ATLAS
MATERIAL TESTING SOLUTIONS

Material Testing Product
and Technology News

Volume 34
Issue 71

SunSpots

Spring 2004

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Page 19*

A Comparison of Laboratory Instruments Using Automotive Test Methods

by Kurt P. Scott
Director, Research and Development, Atlas Material Testing Technology

This paper will report on the use of a test method specifically developed to qualify laboratory weathering devices, as a legitimate means of comparing three currently used weathering instruments. The results of the mandated tests will be used to examine some of the claims and conclusions made in several versions of a widely distributed study by Brennan, et al, comparing different weathering instruments[1].

Weathering tests, their results, and result comparisons are used in a variety of ways. The most obvious and common is to determine, or more practically, to estimate the performance of materials being considered for service applications. Additionally, weathering tests are frequently used to compare, or rank, the relative performance of multiple materials. Somewhat less frequently, they are used to compare the performance of different weathering devices.

Continued on page 5

Atlas Chicago Receives ISO 17025 Accreditation

Atlas is proud to announce that the American Association for Laboratory Accreditation (A2LA) has awarded Atlas certification to ISO/IEC 17025, General Requirements for the Competence of Testing and Calibration Laboratories. The scope of Atlas' accreditation covers two areas: irradiance calibration of xenon and fluorescent light sources associated with the Ci-Series Weather-Ometers, SUNTESTs, UV2000 units, and field service calibrations of these units performed by our Technical Services division. With this achievement, Atlas customers now have independent assurance that the calibrations performed on their instruments meet the level of quality they expect.

"Customers have been inquiring for a long time about our ISO

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In This Issue

AtlasCommitment to Education

Atlas offers two types of Fundamentals of Weathering courses, from basic to advanced, to support the training needs of our customers:

The **Fundamentals of Weathering I** is a basic, one-day seminar offered in various locations around the world. It focuses on lightfastness and weathering durability testing techniques and introduces how various factors of weather and climate may affect materials.

The **Fundamentals of Weathering II** is a continuation of the basic seminar that examines in more detail how various factors of weathering and climate may affect materials and how to test the resistance of a formulation or product to those factors. Measuring devices for light, temperature, and moisture are identified, along with some of the common errors associated with their use. Students will learn more about the primary weather factors that affect the durability of materials and will acquire a more in-depth understanding of the photochemistry occurring during weathering tests. From choosing the appropriate test to analysis and evaluation techniques, students will leave the class with insightful knowledge into the weathering industry.

For information on courses in Europe, contact ATLAS MTT GmbH, attention Bruno Bentjerodt, at +49/6051/707-245 or **clienteducation@atlasmtt.de.** For information on courses in North America, contact Theresa Schultz at +1-773-327-4520 or **tschultz@atlas-mts.com.** Or visit our website at www.atlas-mts.com. ■

2004

Fundamentals of Weathering I

March 30
Dallas, TX

April 14
Hebron, KY

April 14
Boras, Sweden

April 21
Gent, Belgium

May 4
Parsippany, NJ

May 24–28
GB, Ireland

June 2
Oensingen, Switzerland

June 15
Marlborough, MA

August 3–5
India

September 14
Philadelphia, PA

September 20–24
Denmark

September 22
Grand Rapids, MI

October 5
Toronto, Canada

October 19
Phoenix, AZ

November 24
Münster, Germany

Fundamentals of Weathering II

March 31
Dallas, TX

May 5
Parsippany, NJ

April 22
Gent, Belgium

June 3
Oensingen, Switzerland

August 3–5
India

September 15
Philadelphia, PA

September 20–24
Denmark

October 6
Toronto, Canada

October 20
Phoenix, AZ

November 25
Münster, Germany

2004

Weather-Ometer® Workshops

March 1
Ci4000/Ci5000
Weather-Ometer® Workshop

March 2–3
Ci35/Ci65
Weather-Ometer® Workshop

June 7
Ci4000/Ci5000
Weather-Ometer® Workshop

June 8–9
Ci35/Ci65
Weather-Ometer® Workshop

October 11
Ci4000/Ci5000
Weather-Ometer® Workshop

October 12–13
Ci35/Ci65
Weather-Ometer® Workshop

October 14
Advanced Ci35/Ci65
Weather-Ometer® Workshop

Suntest Workshop
October 4
Linsengericht, Germany

Xenotest Workshop
October 6–7
Linsengericht, Germany

See **www.atlas-mts.com/client** for more information on these workshops and to registrer.

Fun(damentals) of Lab Corrosion Testing Seminars

May 6
Parsippany, NJ

June 16
Marlborough, MA

October 7
Toronto, Ontario, Canada

This one-day course is designed to educate operators of lab corrosion testing cabinets on the history of corrosion testing, proper testing procedures including sample evaluation and correlation, available solutions, and future trends. Those new to corrosion testing and sample evaluation will find this to be an excellent introduction, while those with more experience will benefit from the review and receive important updates. Engineers, technicians, quality control personnel, and research & development staff will all find this seminar informative, educational, and beneficial to their corrosion testing needs.

"The Fun(damentals) of Lab Corrosion Testing seminar was very insightful and provided us with a quality educational experience," said Doug Springer of Komatsu America International Company. "The Atlas team that presented the seminar addressed all of our questions and provided participants with a bird's-eye view of the future of corrosion testing. I would certainly recommend this seminar for any company currently conducting any material corrosion tests or using corrosion data for material selection within their laboratories."

For more information on the Fun(damentals) of Lab Corrosion Testing seminar, or to set up a one-day seminar for your company, please contact Theresa Schultz at +1-773-327-4520 or **tschultz@atlas-mts.com** or visit www.atlas-mts.com.

AtlasShows

2004

SAE 2004
March 8–11
Cobo Hall
Detroit, MI
Booth #621

APLIMATEC
April
Valencia, Spain

METAL
April 20–24
Fredericia, Denmark

IGATEX
April 21–24
Karachi, Pakistan

Spectrum of Coatings
April 21
Louisville, KY

ESTECH
April 25–28
Las Vegas, NV
Booth #210

Plastics for Industry
April 27–29
Kortrijk, Belgium

Eurocoat
May 11–13
Rimini, Italy

ANTEC
May 16–20
Navy Pier
Chicago, IL
Booth #121

Sink or Swim 2004
May 18–19
Cleveland, OH

Lab Africa
June 1–3
Johannesburg,
South Africa

ITM 2004
June 1–6
Istanbul, Turkey

Quality Expo
June 9–10
Novi, MI
Booth #641

5th International Meeting on Photostability of Drugs and Drug Products
June 14–16
London, UK

Baltic Textile & Leather
September 8–10
Vilnius, Lithuania

AATCC
September 13–17
Greenville,
South Carolina

Industry Fair 04
September 20–24
Brno, Czech Republic

Chemtec 04
October 6–8
Praha, Czech Republic

K' Show
October 20–27
Duesseldorf, Germany

IFAI 2004
October 27–29
Pittsburgh, PA

Test Expo 2004–North America
October 27–29
Detroit, Michigan

FSCT ICE 2004
October 27–29
McCormick Center
Chicago, IL

AISEX 04
November 18–20
Colombo, Sri Lanka

ITME
December 4–11
Mumbai, India

AtlasSpeaks

2004

Gesellschaft für Umweltsimulation e.V.
March 17–19
Pfinztal, Germany

Dr. Artur Schoenlein, Atlas Material Testing Technology GmbH, will present a paper on temperature measurement in outdoor and weatherfastness testing.

Andreas Kuehlen, Atlas Material Testing Technology GmbH, will present a paper on calculation of solar radiation in materials testing.

TOSCOT (Toronto Society for Coatings Technology)
April 19
Toronto, Ontario, Canada

Allen Zielnik, Atlas Material Testing Technology, will give a presentation on the key elements of a coatings weatherability test.

Spectrum of Coatings
April 21
Louisville, Kentucky

Bill Lucas, Atlas Material Testing Technology, will give a presentation titled "Improvements in Lab Corrosion Testing Cabinets."

FOCUS 2004
Detroit Society of Coatings Technology
May 4
Detroit, Michigan, USA

Allen Zielnik will present a paper titled, "Service Life Prediction of Paints & Coatings: Trends."

