ATLAS
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SunSpots

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Enhancement of the HDT Apparatus: Improved Accuracy of Plastic HDT Measurements

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Atlas' HDV3
HDT/VICAT Tester

Heat Deflection Temperature (HDT), previously referenced as Deflection Temperature Under Load (DTUL), is one of the basic property characteristics used by manufacturers of plastics for their certification. The test method applies to both molded and sheet materials with a thickness of 3 mm or greater. A polymer or compounded plastic specimen is installed on supports with a predefined (by the standards) span between them and preloaded by the force applied in the mid-span plane.

The applied force is calculated from the classic approach of the material strength theory (generally known as stress analysis of a "simple supported beam" of rectangular cross-section under bending load) to achieve the stresses of 0.455 or 1.82 MPa.

$$S = \frac{M}{Wx} = \frac{F \times \left(L/2\right)}{\left(bd^2/6\right)} \qquad [1]$$

From the expression [1], the applied force may be written as:

$$F = S \cdot \frac{(2bd^2)}{3L} \qquad [2]$$

Where S – maximum fiber stress (at the surface) in the specimen, (Pa)
F – the applied load, (N)
L – span value between supports, (m)
b, d – width and depth of the specimen, (m)

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AtlasCommitment to Growth

Atlas Announces Partnerships

Raitech Partnership Expands an Already Extensive Line of Textile Test Products

Atlas Electric Devices Company is pleased to announce a partnership between the Atlas Textile Test Products division and Raitech, Inc. William Lane, Chairman of Atlas Electric Devices Co., announced the purchase of 50 percent of all issued shares of Raitech.

The partnership between Atlas and Raitech will improve Atlas' already strong ability to serve the textile industry. The Atlas Textile Test Products division manufactures a variety of testing instruments for testing colorfastness, abrasion resistance and flammability of textile products. The partnership with Raitech, founded in 1995 by Mark Raiteri, will allow Atlas to expand its product line offerings to include the revolutionary Quickwash Plus™, an instrument developed and commercialized by Raitech to be an accelerated tester for determining dimensional stability or shrinkage of fabric. The Quickwash Plus is able to reduce the traditional test times, which could take between 12 and 24 hours, to about 15 minutes per test. This drastic reduction in test time allows a textile mill or laboratory to improve overall quality.

Bob Lattie, General Manager of Atlas' Textile Test Products division, said that he is pleased to be working with the dynamic and nimble organization of Raitech. This partnership will strengthen and enhance sales channels for Atlas and Raitech, and will allow for an added emphasis on new product development for the textile industry. ■

The Quickwash Plus accelerates testing for determining dimensional stability or shrinkage of fabric.

RAITECH
PARTNER OF ATLAS TEXTILE TEST PRODUCTS

Millipore Partnership Boosts Local Expertise in Purification Technology

Atlas has recently developed a global partnership for water purification systems with Millipore Corporation. The goal of this partnership is to provide Atlas customers with global, high technology coverage supported by local knowledge and expertise.

The utilities connected to the Atlas weathering instruments are very important to the correct operation and longevity of the instruments. In the past, Atlas had tried to assist customers with their local water utility problems. This has not always been successful. The utilities of the local laboratory need to be handled by local experts. Millipore has such local experts in almost every country in the world.

Millipore is a multinational corporation specializing in purification technology products and services. With 4,000 employees and 30 offices around the globe, Millipore provides product sales and service for more than 100 countries. The company is a world leader in high purity water systems and a resource for water quality expertise. Millipore can guarantee that consistently pure water will be delivered to Atlas systems everywhere in the world.

Atlas believes this partnership will provide global solutions to local utility problems and increase customer satisfaction. For more information about the partnership, please contact your Atlas Sales Representative or email us at info@atlas-mts.com. To contact Millipore directly, please visit their web site at **http://www.millipore.com**. ■

Atlas Weathering Services Group Test Sites Re-accredited by AMECA

Atlas Weathering Services Group (AWSG) announces that three of its outdoor exposure sites have been re-accredited by the Automotive Manufacturers Equipment Compliance Agency (AMECA) for the testing of plastic materials for optical lenses.

The sites that have received this re-accreditation are DSET Laboratories in Phoenix, Arizona and South Florida Test Service (SFTS) at both its Miami and Everglades sites. The accreditation permits these sites to conduct exposure tests and to perform visual and optical properties evaluations required to determine the acceptability of "Plastic Materials for use in Optical Parts Such as Lenses and Reflex Reflectors of Motor Vehicle Lighting Devices" (SAE J576 JUL91). The data produced from these evaluations is reported to AMECA for ultimate approval by the United States Department of Transportation for use in vehicles in the United States. The accreditation is valid for two years and will be up for renewal in 2002.

Clients of DSET Laboratories and SFTS can be assured of the competence and quality of services provided. All three sites are accredited to ISO/IEC Guide 25 by the American Association for Laboratory Accreditation (A2LA), and are approved or accredited by Ford Motor Company and General Motors Corporation.

For a full list of accredited tests or calibrations performed by Atlas Weathering Services Group, please contact your Client Services Representative at (800) 255-3738 or (623) 465-7356. Information is also available by visiting the AWSG web site at **www.atlaswsg.com**.

Kasho Merges with Toyota Tsusho Corporation

Kasho Company, Ltd., Atlas Weathering Services Group's (AWSG) exclusive representative in Japan, has recently announced a major and very positive business development. Effective April 1, 2000, Kasho merged with Toyota Tsusho Corporation, a multinational Japanese corporation that serves as the international trading arm of the Toyota Group of companies.

Toyota Tsusho Corporation specializes in automobiles, automotive related products, metals, steel and chemicals. Kasho, in addition to providing AWSG weathering services to the Japanese market, trades chemicals, rubber and food products. This merger will result in a synergistic relationship between the chemical and automotive products sectors and the need for natural and accelerated weathering services for these products.

Although the merger will result in a name change for Kasho, all of the trained and experienced staff will continue to provide their usual outstanding service and expertise in representing AWSG. Mr. Koji Takada, Weathering Services Team Leader in the Polymer Additives Group, will continue his excellent leadership in this area.

