uniformity—Check one 24-h day, at 5 min intervals, monthly for distribution around set point temperature using a minimum of nine thermocouple locations. Thermocouples are attached to the specimen rack (see Figure 2).

A.2 Calibration

A.2.1 Ultraviolet Radiometer—Perform a field transfer calibration every 3 months in accordance with ASTM E 824. Return to the manufacturer no less than annually for absolute calibration.

A.2.2 LM3A Light Monitors—Check every 3 months with a reference unit to verify data. Return to the manufacturer no less than annually for absolute calibration.

A.2.3 Black Panel—Check every 6 months using a hot/cold bath with a NIST traceable thermometer.

A.2.4 Thermocouples—Check every 6 months using a hot/cold bath with a NIST traceable thermometer.

A.2.5 Tilt Angle Verification—Verification of the tilt angle of the exposure cabinet shall be performed at each variable angle change.