5th International Meeting on Photostability of Drugs and Drug Products
June 14–16
London, UK

Dr. Joerg Boxhammer, Atlas Material Testing Technology GmbH, will present papers on several topics:

1. Basics of Photochemistry–From Incident Light to Photoreactions
2. Photostability Testing–Environmental Light Conditions and Artificial Light Systems
3. Radiometric and Photometric Quantities and their Place in Photostability Testing
4. Radiometers and Physical/Chemical Actinometers in Photostability Testing–Requirements, Measuring Systems/Substances and Calibration Procedures
5. Basic Requirements on Chambers for Photostability Testing

Laboratory Instruments, from page 1

Regardless of the objective, comparisons of weathering test results can be a tricky proposition. Comparisons not fully rationalized can potentially lead, wittingly or unwittingly, to misleading conclusions. Like the discipline of statistics—itself a necessary tool to properly evaluate weathering test results—weathering data can be manipulated and selectively analyzed to illustrate or further a particular viewpoint.

Background

Society of Automotive Engineers Weathering Tests

The Society of Automotive Engineers (SAE) weathering test methods, SAE J1885 [2] and SAE J1960 [3] have been used in the automotive industry since their introduction in 1989 for the testing of interior and exterior materials, respectively.

Recently, both have been converted to performance-based formats, J2412 [4] for J1885 and J2527 [5] for J1960. No specific instrument model or manufacturer is mentioned in the new methods. Therefore, to ensure that proposed or candidate instruments are capable of desired and expected test performance, it was necessary to also develop a companion Acceptance Protocol, SAE J2413[6], to qualify instruments.

To be clear; it cannot be legitimately claimed that an instrument "complies with" or "meets the conditions" of either SAE J2412 or SAE J2527 until such is proven by providing the data stipulated by the test protocol outlined in SAE J2413.

The test data required by J2413 are shown verbatim in Appendix A (page 15). The performance of SAE J2413 can be used to answer the following questions (1, 2, 3, and 4 will also address the direct claims of the Brennan paper):

1) **Do the evaluated instruments meet the specified criteria of the SAE J1960/J2527 test?**
2) **Do the evaluated instruments meet the specified criteria of the SAE J1885/J2412 test?**
3) **What is the impact of repositioning the samples in the Q-Sun Xe-3HS?**
4) **How do the instruments compare with each other?**
5) **Do the instruments expose specimens uniformly throughout a test?**

Experimental

The Q-Sun Xe-3HS, Atlas Ci4000 Weather-Ometer®, and Atlas Ci5000 Weather-Ometer® were run according to the SAE J2413 acceptance protocol, first using the conditions of J2527, then followed by J2412.

Note: The Q-Sun Xe-3HS does not comply with the test conditions stipulated in J2527. Its flat, solid specimen tray does not facilitate the "specimen back-spray" requirement of the test. However, the instrument was programmed for all other SAE J2527 test parameters per the manufacturer's instructions.

The polystyrene (PS) chip, which has been used as a Standard Reference Material (SRM) for SAE test methods since the tests were introduced, was included in both the J2527 and J2412 tests. In addition, the American Association of Textiles Chemist & Colorists (AATCC) [7] L2 and L4 Blue Wools that are also SAE-sanctioned SRMs, were tested in the J2412 tests.

The clear, transparent PS chip yellows with increasing radiant exposure. Several past studies have shown that PS is sensitive to two of the critical stresses of a weathering test: light and heat. Other studies have also shown that it is relatively insensitive to moisture.

Continued on next page

Laboratory Instruments, from previous page

Within lot variability of the polystyrene chip is minimized because large homogeneous quantities are molded from a given production run of raw material. Variability between manufactured lots is seldom large, nevertheless, extensive round robin experiments are conducted to establish statistically determined performance criteria for each (manufactured lot).

The upper and lower limits of the allowable performance parameters for SAE J1885 and SAE J1960 and their performance-based equivalents, J2412 and J2527, are included with graphical results where appropriate. All instruments that purport to meet the laboratory SAE weathering methods should produce results that fall within the specified limits.[1]

Polystyrene arrangement for J1960 in Q-Sun samples are not repositioned in this test. Delta b* values shown.

KJ/m²	Quadrant 1							Quadrant 2						
31.6	1.62		1.67		1.86		1.85		2.10		2.14		1.43	
63.2	2.37		2.39		2.73		2.72		2.75		2.81		2.31	
94.8	3.02		3.59		3.57		3.55		3.32		3.59		3.30	
126.4	3.90		3.94		4.44		4.49		4.64		4.39		3.85	
31.6		1.63		1.72		1.83		1.41		2.39		1.75		1.81
63.2		2.38		2.56		2.57		2.19		3.10		2.58		2.67
94.8		3.19		3.50		3.36		2.91		3.89		3.42		3.44
126.4		4.01		4.46		4.42		4.01		4.93		4.54		4.31
31.6	1.52		1.56		1.88		1.83		2.05		1.87		1.77	
63.2	2.24		2.32		2.72		2.75		2.99		2.82		2.57	
94.8	2.92		3.05		3.52		3.56		3.88		3.54		3.35	
126.4	3.74		3.90		4.43		4.58		5.02		4.56		4.24	
31.6		1.65		1.65		1.95		1.70		1.91		1.63		1.59
63.2		2.38		2.43		2.65		2.41		2.85		2.60		2.27
94.8		3.08		3.17		3.39		3.04		3.43		3.04		3.06
126.4		3.82		4.02		4.35		3.88		4.45		3.99		3.96
	Quadrant 4							Quadrant 3						

SAE J1960 Requirements - Reflectance		Q-Sun Results	
		Average	Std. Dev
31.6	0.93 - 1.37	1.78	0.22
63.2	1.48 - 1.92	2.58	0.23
94.8	1.96 - 2.55	3.35	0.27
126.4	2.45 - 3.19	4.26	0.34

Figure 1

Samples in the Q-Sun unit were distributed throughout the exposure area as depicted in the yellow shading in the schematic drawings in Figure 1. They were placed on four specimen trays of equal dimensions, each roughly occupying a quarter of the full exposure area. To average or "even out" inherent exposure variability, the manufacturer recommends that each specimen tray be manually repositioned in a clockwise fashion, such that all samples spend equal exposure time in each quadrant. However, to establish a baseline against which the effectiveness of the repositioning can be determined, the samples in the Q-Sun instrument were not repositioned in one of the four-day (121.6 kJ/(m^2•nm) @340nm)[2] test runs. In all other tests, the instrument manufacturer's recommended regimen for manually repositioning the samples was faithfully followed.

The test duration of four days was chosen in part to accommodate the Q-Sun's recommendation to expose all specimens equally in each quadrant. In any event, a four-day test is sufficient to determine the trend-lines for the polystyrene chip. In addition to the test in which the samples were not repositioned in the Q-Sun instrument, three four-day tests were run at the J2527 conditions in each instrument. Only one four-day test was run at the J2412 conditions.

In the Atlas Ci4000 and Ci5000, where repositioning is unnecessary, each sample was exposed in a specific specimen-rack location for the duration of the four-day test. Figure 2 (page 8) depicts the Ci instruments' sample allocation on the

[1] *Consult appropriate standards for the complete radiant exposure ranges of performance criteria.*

[2] *For the sake of brevity, "kJ/m^2" is used elsewhere throughout the paper in lieu of the technically correct "kJ/(m^2• nm) @340nm)."*

specimen rack, as specified by J2413.

CIE Delta b* color measurements were done according to the method specified in the SAE standards.

Results and Discussion

Specification testing

Specifications with upper and lower limits or tolerances are referred to as double-sided specifications. To test whether a data set or body of test results meets the double-sided specification, a couple of similar statistics are typically used. The double-sided *Student t* is generally used for smaller populations of samples, while the Z statistic is used with large data sets.

If it is uncertain which is more appropriate, the more conservative approach is to use the *Student t* test, which, in any case, produces results that approximate those of the Z test as the sample population increases. Basically, each statistic will test, at a given confidence level, whether the true mean, μ, of a data set lies between the upper and lower limits of a specification. The *Student t* test is used to test whether the evaluated instruments meet the SAE J1960/J2527 and J1885/J2412 specifications.