AWSG congratulates Kasho and Toyota Tsusho Corporation on this fruitful partnership. We look forward to the opportunities and relationships created by the new organization.

For more information regarding the merger, please contact Toyota Tsusho Corporation directly at:

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Weathering Services Team
Polymer Additives Group, Performance Chemical Department
Mr. Koji Takada
2-14-9 Nihonbashi Chou-ku, Tokyo, 103-8666
Phone: 81-3-3242-8267 Fax: 81-3-3242-8509

Toyota Tsusho Corporation, Osaka Branch
Polymer Additives Group, Performance Chemical Department
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Following this approach for a simple supported beam the deflection in the middle section of the beam may be expressed as:

$$\Delta = \frac{F \cdot L^3}{48E \cdot I} \qquad [3]$$

Where Δ – deflection, (m); *F* – the applied load, (N); *E*- modulus of elasticity, (N/m^2); *L* – span value between supports, (m); *I* – moment of inertia of the cross-section, $I=(bd^3/12)$, (m^4).

The specimen and support frame are immersed in a heat transfer medium for linearly raising temperature (typically with a preset gradient of 120°C/minute). The temperature of the medium at the moment when deflection of the specimen bar reaches a value of 0.250 mm represents the Heat Deflection Temperature (HDT) under flexural load. The major test variables are standardized in the ASTM D648 and ISO 75-1, 2 standards: where S=0.455 MPa (66 psi) or 1.82 MPa (264 psi); L=100 mm (4 in); and the deflection measurement device should be readable to 0.01 mm (0.0005 in) or better.

The standards provide guidance in conducting the test and describe general requirements for the design of the test apparatus. However, advancements in plastics technology, the necessity for quality improvement of plastic materials and new quality control methods ("Six Sigma" and "Three Sigma" approaches, for example) required refinement of the HDT apparatus design to provide test repeatability (for replicates of the same material) to within 0.2–0.5°C.

We analyzed the theoretical and design concepts of the available HDT apparatus and enhanced designs of Atlas' HDV3 and **Vi**sta6™ instruments to satisfy the requirements of modern industry and achieve superior accuracy and repeatability of measurements beyond the original needs and requirements of the standards.

Specimen Support Frame Design

Span between supports

The standardization of span values of 100 mm and 4 inches occurred because of the harmonization of the ISO and ASTM standards and the "metrification" of the latter. As a result of interpretation of the span value of 100 mm (the ISO standard) in Imperial ("inch-lb.") measurement unit's system, the ASTM value of 4 inches was accepted as exactly equivalent to 100 mm span. However, in closer analysis 4 inches is equal to 101.6 mm, and not equal to 100 mm. The test results for samples of materials conducted in the same apparatus by using two different span supports, 4 inches and 100 mm, confirmed that this small difference in span value may lead to a difference in measured HDT as high as 4.0 to 5.0°C or more; this is clearly unacceptable measurement error when applying the "6-Sigma" quality control approach of leading global resin producers.

Easily interchangeable universal specimen holder for HDT testing in the Atlas HDV3

Results of analysis and test data regarding this discrepancy between the ISO and ASTM standards, and between the older 4 inch and "new" 100 mm metric ASTM method were reported by Atlas to the ASTM D20 committee on plastics. A proposed modification to the ASTM standard D648 is under consideration.

The span-based discrepancy in final HDT temperature values could be explained by the following. It is evident from expression [3] that in case of equal stress value, for specimens of the same dimensions, the deflection of the specimens would depend on the value of the span between supports as:

$$\frac{\Delta_1}{\Delta_2} = \frac{P_1 L_1^3}{P_2 L_2^3} = \left[\frac{2Sbd^2}{3L_1}\right] * \left[\frac{3L_2}{2Sbd^2}\right] * \left[\frac{L_1^3}{L_2^3}\right] = \frac{L_1^2}{L_2^2} = \left(\frac{L_1}{L_2}\right)^2 \qquad [4]$$

Where Δ_1 and Δ_2 are deflection for span values of L_1 and L_2 respectively.

From expression [4] it follows that for span values of 100.0 and 101.6 mm (4 in) the magnitude of the deflection would be different, with the ratio of

$$\left(\frac{\Delta_2}{\Delta_1}\right) = 1.0323,$$

(the deflection Δ_2 corresponds to the span of 101.6 mm, and deflection Δ_1 for the span of 100 mm respectively).

Therefore, when deflection Δ_2 of the specimen with supports of 101.6 mm span reaches the value of 0.250 mm, the HDT_2 temperature would be registered by the system; the respective deflection Δ_1 of the specimen with a support span of 100 mm would be 0.242 mm and the test would be continued for some period of time until deflection reaches 0.250 mm. As a result, the temperature of the bath medium would continue to rise and the resulting value of the measured HDT_1 for the same specimen of material would be higher.

Experiments conducted at Atlas and at the site of a major engineering resin producer, with the same samples material (polycarbonate) on test frames with spans of 100 mm and 4 inches (101.6 mm), and further ASTM round robin testing on several plastics types with participation by several plastic material producers, indicated that the difference in the measured HDT results could be as high as 4.0–5.0°C or more (the results being higher for equipment with a span width between supports of 100 mm). Further, the value of the difference is material dependent (Table 1).

TABLE 1

Results of HDT for different materials conducted on frames with different span between supports.