For each data set, the region in which we can say with 95% confidence that the true mean, μ, lies, is calculated by the following equation:

$$\text{C.I. for } \mu = \bar{x} \pm \frac{t_{\alpha/2}\, s}{\sqrt{n}}$$

Where:

C.I.	Confidence interval
μ	The true mean
$\bar{x}$	Calculated average of observed values (estimate of mean)
$t_{\alpha/2}$	Critical two sided t value
s	(Calculated) estimate of standard deviation
n	Number of samples

1. Do the evaluated instruments meet the specified criteria of the SAE J1960/J2527 test?

Q-Sun Xe-3HS

The results of the test in which the samples were not repositioned are shown in the schematic of the sample layout (Figure 1). The averages of all 28 samples, measured at daily increments of 31.6 kJ/m^2, and run for a total of four days (126.4 kJ/m^2), are shown in the plot in Figure 3 (page 10). Figure 4 (page 10) shows the individual CIE Delta b* values for all 28 polystyrene chips. In each case, the individual specimen results measured at each test increment are plotted in comparison to the J2527 specified tolerances.

Plots of the daily averages of the samples that were repositioned during three different tests are also shown and identified in Figure 3. Their 95% confidence interval for μ are also shown in Table 1 (page 9). The effectiveness of repositioning is discussed later.

The confidence intervals for the true mean, μ, of the 28 samples of each run, at each radiant exposure increment, are shown in Table 1. They can be compared to the upper and lower J1960/J2527 specifications limits.

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Laboratory Instruments, from previous page

Instrument Model Ci4000

All values are Delta b* on the CIE Lab scale

Position on Rack	Radiant Dosage	0 Degrees PS Chips	90 Degrees PS Chips	180 Degrees PS Chips	270 Degrees PS Chips	Tier	Circumferential Mean - PS	Standard Deviation
1	31.6	1.15	1.02	1.03	1.06	TOP TIER	1.07	0.06
	63.2	1.74	1.60	1.63	1.71		1.67	0.07
	94.8	2.23	2.09	2.11	2.17		2.15	0.06
	126.4	2.83	2.67	2.71	2.73		2.74	0.07
2	31.6	1.08	1.03	1.03	1.05		1.05	0.02
	63.2	1.71	1.67	1.65	1.70		1.68	0.03
	94.8	2.21	2.13	2.16	2.18		2.17	0.03
	126.4	2.82	2.71	2.74	2.77		2.76	0.05
3	31.6	1.07	1.03	1.06	1.01		1.04	0.03
	63.2	1.69	1.69	1.69	1.67		1.69	0.01
	94.8	2.15	2.15	2.17	2.16		2.16	0.01
	126.4	2.76	2.75	2.78	2.75		2.76	0.01
4	31.6	1.11	1.07	1.04	1.07	MID TIER	1.07	0.03
	63.2	1.75	1.73	1.74	1.72		1.74	0.01
	94.8	2.26	2.25	2.25	2.23		2.25	0.01
	126.4	2.88	2.89	2.88	2.92		2.89	0.02
5	31.6	1.10	1.07	1.06	1.05		1.07	0.02
	63.2	1.75	1.76	1.74	1.74		1.75	0.01
	94.8	2.28	2.30	2.28	2.25		2.28	0.02
	126.4	2.92	2.94	2.89	2.90		2.91	0.02
6	31.6	1.09	1.07	1.04	1.07		1.07	0.02
	63.2	1.72	1.76	1.72	1.74		1.74	0.02
	94.8	2.23	2.25	2.23	2.23		2.24	0.01
	126.4	2.86	2.89	2.86	2.88		2.87	0.02
7	31.6	1.03	1.05	1.03	1.00	BOT TIER	1.03	0.02
	63.2	1.66	1.69	1.69	1.65		1.67	0.02
	94.8	2.19	2.16	2.17	2.13		2.16	0.03
	126.4	2.78	2.79	2.79	2.73		2.77	0.03
8	31.6	1.05	1.01	1.02	1.01		1.02	0.02
	63.2	1.68	1.64	1.66	1.65		1.66	0.02
	94.8	2.17	2.13	2.14	2.13		2.14	0.02
	126.4	2.79	2.72	2.77	2.73		2.75	0.03
9	31.6	1.02	0.96	0.97	1.00		0.99	0.03
	63.2	1.63	1.57	1.57	1.59		1.59	0.03
	94.8	2.06	2.02	2.00	2.04		2.03	0.03
	126.4	2.69	2.59	2.57	2.61		2.62	0.05

Instrument Model Ci5000

All values are Delta b* on the CIE Lab scale

Position on Rack	Radiant Dosage	0 Degrees PS Chips	90 Degrees PS Chips	180 Degrees PS Chips	270 Degrees PS Chips	Tier	Circumferential Mean - PS	Standard Deviation
1	31.6	1.05	1.13	1.07	1.08	TOP TIER	1.08	0.03
	63.2	1.64	1.74	1.69	1.71		1.70	0.04
	94.8	2.18	2.29	2.23	2.26		2.24	0.05
	126.4	2.81	2.90	2.83	2.89		2.86	0.04
2	31.6	1.04	1.15	1.08	1.09		1.05	0.05
	63.2	1.66	1.76	1.69	1.68		1.68	0.04
	94.8	2.20	2.31	2.23	2.25		2.17	0.05
	126.4	2.84	2.92	2.84	2.88		2.76	0.04
3	31.6	1.13	1.30	1.07	1.05		1.04	0.11
	63.2	1.74	1.95	1.67	1.68		1.69	0.13
	94.8	2.32	2.53	2.22	2.20		2.16	0.15
	126.4	2.92	3.14	2.84	2.87		2.76	0.14
4	31.6	1.08	1.10	1.13	1.11	MID TIER	1.11	0.02
	63.2	1.74	1.74	1.74	1.74		1.74	0.00
	94.8	2.32	2.31	2.34	2.34		2.33	0.02
	126.4	2.99	3.02	2.97	3.00		3.00	0.02
5	31.6	1.10	1.11	1.12	1.09		1.11	0.01
	63.2	1.74	1.76	1.74	1.72		1.74	0.02
	94.8	2.33	2.36	2.34	2.28		2.33	0.03
	126.4	3.01	3.01	3.01	2.94		2.99	0.04
6	31.6	1.18	1.05	1.14	1.09		1.12	0.06
	63.2	1.83	1.68	1.78	1.72		1.75	0.07
	94.8	2.44	2.25	2.40	2.31		2.35	0.09
	126.4	3.07	2.95	3.06	2.96		3.01	0.06
7	31.6	1.12	1.05	1.07	1.05	BOT TIER	1.07	0.03
	63.2	1.76	1.71	1.71	1.69		1.72	0.03
	94.8	2.34	2.25	2.27	2.25		2.28	0.04
	126.4	2.98	2.94	2.91	2.94		2.94	0.03
8	31.6	1.14	1.08	1.08	1.08		1.10	0.03
	63.2	1.75	1.72	1.71	1.70		1.72	0.02
	94.8	2.36	2.28	2.24	2.23		2.28	0.06
	126.4	2.99	2.95	2.92	2.91		2.94	0.04
9	31.6	1.26	1.03	1.11	1.05		1.11	0.10
	63.2	1.91	1.66	1.73	1.63		1.73	0.13
	94.8	2.51	2.20	2.29	2.21		2.30	0.14
	126.4	3.13	2.84	2.92	2.84		2.93	0.14

Figure 2

Table 1

Radiant Exposure	31.6 kJ/m²	63.2 kJ/m²	94.8.kJ/m²	126.4 kJ/m²
95% C.I. for true mean, μ, Samples not repositioned	1.69–1.87	2.49–2.67	3.25–3.45	4.13–4.39
95% C.I. for true mean, μ, Samples repositioned, run 1	1.73–1.89	2.46–2.64	3.22–3.38	3.77–3.91
95% C.I. for true mean, μ, Samples repositioned, run 2	2.18–2.36	2.68–2.82	3.22–3.32	3.94–4.06
95% C.I. for true mean, μ, Samples repositioned, run 3	1.29–1.41	1.96–2.08	2.56–2.62	3.38–3.39
J1960/J2527: Lower–upper limits, Delta b*	**0.93–1.37**	**1.48–1.92**	**1.96–2.55**	**2.45–3.19**

The plots shown in Figure 3, as well as the data shown in Table 1, clearly indicate that the specification is not met. In fact, in all but the first increment of the fourth test shown in Table 1, it can be said with 95% confidence that Q-Sun Xe-3HS instrument does not meet the specification of J1960/J2527. This directly contradicts the conclusion stated in the Brennan paper.

Atlas Ci4000 Weather-Ometer®

Figure 5 (page 10) shows the Delta b* results of the 36 individual samples from a single Ci4000 run, measured at daily increments (31.6 kJ/m^2) for a total of four days (126.4 kJ/m^2). Since the pattern depicted in Figure 5 was typical and representative, the results of individual samples are not shown for the other test-runs. However, the averages for each run are shown in Figure 8 (page 10), along with the averages for the three Ci5000 runs, plotted in comparison to the J2527 specified tolerances.

Using the data of the three Ci4000 runs, 36 samples each, to do the two-sided *t* test, we can say with 95% confidence that the true mean, μ, lies between the upper and lower limits of the specifications, Table 2. It can therefore be said with 95% confidence that the Ci4000 meets the SAE J2527/J1960 specification.

Table 2

Radiant Exposure	31.6 kJ/m²	63.2 kJ/m²	94.8.kJ/m²	126.4 kJ/m²
95% C.I. for true mean, μ, run 1	1.10–1.14	1.76–1.80	2.24–2.30	2.84–2.92
95% C.I. for true mean, μ, run 2	1.03–1.05	1.68–1.70	2.15–2.19	2.76–2.82
95% C.I. for true mean, μ, run 3	1.04–1.06	1.70–1.74	2.25–2.31	2.80–2.86
J1960/J2527: Lower–upper limits, Delta b*	**0.93–1.37**	**1.48–1.92**	**1.96–2.55**	**2.45–3.19**

Atlas Ci5000 Weather-Ometer®

The analysis of the Ci5000 results replicates that done for the Ci4000. Figure 6 (page 10) shows the individual Delta b* for all 36 polystyrene chips from a single run, measured at daily increments (31.6 kJ/m^2) for a total of four days (126.4 kJ/m^2). The average values for the three four-day runs are included in Figure 6.

Again, using the data of all three runs, 36 samples each, to do the two-sided *t* test, we can say with 95% confidence that the true mean, μ, lies between the upper and lower limits of the specifications, Table 3 (page 11). It can therefore be said with 95% confidence, that the Ci5000 meets the SAE J2527/J1960 specification.

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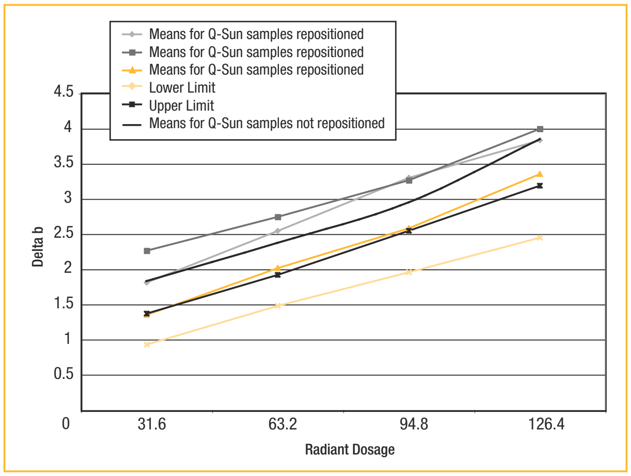

Figure 3

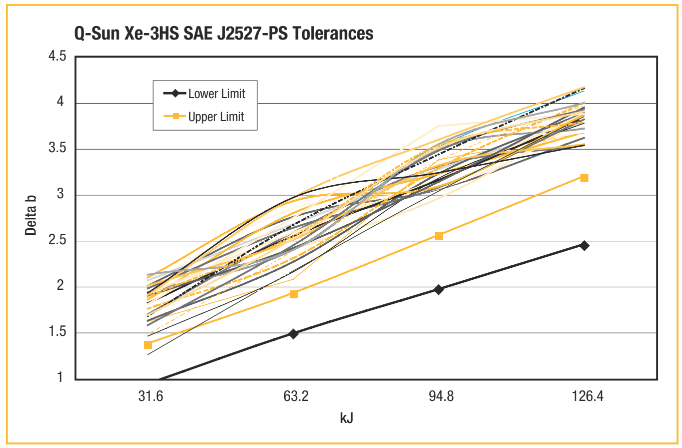

Figure 4

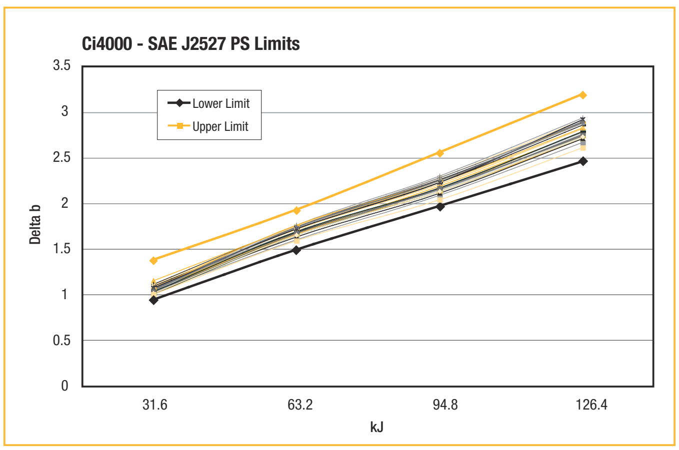

Figure 5

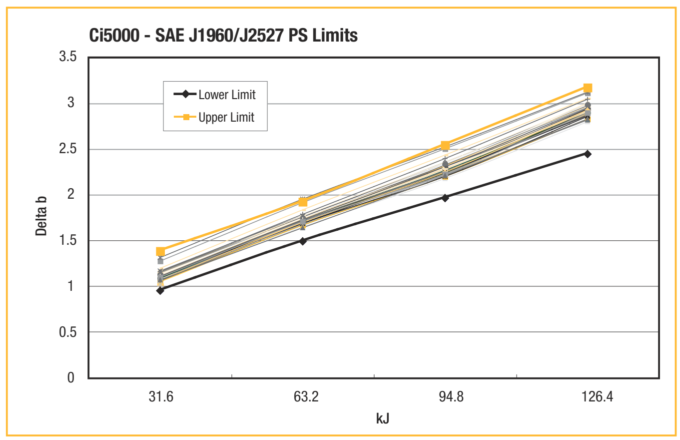

Figure 6

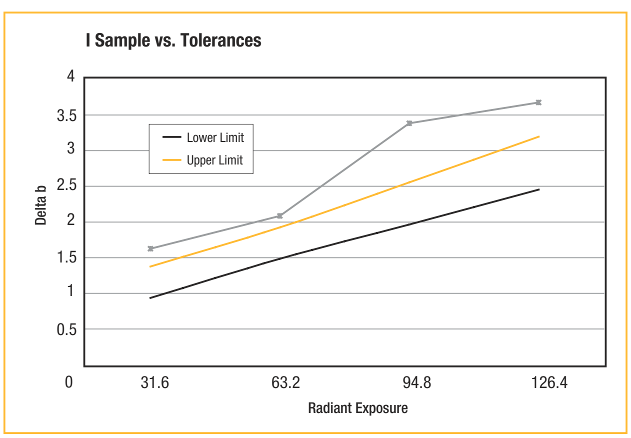

Figure 7

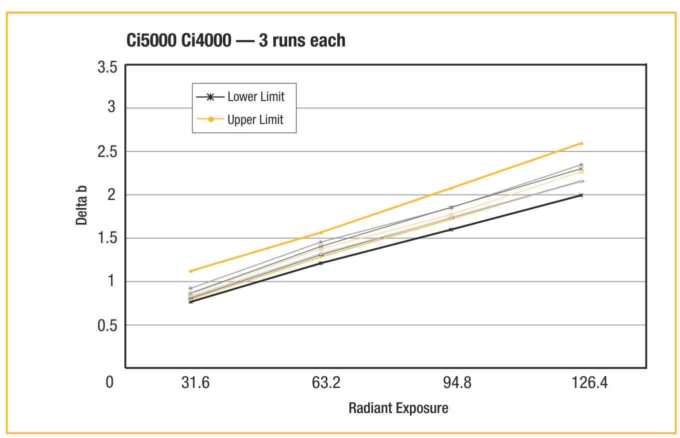

Figure 8

Table 3

Radiant Exposure	31.6 kJ/m²	63.2 kJ/m²	94.8.kJ/m²	126.4 kJ/m²
95% C.I. for true mean, μ, run 1	0.96–0.98	1.56–1.58	2.10–2.12	2.63–2.67
95% C.I. for true mean, μ, run 2	0.93–0.96	1.64–1.68	2.25–2.31	2.77–2.81
95% C.I. for true mean, μ, run 3	0.97–0.99	1.59–1.61	2.12–2.14	2.64–2.66
J1960/J2527: Lower–upper limits, Delta b*	**0.93–1.37**	**1.48–1.92**	**1.96–2.55**	**2.45–3.19**

2. Do the evaluated instruments meet the specified criteria of the SAE J1885/J2412 test?

While emphasis for this study was placed on the comparison of the results of the SAE exterior materials' test, the interior method was also performed, but on a more limited basis.