Material	100 mm span	4 in span (101.6 mm)
ABS, 1.8 MPa	81.87°C	81.01°C
PP natural, 0.45 MPa	85.22	80.93
PP filled, 0.45 MPa	116.57	112.00
Nylon, 1.8 MPa	156.12	153.79

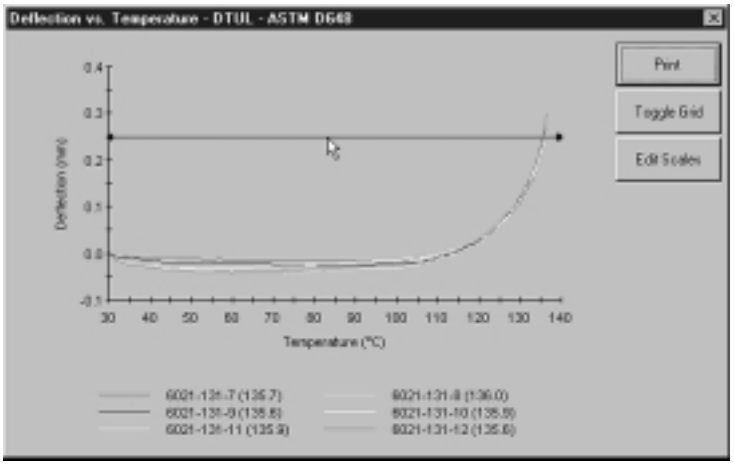

Fig. 1: Most plastics demonstrate non-linear deflection curves near the HDT endpoint temperature.

This could be explained by significant non-linearity in the deformation as most plastics demonstrate non-linear deflection curves near the HDT endpoint temperature (Fig. 1). The "deflection-temperature curve" response characteristic for different plastics could be described mathematically by polynomial expressions of different orders. It could be certainly related to limitations of the theoretical approach that had been used initially for initial design of the HDT test technique. The approach of analysis of bending stresses in the elastic range of deformation was applied to plastic materials which demonstrate non-linear deformation response with temperature. Because of this, Atlas enhanced the span tolerance value for our HDV3 and **Vi**sta6 systems to better than 100 ±0.2 mm.

Support frame materials and high temperature calibration correction software

As a specimen and measurement system support frame design usually includes various bars of circular or rectangular cross-section, which are connected to the base plate

Continued on next page

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and attached specimen supports, it is important that the linear deformation of the frame and its elements due to thermal expansion not affect the measurement of specimen deformation. This can be very detectable in the range of ~250–300°C and can become particularly acute at the high temperatures used for some engineering resin.

Because of this Atlas uses special metal alloys — invar and titanium with coefficients of linear thermal expansion of 0.12 1/°K (in the HDV3 — for application in the temperature range up to 400°C) and 8.9 1/°K (in the **Vi**sta6 — for application in the temperature range up to 300°C) which are respectively 10 and 1.5 times lower than coefficient of linear thermal expansion of steels normally used for this type of apparatus. To increase the accuracy of measurement by considering systematic error due to deformation, a frame calibration/correction procedure is included as a part of the instrument software. This automatically calculates the true deflection of the polymer specimen as the algebraic difference between the results of measurement and the results of the frame calibration correction (if the operator selects the option). Fig. 2 shows the results of the measurement correction calibration of six Invar frames installed in one of the HDV3 apparatuses as an example of the above enhancements.

Heat Transfer Media Circulation

Intensive circulation of the heat transfer media within the bath of HDT instruments (the HDV3 utilizes one stirrer, the **Vi**sta6 two counter-rotating stirrers) provides a temperature gradient across the bath as low as 0.1°C. This also helps assure temperature agreement between the specimen and measurement probe which must be in close proximity but not contacting the specimen.

Temperature Measurement

The size of the thermosensitive probe element, its location in the relation to the specimen, response time of the sensor and associated electronics, and resolution and accuracy of the whole temperature measurement system are critical for accuracy in the HDT test results. As the measurement of temperature of the heat transfer media is conducted in a transient mode (because of the dynamic heating of the media with a preset 120°C/h ramp), the temperature of the sensitive element (thermocouple or RTD) is described by expression [5]:

$$T - T_0 = (T_\infty - T_0) \cdot \left[1 - e^{-\frac{hAt}{\rho V}}\right] \qquad [5]$$

Where:

T_∞ – *Temperature of the heat transfer media*
T_0 – *Initial temperature of the surface of the sensor*
T – *Temperature of the sensor element (inside of the sensor) at any instant of time*
h – *Coefficient of heat transfer at the surface of the sensor (thermocouple or RTD)*
A – *Area of the surface of the sensor*
V – *Volume of the material of the sensor element*
c, ρ – *Specific heat capacity and density of sensor element*

It is clear that in cases of cylindrical or spherical sensor elements, the ratio A/V would be defined by the diameter of the element as:

$$\frac{A}{V} = \frac{(2\pi RL)}{(2\pi R^2 L)} = \frac{1}{R} \qquad [6]$$ For a cylindrical sensor element

$$\frac{A}{V} = (4\pi R^2) \Big/ \left[\left(\frac{4}{3}\right)\left(\pi R^3\right)\right] = \frac{3}{R} \qquad [7]$$ For a spherical sensor element

It is evident from the expressions [6, 7] that the response time of the typical thermosensor is exponentially proportional to the size (diameter) of the sensing element, and that above its critical size value the sensor would lag behind the true rise of the temperature, resulting in a measured HDT temperature lower than actual value.

Because of this "thermal lag" effect from probe size, in the Atlas instruments the size of the sensors (type T thermocouple for HDV3 and RTD for **Vi**sta6) provide total time response within several seconds, with a total resolution of 0.1°C. Because results reflect the temperature at the surface of the specimen (the measured values should be as close to the values of temperature at the specimen surface as possible) in the HDV3 and **Vi**sta6 the thermosensors are located at very close proximity (within 1.5–2.5 mm) to the specimen; unlike of the implementation of some existing apparatus the sensor elements do not contact the components of support frame which can introduce a thermal mass and result in a measurement lag. This high-speed temperature measurement approach increases the accuracy of the measurement HDT temperature in the highly nonlinear deformation mode of plastic specimens to a value of ±0.2°C.

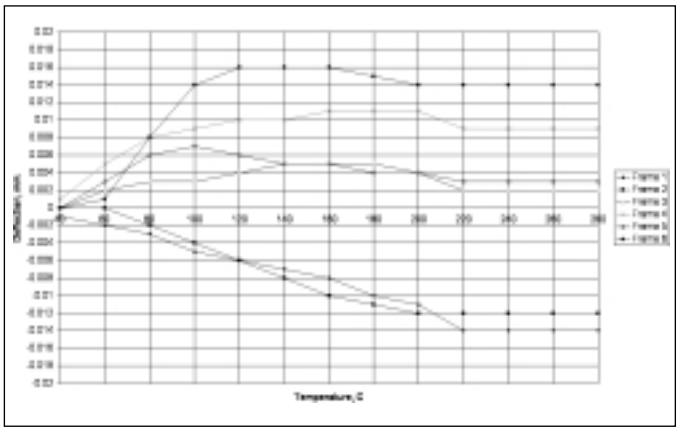

Fig. 2: Calibration of the frame deflection of the HDV3 machine

Deflection Measurement

LVDT transducers used in the HDV3 and **Vi**sta6 provide resolution of the deflection measurement to ±0.001 mm.

Software Enhancements

Windows-based software provides complete automatic control of the test, frame calibration, LIMS data interface, statistical analysis, graphic and numerical presentation of the test results, and test report options. The **Vi**sta6 provides optional input of Mitutoyo electronic micrometer data (measurement of the specimen dimensions) into the software. To increase accuracy of measurement, the software also provides fine interpolation between discrete temperature measurements using cubic spine interpolation techniques at the deflection point of 0.250 mm.

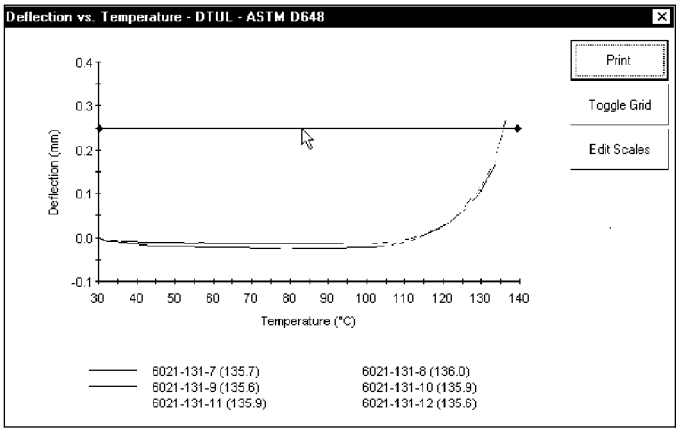

*Fig. 3: Results of tests conducted on HDV3 and **Vi**sta6 instruments*

Test Results

Results of tests conducted on HDV3 and **Vi**sta6 instruments (graphical presentation representative data shown in Fig. 3) demonstrates that the above enhancement provides superior accuracy and repeatability of the test results within the range of 0.2–0.5°C. ■

Atlas' popular MFI2 Melt Flow Indexers will soon have new data acquisition software.

New WinPlast Data Acquisition Package for MFI2 Melt Flow Indexers

The Atlas Polymer Evaluation Products division will introduce a new Windows-based data acquisition package for its popular MFI2 Melt Flow Indexers (extrusion plastometer) at NPE 2000 (Chicago, Illinois, June 19–23). The WinPlast package consists of Windows PC software and a "smart" interface cable to convert the MFI2 output to be compatible with a PC's standard RS232C serial port. No separate cards are placed in the PC, simplifying installation, compatibility and PC networking.

The WinPlast package replaces the earlier DOS-based PC Communications Package accessory; up to nine MFI2s can be daisy-chained to a single PC port. Each MFI2 is coded with a unique address so the software can identify the transmitting instrument in the chain. Test condition parameters, raw test data, calculated results (including rheological properties) and final reports can be automatically sent by the MFI2 after each sample run or stored and manually transmitted to the PC later.

From the PC the user can view, annotate and print all of the above data. The data is automatically saved and named. A key benefit of WinPlast is its ability to convert reports to Microsoft® Excel format (.xls). This allows the Excel user to easily perform custom analysis and report formatting, such as comparing test runs, generating SQC charts and other graphics, flagging off-specification results and generating customized quality or end-user certifications. Other applications software such as LIMS systems can then use the data.

For security purposes only operator or sample related information and test comments can be edited in WinPlast. Actual test conditions and results are sent "as run" by the MFI2 and cannot be edited in WinPlast. This is to comply with requirements of quality systems such as ISO 25/17025 and ISO/QS 9000; test method setup is done directly on the MFI2 and cannot be altered by the PC.

Existing MFI2s, and those currently using the PC Communications Package, can be upgraded to use the new WinPlast system; a simple programming (EPROM chip) change is required plus the WinPlast package. New MFI2s shipped from Atlas will be WinPlast enabled; hardware components are CE compliant.

For information on WinPlast or system upgrades, contact your authorized Sales or Service Representative. ■

BCX Cyclic Corrosion Exposure System Fills Out Atlas' Offerings

Atlas' BCX gives you one more option for corrosion testing.

The Atlas BCX Cyclic Corrosion Exposure System is a perfect addition to our wide range of corrosion instruments. In test method capability, it fits in between the existing Salt Fog and CCX Cyclic Corrosion Exposure System models.

The BCX provides corrosion testing according to ASTM G85 Annex 5 (Prohesion™) and other basic cyclic (Wet/Dry) test methods. Compared with traditional testing, basic cyclic tests in the Atlas BCX offer improved correlation with outdoor exposures. It can also reform traditional salt fog and humidity tests such as ASTM B117, ASTM B368, ISO 9227 and JIS Z2371, in addition to most CASS, SWAAT and acetic acid tests.

BCX standard features include microprocessor-based cyclic controls, which allow automatic changes to environmental conditions. The controls are set by the operator to cycle automatically between Salt Fog, Dry-off/Purge, Dwell and optional Direct Spray. A clear cover allows easy viewing of test conditions. The Omni-Fog™ or Omni-FogII™ Dispersion Tower provides precise control of fall-out rates for compliance with standard test methods. This patented system provides for double baffling of fog, exceeding the requirements of many test methods.

The BCX's modern, all-plastic construction assures accurate, repeatable and reproducible testing, while taking up minimal floor space. The cabinet comes in four standard sizes, 565 liters, 850 liters, 1130 liters and 2550 liters. Custom sizes are available, including walk-in and drive-in.