For the J1885/J2412 tests, all approved SAE SRMs were tested—AATCC L2 and L4 Blue Wools as well as the PS chips. As in the previous series of tests, daily measurements were recorded. The L2 Blue Wools are only meant to be used for one-day (37.6 kJ/m^2) increments, and the L4 for a maximum of three days (112.8 kJ/m^2), measured daily. The Delta E tolerances for the L2 and L4 and Delta b for polystyrene SRMs are shown in Table 4.

To maintain the same pattern for the various types of samples on each tray during the daily repositioning, a different sample arrangement[3] from the one used in the J1960 tests was necessary in the Q-Sun instrument.

The samples tested in the Ci4000 and Ci5000 were arranged in the same top to bottom manner as they had been for the J1960/J2527 tests.

For each instrument, the confidence intervals for the true mean, μ, of each SRM are tabulated. A comparison of the respective confidence intervals and the J1885/J2412 tolerance ranges shown in Table 4 indicate whether, and how well, the specifications are met.

Table 4

J1885/J2412 SRMs	37.6 kJ/m²	75.2 kJ/m²	112.8kJ/m²	150.4 kJ/m²
L2 Blue Wool, Delta E	11.39–14.07	N/A	N/A	N/A
L4 Blue Wool, Delta E	2.86–3.57	4.41–5.49	5.82–6.94	N/A
Polystyrene, Delta b*	1.41–1.79	2.34–2.98	3.08–3.92	3.87–4.93

Q-Sun Xe-3HS

Statistics were calculated from a population of 30 L2, 12 L4, and 28 polystyrene samples.

Applying the two-sided *t* test to the results indicates (Table 5, page 12) that it can be said that the Q-Sun Xe-3HS meets the L2 specification with 95% confidence. It can also be said that the L4 specifications are met 95% confidence at 37.6 kJ/m^2 and 75.2 kJ/m^2, but not at the 150.4 kJ/m^2 level.

Again, the double-sided *t* test indicates that it can be stated with 95% confidence that the Q-Sun does not meet the polystyrene specification at any of the four measurement intervals.

[3] *Q-Sun J1885/J12412 sample arrangement available upon request.*

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Table 5

Radiant Exposure	37.6 kJ/m²	75.2 kJ/m²	112.8kJ/m²	150.4 kJ/m²
95% C.I. for true mean, μ, L2	12.30–12.68	N/A	N/A	N/A
95% C.I. for true mean, μ, L4	3.27–3.51	5.17–5.29	6.83–6.97	N/A
95% C.I. for true mean, μ, polystyrene	2.01–2.07	3.16–3.42	4.30–4.50	5.56–5.68

Atlas Ci4000 Weather-Ometer®

The sample population for SRMs exposed in the Ci4000 are 18 each of L2, L4, and polystyrenes. By comparing the calculated confidence intervals in Table 6 with the specifications (Table 4), it can be said with 95% confidence that the Ci4000 results meet the specifications at all exposure levels.

Table 6

Radiant Exposure	37.6 kJ/m²	75.2 kJ/m²	112.8 kJ/m²	150.4 kJ/m²
95% C.I. for true mean, μ, L2	12.75–13.03	N/A	N/A	N/A
95% C.I. for true mean, μ, L4	3.0–3.2	4.6–4.8	6.2–6.4	N/A
95% C.I. for true mean, μ, polystyrene	1.49–1.65	2.50–2.62	3.51–3.59	4.66–4.84

Atlas Ci5000 Weather-Ometer®

An equal number of SRMs were exposed in the Ci5000 and Ci4000. Similarly, by comparing the calculated confidence intervals for μ in Table 7 with the specifications (Table 4), it can be said that the Ci5000 results meet all the L2, L4, and polystyrene specifications with 95% confidence level.

Table 7

Radiant Exposure	37.6 kJ/m²	75.2 kJ/m²	112.8kJ/m²	150.4 kJ/m²
95% C.I. for true mean, μ, L2	12.89–13.09	N/A	N/A	N/A
95% C.I. for true mean, μ, L4	3.4–3.5	4.5–5.1	6.47–6.73	N/A
95% C.I. for true mean, μ, polystyrene	1.54–1.70	2.54–2.66	3.36–3.64	4.29–4.57

3. What is the effect of repositioning the samples in the Q-Sun Xe-3HS?

In Figure 3, the results of the three J1960 tests in which the samples were repositioned are compared with those where the samples were kept in the same location throughout. The plots clearly show that in all cases the results are substantially outside the respective test method tolerances. Corroborating data is also shown in Table 1. The nonlinear pattern of degradation occurs whether or not the samples are repositioned.

Furthermore, by application of the statistical *t* test, it cannot be said with an acceptable degree of confidence that the results are different. Therefore, for these SAE tests it can be said that the recommended manual repositioning does little to improve the quality of results in the Q-Sun Xe-3HS.

4. How do the instruments compare with each other?

Performance of different test instruments can be effectively compared by analysis of their results. Because the results of any two test instruments may coincidentally agree on a given test or test specimen, legitimate comparisons require robust experiments that include a variety of tests and specimens. A statistical comparison of the results, means, and standard deviations is commonly used to compare instruments.

Statistical means of the results produced by the test instruments evaluated have been previously compared to the standards' performance criteria. However, graphical representation of results from repeat tests can also be very helpful in making comparisons. Comparison of the Q-Sun's results means (Figure 3), and the means of the Ci4000 and Ci5000 (Figure 8, page 10), graphically indicates that the Q-Sun instrument performs significantly different. Furthermore, Figure 8 also indicates that there is no apparent bias between Ci4000 and Ci5000 results.

Comparison of standard deviations is an objective evaluation of the relative precision among the instruments tested. The *F* distribution statistic is appropriate for this evaluation. Using the data from a SAE J2527/J1960 test, shown in Table 8, we can compare the precision of any two of the instruments evaluated. Any difference in sample size is inconsequential, as the *F* test inherently takes that into account.

Table 8

	Std. dev @ 31.6 kJ/m^2	Std. dev @ 63.2 kJ/m^2	Std. dev @ 94.8.kJ/m^2	Std. dev @ 126.4 kJ/m2	Number of samples, *n*
Q-Sun Xe-3HS	0.31	0.32	0.33	0.30	28
Ci4000	0.030	0.040	0.043	0.047	36
Ci5000	0.050	0.053	0.067	0.063	36

At 95% confidence level, it can be said that:

- The Ci4000 is more precise than the Q-Sun.
- The Ci5000 is more precise than the Q-Sun.
  (Note that the above two statements can be said even with 99% confidence.)
- It cannot be said the Ci4000 is more precise than the Ci5000.
- It cannot be said that the Ci5000 is more precise than the Ci4000.

5. Do the instruments expose specimens uniformly throughout a test?

Most materials will change in a linear (or near linear) manner for some initial period of a weathering test, provided they are subjected to constant stresses over the same period. The polystyrene SRM, for example, exhibits this trait in the Ci4000 and Ci5000 test results shown in Figures 5 and 6. In fact, this linear behavior was one of the prerequisite properties of the polystyrene chip, allowing it to be accepted as an appropriate SRM for the SAE test methods. In both SAE J1885 and J1960, the polystyrene SRM has an established near-linear pattern of increase in Delta b* for more than two weeks of exposure.[4]

This established behavior of PS can be used to identify improper functionality of an instrument. If, in a particular test, the polystyrene chip SRM (with its previously established linear behavior) should exhibit significantly nonlinear behavior, one can conclude that the stresses applied during the test are being substantially varied—in effect, causing the specimens to undergo a series of different tests instead of one continuous, stable set of conditions.