To match an Atlas corrosion cabinet with an industry test method, please refer to the chart below.

For more information about the BCX, please check the corresponding box on the reply card or contact the Atlas sales support office for your territory. ■

	Traditional	Basic Cyclic	Advanced Cyclic
Test Methods Include	ASTM B117; ASTM B368; ASTM D1735; ASTM D2247; ASTM G85 A 1; ISO 7253; ISO 9227; DIN 50021; JIS Z2371	ASTM G85 A 2, 3 , and 5; ASTM D5894; ISO 11977 part 1; IEC 60068-2-52 part 2; Prohesion™; Wet/Dry Cyclic; Direct Solution Spray	ASTM G85 A 4; SAE J2334; GM9540P; Nissan CCT I,II, III, IV; VW1210; Immersion; Gas Injection; Variable Humidity; Wet Bottom Humidity; High/Low Temperature
Atlas SF	✓		
Atlas BCX	✓	✓	
Atlas CCX	✓	✓	✓
	Almost no correlation with outdoor exposures.	Some correlation with outdoor exposures for certain materials.	Excellent correlation with outdoor exposures, especially for automotive coatings.

Certain test methods or test cycles may require installed options.

LEF and LHT Launder-Ometers® CE Approved

Joining the many Atlas Textile Test Products with CE approval, the LEF and LHT Launder-Ometers will make use of updated controls and enhanced safety features to comply with CE directives for product safety.

Atlas' LEF Launder-Ometer is now CE approved.

These instruments feature an upright angular console, similar to the LP2 Launder-Ometer and Dyeing System, which makes the controls easy for the operator to read. The updated LEF/LHT models use a Honeywell digital temperature controller with single setpoint display and a digital cycle timer with LED display. The digital timer has a greater range than the rotary dial timer previously used. Two arrow buttons on the timer's panel are used to set the time up to 59:59 minutes:seconds. During a test, the LED will flash as it counts down from the selected running time. Its timing accuracy is ± 0.5% of setting. The digital timer is easily set to count down for extended test times in hours: minutes.

Other features of these Launder-Ometers include:

- Safety temperature switch to protect the system from overheating by shutting down the heaters and rotor
- Door safety switch to automatically stop the rotor from turning if the door is opened during a test
- Warning buzzer to signal the end of a test
- Automatic shut down of the instrument when the test is completed

The Launder-Ometer is the official instrument of the American Association of Textile Chemists and Colorists (AATCC). For more information on these instruments and other Atlas Textile Testing Products please call (773) 327-4520 or visit our web site at **www.atlas-mts.com**. ■

AtlasShows

Visit us at Booth #1214!

The Vista6™ and CL400 ChemiLUME™ Lead the Way at NPE 2000

See page 19 for a complete list of Atlas Shows.

Atlas is excited to announce the debut of the **Vi**sta6 Heat Distortion Tester at NPE 2000, June 19–23, at McCormick Place, Chicago, Illinois. The Atlas **Vi**sta6 was developed in close cooperation with major global resin producers to include features to meet the testing needs of high-volume quality laboratories typical of polyolefin producers. The all new **Vi**sta6 adds to Atlas' widely used HDV line, featuring the HDV1, HDV2 and HDV3. All models comply with the applicable ISO 75, ISO 306, ASTM D648 and ASTM D1525 test standards.

The **Vi**sta6 hardware and PC-based *Vortex* software were designed for high sample throughput, increased automation, ease of calibration and operation, and more data output and custom report options.

The **Vi**sta6 features a high-volume immersion bath and dual-stirrer design for superb temperature uniformity. A pneumatic lift system semi-automatically raises and lowers the test stations platform into the bath. This lift, in conjunction with the quickset LVDT transducer positioning, provides fast and easy sample loading and test setup by any technician. Built-in twin water-cooling coils provide rapid cool-down for quick sample turnaround time; compressed air automatically clears the coils of water during temperature ramping.

The **Vi**sta6 is designed for quality control and research and may be used in either capacity. For research, the **Vi**sta6 offers hardware and software features oriented to a higher volume and the repetitive testing needs of quality control.

In addition to the **Vi**sta6, Atlas offers a full line of polymer evaluation instruments designed to impact resistance, thermal expansion and other physical properties of plastics. Many of these instruments will be on display at NPE. To compliment the **Vi**sta6 in testing heat distortion and flammability properties, Atlas will demonstrate the HDV3 Heat Distortion Tester, the HVUL Flame Chamber and the MFI2 Melt Flow Indexer.

A wide range of instruments will be on display to test physical properties of polymers, including the API Advanced Pendulum Impact Tester, the DDI Dart Drop Tester, the Strograph EL Tensile Tester and the Mini Test Press. Also on display will be the A3 Notcher for sample preparation.

*The Atlas **Vi**sta6 Heat Distortion Tester will make its debut in June at NPE 2000.*

Continued on next page

ATLASSpeaks

Scientific Conference at Universita die Palermo
September 3–7, 2000
Palermo, Italy

Dr. Jörg Boxhammer and Dr. Dieter Kockott, ATLAS Material Testing Technology GmbH, will co-present a lecture titled "Shorter Test Times for Thermal and Radiation Induced Ageing of Polymer Materials." Dr. Boxhammer will present Part 1: Intensified Testing Conditions in Weathering Instruments. Part 2, Early Recognition of Molecular Alterations by Measurement of Chemiluminescence will be presented by Dr. Kockott. The lecture is part of the MoDeSt2000 – 1st International Conference on Polymer Modification, Degradation and Stabilization.

Het Instrument Trade Show
October 9–13, 2000
Utrecht, The Netherlands

ATLAS Material Testing Technology GmbH will present a paper on the analysis of oxidation of polymer material and the evaluation/classification of coating surfaces. The lecture will take place during the show at a seminar titled "Test to Match," organized by Platform Omegivings Technologie (Platform Environment Technology).

Vista6, from previous page

Additional instruments at our booth will include the LME Laboratory Mixing Extruder and LMM Laboratory Mixing Molder with accessories TUS Take-Up System and LEC Chopper. Several instruments will be featured for laboratory lightfastness and weathering exposure such as the Ci5000 Xenon Weather-Ometer® and the Suntest XLS+, a benchtop laboratory instrument for accelerated weathering. A small model of an EMMAQUA (Equatorial Mount with Mirrors for Acceleration with Water) unit will also be at the booth.

Fly into NPE 2000 Booth #1214 to see the full line of Atlas polymer evaluation products.

The last product that will be featured is a product from our Analytical Instruments Group called the CL400 ChemiLUME™ which rapidly and accurately evaluates the oxidative stability of materials by measuring chemiluminescence, or light emission caused by thermal oxidation.

Offering quantitative information on long-term thermal stability in a fraction of the time required by the traditional oven aging method, the CL400 ChemiLUME determines the thermal stability of polymers at the speed of light. The instrument is ideal for a variety of applications including quality control, stabilizer evaluation and routine quality assurance testing and product formulation research.

The CL400 ChemiLUME is computerized for quick, reproducible and accurate operation and has the capability of simultaneously measuring as many as four specimens. Each of the four cells has an independent photomultiplier tube, temperature control and dual gas flow control. The computer monitors and controls the established parameters of the test while it collects the data for subsequent analysis. The test can be run either dynamically, with heating rates from 1 to 15°C/minute, or isothermally with an upper temperature limit of 250°C.

For more information on any of these products, please stop by the Atlas Exhibit at Booth #1214 at NPE 2000. ■

University of Sharjah and Atlas Collaborate on Workshop

About the University

This first workshop in the United Arab Emirates was held in Sharjah, at the University of Sharjah. In 1998, Sharjah was chosen as the Cultural Capital of the Arab world.

The University campus occupies 138 hectares with architectural design that exudes harmony and inspires content, reflecting peace emanating from the perennial desert environment surrounding it. Founded under the patronage of His Highness Sheikh Dr. Sultan bin Mohammed Al-Qassimi, Ruler of Sharjah, Member of the Supreme Council and President of the University, the university has become the epitome of quality education in the Arab world in a short period of time. The University of Sharjah contains five colleges supported with all the facilities and services to enhance its cultural and scientific stature. University interaction with society is one of its goals, which was set by His Highness Sheikh Dr. Sultan bin Mohammed Al-Qassimi, Ruler of Sharjah, Member of the Supreme Council and President of the University. This goal will be achieved through co-operation between the research centre and any government or private entity seeking academic help for development. This workshop was consequently a continuation of the efforts of the university in serving the departments of society.

The Workshop

Dr. Abdallah Alnajar, Director of the Research Centre of the University of Sharjah and his team, excellently organized workshop was held under the patronage of His Highness Sheikh Sultan Bin Mohamend Bin Sultan Al-Qassimi, the Crown Prince of Sharjah. His Highness Sheikh Tariq Bin Faisal Al Qassimi, Chairman of the Economic Development Department gave the inauguration.

During the inauguration, the organization committee and the 50 participants of the workshop were honored by the presence of Prof. Isam Zabalawi, Chancellor of the University of Sharjah, Excellency Dr. Abdel Hamid Hallab, His Highness Special Advisor, and Prof. Salim Sabri, Dean of the College of Arts and Sciences.

During the two-day workshop, the materials scientists and engineers, who attended the workshop from the UAE, Saudi Arabia, Oman, Bahrain and Qatar, were introduced to the fundamentals of

Continued on page 15

2000 Client Ed Remaining Dates

Fundamentals of Weathering I

June 26
Marlborough, MA

July 17
Pittsburgh, PA

July 20
Cincinnati, OH

August 7
Mexico City, Mexico

August 9
Guadalajara, Mexico

August 11
Monterrey, Mexico

September 21
Chicago, IL

September 25
Philadelphia, PA

September 28
Indianapolis, IN

October 9
Plymouth, MI

October 12
Arlington, TX

October 17
Atlanta, GA

December 4
Phoenix, AZ

December 8
Vancouver, BC

Fundamentals of Weathering II

June 27
Marlborough, MA

July 18
Pittsburgh, PA

September 26
Philadelphia, PA

October 10
Plymouth, MI

December 5
Phoenix, AZ

2000 Weather-Ometer® Workshop Schedule

The Weather-Ometer Workshop
November 16-17

Ci4000/Ci5000 Workshop
November 15

Contaminated Water and Weathering Instruments: A Case Study

What is contaminated water? How important is water quality when running a weathering test? Can dirty or contaminated water change the results of a test? How does this "bad" water affect weathering instruments? What can be done to ensure accurate and repeatable results?

Water quality can vary greatly in different geographies. The ions found in water come from minerals in the ground. Organic impurities in water can occur naturally, or be the result of pollution (petroleum products) or industrial and agricultural run-off. Particles and colloids in water will also vary with geological conditions.

Water purification attempts to remove these contaminants; however, even "purified" water can be contaminated. Deionized water is often produced by Service Deionization systems (SDI). SDI involves the repeated use and regeneration of ion exchange resins. Unless this is done extremely carefully, SDI canisters will often contain carryover organic contaminants. In addition, mixed bed deionization systems will not do a good job of removing silica, one of the most common contaminant problems. Silica is often the cause of the white powder seen in contamination problems.

Quality water is important for your Atlas Ci5000 Xenon Arc Weather-Ometer.

Dissolved silica is difficult to remove by ion exchange technology because it is neutral at pH 7. It will go right through a resin whose removal capability relies on a charge-based ion exchange. Even when silica is removed, it is easily released when the resins become saturated or fouled with organics.

In addition, a large percentage of silica exists in a colloidal form that also is not charged. Ion exchange resins will not remove colloidal silica. Complicating this is the fact that besides being difficult to remove, silica is also difficult to detect. The most commonly used colorimetric tests for silica test only for dissolved silica. Total silica, including colloidal silica, is measured by graphite furnace AA. Thus, a colorimetric silica test will completely miss colloidal silica. However, when colloidal silica enters the Weather-Ometer® and comes out of solution in the presence of warm water and radiation from the Xenon lamp, it will show up as the white powder you will find on your samples and in your Weather-Ometer.