The Q-Sun Xe-3HS exposures of the PS SRM show aberrant, non-linear behavior for the all samples shown individually in Figure 4. The slopes of Delta b* values for each test segment are clearly different, with no apparent collective pattern

[4] *The tolerances for the 14-day exposure period are provided with each lot of polystyrene chips sold.*

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amongst them. Similar anomalous patterns are also observed in Figures 1 and 2 of Brennan's paper [1]. To show this phenomenon more clearly, the Delta b* values of a single, typical chip under test is isolated and shown in Figure 7 (page 10). The Delta b* value rank of this particular sample when compared to the other 27 replicates at the four measurement junctures are as follows: 22nd, 28th, 9th, and 24th.

Rank correlation, as used in weathering, is a measure of a laboratory instrument's ability to rate the performance of several materials in the same order that a benchmark test would. The benchmark test is typically a natural, outdoor test. For example, if 10 materials that were exposed in both a laboratory test and an outdoor weathering test indicated the same relative performance in each, their rank correlation would be a perfect 1.0. Good rank correlation of .8 or greater is considered to be the least expected of weathering devices, including those generally regarded as low-end instruments. However, the large variability and varied rankings observed in the Q-Sun Xe-3HS amongst homogeneous SRM samples suggest that it might be difficult to obtain reliable ranking analyses—difficulty that would tend to increase with attempts to make reliable comparisons amongst regular, less homogeneous samples.

Conclusions

Weathering test results are used to make important decisions that frequently have far-reaching technical and economic impact on a company's business. The value of any test is strongly tied to its ability to help make important decisions while minimizing the exposure to risk. As an important tool in decision-making, laboratory weathering devices are most useful when their results demonstrate acceptable accuracy—the ability to meet or duplicate consensus standards—and precision—the ability to replicate its own results.

In this study, the Atlas Ci4000 and Ci5000 devices were shown to demonstrate industry-acceptable precision and accuracy. The Q-Sun Xe-3HS did neither. Its results were variable and significantly outside the allowable ranges for the SAE J1960/J2527 test in particular. Furthermore, while the performances of the Ci4000 and Ci5000 were statistically comparable for all standard reference materials in both tests, the Q-Sun instrument was not comparable to either.

References

[1] Brennan, Patrick; Fedor, Greg; Roberts, Ronald; Xenon Arc Exposure Results: Rotating & Static Specimen Mounting Systems Compared. Technical Bulletin LX-5021, Q-Panel Lab Products & Materials Life Society (Japan), 5th International Symposium on Weatherability, October 2002

[2] SAE J1885, Accelerated Exposure of Automotive Interior Trim Components Using a Controlled Irradiance Water-cooled Xenon Arc Apparatus

[3] SAE J1960, Accelerated Exposure of Automotive Exterior Material Using a Controlled Irradiance Water-cooled Xenon Arc Apparatus

[4] SAE J2412-2003 Accelerated Exposure of Automotive Interior Trim Components Using a Controlled Irradiance Xenon-Arc Apparatus. SAE International Surface Vehicle Standard. Warrendale, PA: SAE International, 2003.

[5] SAE J2527, Performance Standard for Accelerated Exposure of Automotive Exterior Material Using a Controlled Irradiance Xenon Arc Apparatus. SAE International Surface Vehicle Standard. Warrendale, PA: SAE International, 2003.

[6] SAE J2413-2003 Protocol to Verify Performance of New Xenon Arc Test Apparatus. SAE International Surface Vehicle Standard. Warrendale, PA: SAE International, 2003.
[7] American Association of Textiles Chemist & Colorists (AATCC); PO Box 12215, Research Triangle Park, NC 27709 (www.aatcc.org)
[8] Commission Internationale de l'Eclairage (CIE); Kegelgasse 27, A-1030 Vienna, Austria (www.cie.co.at/cie/)

Appendix A

To establish the minimum requirements to which an instrument must perform in order to legitimately claim SAE compliance. J2413 calls for a demonstration of the following:

5. Performance of Standard Reference Material(s)

5.1 The manufacturer shall submit data showing that the test apparatus is capable of producing the required degradation in the standard reference material(s) in the specified time frame, as specified by this test method.

6. Repeatability and Reproducibility

6.1 The manufacturer shall submit data showing that the test apparatus is capable of producing repeatable and reproducible exposure results.

6.1.1 Repeatability shall be documented by repeating the exposure of the standard reference material in three separate exposure runs in the same piece of test apparatus.

6.1.2 Reproducibility shall be documented by repeating the exposure of the standard reference material in three separate exposure runs—one each, in three different test apparatus (same model but different serial numbers).

Follow the SAE J 2413 protocol to establish uniformity as follows:

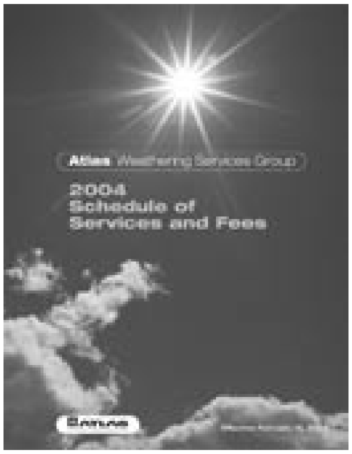
7. Exposure Uniformity

7.1 The test apparatus manufacturer shall submit data documenting the variability within the testing area. The data will include mapping the testing area with the current lot of SRM or other material agreed upon by contractual parties.

7.2 Uniformity shall be demonstrated by exposing replicate specimens of a standard reference material at various locations within the specimen mounting region of the chamber.

Atlas Weathering Services Group 2004 Schedule of Services and Fees

The 2004 Schedule of Services and Fees is now available. AWSG is pleased to announce that our standard outdoor exposures and EMMAQUA® fees have remained unchanged for over a decade. This is another reason we remain the industry leader—reasonable prices, highest quality and best service. The 2004 fees were effective February 15, 2004.



Atlas Weather-Ometers Exclusively Qualified to Run New Automotive Interior Test

No Other Manufacturer Can Claim the Same!

After many years of hard work, SAE has introduced new methods for accelerated testing of automotive materials. The two new standards are SAE J2412 - Accelerated Exposure of Automotive Interior Trim Components Using a Controlled Irradiance Xenon-Arc Apparatus and SAE J2413 - Protocol to Verify Performance of New Xenon Arc Test Apparatus.

SAE J2412 is the performance-based equivalent of SAE J1885, which is currently specified by the automotive companies for testing of interior automotive trim and components. SAE J2413 is used to qualify new xenon arc test apparatus to perform SAE J1885, SAE J1960, SAE J2412, and SAE J2527. "[It] defines the process for analysis of performance capabilities of candidate xenon arc test apparatus for comparison to current xenon arc test apparatus being utilized by the industry."[1] In addition, SAE J2527 - Performance Standard for Accelerated Exposure of Automotive Exterior Materials Using a Controlled Irradiance Xenon-Arc Apparatus, although not published at the time of this publication, will be published shortly. SAE J2527 is the performance-based equivalent of SAE J1960, which is currently specified by the automotive companies for testing of exterior automotive materials.

All Atlas Weather-Ometers that are approved to run SAE J1885 and SAE J1960 are, by default, qualified to run SAE J2412 and SAE J2527. SAE J2412 states "equipment qualified to perform this test is determined by material test comparison between instruments approved for SAE J1885 and those intending to perform SAE J2412."[2]

Data submitted for the last SAE Textiles and Flexible Plastics Committee Standard Reference Material (SRM) round robin study demonstrated that all Atlas Weather-Ometers meet SAE J2412 and SAE J2527 through the guidelines specified in SAE J2413. Xenon weathering instruments manufactured by other manufacturers are not qualified by the automotive companies to perform SAE J2412 or the yet-to-be-published SAE J2527 since they have not submitted the data specified in SAE J2413. Until such data is submitted and approved by the automotive companies, Atlas Weather-Ometers remain the only instruments qualified to perform the new automotive performance standards. ■

References

1. SAE J2413-2003 Protocol to Verify Performance of New Xenon Arc Test Apparatus. SAE International Surface Vehicle Standard. Warrendale, PA: SAE International, 2003.
2. SAE J2412-2003 Accelerated Exposure of Automotive Interior Trim Components Using a Controlled Irradiance Xenon-Arc Apparatus. SAE International Surface Vehicle Standard. Warrendale, PA: SAE International, 2003.
3. SAE J1885-1982 Accelerated Exposure Of Automotive Interior Trim Components Using a Controlled Irradiance Water Cooled Xenon-Arc Apparatus. SAE International Surface Vehicle Standard. Warrendale, PA: SAE International, 1982.
4. SAE J1960-2001 Accelerated Exposure of Automotive Exterior Materials Using a Controlled Irradiance Water-cooled Xenon Arc Apparatus. SAE International Surface Vehicle Standard. Warrendale, PA: SAE International, 2001.

Atlas Announces World's First ISO/IEC 17025 A2LA Accredited Lab for Radiometer Calibrations

Atlas Weathering Services Group (AWSG) has been awarded the first ever A2LA ISO/IEC 17025 accreditation for technical competence in calibrating radiometers used for solar and various light source irradiance measurements. AWSG also meets the requirements of ANSI/NCSL Z540-1-1994 and additional program requirements in this field. Many industry quality and test standards, like ISO 17025, require the use of a calibrated radiometer to accurately measure the amount of solar radiant energy in a given application. Prior to the availability of AWSG's accredited lab, radiometers have been sent back to the original manufacturer for calibration. Because these calibrations were not accredited to ISO 17025, a waiver from the accrediting body was required. This waiver process will no longer be necessary now that AWSG can provide accredited radiometer calibration services.

"We can now offer our clients an ISO 17025 accredited source for the calibration of all solar radiometers in use today," said Jack Martin, President of Atlas Weathering Services Group. "This effort confirms Atlas' continued commitment to quality and leadership in the weathering industry."

Atlas' radiometer racks at DSET Laboratories in Arizona

AWSG uses ISO and ASTM standards in performing calibrations of radiometers. All AWSG solar radiometer calibrations are traceable to the World Radiometric Reference (WRR), a reference measurement that depends on the measured values of solar irradiance determined by a group of absolute cavity pyrheliometers maintained in residence by the World Meteorological Organization at its World Radiation Centre in Davos, Switzerland.

AWSG's absolute cavity radiometer, located at its DSET Laboratories facility in Phoenix, Arizona, is one of the most completely referenced absolute cavities in the world. In fact, the change in the WRR reduction factor for SN17142 from IPC V (in 1980) to IPC IX (in 2000) is only 0.2% (or 2.0 W/m^2 out of a typical solar irradiance of 1000 W/m^2), one of the lowest of any radiometer participating in these IPCs.

The traceability of AWSG's ultraviolet radiometer calibrations is established through the traceability of the standard of spectral irradiance used to calibrate our solar spectroradiometer. This traceability is to primary standards of spectral irradiance, or standard lamps directly traceable to National Institute of Standards and Technology (NIST).

For more information about AWSG's radiometer calibration services, a technical bulletin is available on the AWSG website, **www.atlaswsg.com.** Or you can contact a client services representative at +1-623-465-7356 or **info@atlaswsg.com** for pricing and availability information. ■

Cool Roof Rating Council Approves Atlas as Exclusive Weathering Test Facility

The Cool Roof Rating Council (CRRC) has designated Atlas Weathering Services Group as the sole approved Test Farm facility for the CRRC's Product Rating Program.

To earn the coveted CRRC rating, roofing manufacturers and sellers must perform weathering tests through Atlas for three years at locations in Florida (hot/humid), Arizona (hot/dry), and Chicago (cold/temperate).

The CRRC's product rating program is designed to provide third-party verification of weathered performance claims to help purchasers in the selection of cool roofs that save energy and reduce a building's impact on the environment.

"CRRC ratings are clearly becoming a key measurement of energy characteristics, and they will be a major selling point for roofing manufacturers everywhere," said Jack Martin, President of Atlas Weathering Services Group. "As more states like California adopt tougher energy efficiency standards and require cool roofs, this program takes on added importance."

The CRRC's rating program authorizes manufactures and sellers to label roofing products to indicate their Initial Radiative Properties and Aged Radiative Properties. Certification is a three-stage process:

1. All production-line roofing products must be initially tested by an Accredited Independent Testing Laboratory (AITL) in order to assess their Initial Radiative Properties.
2. The products must then be weather-tested at the Atlas Approved Test Farms.
3. Finally, after weathering the roofing products at Atlas facilities, an Aged Radiative Property can be determined by an AITL.

CRRC schedules four weathering cycles during the year beginning March 21, June 21, September 21, and December 21. Test Specimens must be provided to Atlas' Arizona facility at least 10 days prior to those dates to ensure timely distribution to all test farm locations.

For more information about the Cool Roof Rating Council rating program, visit the CRRC website at www.coolroofs.org. For testing information at Atlas, please call John Wonders at +1-800-255-3738.

For more information about Atlas Weathering Services Group, visit www.atlaswsg.com. You can contact a client services representative at +1-800-255-3738 or **info@atlaswsg.com.**

About CRRC

The Cool Roof Rating Council was created in 1998 to develop accurate and credible methods for evaluating and labeling the solar reflectance and thermal emittance (radiative properties) of roofing products, and to disseminate the information to all interested parties. Based in Oakland, California, the CRRC is incorporated as a nonprofit educational organization. Visit their website at www.coolroofs.org.

Atlas Introduces Live Test Tracking

Ever wonder what your weathering samples are going through while you're in the comfort of your office? Not for long! Atlas' vision to shape the materials testing world in partnership with our customers just took one giant leap forward.

Beginning January 2004, Atlas Weathering Services Group clients now have the ability to track their tests via the AWSG website (www.atlaswsg.com). This new customer service feature is designed to help clients reach their ultimate goals: a quality product, a competitive edge, and a faster time to market.

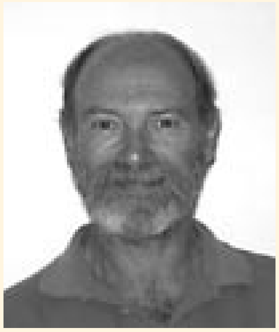
Monitor your tests without leaving your computer!

Benefits of the "test tracking" program include:

- Access to your tests from the comfort of your office
- Live tracking of your evaluation services
- Up-to-date radiation values for your test

To begin tracking your tests, visit **www.atlaswsg.com/testmen.asp** and activate your account today. For more information about the program or to talk with a client services representative, contact us at +1-800-255-3738 or **info@atlaswsg.com.**

DSET Laboratories Appoints New Weathering Manager



Dennis Dietz

Atlas Weathering Services Group is happy to announce the appointment of Dennis Dietz as the new Weathering Manager at DSET Laboratories. He brings to this assignment over 20 years of experience in weathering testing. His education includes Geology, Chemistry, and Meteorology at Mesa Community College, as well as "Surface and Upper Atmosphere Observations" with the United States Naval Weather Service.

Dennis started with DSET Laboratories in 1980 in the solar simulation department. He then gained extensive knowledge in weathering, and evaluations. He developed and managed the then-newly acquired Everglades facility in Miami, Florida for the first year. Moving back to Arizona he oversaw Static, EMMAQUA®, and Evaluations Departments in New River as well as managed the remote sites. He then went on to develop the EMMAQUA® field at the Wittman Arizona facility for South Florida Test Service. He became a certified quality auditor and led the organization in three successful ISO quality systems audits. More recently, he held the position of Operations Coordinator of Static, Evaluations and Maintenance departments. He has firsthand knowledge on all aspects of the business.

Please join us in congratulating Dennis on his new position within the AWSG team!

AtlasCommitment to Growth

Weathering Experimenter's Toolbox: Round Robins and Intercomparisons

by Kelly Hardcastle
Director, Research and Development, Atlas Weathering Services Group

Round robins and intercomparisons are invaluable tools for weathering researchers relying on weathered material analysis at different locations using different measurement systems. A round robin or intercomparison is a simple procedure in which a set of materials is circulated between and measured on each measurement system involved in a project. Often, customers and vendors circulate a standard set of specimens between locations on a regular basis. Specimen sets should approximate the full range of variation expected in a weathering program (e.g., many appearance measurement devices show highly repeatable results on white or light colored materials, but may show poorer reproducibility with darker materials as signal to noise ratios become smaller). Many times researchers fix mis-communications problems regarding procedural details during the intercomparisons rather than after procedural variations have occurred in destructive weathering tests.