Atlas Weather-Ometers require purified water with a total dissolved solids (TDS) of at least 0.1 ppm (about 0.5 Meg-ohm resistivity). The water quality sensor inside the Weather-Ometer typically alarms the operators at values less than 2 Meg-ohms resistivity. Experts advise that the better the water quality, the more reliable the results. In addition to specifying the TDS, a specific requirement for silica is also noted. A maximum value of 0.1 ppm or less for general tests, and a maximum value of 0.02 ppm or less for the "gloss" test is necessary.

Consistently pure water used in the Weather-Ometer is important because contaminants in your water will change your test results. Contaminants can cause spots, clouding, or a powdery coating on samples that makes taking an accurate gloss or temperature reading impossible. Water-borne contaminants can cause other problems as well. Consider

where water is used in the Weather-Ometer. Pure water is run through the Xenon lamp to cool it. Pure water is also run through the spray nozzles and sprayed on samples, as well as run through the vibrasonic humidification nozzle.

Therefore, consistent and valid test results cannot be assured when contaminants enter the Weather-Ometer. A few of the known effects of water contaminants on weathering testing are:

- Organics in water leave spots behind when water dries.
- Silica, calcium, magnesium and iron are common contaminants that affect the temperatures, humidity, irradiance and running costs of your Weather-Ometer.

The effects of a coating or film caused by any of the contaminants listed are as follows:

- A coating on the black panel in the chamber can decrease its heat absorption, resulting in inaccurate temperature readings for the samples; therefore, your test will be run at the wrong temperature.
- Coatings on the chamber light sensor will cause it to incorrectly read the intensity of the Xenon lamp. This will cause it to automatically boost power to the lamp to compensate for its lower output (sensed inaccurately). The result is that the test may be run at too high a light intensity, potentially changing the results, and definitely shortening the life of the Xenon lamp.

If contaminated water is used to cool the Xenon lamp, deposits will form on the lamp case and filter. The result is that part of the lamp radiation will be blocked. The Weather-Ometer, in turn, will boost the power to the lamp in an effort to increase its irradiance. Depending upon the age of the lamp, this may or may not work. The unnatural power boost, however, will definitely shorten the life of the lamp.

Contaminants may also cause plugging of the spray and humidification nozzles, which will influence the reliability of the test and result in the need to clean or replace the nozzles.

Only a carefully designed water system will protect the Weather-Ometer. That system will include pretreatment designed specifically for local water conditions. It will also use an efficient reverse osmosis process to remove ions, including silica, and organics. Finally, it will employ a strong, Type I nuclear grade ion exchange resin for added protection. Where the tap water is more difficult (high TDS) or where larger volumes of water are used for multiple Weather-Ometers, electronic deionization (EDI) can also be used to improve water quality consistency and result in lower operating costs.

Please contact your local Sales Representative to find out how you can learn more about the quality of water running through your instruments. ■

Workshop, from page 13

natural and laboratory weathering by expert speakers from Sharjah University and Atlas:

- Determining the rate of deterioration of plastic materials by all natural meteorological parameters (e.g., heat, humidity, wind, dust) is essential if the useful life of a plastic product is to be sufficiently extended to meet the design requirements for long-term applications.
- An approach to stabilization of plastics subject to outdoor exposure can be developed if there is a full understanding of the characterisation techniques, experimental conditions and the history of the plastic material under investigation.
- Topics on service life prediction, spectroradiometer studies and material evolution
- An overview of the important theoretical and practical techniques used to study materials durability and reliability

The increasing awareness of the effects of weathering on materials exposed to the environment was documented by the number of attendees from governmental institutions as well as the industry and the highly motivated discussions of all participants on the information given after each of the sessions.

The final discussion on the last day of this workshop was indicating the high interest in material testing under the specific effects present in the UAE and the neighbouring countries.

The first Atlas workshop in the UAE was a tremendous success and interesting experience for all that were involved. ■

Current Status of ASTM G26, G23 and G53: Still Alive but Soon to Be Withdrawn

For the last five to six years, ASTM Committee G03 on Weathering has been working on developing new performance standards that will replace G26 (Xenon Arc), G53 (FL UV) and G23 (Carbon Arc) standards. The old standards G23, G26 and G53 are "device specific and descriptive" and these types of standards are being replaced by "performance based" standards. Performance-based standards have been promoted by ASTM and other standards organizations, including government agencies, because the "non-device specific" nature of test methods create competition resulting in economic benefits for the industry. ASTM G151 through G155 standards are the new performance-based standards that will replace the old G23, G26 and G53 standards. The new performance-based standards contain performance criteria that instruments should meet and do not contain any description of particular instruments. The new standard G151 is a general guideline for accelerated weathering, which did not exist with the old standards. The instrument standards (G152 to G155) need to accompany G151 to describe a test method.

PERFORMANCE STANDARDS

Instruments / Description	Old Device Specific Standards	New Performance Based Standards
General Description for Accelerated Weathering	N/A	G151
Open Flame Carbon Arc	G23	G151 & G152
Enclosed Carbon Arc	G23	G151 & G153
Xenon Arc	G26	G151 & G155
Fluorescent UV + Condensation	G53	G151 & G154

Currently, both "device specific" and "performance-based" standards coexist. It means that G23, G26 and G53 are still valid and enforced at this time. The new standards G151 through G155 are also published and enforced at the same time. This is to provide a transition period that users can get acquainted with the change. In addition, there will be "conversion tables" published in the place of the old standards, as well as in new standards, notifying users of the equivalent cycles in the new performance standards. Currently, the committee is working on these tables and Atlas is preparing the first proposal. However, until this work item is completed, the old standards will remain in the book. It is difficult to pinpoint an exact time frame for this task to be complete, but it is safe to assume that the old standards will be deleted from the book by 2002. Currently, work items are being proposed throughout other ASTM committees to reflect this change in many ASTM documents that reference the old standards. There have been reports that the old standards have been withdrawn from the book; please note that this is not the case, and that the old standards are still valid.