One excellent source for a variety of intercomparisons is The Collaborative Testing Services, Inc. (CTS). CTS is a privately owned company that specializes in inter-laboratory tests for a wide variety of company sectors including rubber, plastics, fasteners, metals, container board, paper, and color. Over 2,000 labs from the U.S. and more than 50 other countries participate in CTS programs. The programs allow laboratories to periodically compare the performance of their testing with that of other laboratories.

For The Color and Appearance Collaborative Reference Program, paint chip samples are distributed four times per year to participating laboratories. Gloss and color readings recorded by participating laboratories are reported to the CTS. Results of all laboratories are compared in tables and graphs based on conditions of measurements used and distributed to participants. For further information, contact Collaborative Testing Services, Inc., 340 Herndon Parkway, Herndon, VA 20170; +1-703-742-9107. ■

ISO 17025 Accreditation, from page 1

17025 status," explained Matt McGreer, Director of Quality for Atlas. "Testing laboratories accredited to ISO 17025 receive a deviation if their weathering instruments are not calibrated by an accredited calibration service. Obtaining this certification shows Atlas' commitment to quality, as well as our efforts to meet our customers' needs."

The ISO 17025 audit took place in December of last year, Mr. John Wehrmeyer, the auditor subcontracted by A2LA, recognized Atlas' preparation for the event. "The Atlas Quality Manual is exceptionally well-written, and the laboratory received far fewer deviations than I normally see for an initial assessment. The spirit of continual improvement is apparent throughout the organization, and Atlas management provides sincere support to the efforts of the laboratory." Furthermore, Mr. Wehrmeyer gave special commendation to the Technical Services documentation. "These are some of the best-written and illustrated field procedures I have ever seen."

Earlier in the year, Atlas MTT GmbH test laboratories were also accredited to ISO 17025 for irradiance calibrations. The Chicago Laboratory's ISO 17025 accreditation means even greater global coverage of the supporting calibration services of Atlas instruments. ■

Atlas Partners to Offer Weathering Consulting Services

For many years Atlas has received a steady stream of questions such as "How long will my product last?", "How and why did my product fail?", "Can you tell me how to make my product last longer?", "How do these test results correlate to field performance?", and "What does my weathering data really tell me?"

As a testing laboratory and equipment provider limited to making only general recommendations on testing standards, exposure protocols, measurements, and equipment selection, Atlas has not been able to fully answer these questions—until now.

Inside the Aspen Research lab

Through a pioneering new partnership with Aspen Research Corporation, Atlas has become the first in the weathering community to offer weathering, product research, and technical consulting services all from one source.

Aspen Research Corporation

For the past four years Atlas has been linking its global leadership in equipment, services, technical standards, and testing expertise into a coordinated and comprehensive material testing solutions offering under the Atlas Network of Weathering. The strategic alliance with Aspen brings this concept to the next level.

Customers will benefit from the following solutions provided by the Atlas-Aspen consulting partnership:

- Durability and service life prediction
- Design of experiments
- Product failure and prevention analysis
- Failure mode and effect analysis
- Materials and product R&D
- Product/process/cost improvement
- Weathering test data interpretation and data mining

Aspen Research is an experienced scientific research company with approximately 100 world-class scientists, consultants, and process/productions specialists in a variety of disciplines including chemistry, physics, and statistics. The company has extensive experience in materials durability and weathering, especially of polymeric materials. Operating from a 100,000-square foot (9,290-square meter) facility in St. Paul, Minnesota, USA, Aspen has extensive physical testing and analytical chemical instrumentation as well as processing equipment. Much more than a testing laboratory, Aspen is a full R&D consulting and implementation organization.

Projects of all sizes may be undertaken on a time and materials or fixed cost basis depending on the size and complexity. North American projects will be targeted initially, but international projects are within the scope of capabilities.

For additional information, please contact Allen Zielnik, Director, Strategic Technical Sales, at **azielnik@atlas-mts.com** or +1-773-289-5580. ■

Atlas Announces New Spray/Rain Testing Chamber

Atlas Material Testing Technology announces a new testing chamber to complement its wide range of materials testing instruments.

The **Atlas SRC** performs most industry and OEM spray/rain tests. Used in the automotive, aerospace, electronics, and telecommunications industries, these chambers simulate a variety of rain/spray conditions up to 1450psi. With installed options, this chamber is capable of performing GM, Chrysler, Bosch, IEC, JIS, and SAE test standards.

The Atlas SRC

Available in two standard sizes:

SRC100, 10" turntable

SRC540, 54" turntable

Test methods performed:

- GM9103P
- IEC 68-2-18
- SAE J575
- TSC 300 (Toyota)
- Bosch
- JIS 0203 R1, R2, S1, S2
- IEC 529
- Guide C-20
- Chrysler

Some test methods may require installed options.

Four spray systems:
High pressure spray to 10,000kPa / 1450psi, JIS 203 2-nozzle and 40-nozzle assemblies, IEC 180º spray arc. Quick disconnect unions allow quick change from test to test. Rotating sample platform with variable speed to 15 rpm.

Options:
Premium controls with operator video screen, SAE J575 spray arm, high/low temperature package -40ºC to +125ºC / -40ºF to +257ºF, and heated spray solution reservoir. Turntable options include auto-reverse, powered slip ring, and air-to-top for expanded testing capability.

BCX and CCX Get Supersized

Atlas announces a new, extra large size for both models of cyclic corrosion cabinets—the **BCX11000 for basic cyclic** and the **CCX11000 for advanced cyclic.** With a true testing volume of 110 cubic feet/3,115 liters, they are longer and wider than any cabinet from another manufacturer. They can hold assembled components, large samples, and over 900 standard test panels.

With installed options, they can run advanced automotive tests such as GM9540P, SAE J2334, Ford BQ104-07, and Honda. They will run ASTM B117, CASS, ISO, JIS, Military Standards, Prohesion™, and most traditional salt fog, basic cyclic, and advanced cyclic corrosion tests. Standard features include air-assisted cover lifters and four Omni-Fog II dispersion towers. Both models can be equipped with all options as listed—see bulletins 1576 (BCX) and 1547 (CCX).

For further information, please contact your Atlas sales representative or Harold Hilton, **hhilton@atlas-mts.com.**

Atlas Corrosion Cabinet Now Capable of Freezing/Cooling

Atlas is pleased to announce a new freezing/cooling capability for its **CCX Advanced Cyclic Corrosion Cabinet.** It is available as an option in a CCX with computer controls.

The enhanced CCX is ideal for suppliers to automotive, household appliance, military/defense, and other industries who must perform validation and qualification tests at temperatures well below freezing. This low maintenance system uses LN2 (liquid nitrogen) for cabinet operation as low as -30°C/-22°F. The new freezing/cooling option is also useful for momentary bursts of inert LN2 to reduce transition times from high to low temperature.

Because materials undergo little chemistry change at -30°C, and since greater stress is exerted during temperature transitions, there is no need to hold samples at a low temperature for an extended time. Therefore, a small tank of LN2 can provide multiple freezing or cooling cycles, depending on sample mass and dynamic temperature range.

For further information, please contact your Atlas sales office or e-mail **info@atlas-mts.com.** ■

Controlled RH Option Now Available for CCX with Standard Controls

In another development that provides a distinct competitive advantage, Atlas now has the capability to put **Adjustable RH on a CCX with Standard Controls.** This is a direct result of the recent upgrade to the Koyo grayscale display panel.

With this option, an RH sensor is installed in place of the wet bulb RTD probe, and software is added to the PLC to convert and show "%RH" on the display panel.

For those customers who want to record RH (with standard controls) we have brought back the 6-channel strip chart recorder. Controlling RH is important because more corrosion takes place during transitions from wet to dry (or dry to wet) than when conditions are totally wet or completely dry. Maintaining RH somewhere between dry and saturated—for instance, from 40 to 75%—prolongs the transition time, effectively accelerating corrosion on the sample surface.

This option is available only for a CCX. Unfortunately, it is not possible to offer Adjustable RH as an upgrade for CCX cabinets with standard controls that are already installed.

For further information, please contact your Atlas sales office or e-mail **info@atlas-mts.com.** ■

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