Atlas to Host ASNAW Symposium

Atlas Electric Devices Co. will host its 2000 ASNAW symposium for the automotive industry on the subject of materials durability and weathering October 25–27 in Phoenix, Arizona. Guest speakers will cover new testing and modeling techniques on automotive products, service life predictions, spectroradiometry studies, and advanced evaluation of materials.

Subjects to be covered during the 2000 symposium include: an overview of weathering — natural and accelerated, the effect of light on materials, the factors influencing natural and accelerated weathering, correlation studies, weatherability of specific materials, evaluation techniques and the role of international test standards. Included in the program is a half-day tour of DSET Laboratories — part of the Atlas Weathering Services Group — an independent laboratory and outdoor testing site with over 1 million samples on exposure. This provides hands-on exposure to test sample preparation and handling, exposure orientations, data acquisition and interpretation of test results.

The school benefits anyone involved in materials durability and weatherability testing in the automotive industry. This includes the materials engineer, product manager, quality control supervisor and others involved in determining product durability. Students will learn the effects that various elements of nature have on the degradation of materials.

The course will be held at the Embassy Suites Hotel in Phoenix. During the course, scientific papers are presented by various individuals distinguished in their field and qualified by years of practical experience in materials chemistry, research, testing and evaluation. The speakers represent several major automotive manufacturers and suppliers, including Ford, GM, and DuPont.

Course tuition is $1,295 and covers a welcoming reception, course materials, instruction, refreshments and meals. All other costs are the responsibility of the attendee. Advanced registration is required.

Call the Embassy Suites Hotel directly for room reservations at (800) 527-7715 and be sure to mention the Atlas School for Natural and Accelerated Weathering for a special room rate.

Registration information and ASNAW brochures are available by contacting Theresa Garcia at (773) 327-4520 or by sending a fax to (773) 327-9731. On-line registration is available at **www.atlas-mts.com/prod/client/register.html**. ■

KHS Building Lighting Systems to Meet Your Needs

KHS designs, manufactures and installs large-scale lighting systems. The areas of application are primarily in the field of solar simulation and high-speed photography lighting systems. These systems are most often utilized in the automotive industry for material performance tests (accelerated material aging), heat load testing (solar heating effects) and automotive safety testing, including crash simulation and air bag deployment evaluations (high-speed photography lighting systems). In addition, the KHS technical staff has developed specialty lighting systems for photovoltaic cell/panel evaluation, military applications, agriculture chemical/growth studies, and building product testing.

KHS manufactures application-based engineered products focused on the individual needs and specifications of the customer.

SolarSimulation

The SolarConstant lighting systems are a flexible solar simulation source that provides a spectrum very close to sunlight. The ability to accomplish material performance tests on large test objects in a laboratory environment provides a strategic advantage over traditional outdoor testing. Automotive companies throughout Europe and elsewhere use KHS technology to perform full size vehicle tests and component tests to judge various aspects of material performance.

Some tests include:

- Full vehicle material evaluation — fade, color match, impact strength, dimensional stability, fit and finish, squeak/rattle tests.
- Full vehicle heat load evaluation — when coupled with a windtunnel, air-conditioning performance tests, engine heat management, fuel/tire temperature tests.

- Component material evaluation — fade, color match, impact strength, dimensional stability, fit and finish, air bag system aging.

Test Methods that KHS Systems Meets:

- DIN 75-220 — Automotive Material Performance
- MIL-STD-810 (C, D, E, F) — Military Applications
- EPA 40 CFR — Automotive Emissions
- ISO/TC22/SC12/WG8/N12 — Airbag Performance

High-speed Photography Lighting

One of the most important elements of safety/crash testing is the process of examining film and video taken during the simulation. The process of recording high-speed events demands a specialized lighting system. KHS is a world leader in the design, manufacture, and installation of high-speed photography lighting systems focused on the needs of the automotive industry. Engineered systems for military, aerospace and other applications are within the capabilities of KHS.

For more information about KHS check the corresponding box on the reply card or visit the KHS web site at **KHSLight.com** or contact:

KHS US Office
4114 North Ravenswood Avenue
Chicago, Illinois 60613, USA
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(773) 327-4520 x494

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AtlasShows

2000

NPE 2000
June 19–23
Booth #1214
McCormick Place
Chicago, Illinois

AATCC 2000
September 17–20
Booth #701 & 703
Benton Convention Center
Winston-Salem, North Carolina

International Exhibition Brno
September 18–22
Brno, Czech Republic

EUROCOAT
September 19–21
Torino, Italy

Het Instrument Trade Show
October 9–13
Utrecht, The Netherlands

FSCT ICE 2000
October 16–20
Booth #1815
McCormick Place
Chicago, Illinois

Cloristic Congress and Exhibition
October 18–20
Pardubice, Czech Republic

VISION
October 18–20
Stuttgart, Germany

Interplastica
November 28–December 1
Moscow, Russia

Chemistry 2000
December 1–3
St. Petersburg, Russia

ITME
December 1–10
Mumbai, India

2001

SAE 2001
March 5–8
Cobo Hall
Detroit, Michigan

European Coatings Show
April 3–5
Nuremberg, Germany

ANTEC 2001
May 7–10
Booth #507
Dallas Convention Center
Dallas, Texas

Test 2001
May 8–10
Nuremberg, Germany

K'2001
October 25–November 1
Düsseldorf, Germany

Application Notes Available

The first ten CL-technique (Chemiluminescence) application notes have been published. They are available as a downloadable PDF (Portable Document Format) file from our web site at **www.atlas-mts.com.** Printed versions can be obtained by contacting your local sales representative.

Application notes are based on various tests performed in the CL400 ChemiLUME™. The tests show specific industrial problems successfully investigated using the CL technique. The application notes may serve as a basis to decide if CL testing is useful to your specific applications.

Please check back periodically for further application notes.

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